Post Opening Project Evaluation

M1 J10-13 HSR & Junctions
One Year After Study

October 2016

Notice

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Foreword

Highways England's motorways are some of the safest in the world. Our road network carries a third of road traffic and we have seen demand grow by a quarter since 2000 with continued growth forecast.

One reason for the introduction is smart motorways is because there are more vehicles on the road. By making use of the full width of the road, smart motorways add that extra capacity to carry more vehicles and ease congestion.

They have evolved from **Controlled Motorways** (with variable speed limits) to **Dynamic Hard Shoulder Running** (opening the hard shoulder as a running lane to traffic at busy periods) **to All Lane Running** (permanently removing the hard shoulder and converting it into a running lane).

Compared to a traditional motorway widening they deliver:

- Increased capacity at significantly less cost than traditional motorway widening.
- New technology and variable speed limits to improve traffic flow.
- Less congestion and more reliable journeys for customers.
- Environmental benefits of not taking an extra corridor of land to use as new road.
- A safety record that's at least as safe, if not safer than conventional motorways.

The M1 J10 to 13 was one of the earlier generation of smart motorways enabling the hard shoulder to be used as an extra running lane at busy periods on the main network and introducing variable speed limits. Before the scheme, this section of the motorway experienced high levels of congestion, customers experienced delays on the approach to junctions 11 and 12, both junctions were over capacity at peak times, with queues impacting the mainline M1.

The scheme was designed to make customer journeys **more reliable**; applying speed restrictions to **better manage the flow of traffic** and **improving the capacity** at the junctions.

This report indicates how the scheme was performing within its first year of operation. This initial assessment forms part of a longer-term evaluation which reviews performance over five years. The one year after study is not intended to provide conclusive evidence about scheme benefits but gives an early indication about whether a scheme is heading in the right direction. This helps us identify areas where we can focus effort to optimise the benefits of the scheme.

The evaluation findings highlighted that within the first year of operating the scheme, we needed to improve our processes for opening the hard shoulder. Initially we opened and closed the hard shoulder at similar times each day, to provide customers with a predictable driving experience. We now assess whether the road is reaching its peak capacity and open the hard shoulder, as required.

Personal injury collisions on the strategic road network are very rare and can be caused by many factors. Due to their unpredictable nature, we monitor trends over many years before we can be confident that a real change has occurred as result of the scheme. Within the first year, it has not been possible to conclude the safety impacts of the scheme, but the findings indicate that the scheme is as safe as the original road. We continue to review this as part of the longer-term evaluation for the scheme.

Since this scheme, smart motorways have evolved. More recent all lane running schemes have demonstrated that they are making journeys more reliable for those travelling during congested periods, enabling us to operate the road at a higher speed limit for longer periods, whilst maintaining safety.

We're working to continually improve our smart motorways so that they work better for customers. Our Traffic Officers work around the clock to operate our smart motorways, keeping customers safe from the control room and attending incidents the road. We've committed to additional signs and more visible markings for emergency areas and our latest set of standards will ensure that there's a safe place to stop in an emergency every mile on our upcoming schemes. All of this helps to provide one of the most modern and safe road environments in the world.

January 2020

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Executive Summary

Scheme Description

The M1 motorway is a strategic route in England, linking London with the Midlands and the North. The scheme section is located in the county of Bedfordshire. The scheme section between J10 and J13 is 24km (15 miles) long and provides access to Luton airport at the southern end of the scheme. The A5 and A6 runs parallel to the scheme section. Key urban areas along the route are Bedford, Milton Keynes, Luton and Dunstable. Toddington Motorway Service Area is located between J11 and J12.

The Highways England scheme, which opened in December 2012 is primarily a Dynamic Hard Shoulder Running smart motorway scheme and has the following main components:

- **Dynamic Hard Shoulder Running** – Opening of the hard shoulder as a running lane at certain times of the day to provide four lanes of capacity (with 60mph speed limit) on the mainline M1, including four running lanes through J10, J11 and J12.
- **Junction Capacity Improvements** – at J11 and J12.
- **Variable Mandatory Speed Limits** - (VMSL) – M1 J10 to M1 J13.

The Post Opening Project Evaluation programme considers early scheme performance, providing the opportunity for Highways England to make improvements, if required, in a timely manner to support the delivery of the future performance of the scheme.

Scheme Objectives

Objectives (Environmental Statement and Consultation Report)	Objective Achieved?
Junctions: Improve traffic and safety problems	Partial
Junctions: Improve journey reliability	Partial
Junctions: Reduce fatalities, casualties and incidents	Too early to conclude
Junctions: Reduce congestion and queuing at junction 11 and 12	✓
Mainline: Reduce congestion and improve journey time reliability	✗[1]
Mainline: Reduce the frequency of accidents	Too early to conclude
Mainline: Reduce driver stress	Partial

[1] Early findings indicate increased journey times on the M1 post opening. Further analysis (detail provided later in this summary) suggests that the operation of the smart motorway may not have been optimal during the first year of operations, particularly relating to the length of time that the hard shoulder is open, the use of VMSL and the impact of driver behaviour leading to the under-utilisation of the hard shoulder as a running lane (when open).

Key Findings

- Weekday traffic flows have increased by between 8% at the southern end of the scheme to 6% at the northern end of the scheme at the one year after (OYA) stage.
- Journey times for traffic using the two upgraded junctions have generally improved. But average journey times for each peak period in the post-opening period are consistently higher than the pre-scheme journey times along the length of the scheme.
- Overall analysis indicates that higher journey times are a result of a combination of; inefficient use of the hard shoulder by vehicles, an increase in flows, particularly in the peak periods, and excess use of lower speed limits, particularly at the southern end of the scheme.
- The standard deviation of journey times results provide sufficient evidence to conclude that the scheme has not achieved its objective of improving journey time reliability along the scheme section.

- The scheme has not resulted in an improvement in safety based on the evidence available at this stage. Safety impacts will be re-examined in the five years post opening evaluation study.
- As a result of this evaluation report, we have identified some instances where hard shoulder running was used at times which did not provide a benefit to our customers, and have made changes in our control centre to prevent this.
- In addition, the technology on the scheme is being re-calibrated, we are reviewing the appropriateness of the location of the vehicle count sites which trigger the reduced speed limits; and we are considering whether there are any improvements we could make to the road layout in the vicinity of junction 11.

Summary of Scheme Impacts

Traffic

- Traffic volumes on the section of the scheme have increased at the one year after stage (2014).
- An increase of 8% for weekday traffic flows is observed between J10 and J11 at the southern end of the scheme. The middle section of scheme (J11 to J12) has seen an increase of 7% whereas at the northern end of scheme (J12 to J13) the change in traffic is 6%. This is less than forecast.
- A small decrease in traffic is seen on the A5 which runs parallel to the M1, indicating that the increased capacity on the M1 has resulted in some rerouting of traffic onto the M1.
- Almost all non-parallel A roads within the study area where data is available have shown increases in traffic volumes between the before and OYA period.
- Journey time forecasts were inaccurate for mainline M1 traffic, as times have increased post opening, compared to a saving which was forecast.
- Average journey times for each peak period in the post-opening period are consistently higher than the pre-scheme journey times along the length of the scheme in the southbound direction by up to 42 seconds in the interpeak, to an increase of 2 minutes 40 seconds (18%) in the AM peak. In the northbound direction an increase of 11% (approx. 2 minutes) is seen for the AM peak, although in the PM peak a small time saving of 1% (12 seconds) is observed post opening. Journey times have generally improved for traffic using the upgraded junctions.
- Delays at the upgraded junctions have generally reduced, particularly for those using the A5120 at J12.
- In the AM peak speeds deteriorate towards the southern end of the scheme. In the evening peak, speeds are also lower at the southern end of the scheme.
- The hard shoulder (when open) is significantly under-utilised by traffic compared to a standard four lane motorway. There have been increases in flow during peak periods, if traffic were to make better use of the hard shoulder when it is opening as a running lane then improved traffic speeds might have been observed. It is clear that driver behaviour on hard shoulder running schemes is having a significant impact on the success of this scheme.
- Halogen data has demonstrated the extent of use of the hard shoulder running (HSR) and variable mandatory speed limits (VMSL) and shows that VMSL is operational for significant proportions of the peak periods. Post-opening traffic speeds are at just under 100kph (60mph) along a large proportion of the scheme, particularly in the evening peak. This is an indication that traffic speeds are being limited by the HSR being operational for a large proportion of the time and hence a maximum of 60mph is enforced.
- Journey time variability has generally not improved, indicating either congestion still occurs along the scheme section, particularly in the peaks or, more likely the VMSL displayed is inappropriate for the road conditions.
- The standard deviation of journey times results provide sufficient evidence to conclude that the scheme has not achieved its objective of improving journey time reliability along the scheme section.

Safety

- Post opening, the annual average number of collisions (January to December 2013) along the M1 mainline has increased although as this change is not statistically significant, it cannot be conclusively linked to the scheme. No fatal collisions have been recorded on the mainline M1 in 2013.
- There have been no discernible changes in collision numbers at the junctions, although post opening there have been no fatal or serious collisions to date.
- The collision severity index has increased marginally post opening, providing an indication that the scheme is not currently achieving the objective of reducing the severity of collisions. Given the limited quantity of post-opening collision data, it is however too early to draw firm conclusions on the impact of the scheme on severity and this should be considered an indication only. The Five Year After evaluation will consider a larger sample and therefore provide a more comprehensive picture of the impact of the scheme on safety.
- Post opening, the collision rate (number of collisions compared to traffic flows) for the mainline M1 has increased by 19% from 0.048 collisions per mvkm pre scheme to 0.059 post opening, in contrast to the forecast 15% collision rate saving expected for a smart motorway.
- The scheme's impact on security is considered to be as forecast for both elements of the scheme (largely beneficial for mainline, neutral for junctions), due to the installation of CCTV cameras and direct emergency call to operators at the Emergency Refuge Areas.

Environment

- Landscape and townscape proposals have largely been implemented as expected for the junction improvements. For J12, impacts are potentially worse than expected for J12 due to immaturity of planting at OYA stage. For J11, landscaping treatments have not been fully implemented as expected, and failure of plant stock and poor maintenance has meant that overall benefits for townscape have not been achieved at OYA. The HSR impacts are not fully understood due to lack of appraisal and as-built information.
- There are limited biodiversity effects at J11 due to the urban nature of the setting and the small scheme footprint. There are no significant biodiversity impacts at J12, but some loss of habitats including net gain of hedgerows and species rich grassland but net loss of broadleaf woodland. There have been no direct impacts on protected species. At this stage, the biodiversity impact of the HSR component of the scheme is not fully understood.
- Overall neutral drainage effect for the junction improvement proposals is observed. Proposals at J12 appear to be implemented as expected. Details of drainage at J11 and associated with HSR scheme to be clarified.
- There has been a general improvement for pedestrians and cyclists due to the junction improvements through provision of dedicated footways and signalised junctions is noted.
- There are general improvements to journey ambience, but benefits are not as great as expected due to slower than expected journey times along the M1. Local perceptions of route uncertainty and fear of accidents at J12 are worse than expected.
- Assuming appropriate mitigation in place, noise impacts are likely to be less than expected due to lower traffic and HGV flows than expected. Information regarding the noise mitigation proposals for HSR is required before overall conclusions can be drawn.
- Air quality impacts are likely to be better than expected due to lower traffic and HGV flows than expected.

Accessibility and Integration

- The scheme's observed impact on the Option Values, Severance and Access to the Transport System sub-objectives of neutral is consistent with that forecast.
- This scheme is compatible with regional and national transport polices and most local policies.

Summary of Scheme Economic Performance

All monetary figures in 2002 Prices and values	Forecast	Outturn Re-forecast
Mainline M1 (J10-13) Journey Time benefits	£512.65m	-£240.34m
Junction 11 and Junction 12 Journey Time benefits	£114.64m	£29.30m
Total Journey Time Benefits	£627.29m	-£211.03m
Vehicle Operating Costs (VOC)	-£258.67m	-£43.97m
TEE impacts during construction	-£93.13m	
TEE impacts during maintenance	-£5.00m	
Safety Benefits	-£3.97m	£0m
Noise	£7.91m	
Carbon	-£45.33m	£0m
Total Present Value Benefits (PVB)	**£229.11m**	**-£345.22m**
Investment Cost (Construction)	£291.12m	£222.32m
Do Minimum costs	-£21.14m	
Operating Cost	£111.64m	
Indirect Tax	-£317.08m	-£52.35m
Total Present Value Costs (PVC)	**£64.54m**	**£260.47m**
Benefit Cost Ratio (BCR)-Indirect Tax as Cost	**3.55**	**n/a**
Benefit Cost Ratio (BCR)-Indirect Tax as Benefit	**1.43**	**n/a**

- The outturn journey time disbenefits of -£211.03m are significantly lower than the forecast benefits due to the increased average journey times on this section post opening.
- The disbenefit from vehicle operating costs is less than forecast, due to lower traffic than forecast, and more efficient speeds.
- Post opening no safety benefits or dis-benefit can be attributed to the scheme, as it is too early to conclude at this time.
- Overall, the outturn PVB is negative, compared to the large forecast benefits of £229.11m.
- The outturn investment cost is lower than the forecast cost by 35%.
- The outturn reforecast of the impact of the scheme on indirect tax revenue as a cost is lower than forecast. This is due to the fact that the forecasts assumed higher background traffic growth resulting in greater changes to indirect tax, whereas one year after, observed traffic growth is lower than forecast.
- No outturn reforecast BCR has been calculated for this scheme due to the negative PVB at OYA.
- In the absence of a full evaluation, our evaluation of wider economic impact of this scheme is in agreement with the appraisal's assessment of 'neutral'.

1. Introduction

Background

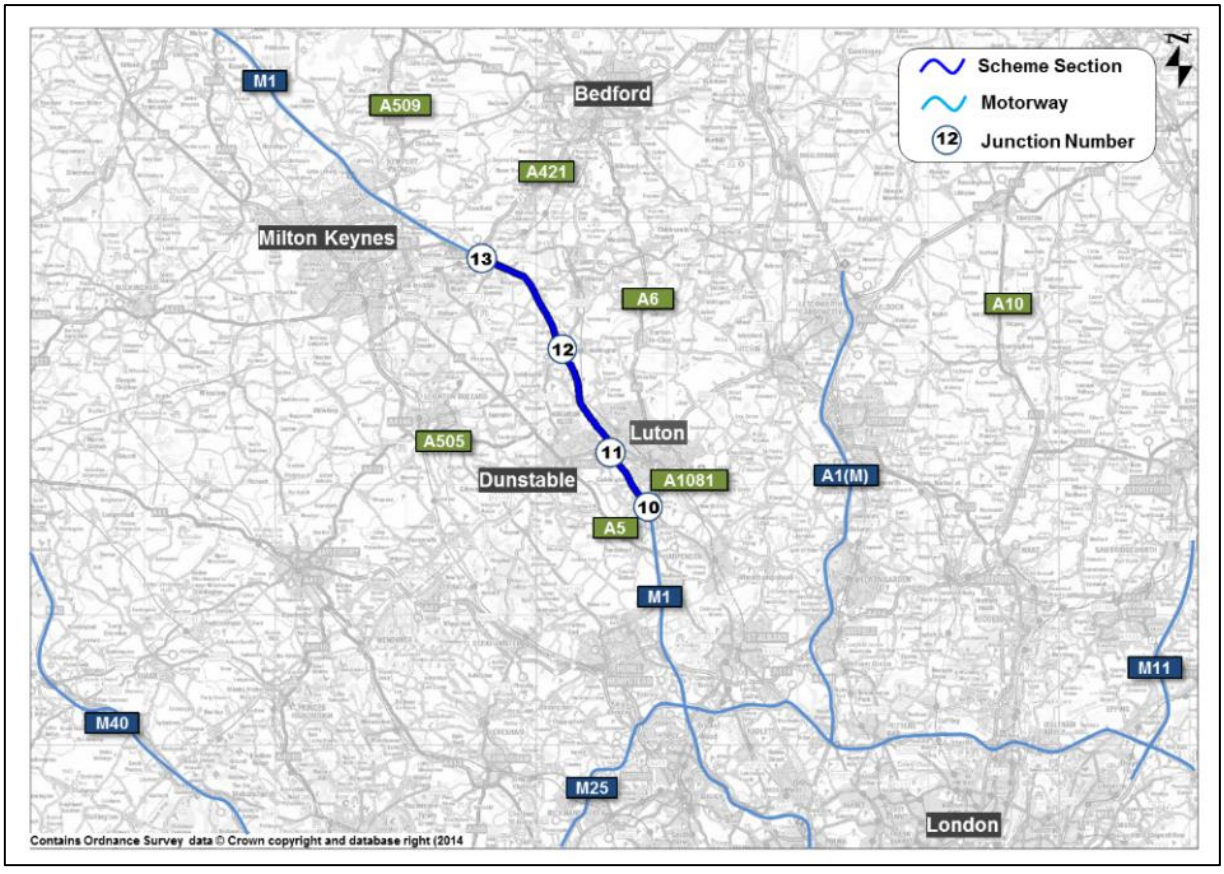
1.1 This report represents the One Year After (OYA) post opening study of the M1 J10-13 Hard Shoulder Running (HSR) and Junctions scheme (hereafter known as 'the scheme') which opened in December 2012. The evaluation has been prepared as part of Highways England's (formerly the Highways Agency's (HA's)) Post Opening Project Evaluation (POPE) programme.

Scheme Context

1.2 The M1 motorway is a strategic route in England, linking London with the Midlands and the North. The scheme section is 24kms long and is located in Bedfordshire between J10 and J13 as shown in **Figure 1.1**. The A5 and A6 run parallel to the scheme section. Key urban areas along the route are Bedford, Milton Keynes, Luton and Dunstable. Toddington Motorway Service Area (MSA) is located between J11 and J12.

1.3 A number of key strategic routes join the M1 in the vicinity of the scheme including the A5 at M1 J9, the A505 at M1 J11, A5120 at M1 J12 and A421/ A507 at M1 J13.

Figure 1.1 –Geographical context of the M1 Junctions 10-13 Widening Scheme



Problems prior to the Scheme

1.4 The Outline Statement of Case (2010) prepared for the public inquiry noted the following; *'this section of the M1 carries over 115,000 vehicles a day (and up to 140,000 vehicles per day in some locations), of which approximately one in five are heavy vehicles'.* In addition, queuing traffic was noted as a problem on the approach to J11 and J12 which were considerably over capacity at peak times, which impacted upon the mainline traffic on the M1. This congestion,

particularly in peak times, was noted to be the cause of delays and an increase in the risk of collisions occurring. Road works and incidents were also noted as causing delays, and increasing the risk of collisions.

Scheme Description

1.5 The scheme comprised two main components: hard shoulder running and junction improvements as shown in **Figure 1.2**.

Figure 1.2 – Scheme layout

Hard Shoulder Running

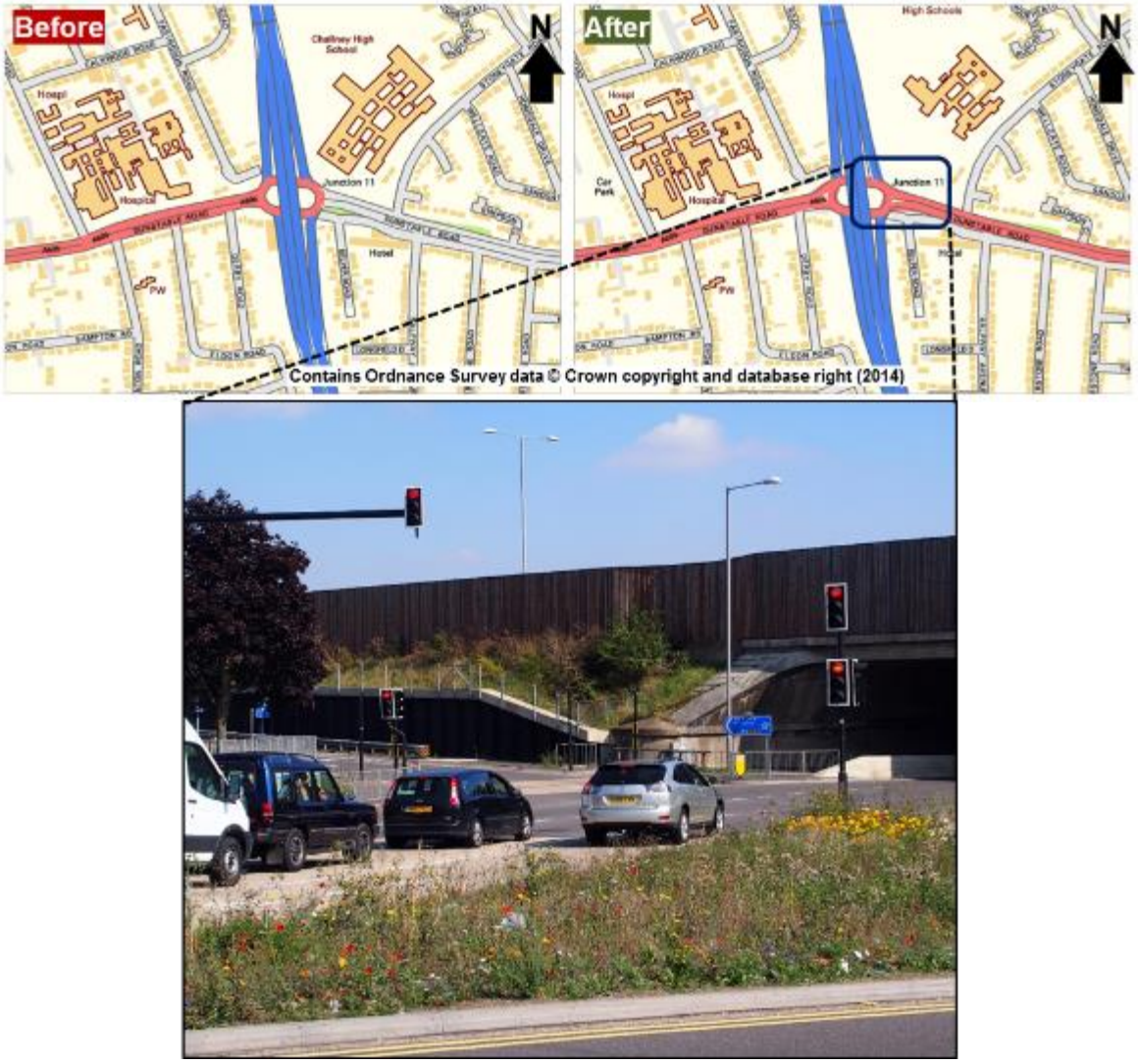
1.6 The Hard Shoulder Running (HSR) aspects of the scheme included managed (smart) motorway between J10 and J13 of the M1, allowing four lanes of traffic at specified times and through

junction running (maintaining four running lanes at junctions) at J10, J11 and J12. Variable Mandatory Speed Limits (VMSL) was also introduced.

Junction 11 and 12 improvements

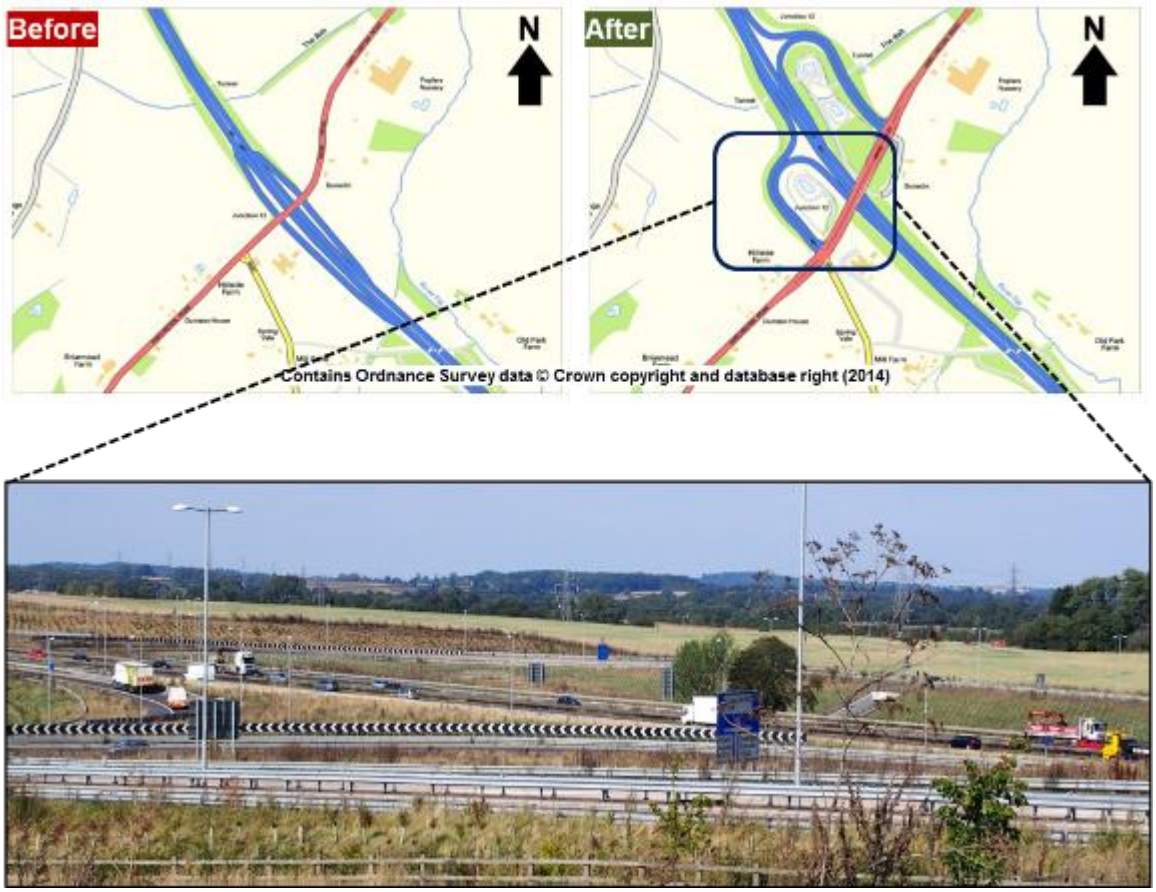
1.7 M1 J11 is a grade separated junction located in the vicinity of Luton, where the motorway passes over a roundabout on the A505 Dunstable Road. The pre and post-scheme layout of J11 is shown in **Figure 1.3**. The improvements comprised the widening of slip roads and the introduction of more traffic signals at the junction itself including the circulatory carriageway and the A505 (as shown in photograph below).

Figure 1.3 – Junction 11 Before and After Layout



1.8 M1 J12 is located in a rural area, 1.4km to the north of the Toddington MSA, where the motorway passes under the A5120 Harlington Road. Four slip roads connected the motorway with the A5120, and traffic signals operate at all times to control traffic movements between the slip roads and the A5120. The improvements comprised a new bridge over the M1, installation of new traffic signals and new slip roads built to the north of the junction to increase capacity. The existing and proposed layout of J12 is shown in **Figure 1.4.**

Figure 1.4 – Junction 12 Before and After Layout



Scheme Objectives

1.9 The objectives of the scheme, as given in the Environmental Statement (ES), December 2009 (junctions), and Managed Motorway M1 J10-13 Response to Consultation report, October 2011 (smart motorways element), were:

Junctions

- To improve traffic and safety problems.
- To improve journey time reliability.
- To reduce fatalities, casualties and incidents.
- To reduce congestion and queuing at junctions 11 and 12.

Managed Motorway (Smart Motorway)

- Reduce congestion and improve journey time reliability.
- Reduce the frequency of accidents.
- Reduce driver stress.

1.10 In addition, there was an overall aim to mitigate the detrimental environment effects of the scheme where technically feasible and economic to do so.

History of the Scheme

1.11 In February 2003 the London to South Midlands Multi-Modal Study (LSM-MMS) recommended that the M1 should be widened to four lanes between J6A and J13. Following this, the Secretary of State confirmed on July 2003 that the proposal to widen the M1 between J10 and 13 was to

be added to the Highways Agency's (as in place at the time) Targeted Programme of Improvements (TPI).

1.12 The preferred route was published in January 2006 and the draft orders and environment statement was published in March 2007. In June 2008, the Highways Agency (as operational at the time) carried out a study to determine whether the implementation of managed (smart) motorway was an appropriate alternative to widening for increasing the capacity. In March 2009 draft orders for the widening scheme were withdrawn. A brief history of the scheme is presented below in **Table 1-1**.

1.13 To facilitate the progress of the scheme, the scheme was divided into two components for the purpose of the statutory process. The HSR scheme did not require any land take and no public inquiry (PI) was necessary. The major changes at J11 and J12 meant that a PI was required. Construction for the HSR scheme was started whilst the PI for the junctions was completed. Following the successful PI for junction improvements, the separate components of the scheme were combined and have since been considered a single scheme.

Table 1-1 – History of the scheme

Date	Event
February-2003	London to South Midlands Multi-Modal Study recommended that the M1 should be widened to four lanes between J6A and J13.
July-2003	Widening of M1 J10-13 from three to four lanes enters the Highways Agency's Targeted Programme of Improvements
September-2005	Highways Agency award contract for the development of the project under full Early Contractor Involvement (ECI) commission
January-2006	Preferred Route Announcement for M1 J10-13 Widening Scheme
March-2007	Draft Orders and Environment Statement published
June-2008	Highways Agency carried out a study to determine the whether the implementation of Managed Motorway is an alternative to widening for increasing the capacity
January-2009	Secretary of State announced that the M1 J10-13 would be improved using Hard Shoulder Running
March-2009	Draft Orders for the widening scheme were withdrawn
June to September 2009	Public Consultation for junction improvements
November-2009	Preferred Route Announcement for the improvement to each junction
December-2009	Draft Orders and Environment Statement published for junctions
December-2009	Start of Construction
April 2010	Public Inquiry for junctions 11 and 12 improvements
December-2012	Scheme Opened to traffic

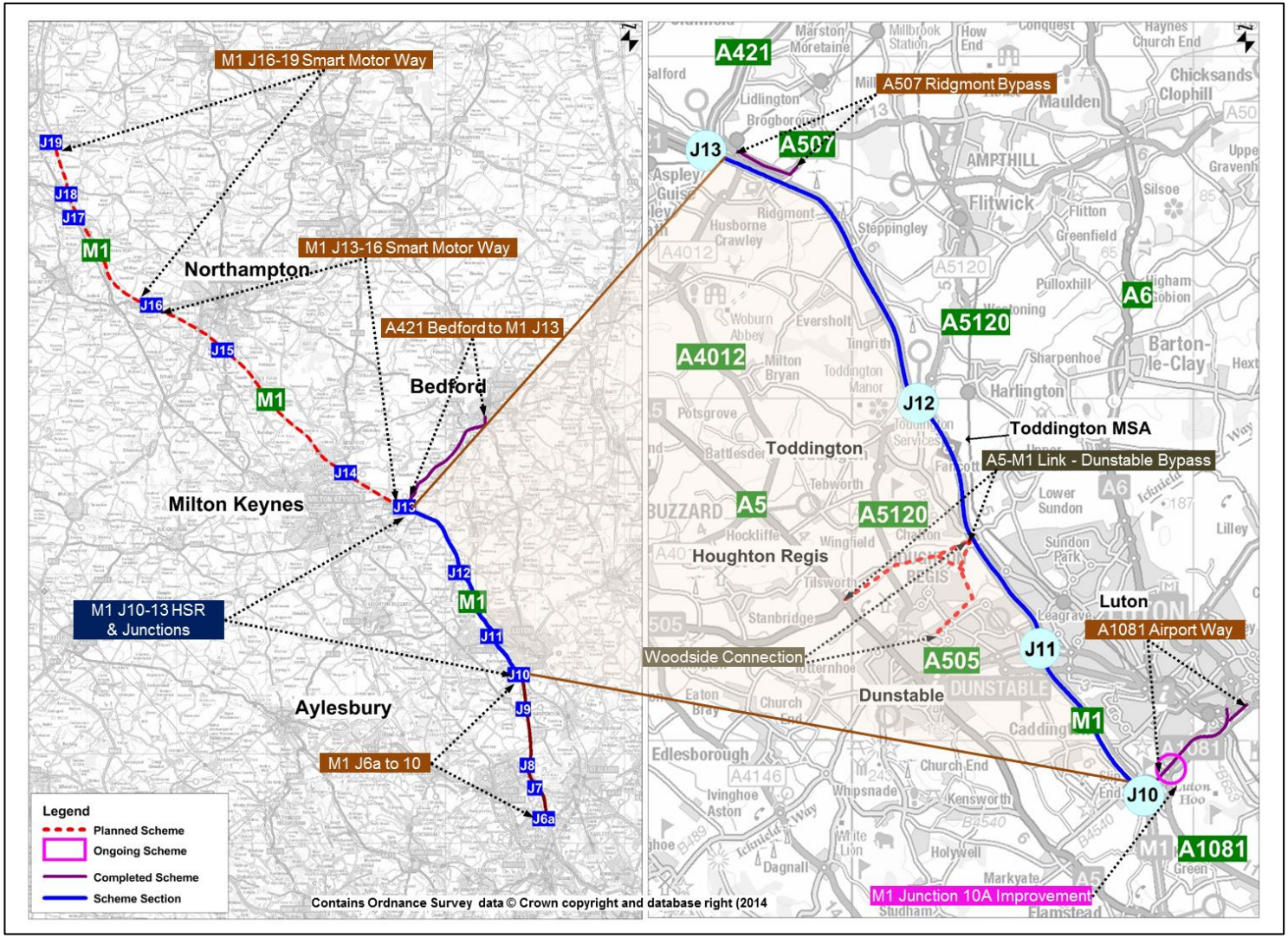
Local Network Supply and Demand Changes

1.14 Local road network changes in the locality of the scheme area can sometimes have an impact on traffic flows, journey times or collisions. A number of schemes are either in construction or have been completed recently on, or in the vicinity of the M1. Those of most relevance to the scheme between J10 and J13 are listed in **Table 1-2** and shown in **Figure 1-5.**

Table 1-2 – Other schemes in the vicinity of the M1 Junction 10-13 Scheme

Scheme Name and Description	Current Status	Construction	
		Start	End
M1 J6a-10 Widening ***Description:*** *The M1 between Junction 6a and Junction 10 is now dual 4-lane motorway standard. The layout of Junction 10 was upgraded as a part of this scheme*	**Completed**	2006	2008
A507 Ridgmont Bypass ***Description:*** *The scheme includes a bridge to carry the road over the Marston Vale railway and two pedestrian/bridleway bridges.*	**Completed**	2006	2008
A1081 Airport Way ***Description:*** *The A1081 Airport Way is a new dual carriageway to the south of Luton that was opened to traffic in December 2008. The road links the M1 at Junction 10, 10A and Luton Airport.*	**Completed**	-	2008
A421 M1 Junction 13 to Bedford Improvement ***Description:*** *This scheme comprised 13km of new dual two and three lane carriageway between junction 13 on the M1 and the west side of Bedford at the junction with the A6.*	**Completed**	2008	2010
M1 Junction 10A Improvement ***Description:*** *The M1 Junction 10A Improvement scheme proposes to upgrade M1 Junction 10A from the existing at grade roundabout to a grade-separated junction. The scheme runs between M1 J10 (east), M1 J10a (east and west) and Capability Green (west).*	**Ongoing**	2014	2015
A5-M1 Link - Dunstable Bypass ***Description:*** *The A5 – M1 link will form a northern bypass to Dunstable linking A5 with the A505 Leighton Southern Bypass, to the M1via a new Junction 11A on the motorway.*	**Underway**	2015	2017
Woodside Connection ***Description:*** *The Woodside Connection comprises a new access route from the proposed new M1 Junction 11a and the south / east of Houghton Regis.*	**Planned**	2016	2018
M1 Junction 13 to 16 Smart Motorway ***Description:*** *M1 Junction 13 to 16 smart motorway all lane running is part of Highways England's recently announced programme to add capacity to the existing strategic road network in order to support economic growth and maintain mobility.*	**Planned**	2017	2019
M1 Junction 19 to 16 Smart Motorway ***Description:*** *M1 Junction 16 to 19 smart motorway all lane running is part of Highways England's recently announced programme to add capacity to the existing strategic road network in order to support economic growth and maintain mobility.*	**Planned**	2015	2017

Figure 1-5 – Other Schemes in the Vicinity of M1 Junction 10-13 HSR scheme



Post Opening Project Evaluation (POPE)

1.15 Highways England is responsible for improving the strategic highway network (motorways and trunk roads) by delivering the Major Schemes Programme. At each key decision stage through the planning process, schemes are subject to a rigorous appraisal process to provide a justification for the project's continued development. When submitting a proposal for a major transport scheme, the Department for Transport (DfT) specifies that an Appraisal Summary Table (AST) is produced which records the degree to which the DfT's objectives[1] for transport have been achieved. The contents of the AST allow judgements to be made about the overall value for money of the scheme. The AST for this scheme is presented in **Table 7.1** and **Table 7.2.**

1.16 POPE studies are carried out for all major schemes to evaluate the strengths and weaknesses in the techniques used for appraising schemes. This is so that improvements can be made in the future. For POPE, this is achieved by comparing information collected before and after the opening of the scheme to traffic, against forecasts made during the planning process. The outturn impacts of a scheme are presented in an Evaluation Summary Table (EST) which summarises the extent to which the objectives of a scheme have been achieved. The EST for this scheme can be found in **Table 7.3**

1.17 POPE of Major Schemes goes beyond monitoring progress against targets set beforehand. Instead, it provides the opportunity to study which aspects of the intervention and appraisal tools used to evaluate it are performing better or worse than expected, and how they can be made more effective. More specifically the objectives of POPE evaluation reports are as follows:

- Provide a quantitative and qualitative analysis of scheme impacts consistent with national transport appraisal guidance (WebTAG) and scheme specific objectives.
- Identification and description of discrepancies between forecast and outturn impacts.
- Explanations of reasons for differences between forecast and outturn impacts.
- Identification of key issues relating to appraisal methods that will assist Highways England in ongoing improvement of appraisal approaches and tools used for major schemes.

Report Structure

1.18 The remainder of this report is structured as follows:

- Section 2 – Traffic Impact Evaluation. This section looks what impacts the scheme had on traffic volumes and journey times on the M1 and surrounding roads.
- Section 3 – Safety Evaluation. This section compares the pre and post opening collision numbers and looks at collision rates.
- Section 4 – Economy Evaluation. This section compares the monetary value of any changes in journey times and collisions and compares these benefits with the cost.
- Section 5 – Environment Evaluation. This section looks at the environmental impacts of the scheme and the success of any mitigation.
- Section 6 – Accessibility and Integration Evaluation. This section contains a review of the scheme impacts on accessibility for pedestrians and cyclists and considers the impact of the scheme on local land use and Government Policies.
- Section 7 – Appraisal Summary Table (AST) and Evaluation Summary Table (EST). This section contains an overview of the actual scheme impacts compared to those predicted in the original AST.

[1] As of August 2011, this approach has been revised. However, POPE is concerned with evaluation against the appraisal and as such use objectives valid at the time of appraisal.

- Section 8 – Conclusions. This section summarises the main findings of this study against the key objectives.

1.19 There are also a number of appendices listed below as follows:

- Appendix A – List of Tables and Figures.
- Appendix B – Glossary.
- Appendix C – Information requested for Environmental Section
- Appendix D – Photographic Record of the Scheme

2. Traffic Impact Evaluation

Introduction

2.1 This section examines traffic data from a number of sources to provide a before and one year after opening comparison of traffic flows and journey times on the scheme and other roads in the vicinity. The purpose of this evaluation is to understand whether changes in traffic flows and journey times may be attributable to the scheme.

2.2 This section comprises:

- A summary of the sources used to compile data for this evaluation.
- A description of national, regional and local background traffic trends to provide context against which observed changes in actual traffic can be considered.
- A detailed comparison of before and one year after traffic flows on key routes in the study area likely to be affected by the scheme.
- An evaluation of key differences between the forecast and outturn impacts of the scheme in terms of traffic flows and journey times to identify whether traffic flow changes were as expected or otherwise. Consideration is then given for any differences to identify whether alternative approaches in scheme appraisal would have led to a more accurate forecast.

Data Sources

2.3 This section of the report uses data from several sources to inform the before and after analysis of changes in traffic volumes and journey times on key routes that may be attributable to the scheme.

Traffic Count Data

2.4 For the purposes of this evaluation study, the main sources of traffic count data include the following:

- Permanent count data obtained from the TRADs[2] database for count locations on the strategic road network.
- Pre-scheme 24-hour classified automatic traffic count (ATC) data conducted in October 2009 and post-opening 24-hour classified ATC surveys conducted in July 2014, commissioned for the purpose of this study.
- Permanent monitoring count site data provided by Luton Borough Council (LBC), both pre-scheme and post-opening.
- Permanent monitoring count site data provided by Bedford Borough Council (BBC), both pre-scheme and post-opening.

Journey Time Data

2.5 Satellite navigation data[3] for the mainline M1 between J10 and J13 has been used to determine if there has been a change in the average journey times and whether the distribution of the journey times has changed since the introduction of the scheme. Journey times for March 2009 have been compared with March 2014 after opening. Trafficmaster data has also been interrogated at

[2] TRADS is the Highways Agency website containing traffic flow data from automatic traffic counts on the HA's strategic network.
[3] Motorists who use satellite navigation devices have the option to voluntarily allow anonymous data about their journeys to be collected and used to provide a range of services, including the analysis of historic journey times along specified routes.

the two upgraded junctions to ascertain any changes in traffic speeds at the junction, for both slip road and local road traffic.

Halogen Data

2.6 Halogen data is available from Highways England and can be downloaded for the message screens displayed on overhead gantries forming part of a managed motorway scheme. The data can be used to determine when, and for how long, the hard shoulder was open for traffic and the different speed limits in place as part of the variable speed limit (queue protection) used in Smart Motorways.

MIDAS Data

2.7 MIDAS data available from Highways England provides lane by lane traffic flows and speeds. MIDAS technology forms part of the Smart motorway operation, but records of lane by lane speeds and flows, together with the settings from the overhead gantries from Halogen data (i.e. whether the hard shoulder is open and what speed the Variable Mandatory Speed Limit is operating at) can provide additional insight into the operation of the Smart motorway. As this data forms part of the Smart motorway, it is not possible to perform a pre and post analysis.

Background Changes in Traffic

2.8 Historically in POPE scheme evaluations, the 'before' counts have often been factored to take account of background traffic growth so that they are directly comparable with the 'after' counts.

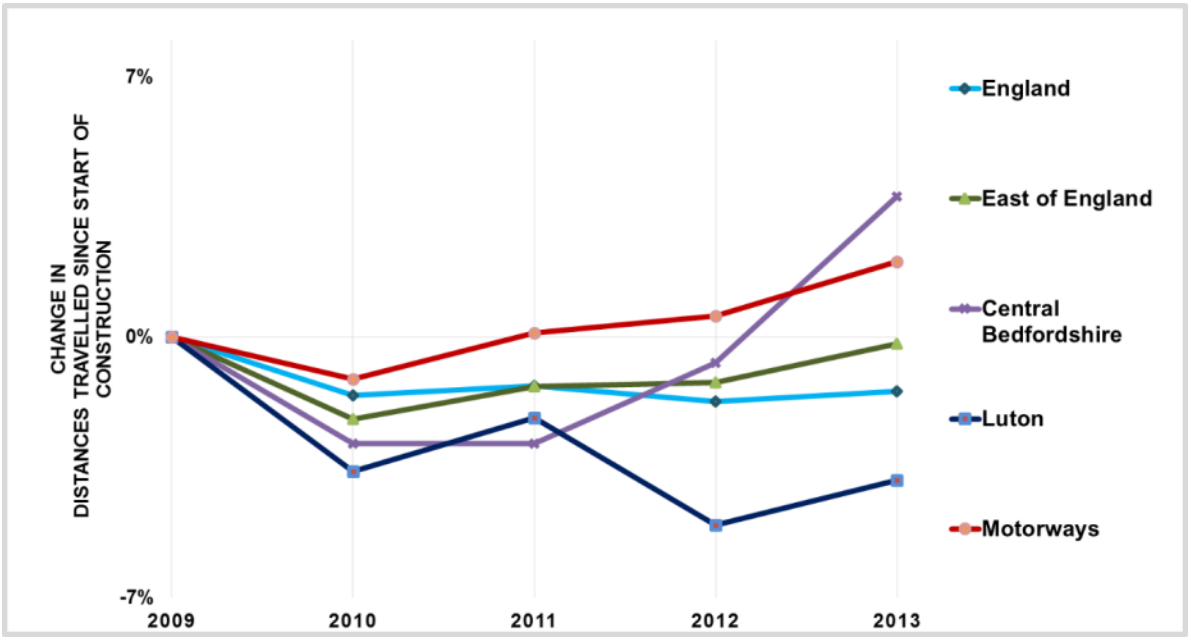
2.9 However, in light of the recent economic climate, which has seen widespread reductions in motor vehicle travel in the United Kingdom (UK) as a whole since 2008, it is no longer deemed appropriate to use this method of factoring 'before' counts to reflect background changes in traffic. Rather, recent POPE studies have taken a more considered approach in order to assess changes in the vicinity of the scheme, within the context of national, regional and locally observed background changes in traffic.

National Trends, Regional and Local Trends

2.10 The Department for Transport (DfT) produces observed annual statistics for all motor vehicles by local authority[4]. Data between 2009 (before start of construction) and 2013 (the latest available) is shown in million vehicle kilometres (mvkm) for Luton, Central Bedfordshire, East of England and England in **Figure 2.1.** Non location specific trends on motorways are also shown.

[4] Motor vehicle traffic (vehicle kilometres) by region in Great Britain, annual from 1993 to 2013. Table TRA8904 (Department for Transport).

Figure 2.1 – National, Regional and Local Traffic Trends



2.11 It can be seen from ***Figure 2.1*** that:

- Traffic levels in England show an initial decrease of around 2% from 2009 to 2010 (during the construction period for this scheme); but traffic levels then increase in 2011 through to 2013.
- Traffic levels in the East of England show a decrease of around 2% from 2009 to 2010; however, 2011-13 figures indicate a slight increase as compared to 2010, although traffic levels remain lower than the base year of 2009.
- Central Bedfordshire traffic levels show a similar decrease between 2009 and 2010. Traffic levels show a large increase from 2011 to 2013.
- Traffic trends in Luton have decreased from 2009 to 2013 with the slight increase in traffic in 2011.

Long Term Traffic Trends

2.12 The remainder of this section explores the changes that have occurred since the opening of the scheme, and attempts to establish to what degree the changes can be attributed to the scheme, it is therefore fitting to establish how the M1 motorway fits within this wider context of background traffic changes. A control site has been chosen on M1 between J14 and J15 to the north of the scheme. **Table 2-1** shows the change in annual average daily traffic (AADT) by direction observed between 2009 and 2013 for the control sites.

Table 2-1 – Long Term Trends in AADT

Year	AADT		Factor of Change from 2009 (%)	
	M1 J14-15		M1 J14-15	
	NB	SB	NB	SB
2009	54,400	56,000	-	-
2010	53,900	54,300	-1%	-3%
2011	53,100	53,700	-2%	-4%
2012	54,000	55,000	-1%	-2%
2013	56,100	57,100	3%	2%

2.13 It can be seen from Table 2-1 that traffic levels on the M1 to the north of the scheme have followed the trend of traffic shown in **Figure 2.1**, of a small reduction between 2009 and 2011. A recovery is seen between 2011 and 2013, with flows in 2013 being around 2-3% higher than seen in 2009 just prior to construction.

Conclusions on Background Growth

2.14 This section has considered a number of issues which may have influenced observed traffic flows pre-scheme and post-opening.

2.15 In addition to the implementation of the scheme itself, it is clear that other factors such as the economic recession since late 2008 have also had noticeable impacts on traffic flows.

2.16 As traffic trends in the study area show inconsistent trends between 2009 and 2013, with some areas showing a decrease in traffic followed by a recovery by 2013, others show traffic levels in 2013 as being lower than in 2009, it is not appropriate to derive a factor to apply to the before traffic counts to account for background traffic changes.

Traffic Volume Analysis

2.17 Changes between pre-scheme and post-opening traffic flows on key roads in the near vicinity of M1 J10-J13 are considered in detail here, in order to assess the impact of the improvements.

2.18 This section of the report uses data from a variety of sources to inform the before construction (2009) and after opening (2014) analysis of changes in traffic volumes and journey times for the scheme.

2.19 The locations of the main traffic count data sources used in this evaluation are shown in **Figure 2.2** and **Figure 2.3** for the TRADS locations and for the local roads alongside details of each traffic count site. Flow changes at J11 and J12 are also considered in this chapter, but are not shown on this map. The locations of the counts sites are also mentioned in **Table 2-2.**

Table 2-2 – Traffic count locations and Map Reference

	Map Reference	Site Name and Description
TRADS	B	M1 between J11 and J12
	C	M1 between J12 and J13
	D	M1 between J10 and J11
	A	M1 between J14 and J15
	E	M1 between J9 and J10
	F	M1 between J13 and J14
	G	A5 between A5120 and A505
	H	A5 between A4012 and B4100
	I	A5 between B4100 and A4146
	J	A5, Little Brickhill
Luton CC	1	Lower Harpenden Rd
	2	Toddington / Luton Rd
	3	Dunstable Rd EB
	4	Barton Rd
	5	Farley Hill
	6	Hatters Way
	7	Sundon Park Rd
	8	London Rd
	9	Airport Way
Bedfordshire and ATC	10	A5120 Harlington Rd, North East of Toddington
	11	A5120 Park Rd, Westoning
	12	A5130 Woburn Road, Woburn Sands
	13	A507 Ridgmont Bypass-North of Bypass
	14	North of Beckerings Park Road
	15	Harlington Road (North of M1)
	16	Sundon Road (West of M1)
	17	North of Thorn Road
	18	East of Toddington

Observed Traffic Flows

2.20 A comparison of pre-scheme and post-opening 24-hour Average Weekday Traffic (AWT) flows along the scheme section is presented in **Figure 2.4.** The change in traffic flows across the wider area is shown in **Figure 2.5.** The percentage change in flow at OYA compared to the before stage is indicated by colour code.

Figure 2.2 – Location of TRADS Count Sites

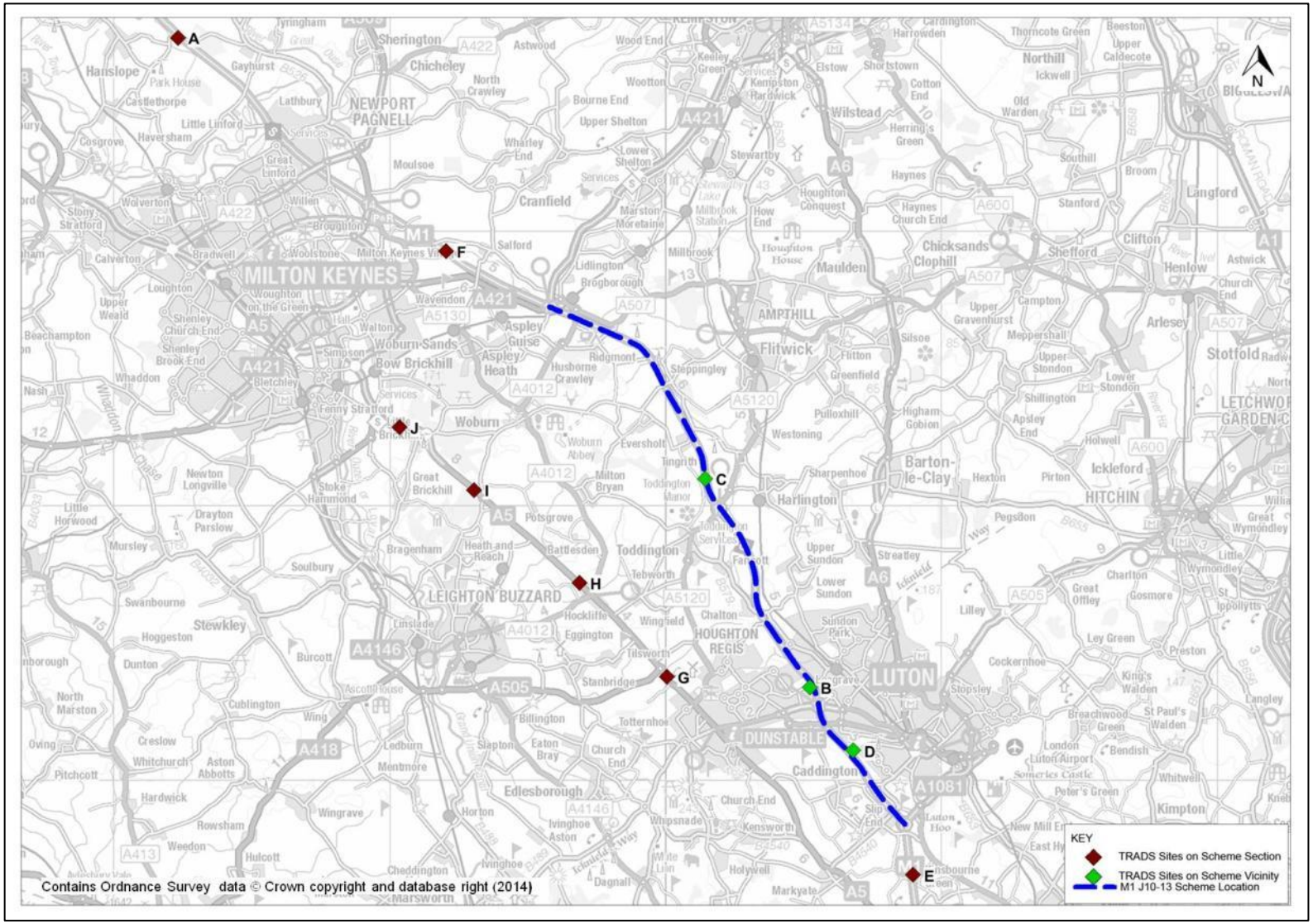


Figure 2.3 – Location of Count Sites in the wider area

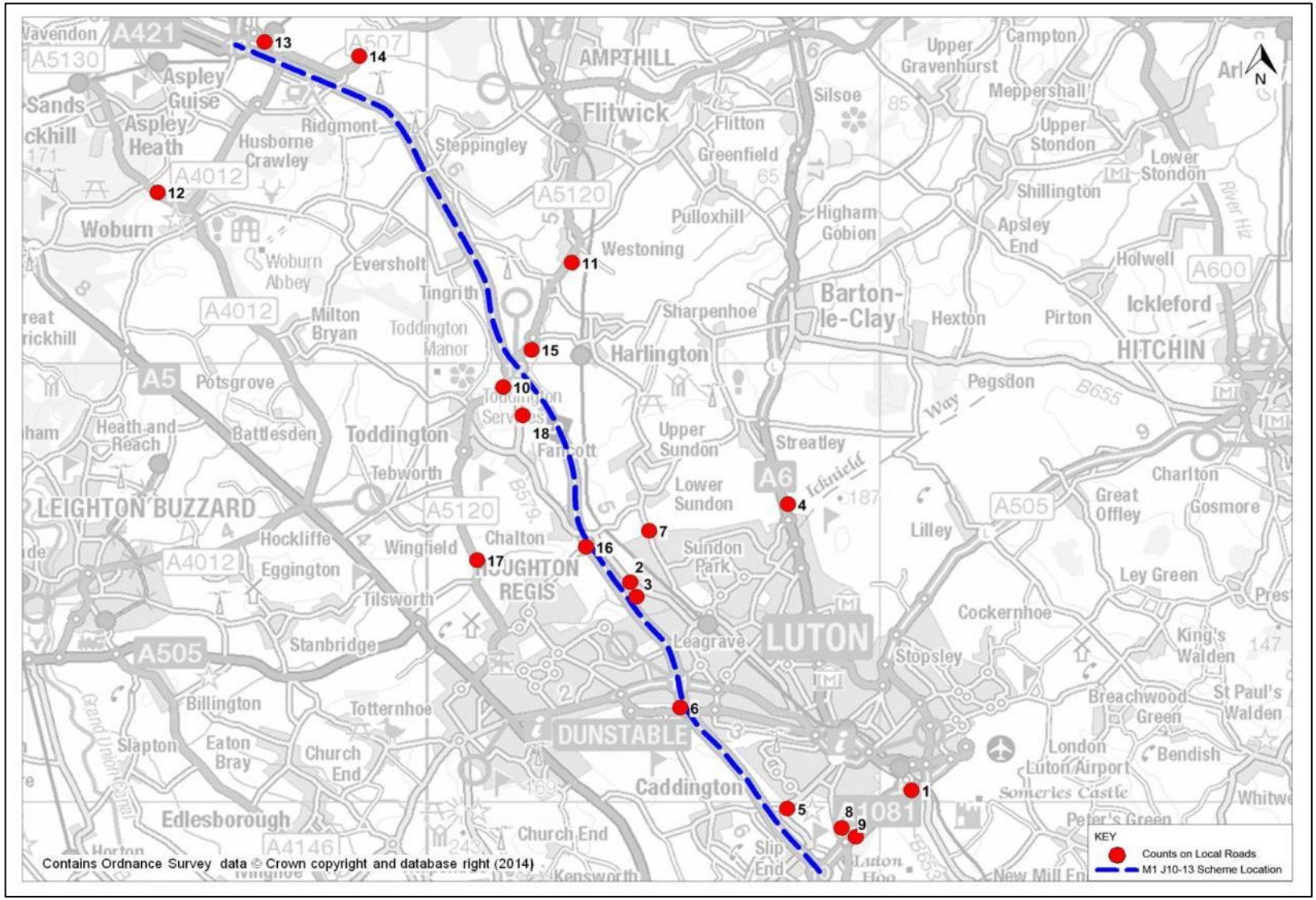


Figure 2.4 – Comparison of Pre-scheme and Post-opening Two-way AWT for the strategic locations

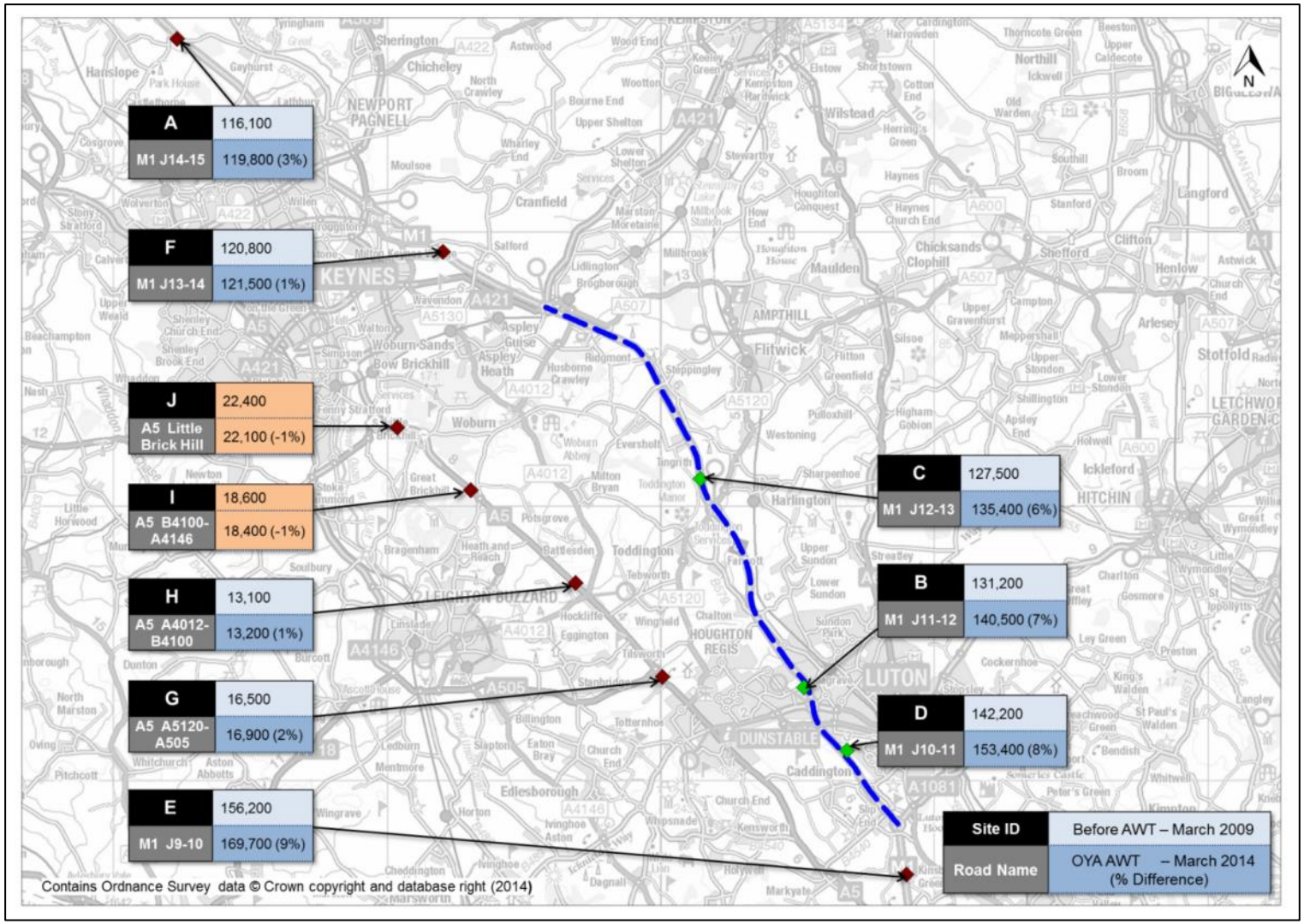
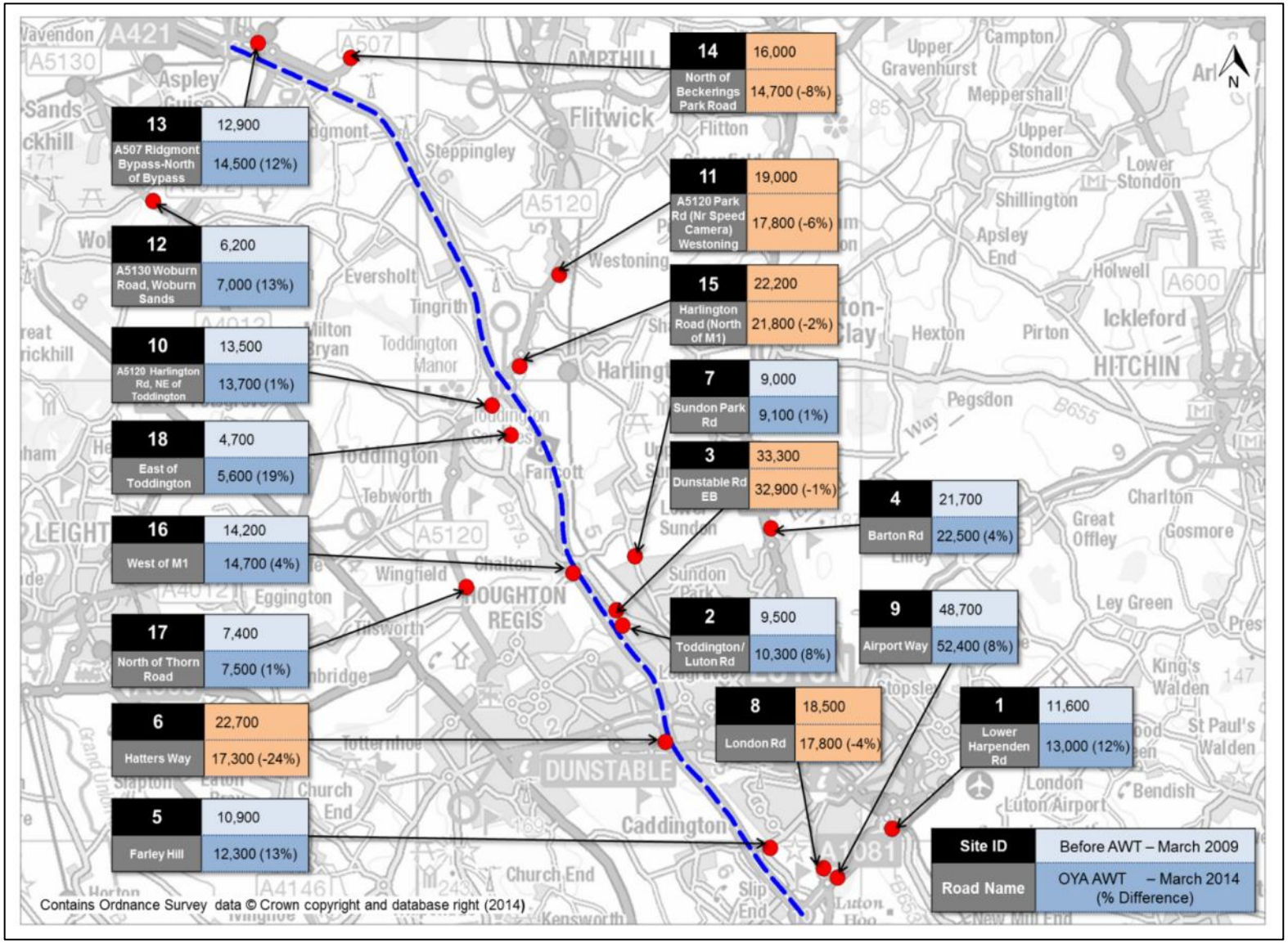


Figure 2.5 – Comparison of Pre-scheme and Post-opening Two-way AWT in the wider area



2.21 The following observations can be made regarding changes in average AWT along the scheme section, other motorways and local roads in the study.

Scheme section

- Traffic volumes on the section of the scheme have increased at the one year after stage.
- An increase of 8% is observed between J10 and J11. The middle section of scheme (J11 to J12) has seen an increase of 7% whereas at the end of scheme (J12 to J13) the change in traffic is 6%. This is against a background growth of 2% regionally suggesting the additional traffic may be a result of scheme in place.

Other sections along the M1

- It can be seen that the traffic at the northern end of the study area on the M1, between J13 and J14 and J14 and J15, has shown a negligible increase of 1% and 3% respectively. To the south of the scheme, between J9 and J10, traffic has increased by 9%. The M1 J6a to 10 widening scheme opened in 2008, so part of this increase may be associated with the combined impact of the two schemes.

Effect of scheme on parallel route A5

- Traffic flows were analysed along the A5 to determine the effect of the scheme on this parallel route.
- Along the southern section of A5 i.e. around the Toddington area; there is a slight increase in traffic of 1% to 2%.
- At the northern end of the section i.e. parallel to M1 J13 and J14, there is a slight decrease in traffic of 1%. The decrease is likely to be due to the increased capacity on M1 which provides traffic relief for the A5 that runs parallel and is an alternative to the M1.

Other Local Roads in the Study Area

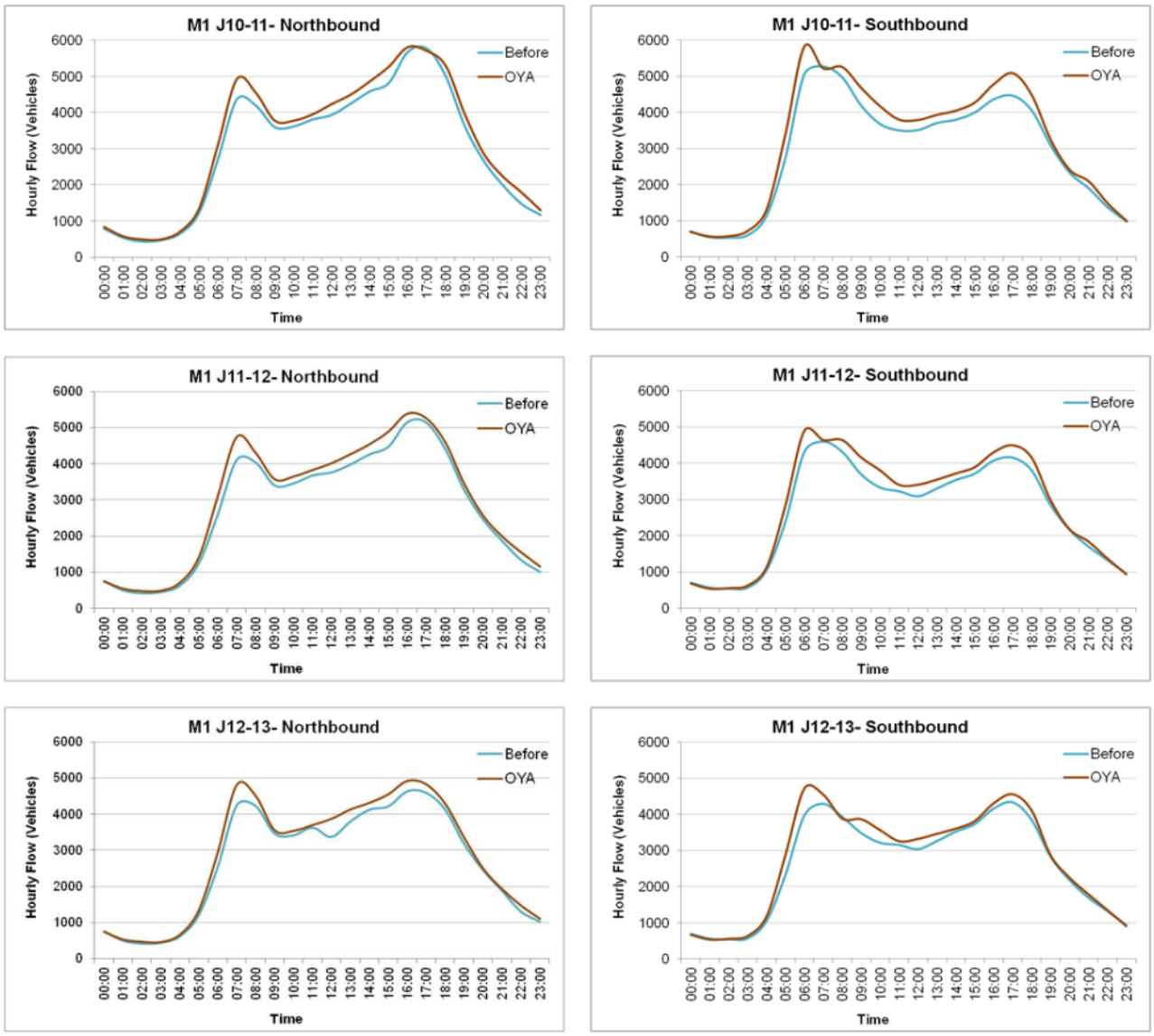
- Almost all of the other A roads where data is available within the study area have shown an increase in traffic volumes between the before and OYA period.
- Along the Hatters Way Road (site 6) which joins the M1 to the south of J11, there has been a noticeable decrease in average weekday traffic flow of 24% whilst there has been an increase in traffic along the other roads which joins the M1 from the west.
- There has been a slight decrease in traffic along the local roads joining the M1 junctions from the east, whereas Toddington Road, Harpenden Road, Airport Way, Sundon Park Road and Barton Road have shown an increase of traffic.
- This provides a clear indication that traffic was re-routed post scheme opening, to utilise the increased capacity on the M1. This re-routing will bring positive benefit to the local communities through which the local road passes.

Hourly Distribution of Flows on the M1

2.22 As shown previously, flows have increased on the scheme section post opening. The hourly distribution of flows across the day can be used to determine the nature of peak flows on a particular link, and whether peak periods have altered post opening.

2.23 The following figures present the hourly profile of traffic throughout an average weekday, before and one year after opening for the three sections of the scheme where data is available.

Figure 2-6– Hourly Flow Profile on various sections of M1 between J10 and J13



2.24 The following conclusions can be drawn from **Figure 2-6:**

- At OYA, each section has seen an increase in traffic, particularly in the AM and PM peaks.
- Whilst the increase in flow is evident in the AM and PM peaks and, to some extent, during the inter peak period, the flow has remained the same during the off-peak/overnight period, which was comparatively uncongested pre scheme.
- There is evidence therefore of congestion pre scheme leading to the suppression of traffic in the peaks which has either rerouted or re-timed into the peaks on the M1 after opening of the scheme.

Traffic flow changes at the improved junctions

2.25 The impact of the scheme on traffic flow at the improved junctions is shown in more detail here. **Figure 2-7** shows the observed changes at J11 and **Figure 2-8** shows the observed changes at J12.

Figure 2-7– Before vs. After opening traffic flows at M1 Junction 11

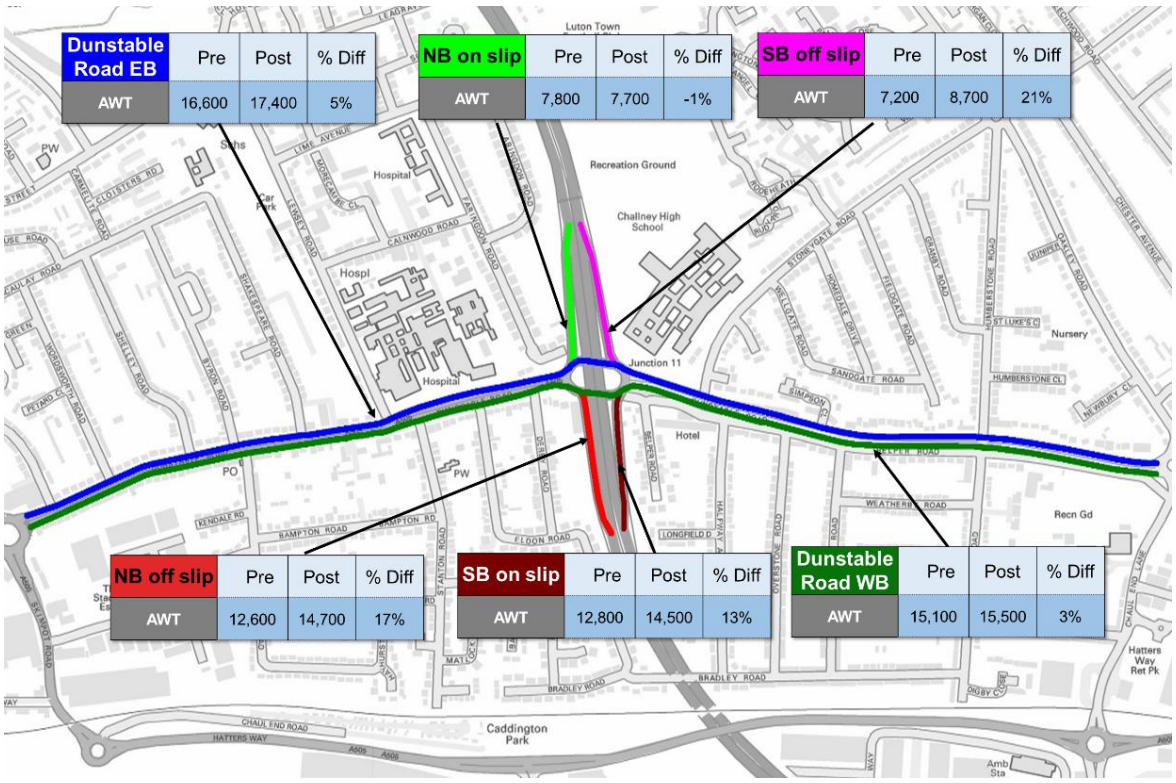
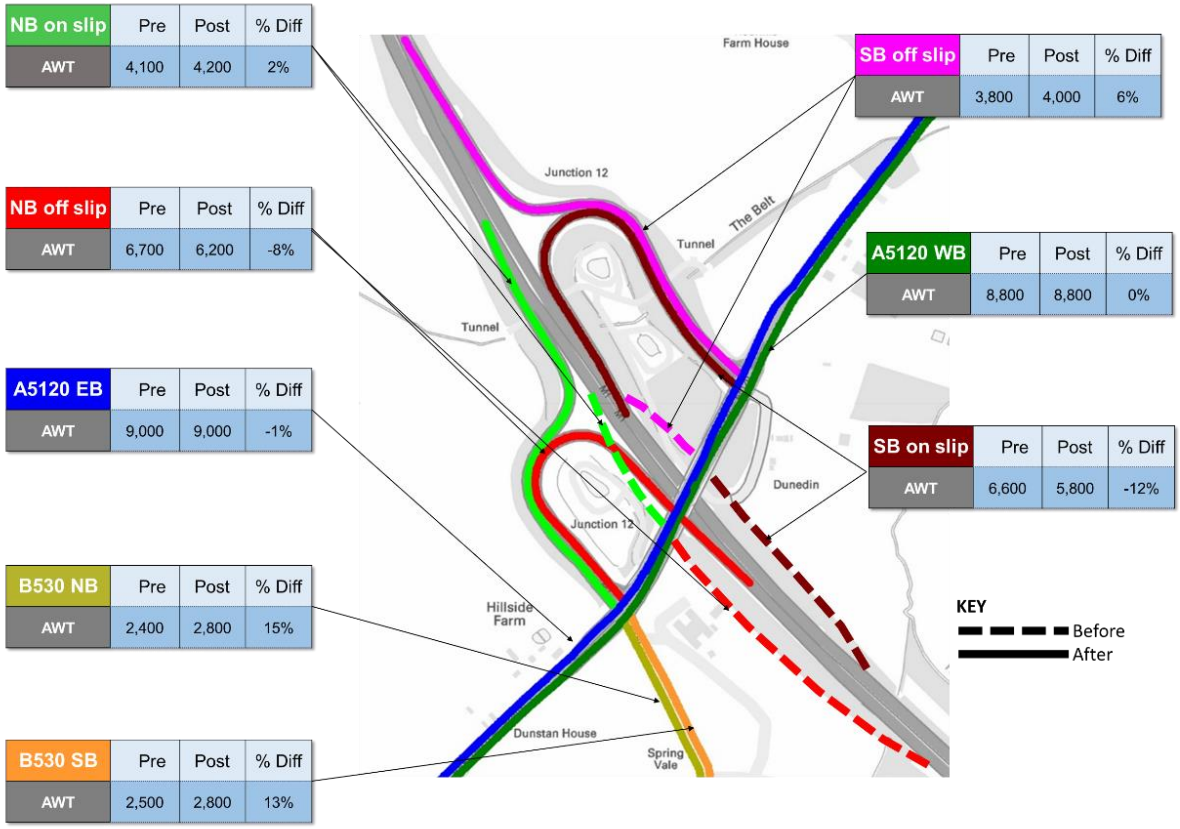


Figure 2-8– Before vs. After opening traffic flows at M1 Junction 12



The traffic flow changes presented in Figure 2-7 and Figure 2-8 shows the following:

- At M1 J11:
  - Traffic flows on the northbound and southbound off slips have increased. This is likely to be due to the increased capacity provided by the junction improvement scheme. On the southbound off slip the flows have increased by approximately 20%. This may be linked to the reduction in congestion in the AM peak at this location, as shown in Table 2.5 later in this chapter. The reduction in queuing may have attracted more traffic to this junction in order to access Luton.
  - Traffic flows on both on slips are similar with and without the scheme.
  - Flows on Dunstable Road both east and west of the junction have experienced a slight increase in traffic.
- At M1 J12:
  - Traffic flows on the A5120 east and west of the improved junction remain virtually unchanged.
  - There appears to be a clear pattern to the changes of traffic flows on the slip roads, with the M1 southbound on slip and M1 northbound off slip experiencing lower traffic flows and the M1 southbound off slip experiencing higher flows. There is no change at M1 northbound on slip.

Forecast vs. Outturn Traffic Flows

2.26 This section compares the observed traffic impacts of the scheme to the traffic changes forecast in the scheme appraisal. Before undertaking an evaluation of the forecast traffic impacts compared to those which have actually occurred, it is first necessary to develop an understanding of how the scheme was appraised and the key assumptions used. This may then assist in explaining any potential differences between the traffic forecasts and the observed impacts.

Traffic Modelling Approach and Forecast Assumptions

2.27 The local model developed for the appraisal of the proposed schemes consisted of a local assignment model (the 'LAM') and a strategic model (EERM). Both were developed using SATURN. Both models were developed independently although they were derived from the same original network structure. The strategic model was developed in order to cater the long distance north-south movements through the area.

2.28 The base month and year for the LAM was September 2005. The year 2005 was chosen because this date was prior to the start of construction of the adjacent M1 junction 6a to 10 scheme. The traffic management associated with these construction works reduced the traffic volumes on the M1 so were avoided for the base year.

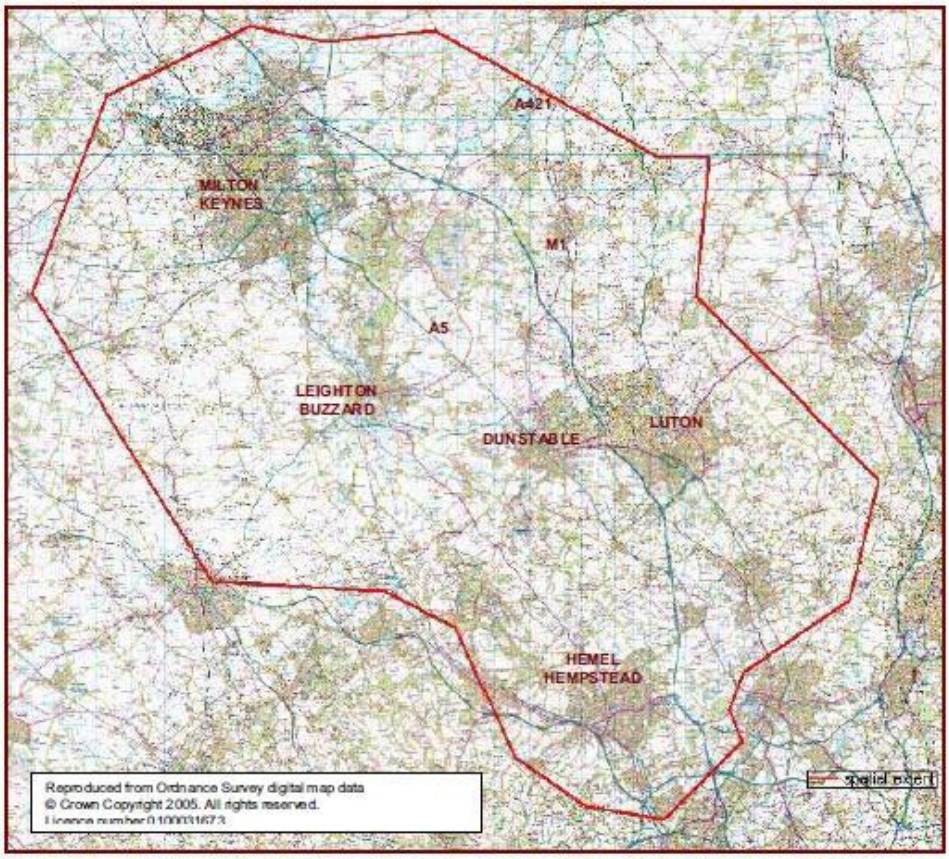
2.29 The years 2013 and 2028 are the scheme's opening year and design year respectively. The Do Minimum (DM i.e. without scheme) network was adapted from the base network with the addition of the following schemes, in the specified years:

Scheme	Included in Year
M1 Widening J6a to 10	2011
A421 dualling from M1 J13 to Bedford	2011
A421 dualling from M1 J13 to Milton Keynes	2016
A507 Ridgmont Bypass/Woburn Link	2011

Source: M1 J10-13 Traffic forecasting report

2.30 The spatial extent of the M1 Widening Junctions 10 to 13 LAM as shown in **Figure 2-9**.

Figure 2-9– Spatial extent of Local model



Source: M1 J10-13 LMVR

2.31 Two "With M1 J10-13 scheme scenarios" were tested in the model which includes:

- DSB – Without A5-M1 Link (Dunstable Northern Bypass)
- DSA – With A5-M1 Link (Dunstable Northern Bypass)

2.32 The traffic flow and economics figures[5] have been taken from the DSB scenario for the comparison with the evaluation results, as at the time of this evaluation, the Dunstable Northern Bypass has not been constructed.

2.33 The modelled time period considered are:

- AM Peak hour (0800-0900)
- Inter-peak average hour (1000-1600)
- PM Peak hour (1700-1800)

2.34 The overall planning data used in the model was constrained to TEMPRO and in particular the NTEM data set version 5.4.

Reassignment of Traffic

2.35 Reassignment effects on the local road network were examined in the forecast year models and some of the key reassignment effects are summarised below.

[5] Consistent with the Project Control Framework (PCF) Stage 3 Appraisal Summary Table for the M1 junction 10 to 13 Hard Shoulder Running Scheme (22/09/09) Version 3.

- Flows on the A5 north of Dunstable would reduce as a result of the scheme.
- Flows on the A5120 north-east of M1 J12 would increase as a result of improvements to J12.
- Flows on the A5120 south-west of M1 J12 (through Toddington) would increase as a result of improvements to J12.
- Flows on the A507 through Husborne Crawley would reduce as a result of the scheme.
- Flows on the A5 High Street North and south of Dunstable would reduce as a result of the scheme.

Forecasts vs. Observed Traffic Flows for the M1 scheme section

2.36 Forecast traffic flows and speeds are provided in the 'M1 Junctions 10 to 13 Improvement PCF Stage 5: Forecasting Report (January 2010)'. This report provides the forecast traffic flows which are presented for all the M1 mainline links between and adjacent to J10 to J13 of the M1, including both the flows between the junctions and the flows passing straight through the junctions in each modelled period, i.e. Morning Peak Hour, Inter Peak Hour and Evening Peak Hour for weekdays. **Table 2-3** presents the modelled Do Minimum(DM) flows and Do Something (DS) flows for the 2013 opening year and observed flows - pre-scheme (2009) and post-opening (2014) in the study area for each time period respectively. Observed flows are unadjusted for background traffic growth, as noted in the previous sections. No forecast flows were available for the slip roads at the improved junctions.

Table 2-3 – Forecast vs. Observed Traffic Flows- Two way Peak hour flows

Time Period	Section	Forecast			Observed		
		DM-2013	DS-2013	% Diff	2009	2014	% Diff
AM Peak Hour (08:00-09:00)	J10-11	10,400	11,900	13%	9,200	9,800	6%
	J11-12	9,800	10,700	8%	8,400	8,900	6%
	J12-13	9,600	10,300	7%	8,200	8,400	2%
Inter Peak Hour (10:00-16:00)	J10-11	9,800	10,600	8%	7,900	8,400	6%
	J11-12	8,900	9,700	8%	7,300	7,800	6%
	J12-13	8,400	8,800	5%	7,100	7,500	5%
PM Peak Hour (17:00-18:00)	J10-11	10,700	13,200	19%	10,200	10,800	6%
	J11-12	9,900	12,000	18%	9,300	9,800	5%
	J12-13	9,600	11,100	14%	8,900	9,400	5%

2.37 It can be seen from the **Table 2-3** that:

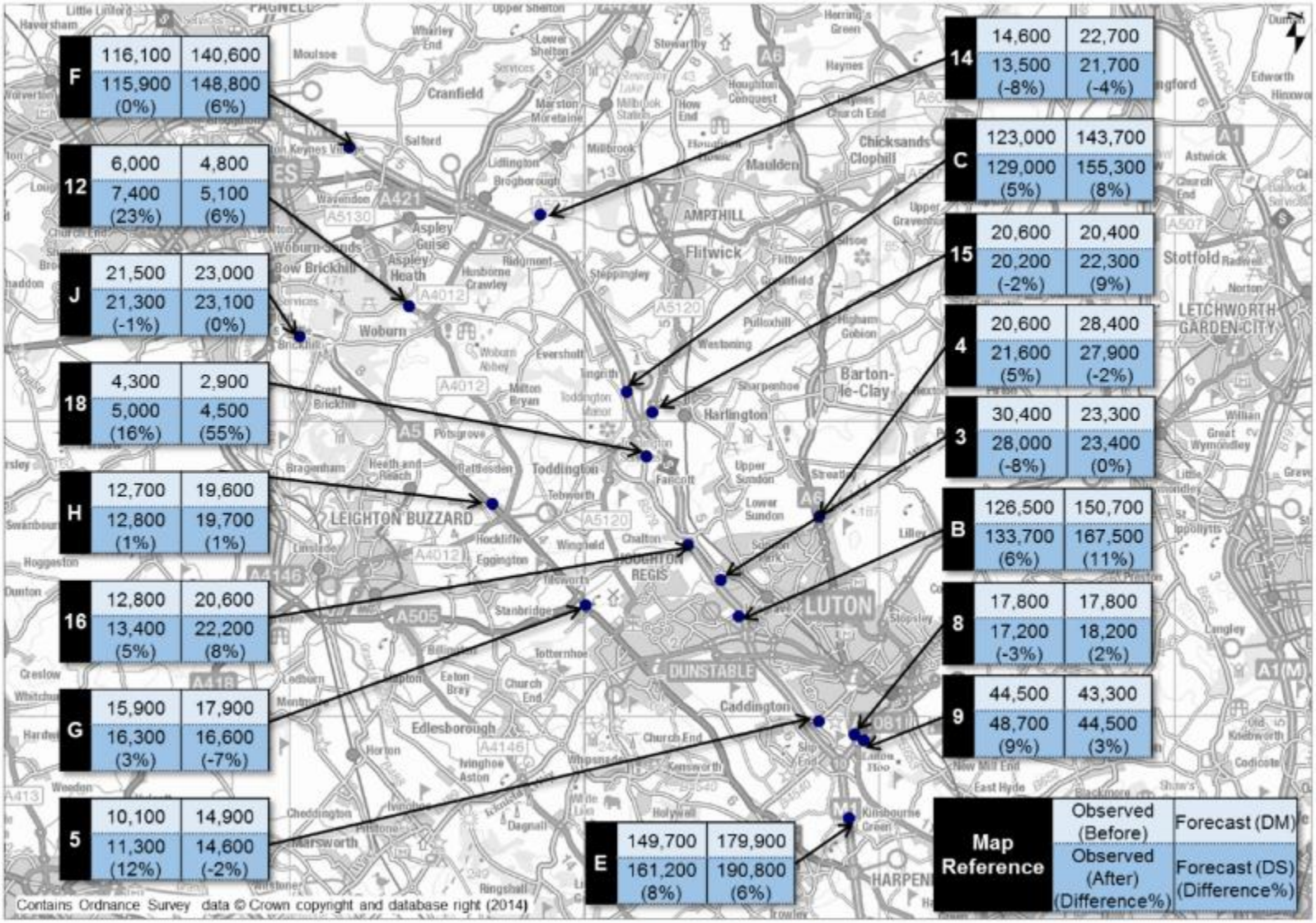
- The average increase along the scheme section was forecast to be approximately 9% in the AM peak, 7% in the interpeak and 17% in the PM peak, whereas the observed increase is 5%, 6% and 5% respectively.
- The forecasts assumed a consistent growth in background traffic between the base year of 2005 and opening year of 2013, whereas the observed trend shows only modest growth in traffic between 2009 and 2013 in both national and regional traffic data. This suggests that the forecasts overestimated the traffic using the corridor in the opening year. In this case the 2009 before scheme traffic is considered comparable to the DM 2013 value due to the modest growth between 2009 and 2013.
- The forecast difference between DM and DS is consistent with the observed change during the interpeak period.
- The main difference between the forecast and observed values is the increase in traffic with the scheme in place, which is far lower in the observed traffic flows than was forecast. There are some ongoing works such as resurfacing works at J12, installing some

additional CCTV cameras, environment barriers etc. requiring some overnight closures which might have had an impact on the daily traffic flow, but would not be expected to affect the peak hour traffic.

Forecasts vs. Observed Traffic Flows for the wider area

2.38 In **Figure 2-10**, the observed traffic flows “Before” and “OYA” are compared against forecasts for the Do Minimum and Do Something scenario. The published forecasts were for 2013.

Figure 2-10– Forecast vs. Observed Traffic Flows- Two Way ADT



2.39 It can be seen from **Figure 2-10** that:

- The average increase along the scheme section (Site B and C) was forecast to be approximately 8%, whereas the observed increase is approximately 5%. This increase in traffic is likely to be a result of traffic being attracted to the M1 corridor as a result of the increased capacity from the scheme.
- The observed traffic along the A5 (Sites H, G and J) shows an increase with the exception of a minor decrease at Site J. This can be compared to a forecast decrease on the A5 of 7%. This shows that the reassignment effect that was forecast was not fully realised with the scheme in place.
- The scale of the observed and forecast impact on local roads along the west of the scheme was consistent. Other locations in the study area have not been this consistent with increases in the observed traffic flows compared to decreases in the forecasts and vice versa.
- Based on the observed trends for almost all the local roads in the wider area, the change in traffic between DM and DS is likely due to additional strategic traffic movements, with few local movements switching to the new scheme, whereas the traffic forecasts predicted both local and strategic movements on the scheme.

Journey Time Analysis

2.40 This section considers the impact on journey times following the scheme's implementation. Pre-scheme journey times along the M1 route are compared with post-opening journey times for both directions. The journey time analysis is split into three components:

- Analysis of pre and post-scheme journey time differences along the scheme.
- A comparison of forecast and outturn journey times along the scheme.
- A comparison of journey time reliability pre-scheme and post-opening.

2.41 The journey time periods assessed align with the modelled journey times in the Traffic forecasting report(TFR), and are as follows:

- Weekdays AM peak (08:00 to 9:00);
- Weekdays inter-peak period (10:00 to 16:00); and
- Weekdays PM peak (17:00 to 18:00).

2.42 The calendar periods used in this OYA study are:

- Pre-scheme: March 2009; and
- Post-Opening: March 2014.

Observed Journey Times and Speeds

2.43 Observed journey times have been obtained using satellite navigation data. This section analyses the journey time results along the M1 between J10 to J13. **Table 2-4** gives the direction wise pre-scheme and post-opening journey times along the scheme section and the observed savings in journey time.

Table 2-4 – Average Journey times and savings on the M1 J10-J13 (mm:ss)

Location	Time Period	Before	OYA	Savings (in seconds)	% Change
M1 J10-J13 Northbound	AM	00:14:49	00:16:40	-111	-12%
	IP	00:15:20	00:15:47	-27	-3%
	PM	00:17:12	00:17:00	12	1%
M1 J10-J13 Southbound	AM	00:16:58	00:20:38	-220	-22%
	IP	00:14:07	00:14:49	-42	-5%
	PM	00:14:48	00:15:48	-60	-7%

2.44 It can be seen from the table above that:

- In the northbound direction, average journey times for each peak period in the post-opening period are consistently higher than the pre-scheme journey times along the length of the scheme. An increase of 12% and 3% are shown for the AM and IP periods, where as in the PM peak a moderate time saving can be seen.
- Time savings have increased in the southbound direction in all time periods, with the largest increase of 22% being observed in the AM peak. Increases of 5% and 7% are seen in the IP and PM peaks respectively.
- Whilst the scheme has attracted additional traffic, this is unlikely to be the cause of the adverse impact on traffic speeds. This is more likely to be due to the operation of variable mandatory speed limits which are in place along the length of the scheme. The use of VMSL is considered at the end of this section.
- In general, the scheme has not resulted in journey time savings.

2.45 Traffic speeds for the mainline sections of the M1 can also be compared with and without the scheme in place as shown in **Table 2-5** below. Figure 2-11 to Figure 2-16 show the before and after speeds by direction for the AM and PM peaks.

Table 2-5 – Average Speed on the M1 J10-J13 (kph)

Location	Time Period	Before	OYA	Savings	% Change
M1 J10-J13 Northbound	AM	102	91	-11	-11%
	IP	98	95	-3	-3%
	PM	88	89	1	1%
M1 J10-J13 Southbound	AM	89	73	-16	-18%
	IP	107	102	-5	-5%
	PM	102	96	-6	-6%

2.46 It can be seen from **Table 2-5** that:

- As for journey times, the average speed for each peak period in the post-opening period are consistently lower than the pre-scheme journey times along the length of the scheme.
- As stated in the “Report to the Secretary of State for Transport and the Secretary of State for Communities and Local Government”, new technology was used as part of the HSR Scheme enabling mandatory speed limits to be applied to the motorway. When HSR is in operation, a maximum speed limit of 60mph would apply to all traffic although a lower speed limit may be applied if necessary during periods of congestion or in the event of an accident. In reality, the variable speed limits may not be operating at the most efficient level.

Figure 2-11– Speed AM Peak - Northbound

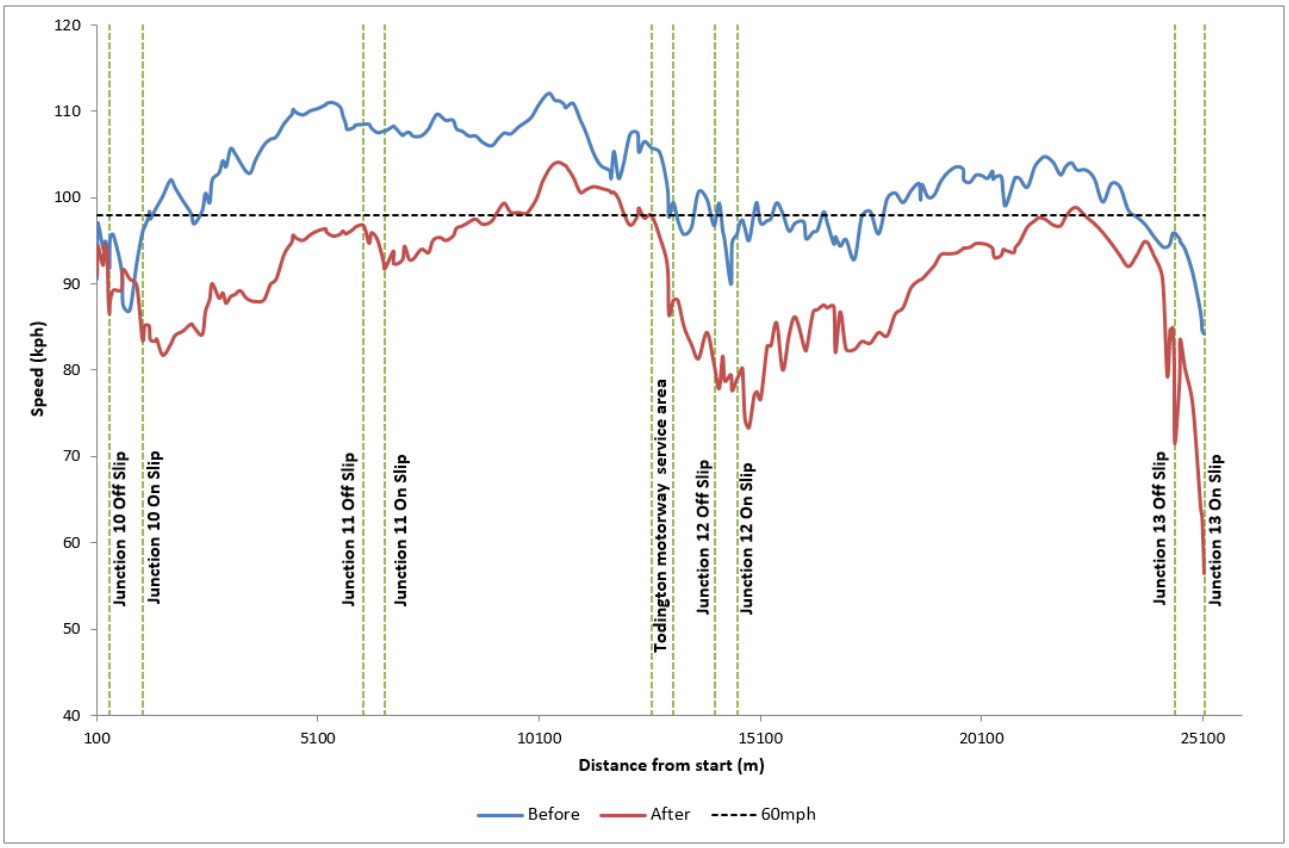


Figure 2-12– Speed AM Peak – Southbound

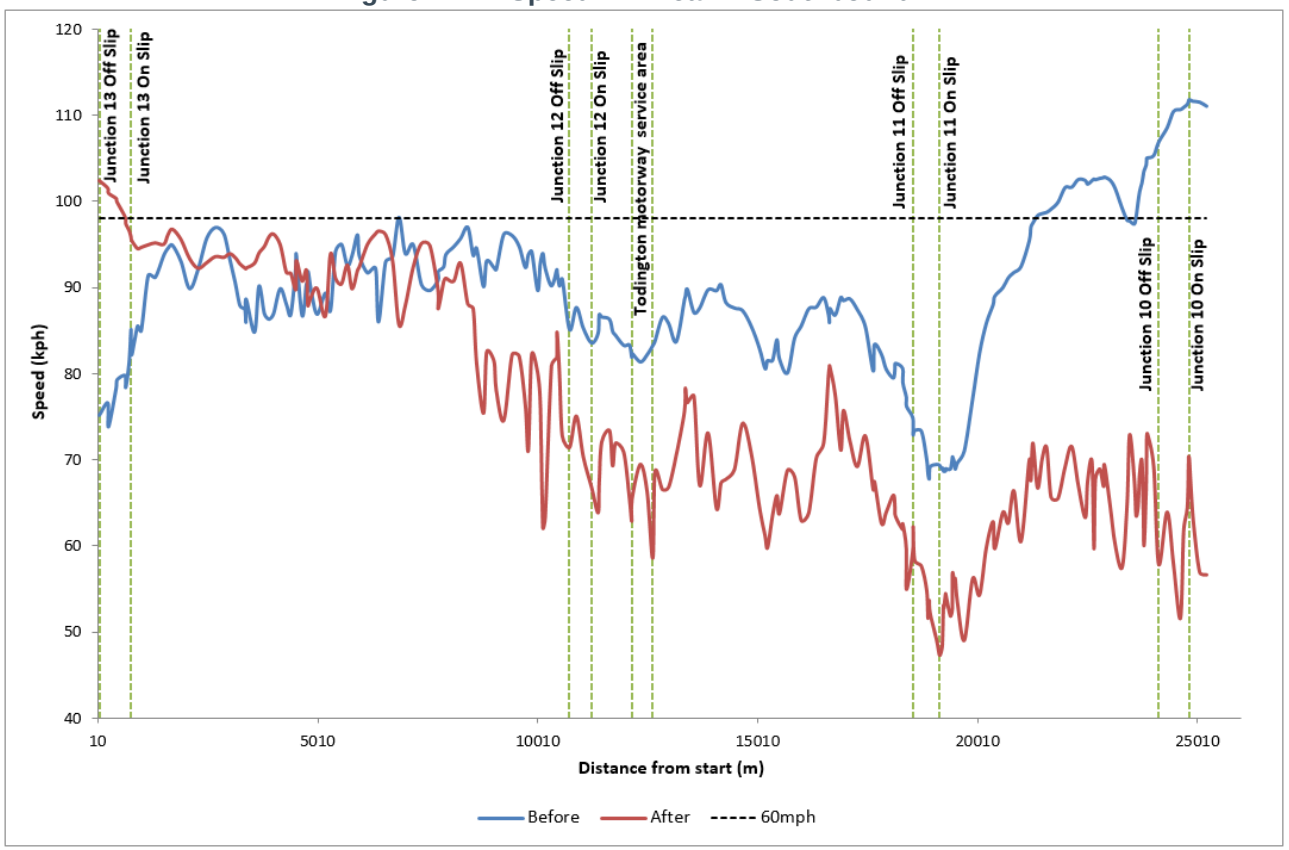


Figure 2-13– Speed Inter Peak - Northbound

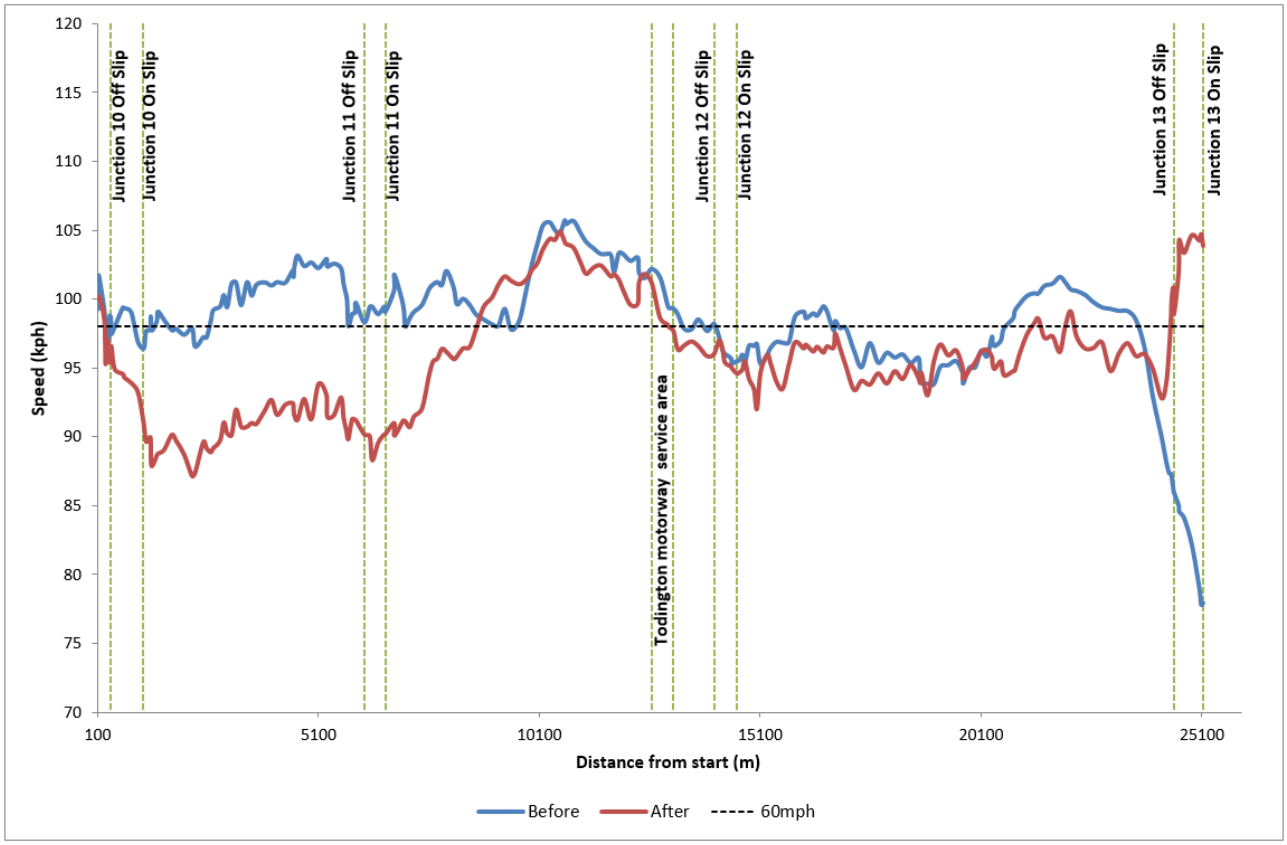


Figure 2-14– Speed Inter Peak – Southbound

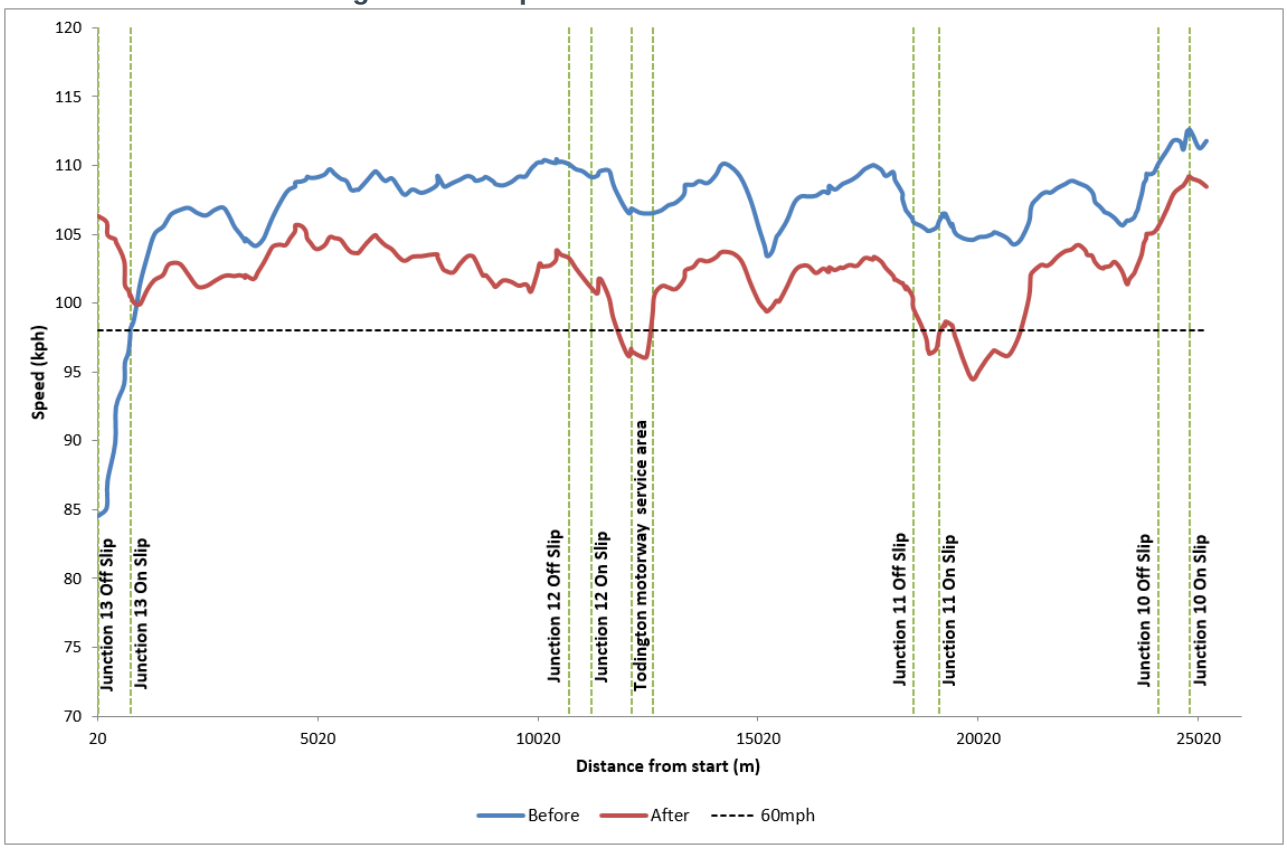


Figure 2-15– Speed PM Peak - Northbound

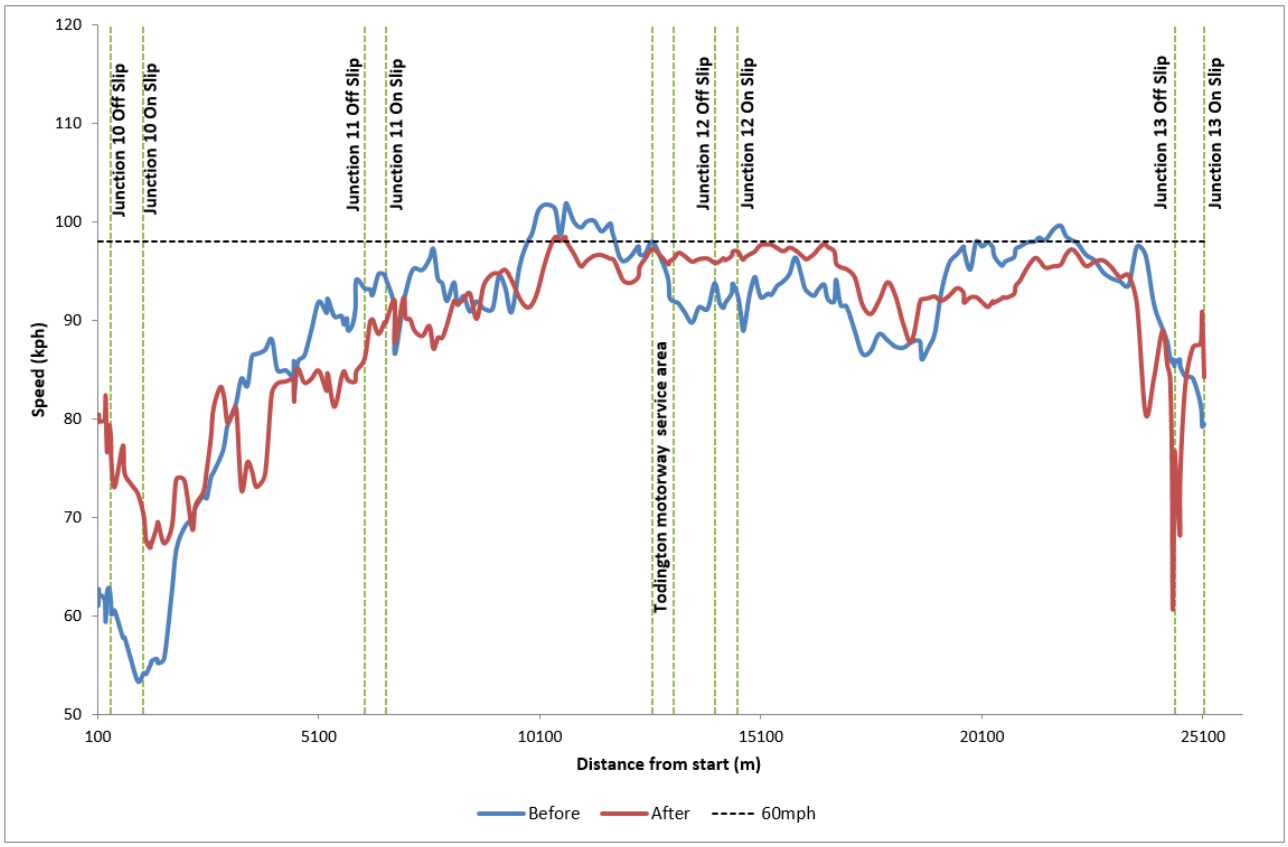
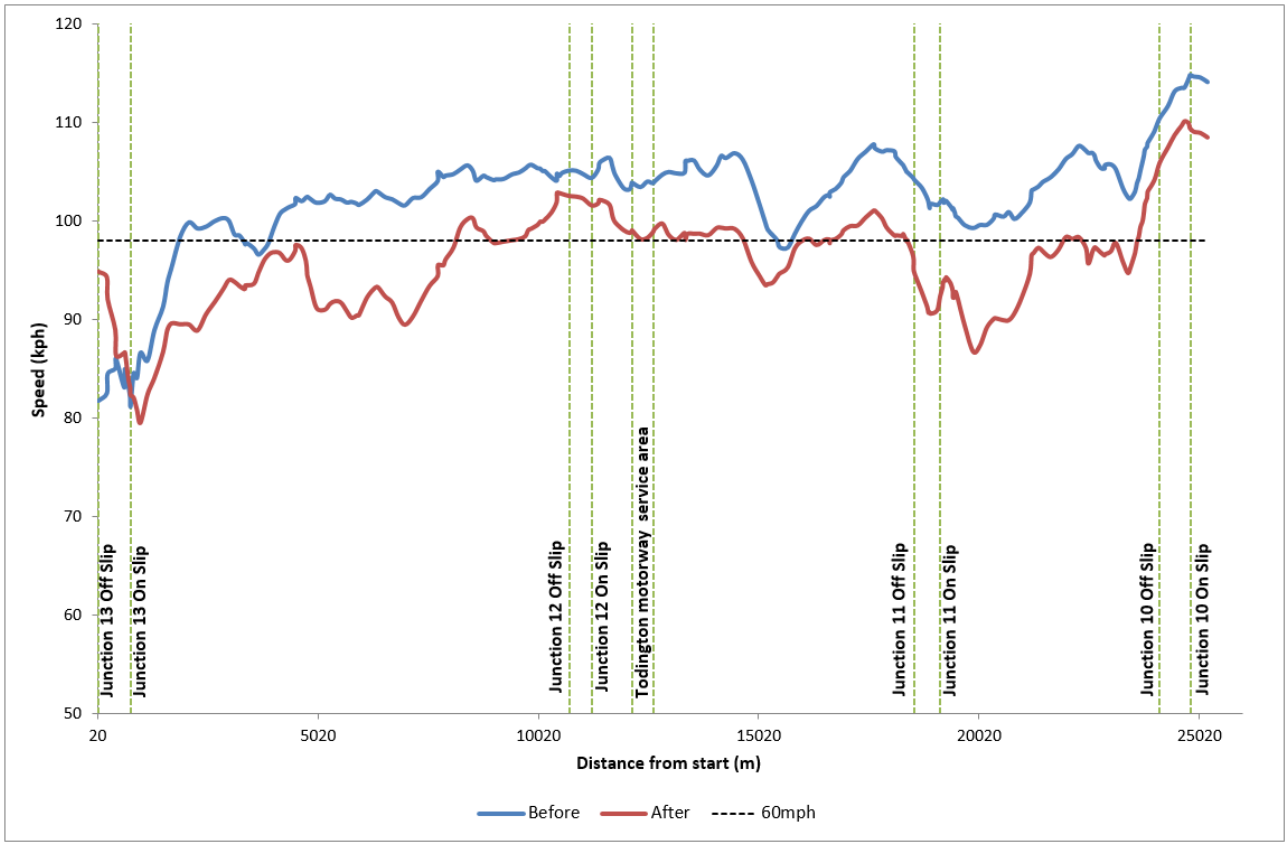


Figure 2-16– Speed PM Peak - Southbound



2.47 It can be seen from **Figure 2-11** to **Figure 2-16** that:

- Speeds have generally decreased along the length of the scheme for all the time periods.
- The speed trend remains the same in the 'before' and 'OYA' during all peaks in the northbound direction. In the southbound direction, the trend remains the same except at J10 and J13.
- Both in the 'before' and 'OYA', a speed reduction is seen in the vicinity of the junctions and also around the Toddington MSA.
- At J13 during all the peak hours at the OYA stage, there has been a reduction in speed in the northbound direction and an increase in speed in the southbound direction.

2.48 The consultation response received from Toddington Parish Council stated that:

- *The scheme has improved traffic and reduced the queuing at peak times at junction 12.*
- *The use of the speed limit reduction and the advisory statements about congestion seem to be used inappropriately at times.*
- *The speed limit of 60mph and the 'congestion- use the hard shoulder' notice was displayed when there were only a dozen vehicles in sight ahead of display. This resulted in some vehicles ignoring it and undertaking those vehicles that adhere to it.*
- *Junction 13: The traffic leaving the M1 and wishing to access the A507 including the traffic to the newly completed centre parks or HGV's accessing the distribution centre at Brogborough have a very short section of the old A421 before filtering right for the right turn. This leads to the both confusion and congestion at times.*
- *Junction 12: There was concern expressed about the whole of the design of this junction. In particular the entry lane to the M1 going south is far too short and ends suddenly and also while approaching the junction from the direction of Flitwick there is confusion for drivers unfamiliar with the area as counter-intuitively one turns north to go south. This leads to the confusion and congestion at the junction which may lead to the increase in journey time.*

Journey Times at M1 Junctions 11 and Junction 12

2.49 The Stage 5 Economic Assessment Report for the junctions published in February 2011 as part of the public inquiry notes the following. Prior to the scheme, J11 experienced heavy congestion in the peak periods, both on the A505 approaches and on the M1 off slips. J 12 experienced heavy congestion at peak times, and in order to reduce queuing back on to the mainline motorway, signal green times were weighted in favour of traffic exiting the motorway, resulting in long delays on the A5120 to the east and west in peak periods.

2.50 **Table 2-6** details the observed average speeds for traffic at a number of locations at each of the junctions, during the AM peak, interpeak and PM peak.

Table 2-6 – Before vs. After opening average speeds at the junctions (kph)

Junction	Route	Pre scheme average speed (2009) kph			Post scheme average speed (2014) kph			Difference (kph %)		
		AM (8-9)	IP	PM (5-6)	AM (8-9)	IP	PM (5-6)	AM (8-9)	IP	PM (5-6)
J11	A505 EB	14	27	12	13	30	19	-1	3	8
	A505 WB	20	32	23	15	32	26	-5	0	3
	NB off slip	28	29	16	21	21	21	-7	-8	5
	NB on slip	60	49	60	81	43	54	21	-6	-6
	SB off slip	20	26	26	59	23	23	39	-4	-3
	SB on slip	48	55	53	22	33	22	-26	-21	-31
J12	A5120 EB	31	45	32	41	43	41	10	-2	9
	A5120 WB	26	42	20	42	47	45	17	5	26
	B530 NB	49	60	45	59	60	65	11	1	20
	B530 SB	65	67	66	55	57	65	-10	-10	-2
	NB off slip	24	27	13	43	43	39	19	16	26
	NB on slip	56	56	58	60	62	64	4	6	6
	SB off slip	9	13	9	49	54	50	40	41	41
	SB on slip	56	59	58	38	57	56	-18	-2	-2

2.51 The key points to note from **Table 2-6** are:

- At M1 Junction 11:
  - The largest improvement is seen to the north of the junction, for southbound traffic in the AM peak and northbound traffic in the PM peak. This indicates that the additional capacity has helped to reduce congestion.
  - Limited improvements are seen for traffic travelling on the A505, but this is likely to be influenced by the introduction of traffic signals, which enforce stopping on the approach to the junction.
  - A disbenefit is seen for all time periods for traffic accessing the junction from the M1 northbound off slip. As shown earlier, traffic flows have increase on this approach by approximately 20%.
  - A worsening in journey time is seen on the SB onslip. It is unclear at this stage what has caused this – it may be linked to speeds on the mainline M1 delaying traffic joining.
- At M1 Junction 12:
  - The largest improvements at this junction come from traffic on the A5120 travelling westbound, which is likely to be due to the changes in signal priorities no longer penalising non motorway traffic. This is where the highest increase in speed was expected to come from, due to a reduction in queuing traffic.
  - Large speed increases are also seen on the M1 northbound and southbound offslips, this improvement in speed is partly offset by the increased length of the slip roads. The improved speeds are likely to be down to the change of layout and redesign of signals.
  - The M1 on slips have experienced limited change, although the southbound on slip shows a reduction in speed, which may be related to slow traffic between J12-11 (possibly around the MSA).

Halogen Data Analysis

2.52 Halogen Data has been downloaded for March 2014 for consistency with the traffic and journey time data used elsewhere in this report. The Halogen data has been used for the following purposes:

- To determine how much, on average, the hard shoulder was open for traffic during the different peak periods.
- To determine how much, on average, different speed limits were in place during the peak periods.

2.53 The peak periods used in this analysis are 0700-1000, 1000-1600 and 1600-1900 for the AM, interpeak and PM peaks respectively.

2.54 Halogen data has been used for each section and direction of the scheme. Halogen data points have been taken roughly in the centre of each junction to junction section. The speed limits set by VMSL can vary along a section of carriageway, so the speed limit analysis is relevant to the location chosen The HSR analysis is, however, appropriate for the full length of each section.

2.55 **Table 2-7** below presents the proportion of time that the hard shoulder is open for traffic on an average weekday in May 2014.

Table 2-7 – Use of HSR during weekday peak periods

	Location	Direction	AM	IP	PM
Average time HSR is in operation during peak period	M1 J10-J11	NB	00:57:31	00:58:14	02:36:46
		SB	02:53:55	00:47:22	01:46:17
	M1 J11-J12	NB	00:30:26	00:25:50	02:30:36
		SB	02:36:59	00:15:08	00:47:56
	M1 J12-J13	NB	00:19:20	00:17:58	01:59:57
		SB	02:37:27	00:04:20	00:39:02
% of peak period HSR in operation	M1 J10-J11	NB	32%	16%	87%
		SB	97%	13%	59%
	M1 J11-J12	NB	17%	7%	84%
		SB	87%	4%	27%
	M1 J12-J13	NB	11%	5%	67%
		SB	87%	1%	22%

2.56 It can be noted from **Table 2-7** that HSR is in operation for a high proportion of the AM peak in the southbound direction and the PM peak in the northbound direction. At the southern end of the scheme (J10-J11) the scheme is also on for a relatively high proportion in the opposite direction. HSR is not generally in operation during the inter-peak period, except at the southern end of the scheme.

2.57 **Table 2-8** considers a similar analysis for the weekends for 0700-1900.

Table 2-8 – Use of HSR during weekend daytimes

	Location	Direction	Saturday	Sunday
Average time HSR is in operation during peak period	M1 J10-J11	NB	00:00:00	00:30:25
		SB	00:29:53	03:02:05
	M1 J11-J12	NB	00:00:00	00:20:23
		SB	00:06:35	03:09:14
	M1 J12-J13	NB	00:01:57	00:19:25
		SB	00:00:00	02:08:43
% of peak period HSR in operation	M1 J10-J11	NB	0%	4%
		SB	4%	25%
	M1 J11-J12	NB	0%	3%
		SB	1%	26%
	M1 J12-J13	NB	0%	3%
		SB	0%	18%

2.58 From **Table 2-8** we can see that HSR is not often in operation on Saturdays, but is more frequently used on Sundays. The detailed analysis shows that the majority of the time HSR is on operation on a Sunday is in the late afternoons.

2.59 **Table 2-9** and **Table 2-10** present the use of the 60mph, 50mph and 40mph speed limits with the Variable Mandatory Speed Limit (VMSL) element of the smart motorway.

Table 2-9 – Use of 60mph VMSL during weekday peak periods

	Location	Direction	AM	IP	PM
Length of time 60mph is in place during peak period	M1 J10-J11	NB	01:13:29	01:25:19	01:11:35
		SB	02:04:27	01:10:19	01:52:25
	M1 J11-J12	NB	00:38:12	00:50:52	02:38:05
		SB	01:52:48	00:17:49	00:50:54
	M1 J12-J13	NB	00:51:17	00:38:52	01:54:35
		SB	02:35:05	00:24:50	01:28:09
% of peak period 60mph in place	M1 J10-J11	NB	41%	24%	40%
		SB	69%	20%	62%
	M1 J11-J12	NB	21%	14%	88%
		SB	63%	5%	28%
	M1 J12-J13	NB	28%	11%	64%
		SB	86%	7%	49%

2.60 **Table 2-9** demonstrates that a 60mph speed limit is in place most often in the southbound direction in the AM peak and the northbound direction in the PM peak. The section of the carriageway where VMSL is most often used is between junctions 10 and 11 at the southern end of the scheme. This is consistent with the use of HSR as when the hard shoulder is open for traffic a 60mph is in automatically in place.

2.61 **Table 2-10** considers the amount of time either a 40mph or 50mph speed limit is in place with the VMSL. This shows those periods where congestion is significant enough for the smart motorway to implement these lower speed limits as queue protection. It can be noted that there are isolated occasions where either a 20mph or 30mph speed limit has been in place but these are associated with incidents rather than being enforced by the queue protection system.

Table 2-10 – Use of 40 or 50mph VMSL during weekday peak periods

	Location	Direction	AM	IP	PM
Length of time 40&50mph is in place during peak period	M1 J10-J11	NB	00:24:37	00:46:53	01:35:27
		SB	00:52:35	00:21:22	00:00:16
	M1 J11-J12	NB	00:08:15	00:05:07	00:00:28
		SB	00:47:50	00:03:42	00:01:13
	M1 J12-J13	NB	00:10:10	00:16:20	00:13:24
		SB	00:08:18	00:03:41	00:47:53
% of peak period 40&50mph in place	M1 J10-J11	NB	14%	13%	53%
		SB	29%	6%	0%
	M1 J11-J12	NB	5%	1%	0%
		SB	27%	1%	1%
	M1 J12-J13	NB	6%	5%	7%
		SB	5%	1%	27%

2.62 **Table 2-10** shows that those sections where the lower speed limits of 40mph and 50mph are in place most often are southbound between junctions 10 and 12 in the AM peak and northbound between junctions 10 and 11 and 12 and 13 in the PM peak. This is consistent with the journey time analysis from the satellite navigation data, i.e. those are the periods and locations where speeds are lower.

2.63 Interestingly, by comparing these patterns with the flow profiles seen in **Figure 2-6** the largest increase in traffic has come outside of these areas and locations. For example, northbound between junctions 10 and 11 there has been a large increase in traffic during the AM peak as facilitated by the additional capacity from HSR. The lower speed limits are in place for a relatively low proportion of the AM peak in this direction.

2.64 These tables, combined with the journey time analysis, suggests that the speed limit reductions start too early and/or turned off too late for maximum efficiency. For example in the southbound direction in the PM peak we can see that a 60mph speed limit is in operation for quite a high proportion of the time, whereas Figure 2.16 suggests that conditions are relatively free-flow for the length of the scheme.

MIDAS Data Analysis

2.65 In addition to the traffic flow and journey time analysis presented in this chapter, additional analysis has been completed using MIDAS data focusing on the AM peak in the southbound direction and the PM peak in the northbound direction.

2.66 The graphs presented in the remainder of this section show the lane by lane traffic flows and speeds on an average March 2014 weekday. This is the same month that has been used for post-opening analysis throughout this chapter. In each figure, the different coloured lines represent the different lanes as shown in the key. The distance on the x-axis is the distance from within junction 10 in the northbound direction and within J13 in the southbound direction. All analysis has been completed on the mainline MIDAS sites.

2.67 It should be noted that the average flow in Lane 1 (i.e. the hard shoulder) will be zero if the hard shoulder running is not open, the traffic presented in the figures therefore represents the average use over the month, including those times when the hard shoulder is not open for traffic. During the hours considered (0800-0900 and 1600-1700).

AM peak southbound

Figure 2-17 – AM 0800-0900 Flow

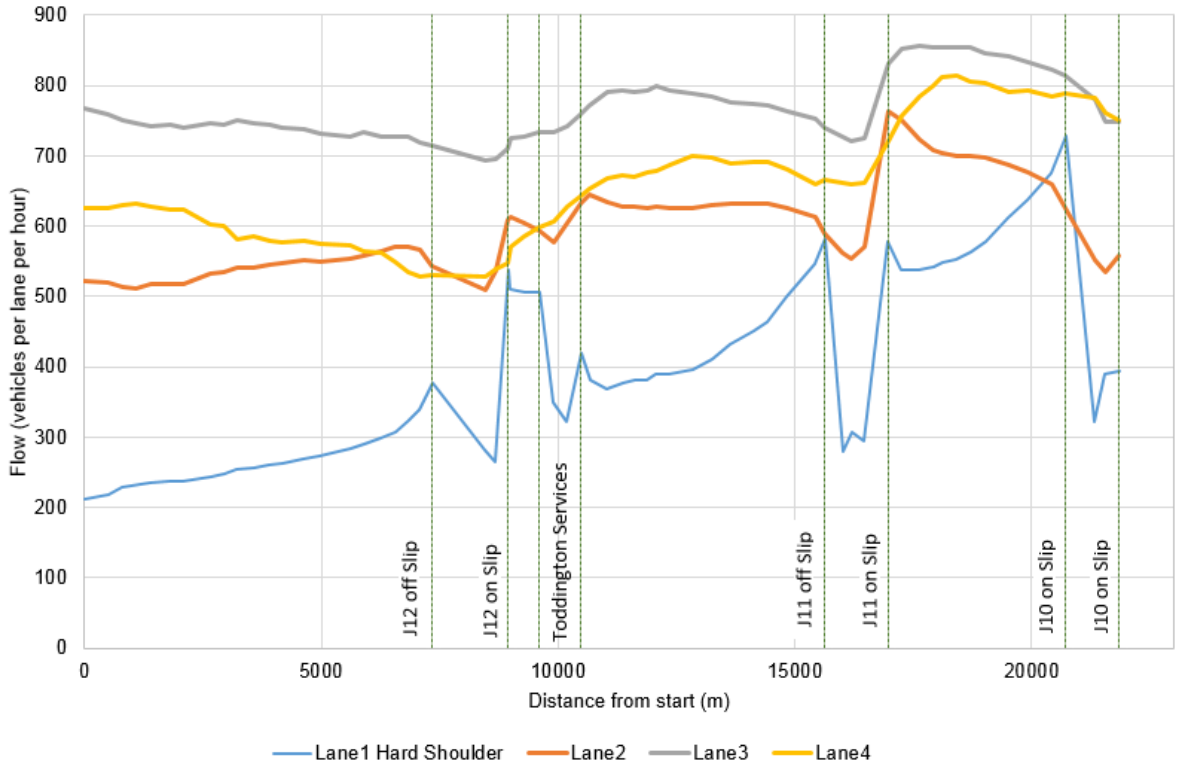
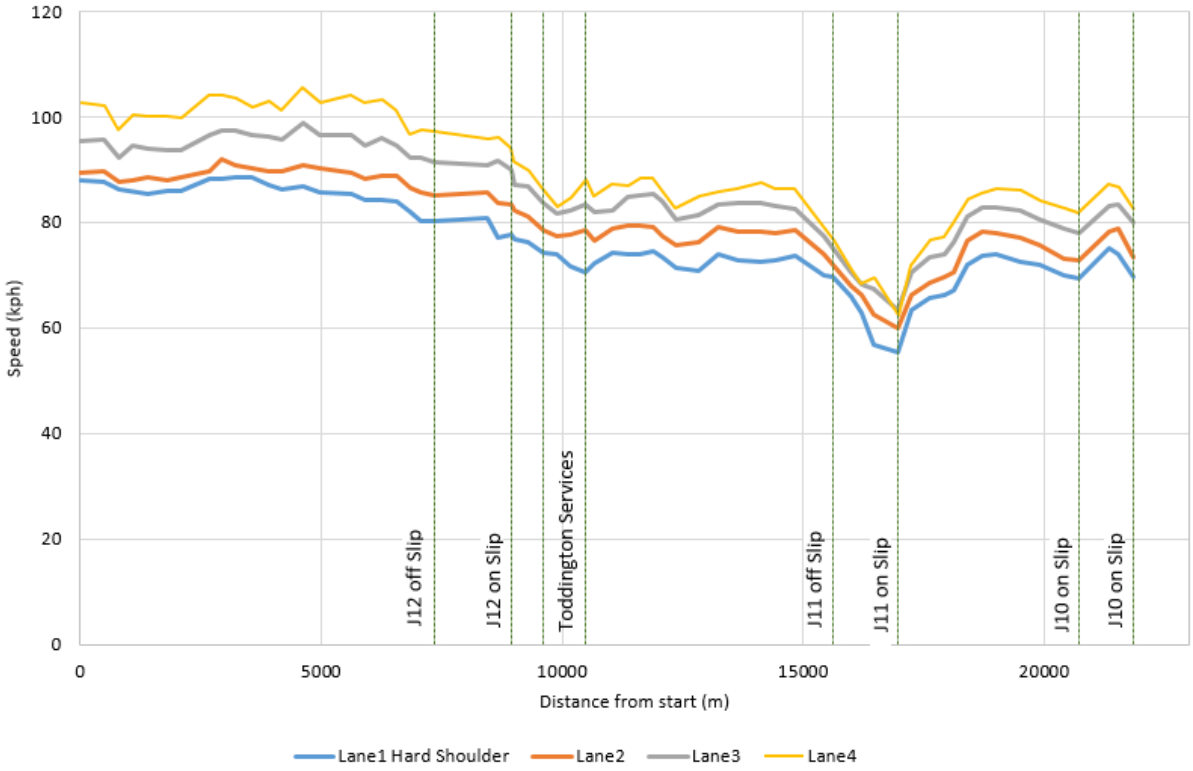


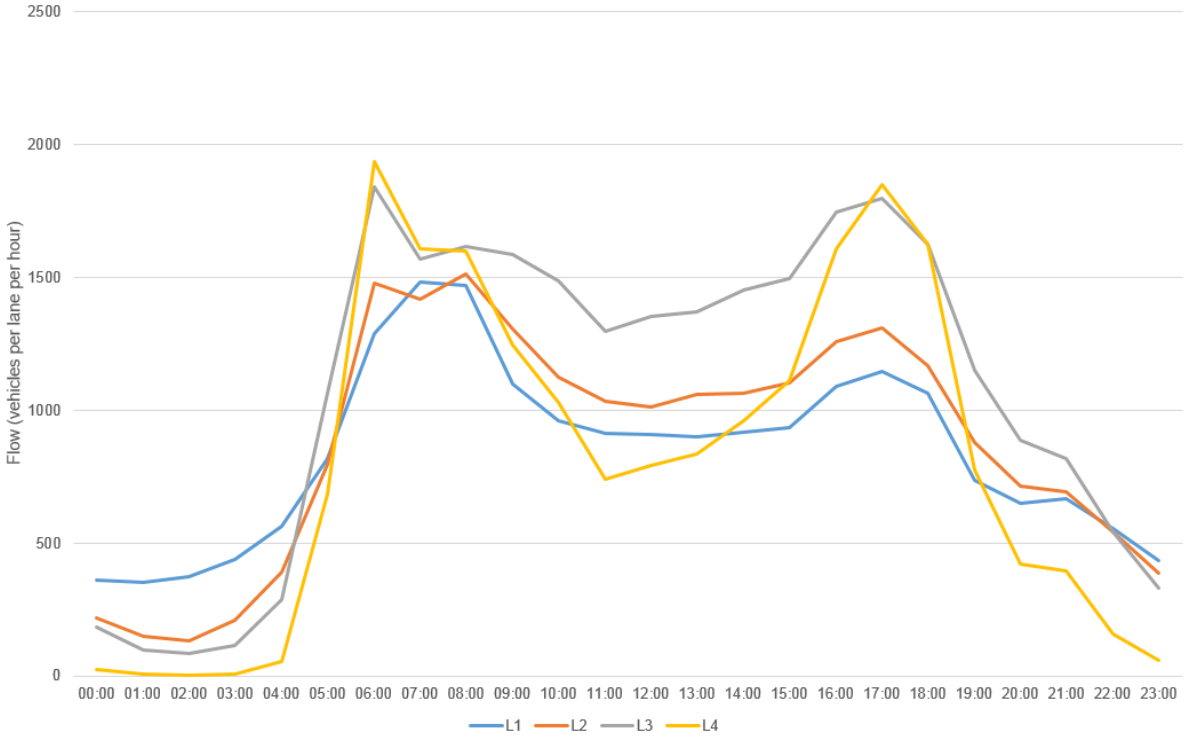
Figure 2-18 – AM 0800-0900 Speed



2.68 It can be seen from **Figure 2-17** that the level of traffic flow using the hard shoulder increases heading south along the scheme. There is a drop in flow on the hard shoulder at each junction that is consistent with the amount of diverging traffic. The use of the hard shoulder is also particularly high on the approach to Toddington services. The use of the hard shoulder is lowest through junction 11, as can be seen in **Figure 2-18** there is a drop in speed across all lanes at this junction. Increased use of the hard shoulder at this location would presumably have a beneficial impact on speeds.

2.69 Considering a typical distribution of traffic across a standard four lane motorway, it would be expected that there would be a higher traffic flow in lane 1. **Figure 2-19** below shows the distribution of traffic flows across lanes on the M1 between J10-J9. The analysis has been completed for a mainline MIDAS site midway between the two junctions. We can see that throughout the day, the traffic flow in lane 1 is nearly as high as lane 2. Along the length of the M1 J10-J13 hard shoulder running scheme, traffic flows in lane 1 only ever reach a similar flow to lane 2 on the approach to junctions. This suggests that driver behaviour is likely to be different on the Smart motorway and that lane 1 is being under-utilised. This will have the effect of reducing traffic speeds along the length of the scheme (60mph is enforced when the hard shoulder is open), without providing an additional lane of full capacity.

Figure 2-19 – M1 Junction 9-10 SB flow distribution across lanes



PM peak northbound

2.70 **Figure 2-20** and **Figure 2-21** show the lane by lane flows and speed along the length of the scheme in the PM peak (1700-1800) in the northbound direction.

Figure 2-20 – PM 1700-1800 NB Flow

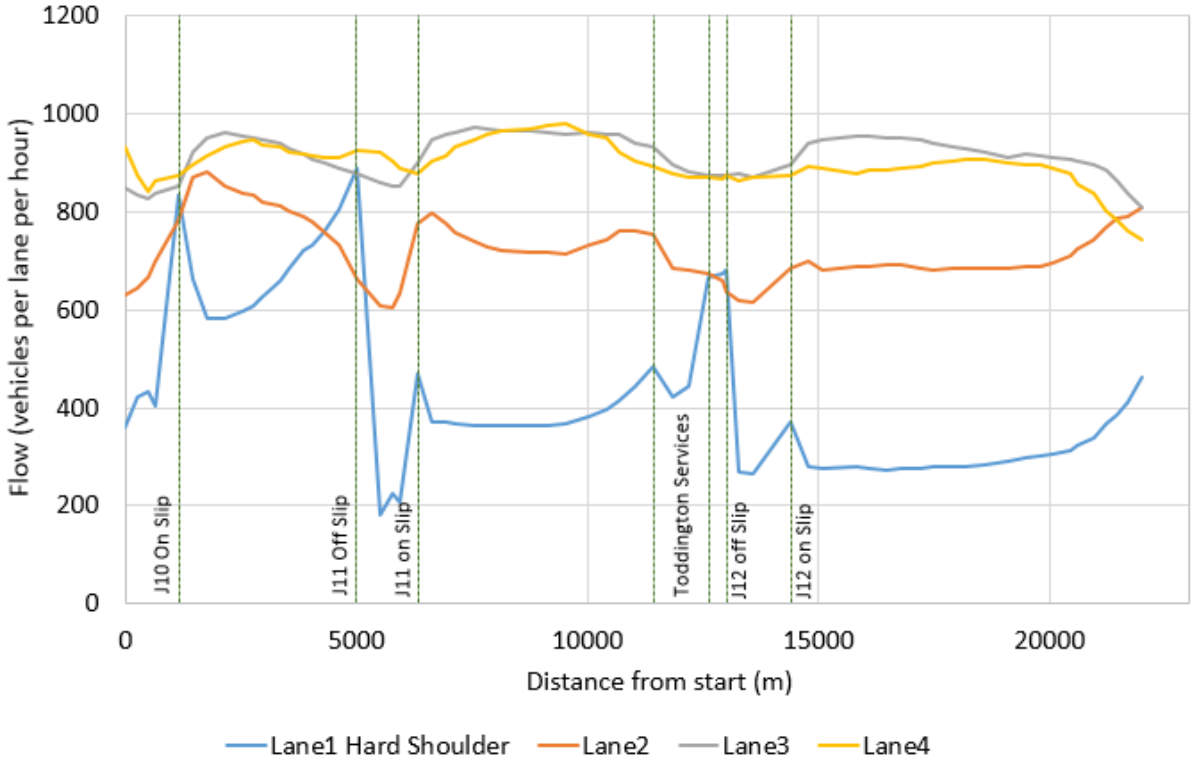
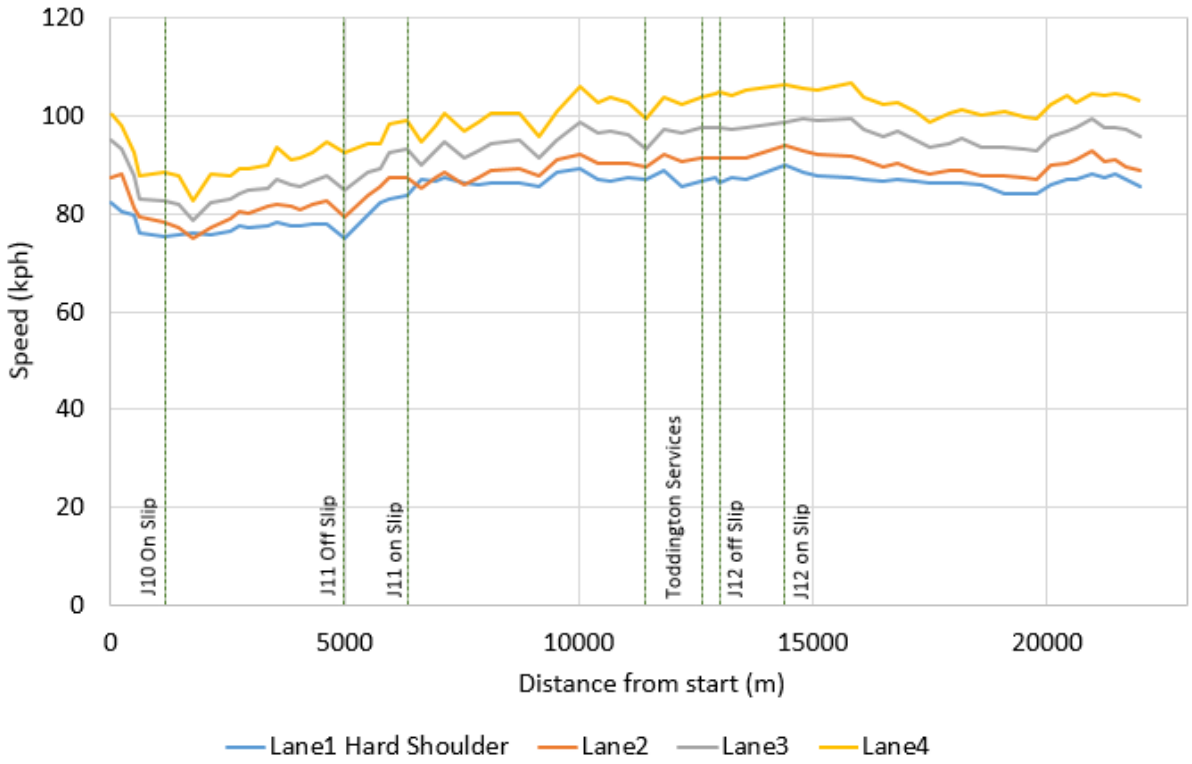


Figure 2-21 – PM 1700-1800 NB Speed



2.71 Similarly to the AM peak, traffic flows are highest at the southern end of the scheme with flows decreasing as we travel north. Along the length of the scheme traffic speeds are generally below 60mph (98kph), this is a result of the HSR being switched on for a relatively high proportion of the time which enforces the 60mph speed limit. Corresponding to the high traffic flows, use of the hard shoulder is greatest between J10-J11. Similarly to the southbound traffic, we see the highest traffic flows in lanes 3 and 4.

Journey Time Reliability

Scheme Objective: to improve reliability

2.72 This section considers the impact that the scheme has had on the variability of journey times. Variability is the extent to which journey times vary from the expected average journey time on a particular day of the week at the time of day in question. The distribution of journey times is considered to be a good indication of how much journey times vary. Although a monetised impact was calculated using INCA (considered further in the economy chapter of this report), no quantified impact showing the forecast change of variability of journey times is available to compare against the observed change.

2.73 The satnav data used to determine the average journey time along the route also provides the distribution of journey times by percentile ranges. **Figure 2-22** and **Figure 2-23** overleaf present the variability in journey times for the different peak periods. The analysis presented is for the route as a whole. The nature of traffic flows and congestion issues vary by peak and direction depending on the section of the scheme so, in turn, the variability may be greater for individual sections of the scheme.

Figure 2-22– Northbound Journey Time Variability

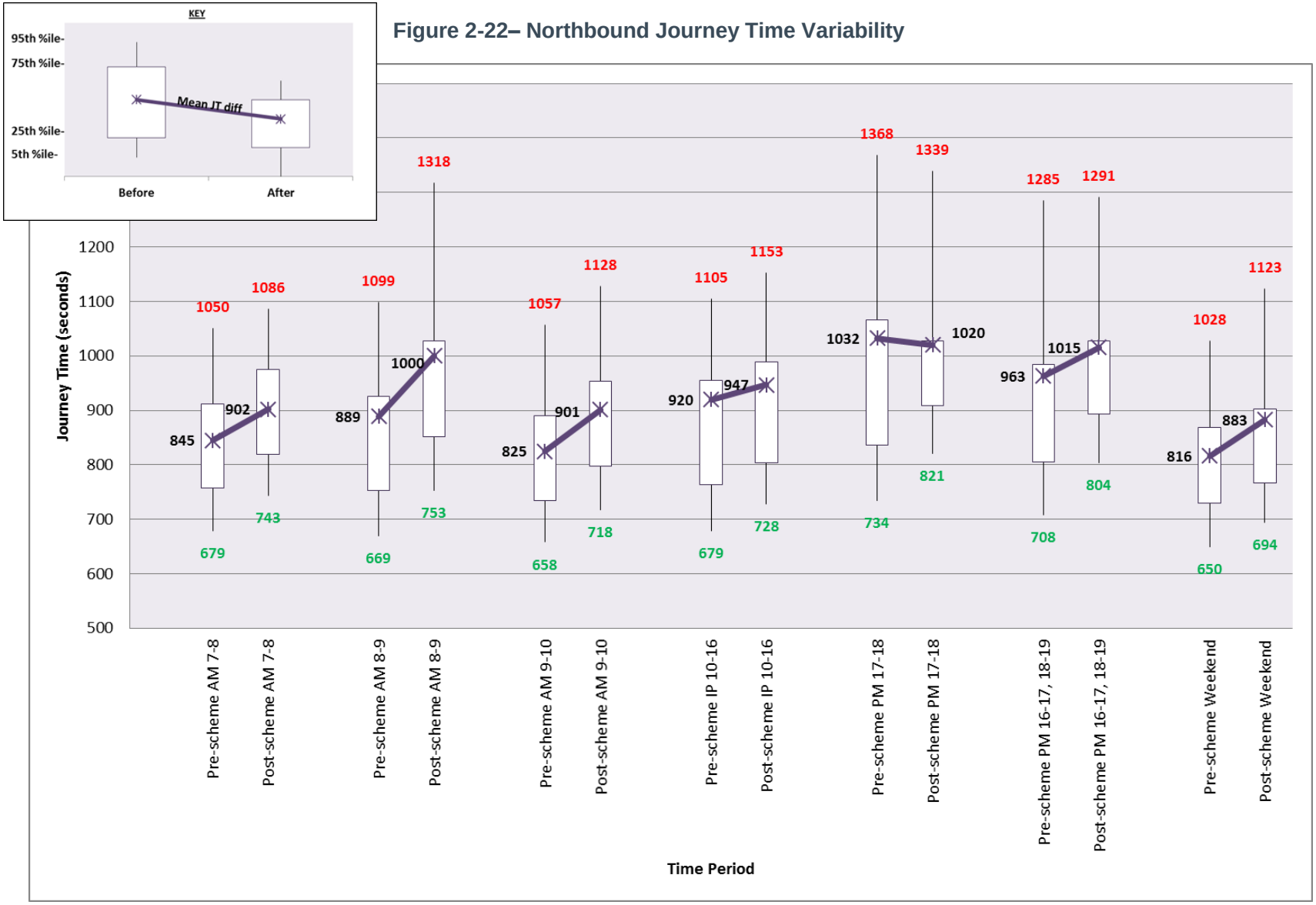
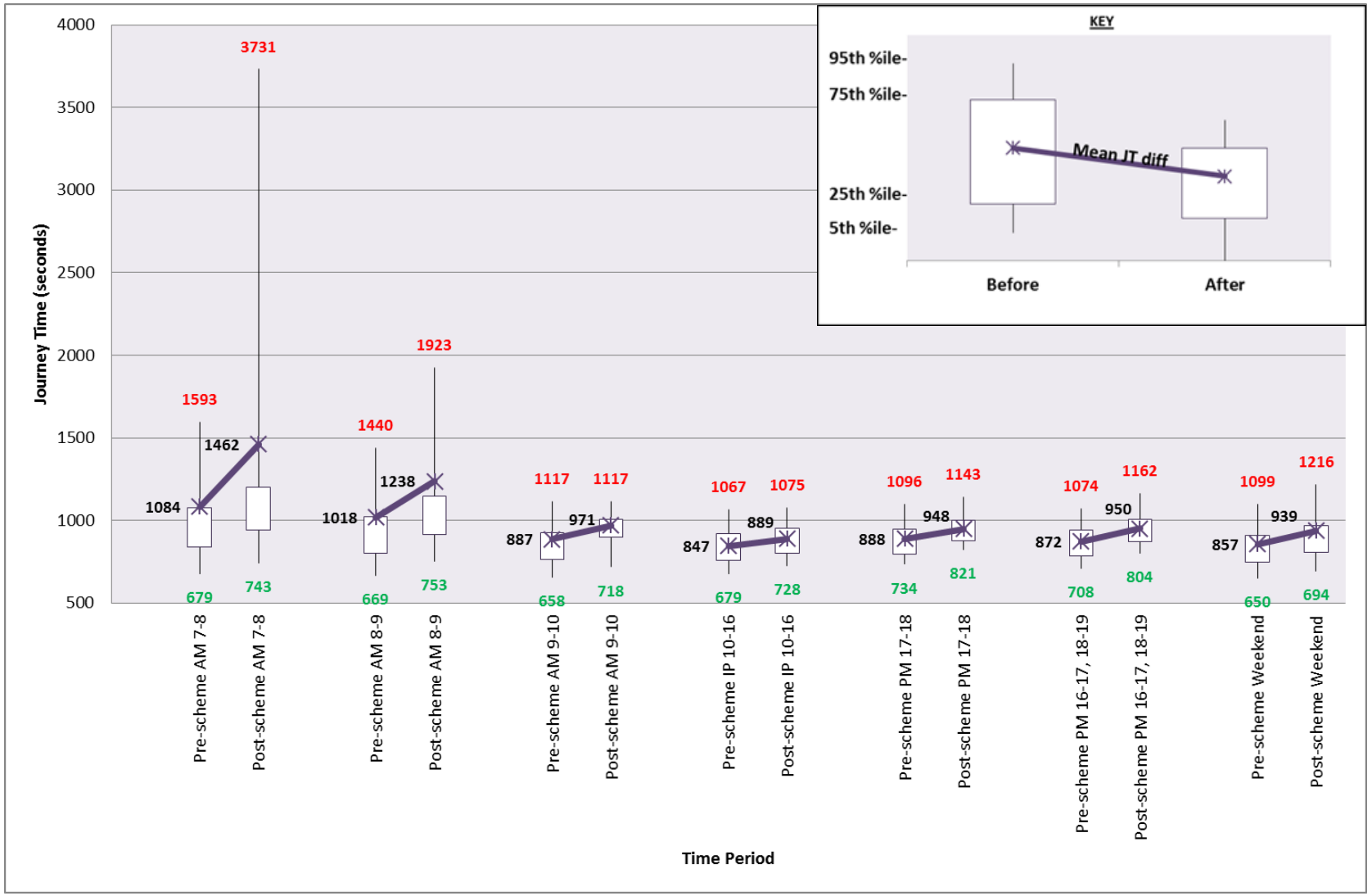


Figure 2-23– Southbound Journey Time Variability



2.74 It can be seen from **Figure 2-22** and **Figure 2-23** that:

- The inter-quartile range (difference between 75th and 25th percentile) and extremes of journey times (95th percentile) have shown an increase at the OYA stage compared to the before stage.
- It has been noted above that in the northbound direction the average journey times have increased except for in the evening peak. Where the journey times have reduced compared to before, the inter-quartile range of the journey times has decreased (and by implication the reliability has improved).
- In the southbound direction, the average journey times have increased in all of the peak periods. The variability of journey time is similar for pre and post scheme opening with the exception of the morning peak where the variability has increased.
- The analysis of morning 07:00-08:00 southbound journey times shows the significant difference between the extremities because of the sudden jump in journey time between the 90th percentile sample and 95th percentile sample. The wide difference between the 75th and 95th percentiles (which are shown on the graph) indicates the presence of severe congestion or incidents within the observed data. The months used in the evaluation were checked for consistency with regards to bank holidays and school term times but it isn't possible to remove all atypical days from the data that might skew the results.

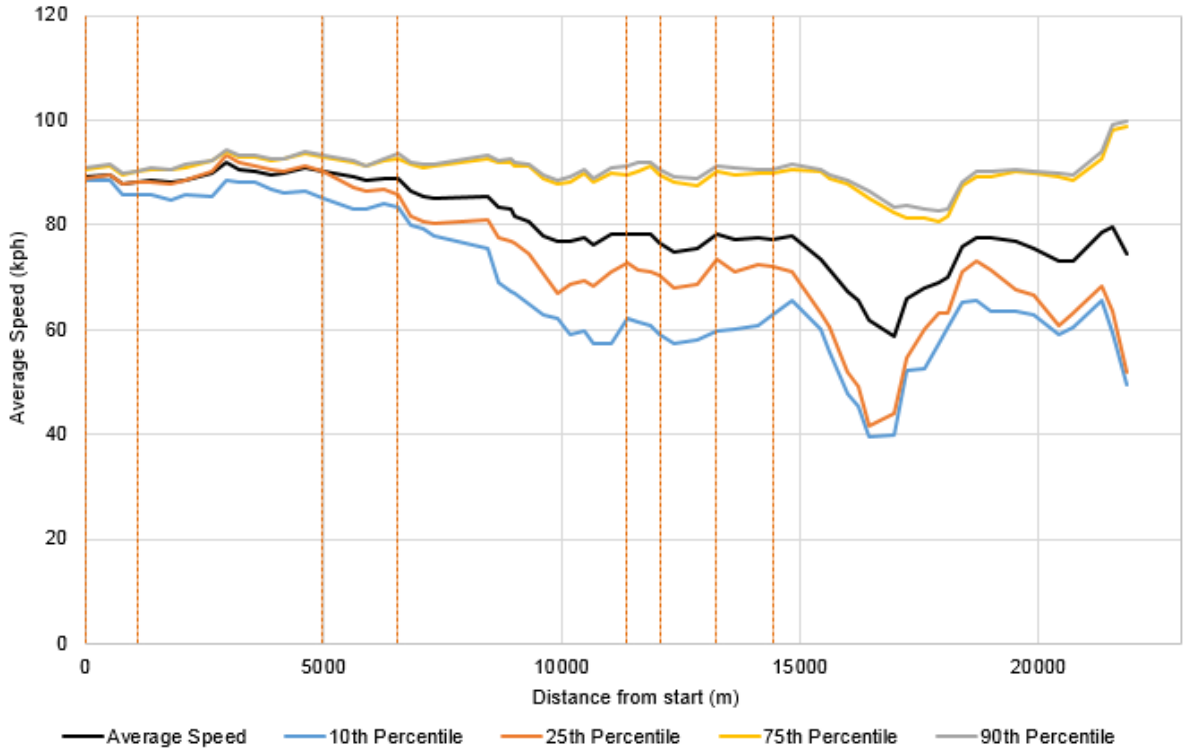
2.75 In addition to the change in variability for the scheme length as a whole, the variability in traffic speeds has been considered in the post-opening scenario along the scheme.

2.76 **Figure 2-24** and **Figure 2-25** show the variability in traffic speeds on lane 2 along the length of the scheme for the southbound direction between 0800 and 0900 and in the northbound direction between 1700 and 1800. The variability in speeds is demonstrated through the different speed percentiles compared to the average (mean) speed.

AM peak southbound

2.77 **Figure 2-24** shows that there is generally a high level of variability in traffic speeds across weekdays in the AM peak in the southbound direction. The variability in speed increases as we travel south along the scheme, with the greatest difference between the 10th and 90th speed percentiles occurring between junctions 11 and 10.

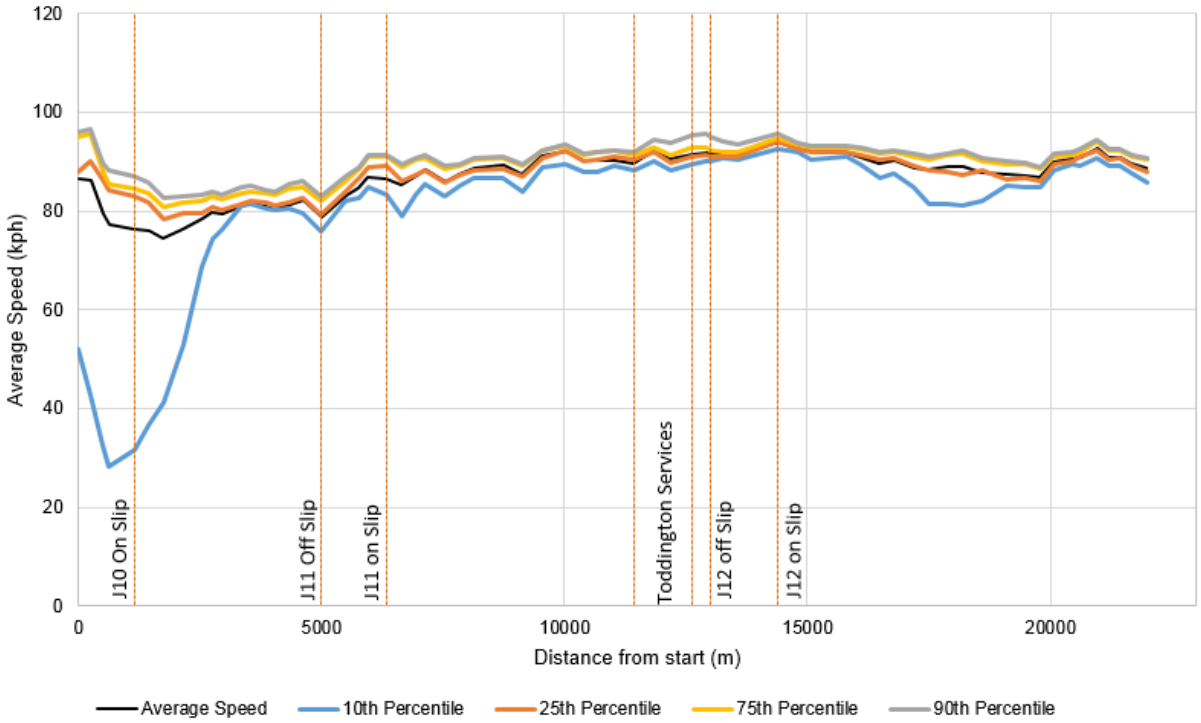
Figure 2-24– Lane 2 SB Speed Variability (0800-0900)



PM peak northbound

2.78 **Figure 2-25** show that traffic speeds in the PM peak in the northbound direction are generally quite consistent across the different days of the month. This is demonstrated by the speed percentiles being reasonably similar along the length of the scheme. The exception to this is between junctions 10 and 11 where the 10th percentile speeds are much lower, indicating that in there have localised issues with congestion (either through an accident/incident or otherwise) that has affected speeds on certain days in the month.

Figure 2-25– Lane 2 NB Speed Variability (1700-1800)



Forecast vs. Observed Journey Time Savings

2.79 Forecast journey times were provided in the 'Traffic Forecasting Report: PCF Stage 5 Final'. This provided forecast information for the M1 mainline for the DM and DS scenarios for the year of 2013. For the analysis of forecast travel times along the M1 itself, SATURN joy-rides were undertaken along the M1 between J10 and J13 in the DM and DS scenarios for both opening and design year.

2.80 Comparison of the DM and DS scenarios for 2013 shows that the scheme was expected to reduce journey times in both direction in all time periods, and that the average reduction would be 1 minute 25 seconds (i.e. 8% to 9% of the Do-Minimum travel time).

2.81 The forecast journey times, alongside observed journey times are presented in **Table 2-11.** Observed journey times for the without scheme scenario are taken from March 2009, before scheme construction. For the 'with scheme' scenario, observed journey times are taken from March 2014, after the scheme opened.

Table 2-11 – Forecast vs. Observed Journey Times (mm:ss)

Section	Time Period	Forecast				Observed			
		DM	DS	Diff (in Sec)	% Diff	2009	2014	Diff (in Sec)	% Diff
M1 J10-13 Northbound	AM	16:27	14:57	90	10%	14:49	16:40	-111	-11%
	IP	16:00	14:43	77	9%	15:20	15:47	-27	-3%
	PM	16:11	15:27	44	5%	17:12	17:00	12	1%
M1 J10-13 Southbound	AM	17:29	14:48	161	18%	16:58	20:38	-220	-18%
	IP	15:37	14:34	63	7%	14:07	14:49	-42	-5%
	PM	16:04	14:50	74	8%	14:48	15:48	-60	-6%

2.82 **Table 2-11** shows that:

- Observed journey times indicate that savings have not occurred as forecast. The scheme has generally increased journey times compared to a forecast decrease, with the exception of a minimal saving in the PM peak for traffic travelling northbound.
- The observed journey times along the scheme section during all the peak periods were greater than the forecast journey times.
- These results provide sufficient evidence to conclude that the scheme has not achieved its objective of reducing congestion along the scheme section.

Key Points – Traffic Impacts

Traffic Flow impacts

- Traffic volumes have increased at the one year after stage along the scheme section.
- An increase of 8% is observed between junctions 10 and 11. The middle section of scheme (junctions 11 to 12) has seen an increase of 7% whereas at the northern end of scheme (junctions 12 to 13) the change in traffic is 6%. Peak hour flows have increased more than interpeak flows.
- North of the scheme between junctions 13 and 14 and junctions 14 and 15, traffic has shown a negligible increase of 1% and 3% respectively. To the south of the scheme, between junctions 9 and 10, traffic has increased by 9%. The M1 junction 6a to 10 scheme opened in 2008, so part of this increase may be associated with the combined impact of the two schemes providing an improved route to the M25.
- On the A5, parallel to M1 junctions 13 and 14, there is a slight decrease in traffic of 1%. The decrease is likely to be due to the increased capacity of the M1 which provides traffic relief to the A5 that runs parallel to the M1.
- Almost all non-parallel A roads where data is available within the study area have shown an increase in traffic volumes between the before and OYA period.

Traffic Forecasting

- The forecasts assumed consistent growth in background traffic between the base year of 2005 and the opening year of 2013, whereas the observed trend shows only a modest growth in traffic in both national and regional traffic data. The forecasts overestimated the traffic that would use the corridor in the opening year.
- The average increase in flows along the scheme section was forecast to be approximately 8%, whereas the observed increase is approximately 5%. This increase in traffic is a result of traffic being attracted to the M1 corridor as a result of the increased capacity from the scheme particularly from long distance strategic traffic.
- The reassignment effect from local roads that was forecast has not been fully realised with the scheme in place.
- Based on the observed trends for almost all the local roads in the wider area, the change in traffic between DM and DS has largely been due to additional strategic traffic movements, with little local movements switching to the new scheme, whereas the traffic forecasts predicted both additional, local and strategic movements on the scheme.

Journey Times

- Northbound average journey times for each peak period in the post-opening period are consistently higher than the pre-scheme journey times along the length of the scheme in the southbound direction by between 42 seconds in the inter peak period to an increase of 2 minutes 40 seconds (18%) in the AM peak. In the northbound direction an increase of 11% (approx. 2 minutes) is seen for the AM, although in the PM peak a small time saving of 1% (12 seconds) is observed post opening.
- MIDAS data has been used to consider the lane by lane speeds along the length of the scheme. It is evident from this analysis that conditions at the southern end of the scheme need further consideration.
- The MIDAS analysis also indicates that the hard shoulder is under-utilised by traffic. There have been increases in flow during peak periods, if traffic were to make better use of the hard shoulder when it is opening as a running lane then improved traffic conditions might be observed.
- Halogen data has demonstrated the extent of use of the hard shoulder running (HSR) and variable mandatory speed limits (VMSL). Post-opening traffic speeds are at just under 100kph (60mph) along a large proportion of the scheme, particularly in the evening peak. This is an indication that traffic speeds are being limited by the HSR being operational, when a 60mph is enforced.

Journey Time Forecasting

- The scheme was forecast to result in journey time savings in both directions in all time periods. However this has not been seen, showing that the forecasts were inaccurate. This would be largely due to the impact of restricted speeds from the smart motorway operation.
- These results provide sufficient evidence to conclude that the scheme may have achieved its objective of reducing congestion along the scheme section, but not increased journey speeds due to inefficient operation of VMSL.

3. Safety Evaluation

Introduction

3.1 This section of the report examines how successful the scheme has been in addressing the objective of improving safety. The focus of this objective is to reduce the loss of life, injuries and damage to property resulting from transport accidents and crime. This is assessed by analysing the changes in Personal Injury Collisions[6] (PICs) occurring in the five years before start of construction compared to the available post-opening data.

3.2 In order to assess the impact of the scheme on collisions, this section of the report analyses the change in PICs occurring in the pre-construction period, and the post-opening period. Evaluation of the scheme's impact on personal security has been undertaken through the use of observations made during a site visit.

Data Sources

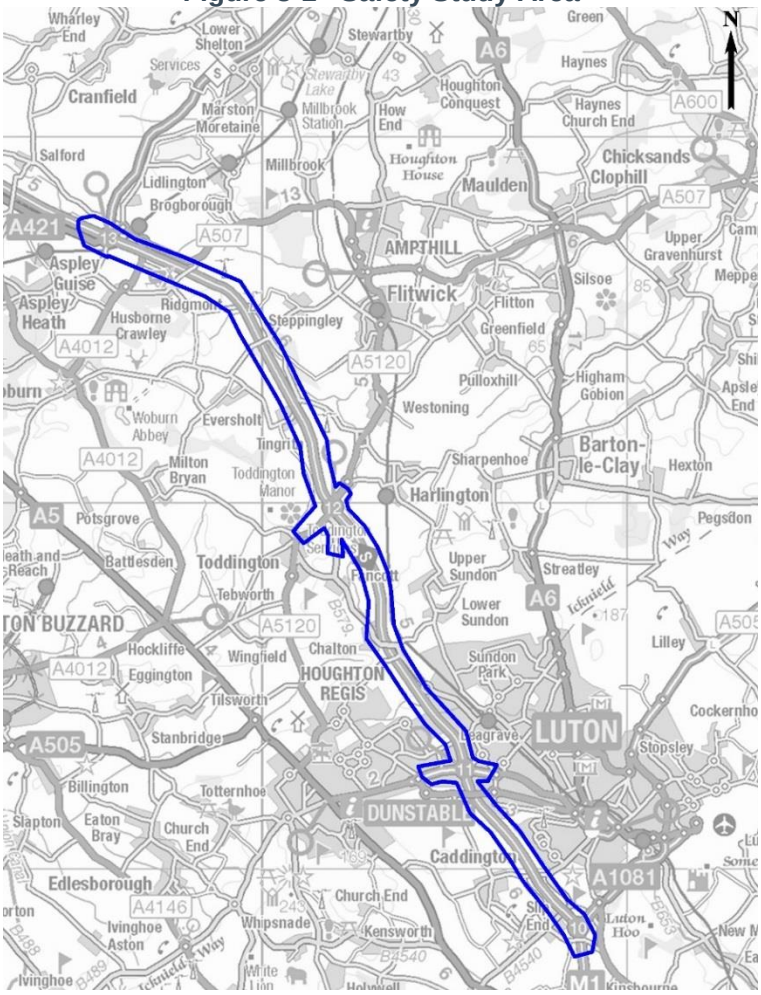
Forecast Data

3.3 Forecasts of the impact of the scheme on safety have been obtained from the M1 Junctions 10-13 HSR Improvement EAR (2010) which details the forecast safety impact of the combined scheme. The safety study area for the scheme as detailed in the report includes the East of England Regional model (EERM) area covering a large part of the UK. Also included in the appraisal was savings from the local COBA area (covering the M1 and surrounding roads as well as the urban areas of Milton Keynes, Luton and a number of local roads as far south as the M25). In order to try to identify the impact of the scheme, the area has been reduced and as such the POPE collision evaluation area has been taken as the M1 between junctions 10 to 13. The extent of the collision area considered as shown in **Figure 3-1.**

3.4 The forecast impact on safety is expressed in terms of numbers of PICs saved with the associated numbers of casualties and the economic benefit of the saving. This section of the evaluation concerns collision numbers; the economic impact of changes in collisions is evaluated in **Section 4** of this report.

[6] Collisions previously referred to as accidents, naming convention has been changed in line with HA's current terminology.

Figure 3-1– Safety Study Area



Observed Data

3.5 Collisions by their nature include a random element and are somewhat unpredictable events therefore to ensure that the scheme is the only known change, pre scheme collision data has been obtained for the most recent five years prior to construction. Collision data for this study was obtained from the Highways Agency (at time of request) Pavement Management System (HAPMS) and the DfT national collision statistics covering the following time periods:

Period	Time Period	
	From	To
Before	01 December 2004	30 November 2009
Construction	01 December 2009	31 December 2012
OYA	01 January 2013	31 December 2013

3.6 The collision data is based on the records of PICs (i.e. collisions that involve injuries to one or more persons) recorded in the STATS19 data collected by the police when attending collisions. Collisions that do not result in injury are not included in this dataset and are thus not considered in this evaluation. It should be noted that this report has only used 12 months of post opening data and so any conclusions at this stage should bear this fact in mind.

Background Changes in Collision Reduction

3.7 It is widely recognised that, for over a decade, there has been a year-on-year reduction in the number of personal injury collisions on the roads, even against a trend of increasing traffic volumes during much of that period. The reasons for the reduction are considered to be wide

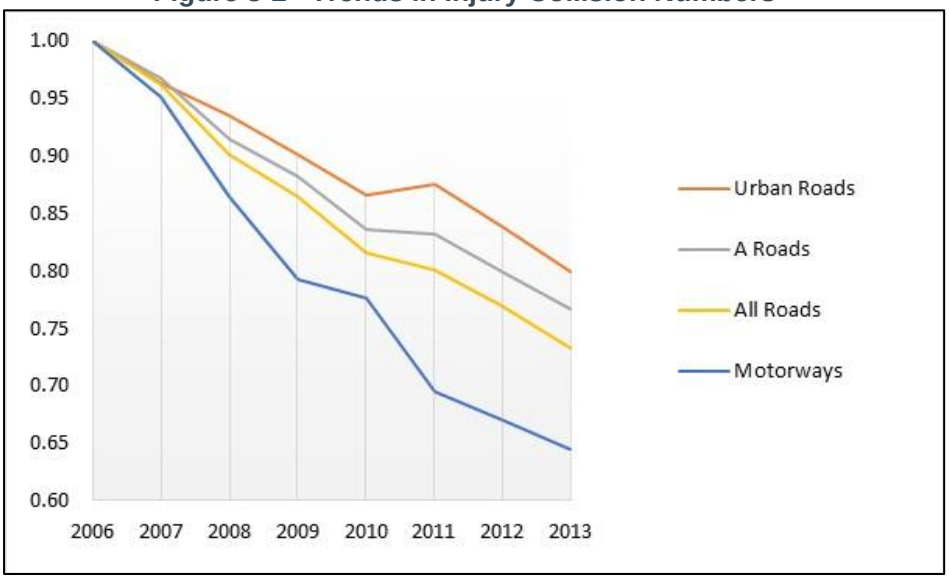
ranging and include improved safety measures in vehicles and reduced numbers of younger drivers. This background trend is accounted for here when considering the changes in collision numbers in the scheme area in the before and after periods. If the scheme had not been built, collision numbers in the area are still likely to have been influenced by wider trends and to have reduced.

3.8 When the number of collisions in this area in the years before and after the scheme was built is compared, the associated net change is primarily linked to the scheme; to take into account the background reduction, the best way to do this is to assume that, if the scheme had not been built, the number of collisions on the roads in the study area here would have dropped at the same rate as they did nationally during the same time period[7]. This gives us what is known as a counterfactual scenario. This data for the counterfactual 'without scheme' scenario can be compared on a like-for-like basis with the observed post opening data which is the 'with scheme' scenario.

3.9 The difference between the numbers of collisions in these two scenarios can then be attributed to the scheme rather than the wider national trends. This result will inform the calculation of monetised safety benefits achieved by the scheme as discussed in the economy chapter of this report.

3.10 The comparison or the counterfactual scenario compares the national collision data in the OYA period (2013) and for a representative year in the pre-construction period (taken as the middle year of the available data, 2006). The change in the number of collisions over this period for motorways is calculated from the national collision data.[8] **Figure 3-2** illustrates the change in collision numbers nationally by road type between 2006 and 2013.

Figure 3-2– Trends in Injury Collision Numbers



3.11 The reduction in national collision numbers presented above is used in the development of the counterfactual scenario shown in this chapter.

Collision Numbers

3.12 For presentation purposes, collisions have been presented in two sections. Firstly, the mainline M1, comprised of the M1 mainline carriageway between J10 to J13, excluding the slip roads. The second evaluation is based around the upgraded junctions and shows the observed changes

[7] National trend data is sourced from DfT table RAS10002
[8] Data sourced from DfT table RAS10002 which includes reported accidents and accident rates by road class and severity, Great Britain.

seen at both J11 and J12, including the motorway slip roads which were altered as part of the scheme.

Collision Numbers – Mainline carriageway

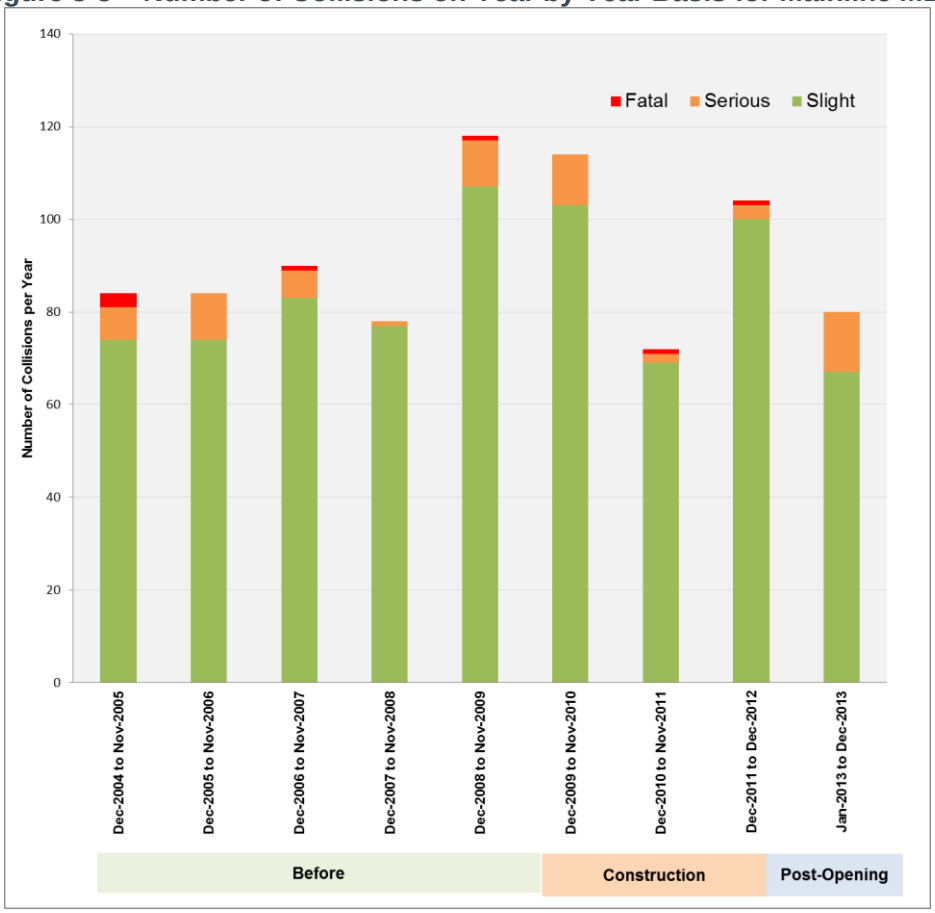
3.13 An evaluation of the before and after collision numbers by year for the mainline M1 is shown in **Table 3-1** and **Figure 3-3**. The severity of a collision is defined by the most serious injury incurred.

3.14 The table also includes the counterfactual without scheme which is comparable to the after data.

Table 3-1 – Number of Collisions by Severity on the M1 mainline

Period	Time Period		Collision Severity			Total	Annual Average	Annual severity index
	From	To	Fatal	Serious	Slight			
Pre Scheme	Dec-2004	Nov-2005	3	7	74	84	91	9%
	Dec-2005	Nov-2006	0	10	74	84		
	Dec-2006	Nov-2007	1	6	83	90		
	Dec-2007	Nov-2008	0	1	77	78		
	Dec-2008	Nov-2009	1	10	107	118		
Without scheme Counterfactual (adjusted for background reduction)[9]							**61.5**	**-**
Construction	Dec-2009	Nov-2010	0	11	103	114	94	6%
	Dec-2010	Nov-2011	1	2	69	72		
	Dec-2011	Dec-2012	1	3	100	104		
Post Opening	Jan-2013	Dec-2013	0	13	67	80	80	16%

Figure 3-3 – Number of Collisions on Year by Year Basis for Mainline M1



[9] Background factor in collision numbers for Motorways 2007-2013 was 0.68

3.15 It can be seen from **Figure 3-3** and **Table 3-1** that:

- When the background reduction is considered, an average annual increase of 18.5 collisions per year is seen post opening, an increase of 30%. This increase is not considered statistically significant, and therefore cannot be directly linked to the scheme at this stage.
- Without the background reduction, an average annual decrease of 10.9 collisions is seen, a decrease of 12%.

3.16 It can also be seen that the collision severity (ratio of the number of collisions classed as serious or fatal compared to the total number of collisions) has increased in the post opening period, although no fatal collisions have been recorded post opening. Given the limited quantity of post-opening accident data, it is too early to draw conclusions on accident severity and a clearer picture will be available at the Five Years After (FYA) POPE stage when a larger sample size will be available to fully identify the impact of the scheme on accidents. It is also noted that whilst the scheme was opened to traffic in December 2012, residual road works remained for the first part of 2013 to finalise part of the central reservation which, whilst cannot be confirmed, may have had an impact on collisions.

Collision Numbers – Junction 11 and Junction 12

3.17 An evaluation of the before and after collision numbers by year for each of the upgraded junctions is shown in **Table 3-2** and **Table 3-3**. The severity of a collision is defined by the most serious injury incurred.

3.18 The table also includes the counterfactual without scheme which is comparable to the after data.

Table 3-2 – Number of Collisions by Severity at Junction 11

Period	Time Period		Collision Severity			Total	Annual Average	Annual severity index
	From	To	Fatal	Serious	Slight			
Pre Scheme	Dec-2004	Nov-2005	0	3	13	16	**14.2**	**18%**
	Dec-2005	Nov-2006	0	4	14	18		
	Dec-2006	Nov-2007	1	3	8	12		
	Dec-2007	Nov-2008	0	1	8	9		
	Dec-2008	Nov-2009	0	1	15	16		
Without scheme Counterfactual (adjusted for background reduction)[10]							**10.8**	**-**
Construction	Dec-2009	Nov-2010	1	1	9	11	**12.6**	**10%**
	Dec-2010	Nov-2011	0	1	10	11		
	Dec-2011	Dec-2012	0	1	16	17		
Post Opening	Jan-2013	Dec-2013	0	0	12	12	**12.0**	**0%**

[10] Background factor in collision numbers for all roads 2007-2013 was 0.76.

Table 3-3 – Number of Collisions by Severity at Junction 12

Period	Time Period		Collision Severity			Total	Annual Average	Annual severity index
	From	To	Fatal	Serious	Slight			
Pre Scheme	Dec-2004	Nov-2005	0	1	6	7	4.6	4%
	Dec-2005	Nov-2006	0	0	2	2		
	Dec-2006	Nov-2007	0	0	9	9		
	Dec-2007	Nov-2008	0	0	3	3		
	Dec-2008	Nov-2009	0	0	2	2		
Without scheme Counterfactual (adjusted for background reduction)							**3.5**	**-**
Construction	Dec-2009	Nov-2010	0	1	6	7	5.5	12%
	Dec-2010	Nov-2011	0	0	3	3		
	Dec-2011	Dec-2012	0	1	6	7		
Post Opening	Jan-2013	Dec-2013	0	0	3	3	**3.0**	**0%**

3.19 It can be seen

3.20 **Table 3-2** that at junction 11:

- When the background reduction is considered, an average increase of 1.2 collisions per year is observed, an increase of 11%. This increase is not considered statistically significant, and therefore cannot be directly linked to the scheme at this stage.
- Without the background reduction, an average decrease of 2.2 (-16%) collisions is seen.
- Post opening, the severity index has reduced to 0%, as no fatal or serious collisions have occurred up to the end of 2013.

3.21 It can be seen that at junction 12:

- When the background reduction is considered, an average decrease of 0.5 collisions per year is observed, saving of 14%. This decrease is not considered statistically significant and therefore cannot be directly linked to the scheme.
- Without the background reduction, an average decrease of 1.6 (35%) collisions is seen.
- Post opening, the severity index has reduced to 0%, as, like junction 11, no fatal or serious collisions have occurred.

3.22 Overall, when both junctions are considered together, there has been no discernible change post opening in terms of a reduction in the number of collisions, however the severity of collisions has reduced.

Consultation response

3.23 With regards to safety, Steppingley Parish Council raised concerns over the improper scheme design related to the layout of J12 and J13 causing confusion to the drivers.

3.24 The various concerns raised by Steppingley Parish Council are as detailed below.

Junction 12:

- *Concerns expressed about the whole of the design of this junction and it was considered that it added nothing to the safety of the M1. In particular the entry lane to the M1 going south is considered far too short and ends suddenly. This is now seen as something of a black spot and a target for some 'cash for crash' insurance fraudsters with vehicles deliberately stopping suddenly causing a following vehicle to collide.*

- *Approaching the junction from the direction of Flitwick is confusing drivers unfamiliar with the area, though it was provided with proper signs. The multiple sets of traffic lights which the layout seems to necessitate are also confusing for some drivers.*
- *The exit from the M1 from the south is also more awkward than previously and seems to have added nothing to road safety.*

Junction 13:

- *Traffic leaving the M1 and wishing to access the A507 including traffic to the newly completed Centre Parcs at Woburn or HGVs accessing the distribution centre at Brogborough have a very short section of the old A421 before filtering right for the right turn.*

3.25 The limited collision data available at this evaluation stage does not highlight a particular problem at these locations; however this should be looked into in more detail at the FYA evaluation stage when a larger data set is available to identify trends.

Fatalities & Weighted Injuries

3.26 The collision rate discussed previously and shown in **Table 3-1** does not take into account the severity of collisions. To analyse this, the Fatalities and Weighted Injuries metric can be used, which is a combined measure of casualties based on the numbers of fatal, serious and slight casualties. However, casualty data was not available and therefore the Fatalities and Weighted Injuries metric has not been analysed for this scheme.

Forecast vs Outturn Collision Numbers

3.27 The EAR for the combined scheme records a total safety disbenefit, which equated to an increase of 785.3 collisions over the whole appraisal area over 60 years. No explicit reason for this is given, but the AST for the HSR states that increased collisions are forecast due to the increase in traffic over the appraisal period with the scheme. No COBA files were made available to enable POPE to isolate the scheme impact on the directly affected links and junctions, therefore no comparison can be made to the forecasts.

Collision Rates

3.28 The number of collisions along a length of road used together with the AADT for the same section can be used to calculate a collision rate, known as PIC/mvkm. This allows comparisons to be made which take into account changes in traffic flows.

3.29 Whilst the EAR shows a disbenefit for the whole appraisal area, it also notes that the appraisal 'assumes a 15% reduction in accident rates' as a result of implementing hard shoulder running but that 'savings would be countered by forecast increases in traffic on the motorway'. In this section, observed collision rates during the pre and post scheme periods for the M1 mainline between junction 10 and junction 13 are compared with the forecasts (from the EAR).

3.30 **Table 3-4** shows the collision rates calculated for the M1 links forecast vs. observed pre and post opening.

Table 3-4 – Forecast vs. Observed Collision Rates (PIC/mvkm) for Mainline M1

Predicted	Forecast Saving	15%
Observed (Pre-scheme vs. Post-opening collision rates)	Before Opening Observed	0.072
	Without scheme (Counterfactual rate)[11]	0.048
	After Opening Observed	0.059
	Observed Saving	**-0.011(-19%)**

3.31 **Table 3-4** shows that the appraisal forecast assumed an improvement in accident rate of 15% for the mainline M1 as a result of the scheme. The assumption is based on observed reductions achieved on the M25 with a variable speed limit (VSL) in place. However post opening, there is an increase of 19% compared to before construction, after accounting for the background trend in collisions.

Statistical Significance of Outturn Collision Impacts

3.32 In order to determine whether the changes in collision rates observed before and after the scheme opened are statistically significant, a Chi-Squared test has been undertaken. This test uses the before (counterfactual) and after numbers of collisions and traffic flows to establish whether the changes are significant or likely to have occurred by chance.

3.33 The result found that, when adjusted for the background reduction in collisions over the same time period, the increase in collisions observed is not statistically significant for either the M1 mainline or the junctions and therefore cannot be considered a direct result of the scheme at this stage.

3.34 A clearer picture will be available at the five years after stage for this scheme when a larger post opening sample will be available for comparison.

Security

3.35 The aim of this sub-objective is to consider both the changes in security and the likely number of users affected by the changes. For highway schemes, security includes the perception of risk from damage to or theft from vehicles, personal injury or theft of property from individuals or from vehicles. Security issues may arise from the following:

- On the road itself (e.g. being attacked whilst broken down).
- In service areas/car parks/lay-bys (e.g. vehicle damage while parked at a service station, attached whilst walking to a parked car).
- At junctions (e.g. smash and grab incidents while queuing at traffic lights.

3.36 The primary indicators for roads include surveillance, landscaping, lighting and visibility, emergency call facilities and pedestrian and cycling facilities.

Forecast

3.37 The HSR AST states that the impact of the scheme on security was forecast to be a 'Large Positive'. The AST stated that "Activity on the motorway would be monitored by CCTV systems. Emergency refuge areas are to be monitored and controlled".

[11] Counterfactual without scheme is the observed rate in the before period multiplied by the national reduction in collisions rate per mvkm during the comparable period, for the middle year of the data collection periods, in this case 2007 for before the period and 2013 for the after period. The reduction factor in the collision rate for motorways was 0.67.

3.38 The AST for the junctions notes that 'the security of road users would not be changed by the improvements' scoring it as neutral.

Evaluation

3.39 This evaluation supports the HSR AST assessment as the facilities were introduced as proposed as can be seen in the photograph (**Figure 3-4**) below, showing the emergency refuge areas, CCTV and emergency telephone facilities. Overall the impact of the HSR element of the scheme is considered to be large positive, as expected.

3.40 The junctions element of the scheme includes further signals at the junctions, however does appear to have reduced queuing at peak times. Overall, the impact of the junction upgrades is considered to be neutral, as expected.

Figure 3-4 – Security Facilities

Key Points - Safety

Observed Collisions

- The observed annual collision rate post opening is higher than the 'without scheme' counterfactual collision rate by 19% (when accounting for the background reduction in collisions over time) when traffic changes are taken into account.
- The average number of collisions has increased post opening along the M1 mainline when compared to the without scheme counterfactual.
- When collisions numbers are considered at junction 11 and 12, the scheme has had no discernible impact, although the severity index of collisions has decreased at both upgraded junctions.
- The collision severity index has increased to 19% post opening for the mainline M1. Given the limited quantity of post-opening accident data, it is too early to draw conclusions on accident severity and a clearer picture will be available at the Five Years After (FYA) POPE stage when a larger sample size will be available to identify the impact of the scheme on accidents.

Forecast Collisions

- The scheme appraisal forecast an improvement in the collision rate of 15% for mainline M1 traffic as a result of the implementation of smart motorways, although this would be outweighed by the increase in traffic levels on the M1. The rate reduction assumption was based on reductions achieved on the M25 using a similar variable speed limit (VSL) system. Post opening, there is an increase in the collision rate of 19% compared to the before case, after accounting for the background trend in collisions. The amount of data available at this time means that this increase is not statistically significant

Security

- The scheme's impact on security is considered largely positive as forecast in the HSR AST due to the installation of CCTV cameras and direct emergency call to operators at the Emergency Refuge Areas. The score for the junction's element of the scheme of neutral for security is also upheld.

4. Economy

Introduction

4.1 This section presents an evaluation of how the scheme is performing against the DfT's economy objective, which is defined in WebTAG as:

To support sustainable economic activity and achieve good value for money

4.2 The sub-objectives for economy are as follows:

- To achieve good value for money in relation to impacts on public accounts.
- Improve transport economic efficiency for business users and transport providers.
- Improve transport economic efficiency for consumer users.
- Improve reliability.
- Provide beneficial wider economic impacts.

4.3 When a scheme is appraised, an economic assessment is used to determine the scheme's value for money. This assessment is based on an estimation of costs and benefits from different sources:

- Transport Economic Efficiency (TEE) benefits (savings related to travel times, vehicle operating costs and user charges).
- Accident costs (savings related to numbers and severity level of accidents).
- Costs to users due to delays during construction and future maintenance periods.

4.4 This section provides a comparison between the outturn costs and benefits and the forecast economic impact, as well as evaluating reliability and the scheme's wider economic impacts.

Sources

4.5 The economic assessment presented in this section is based upon:

- M1 Junctions 10 to 13 Improvement Economic Appraisal Report (EAR) PCF Stage 5 update (February 2010).
- M1 Junctions 10 to 13 HSR Improvement Traffic forecasting Report PCF Stage 5 update (January 2010).
- Forecast cost has been taken from the Economic Appraisal Report PCF Stage 5 update (February 2010).
- Outturn costs from the Regional Finance Manager in May 2014.

4.6 The reports provide forecasts of the benefits for a 60 year appraisal period. All costs presented in the EAR and this chapter are in 2002 prices discounted to 2002 unless otherwise stated.

Forecast Benefits

4.7 As detailed in previous chapters, the HSR and junctions were was originally appraised as one scheme, although was separated out into mainline and junctions in order to proceed through planning requirements. This meant that separate appraisal documents were produced for the junctions scheme to justify it in its own right. The junction scheme had a separate AST, detailing impacts for each sub objective, whilst the HSR schemes AST (presented in the Appendix) details

the impacts of the smart motorway element on most sub objectives, but includes the combined impact of both schemes for safety and economy.

4.8 For simplicity however, the EAR noted in the source list above combines the benefits of the two schemes together for the purposes of the economic appraisal, and therefore as it is inherently difficult post opening to isolate which observed changes to attribute to which element of the scheme, the combined economic appraisal published in the EAR is used here to evaluate the scheme against. A summary of the predicted scheme impacts from the EAR is shown in **Table 4-1.**

Table 4-1 – Economic Impacts of Scheme

Benefit Stream	Predicted Benefits	Evaluation	
	£m	Evaluate?	Evaluation methodology
Journey Times	627.29	✓	Observed vehicle hours saved per annum based on the OYA journey times and traffic flows.
Vehicle Operating Costs (VOC)	-258.67	✓	Ratio between EAR forecast and POPE re-forecast changes in indirect tax applied to the monetary forecast VOC in order to calculate a proxy outturn reforecast value of VOC
TEE impacts during construction	-93.13	✗	Not known and this stage and not within the remit of POPE.
TEE impacts during future maintenance	-5.00	✗	Not within the remit of POPE to re-evaluate. A small proportion of the overall scheme impacts.
Safety	-3.97	✓	Safety impact not monetised as shown in safety chapter to not be statistically significant.
Noise	7.91	✗	Small proportion of the overall scheme impacts.
Carbon	-45.33	✓	The outturn carbon emissions were calculated using the DMRB methodology
Total	**229.11**		

Journey Time Benefits

Forecast Journey Time Benefits

4.9 Journey time benefits for this scheme were forecast using the Department for Transport's (DfT) TUBA (Transport Users Benefit Analysis) program. The forecast journey time benefits over the whole 60-year appraisal period have been taken from the EAR Report. These are shown in **Table 4-2** and include the benefits expected from both the mainline and junction improvements.

Table 4-2 – Summary of forecast Journey time benefits

Consumer & Business users combined	£m 2002 prices and values
Journey Times	£627.29m

4.10 Table 4-2 shows that the appraisal forecast as stated in EAR for M1 J10-13 HSR and improvement scheme was £627.29m. This was based on the assumption that the HSR would result in an increase in average trip speeds on the M1 from 55mph to 60 mph at congested times, as well as reduced congestion for traffic using the two upgraded junctions.

Evaluation of Journey Time Benefits

4.11 The POPE methodology for evaluating the economic value of benefits arising from journey time benefits is based upon comparing the observed vehicle hour savings in the opening year against

a forecast of the savings. It is then assumed that the ratio between these at OYA is indicative of the long term trend, hence the 60 year outturn monetised benefits can be derived from the forecast 60 year benefits.

4.12 Vehicle hour savings were considered for the weekday AM, IP and PM peak hours between M1 junctions 10-13 in both directions. In order to establish the proportion of vehicle hours saved compared to that forecast, it was necessary to calculate the observed vehicle hours saved per annum based on the before and OYA journey times and traffic flows as presented earlier in this report. This was done using a 'saving per vehicle' approach for existing traffic.

4.13 Although there is additional traffic in the corridor, as the journey times on the M1 are slower, this traffic is not included in the outturn calculations which have been based solely on the existing traffic.

4.14 The opening year forecast and observed vehicle hour savings for the mainline M1 traffic are shown in **Table 4-3**.

Table 4-3 – Opening Year Vehicle Hour Savings (hours)

Scheme Section	Forecast	Observed
M1 between J10 and J13	1,849,634	-867,123

4.15 From **Table 4-3** it can be seen that the observed vehicle hour changes on the M1 mainline show that vehicle hours have actually increased with the scheme.

4.16 This difference between the forecast and outturn vehicle hour savings has been applied to the forecast monetary journey time benefits to calculate the outturn as shown in **Table 4-4.**

4.17 Detailed traffic flow and journey time forecasts were not available for all the links each of the junctions, therefore a similar comparison has not been possible. However, in order to ensure that any benefits are captured in the monetised benefits, a comparison of before and after observed journey times and flows at specific locations at each of the junctions (including the M1 on and off slips) has been undertaken to calculate the observed vehicle hour savings. This difference in vehicle hours has been monetised using the Project Appraisal Report (PAR) approach. This approach has just considered a 12 hour benefit from 7am-7pm on weekdays, as this is where the main benefits were expected to occur. The PAR approach is normally used by Highways England for the appraisal of smaller schemes and will therefore only provide an estimate of economic benefit, as it is based on a small number of links. It is noted that this is a conservative estimate, as it does not include any benefits accrued by weekend and off peak traffic.

Table 4-4 – Monetised Journey Time Benefits (60 years)

Present Value Journey Time Benefits (£m 2002 prices, discounted)	Forecast	Outturn
Mainline M1 traffic	£512.65m	-£240.33m
Junction traffic	£114.64m	£29.30m
Journey Time Benefits for whole scheme	£627.29m	-£211.03m

4.18 From Table 4-4 it can be seen that the reforecast 60 year monetary disbenefit for the scheme of -£211.03million is significantly different than the original forecast. It can see that there is a small benefit at the junctions, but that this is significantly outweighed by the disbenefit seen for the mainline M1 traffic.

Vehicle Operating Costs

4.19 WebTAG guidance states that the use of the road system by private cars and trucks gives rise to operating costs for the user. These include fuel and non-fuel costs, where fuel costs are the majority net cost impact of conventional highways schemes. In the case of this scheme, the forecast changes in Vehicle Operating Costs (VOC) are a large negative benefit for users and have a considerable impact on the overall TEE benefits. For this reason, it has been necessary to evaluate the impact.

4.20 VOC impact was evaluated by looking at changes in fuel consumption in the opening year similarly to indirect taxation impact. This has used the ratio between the EAR forecast and POPE re-forecast changes in fuel use as detailed in the evaluation of indirect tax in **Table 4-8**. This ratio is applied to the monetary forecast VOC in order to calculate a proxy outturn reforecast value of VOC. The results of this calculation are shown in **Table 4-5**.

Table 4-5 –Summary of Vehicle Operating Costs Benefits (60 years)

Present Value (£m 2002 prices, discounted)	Forecast	Outturn
VOC	-£258.67m	-£43.97m

4.21 The results in **Table 4-5** show that both the forecast and outturn assessments of the VOC impact are negative benefits for users. The outturn evaluation of this disbenefit is lower than that forecast and it is noted that this is due to the traffic flows being lower than forecast and the level at which this traffic has changed to less fuel efficient speeds being below forecast.

Collision Benefits

4.22 Forecast collision savings for the M1 10-13 improvements and HSR scheme have been taken from the Economic Assessment Report (EAR),which showed a monetary impact of -£3.97million (2002 prices and discounted values), over 60 years for the combined mainline and junctions scheme.

Forecast Benefits

4.23 The evaluation of outturn safety benefits is based on the forecast 60 year appraisal period safety benefits and the comparison between the forecast and observed number of collisions saved in the opening year. The economic impact of changes in safety is calculated by assigning monetary benefits to the predicted reduction in the number and severity of personal injury collisions over the appraisal period.

Evaluation of Collision Benefits

4.24 The analysis performed at this OYA stage in the previous chapter showed that although an increase in collision numbers is seen on the mainline M1, there is no statistical confidence that this can be directly related to the scheme. In addition, analysis of collisions at the upgraded junctions shows no change in collision numbers. As such the outturn monetised safety impact is reforecast to be £0m (see section 5 for more details). It should be noted that this analysis is based on a limited sample size and will be revisited for the FYA study for this scheme when a more robust sample size will be available.

Journey Time Reliability

4.25 The scheme appraisal estimated the reliability benefits for the scheme. The monetised reliability benefit was not included in the Analysis of Monetised Costs and Benefits table (AMCB) in the EAR. The reliability sub-objective includes the impact of the scheme on incidents and day-to-day journey time variability.

4.26 The appraisal used INCA (INcident Cost Benefit Assessment) version 4.1 for estimating the benefits of reduced delay and travel time variability (TTV) caused by unforeseen incidents that reduce capacity, such as accidents, breakdowns, debris on the carriageway and major disruptions such as fire, load shedding or spillage. The combined impact on variability and delay are known as reliability.

4.27 The benefits presented in this section are in central growth in 2002 prices, discounted to 2002.

Table 4-6 – Monetised Journey Time Reliability Benefits Forecast

Journey Time Reliability Benefits	£m 2002 prices and values
Total Variability Benefit	£143.75m
Total Delay Benefit	£52.74m
Total	**£196.49m**

4.28 The above results show forecast reliability benefits of £196.49 million as a result of the M1 10 to 13 HSR and junction improvement scenario.

4.29 It should be noted that the EAR noted that there was less confidence in the method used for calculating reliability benefits than TEE benefits, hence reliability benefits were not included in the total benefits calculation in the EAR. The reliability benefit was shown in the appraisal AST but is not included in the EAR table used to calculate the BCR. This approach will be replicated in this evaluation report.

Evaluation

4.30 **Section 2.72** of this report considered the change in the standard deviation of journey times resulting from the scheme and the results provide sufficient evidence to conclude that the scheme has not achieved its objective of reducing congestion along the scheme section, at the one year after opening stage.

Carbon Impact

4.31 The impact of the scheme on greenhouse gases (change in carbon outputs) is considered in detail in the next chapter of this report. At the time this scheme was appraised, an output from the TUBA model was a monetary value for the change in carbon emissions. Estimates of the value of the additional global damage arising from an additional tonne of carbon being emitted into the atmosphere are referred to as estimates of the Shadow Price of Carbon (SPC). WebTAG also states that guidance suggests a shadow price per tonne of carbon dioxide of £25.50/t CO2 in 2007 prices and values, rising by 2% per year in real terms,

4.32 As this scheme was appraised using TUBA, this calculation has already been made to estimate that the scheme would result in an increase in carbon, at a cost of -£45.33m over the 60 year appraisal period.

4.33 A proxy change in carbon emissions has been calculated using the forecast and observed journey times and traffic flows along the M1 mainline between J10-J13. This indicates that an equivalent of 0% (156 tonnes of carbon) is observed compared to a reforecast 22% increase. As no change

is observed in carbon post opening, the monetary value at the one year after stage is assumed to be £0m.

Summary of Present Value Benefits (PVB)

4.34 A cost benefit analysis of a major scheme requires all the benefits to be considered for the whole of the appraisal period and they need to be expressed on a like-for-like basis with the benefits. This basis is termed Present Value. Present Value is the value today (or at a set consistent date) of an amount of money in the future. In cost-benefit analysis, values in differing years are converted to a standard base year by the process of discounting giving a present value.

4.35 Following current Treasury Green Book guidance, calculation of the present value entails the conversion to market prices, then discounting by year. This using a rate of 3.5% for the first 30 years and 3% thereafter.

4.36 A comparison of all forecast and outturn benefits is presented in **Table 4-7**.

Table 4-7 –Summary of Forecast and Observed Present Value Benefits

Present Value Benefits (£m 2002 prices, discounted)	**Forecast**	**Outturn**
Journey Times	£627.29m	-£211.03m
Vehicle Operating Costs	-£258.67m	-£43.97m
TEE impacts during construction	-£93.13m	
TEE impacts during future maintenance	-£5.00m	
Safety	-£3.97m	£0.00m
Noise	£7.91m	
Carbon*	-£45.33m	£0m
PVB	**£229.11m**	**-£345.22m**

*See Section 5, Greenhouse Gases

4.37 **Table 4-7** demonstrates that the total outturn PVB is significantly different to the forecast PVB. This is largely owing to journey time benefits being far less than anticipated (-£211.03m compared to £627.29m for the forecast central growth scenario).

Indirect Tax Revenues Impact

4.38 Indirect tax revenue is the expected change in tax revenue to the Government due to changes in the transport sector as a result of the scheme over the appraisal period. For the highway scheme in this study, the tax impact is derived primarily from the change in fuel consumption over the 60 year period resulting in changes to the revenue from tax on fuel. A scheme may result in changed fuel consumption due to the following reasons:

- Changes in speeds resulting in greater or lesser fuel efficiency for the same trips.
- Changes in distance travelled.
- Increased road use through induced traffic or the reduction of trip suppression.

4.39 Forecast changes to indirect tax revenues were taken from the EAR PCF stage 5 update. The scheme was expected to increase tax revenue over the 60 year appraisal period in comparison with the Do Minimum (i.e. no scheme) scenario.

4.40 To assess the outturn impact, the change in fuel use along the mainline M1 between J10-J13 at OYA has been calculated from observed changes to traffic flows and speeds. A corresponding calculation of the predicted change in fuel use has been performed using the forecast changes to traffic flows and speeds for the same section. The ratio between the forecast and observed changes in fuel use is the applied to the monetised impact on indirect tax revenues in the appraisal process to determine an outturn impact. This is shown in **Table 4-8**. This calculation has not considered the impact of the junctions explicitly due to the lack of detailed forecast changes in flows and speeds. However, the majority of the revenue changes would be as a result of the mainline M1 flows and speeds, and would dwarf the small anticipated impacts of the junctions.

Table 4-8 – Indirect Tax Revenue Impact as a cost (60 years)

£m 2002 prices and values	Forecast	Outturn
Change to Indirect Tax Revenues	-£317.08m	-£52.35m

4.41 This evaluation shows that the outturn reforecast of the impact of the scheme on indirect tax revenue as a cost is lower than forecast. That it is a negative cost here means that there are expected to be more payments in tax in the 60 year appraisal period i.e. a benefit to the Treasury. The difference between forecast and outturn is due to the fact that the forecasts assumed higher traffic growth on the M1 and increased speeds resulting in greater increase in fuel use, whereas one year after opening the observed traffic growth is negligible compared to pre-scheme giving much lower change in fuel use. This much reduced change in the predicted increase means that revenues are lower than expected.

4.42 This assessment is based on the scheme section where both pre-scheme and post opening traffic counts and speeds are available.

Scheme Costs

Introduction

4.43 This section compares the forecast costs of the scheme as of the start of the construction period with the actual spend at the time of this evaluation.

4.44 Costs of the scheme are also considered for the full appraisal period of 60 years such that they can be compared with the benefits over the same period. The full costs examined were made up of the following:

- Investment costs : before and during construction;
- Indirect Tax Revenues: during the 60 years after opening.

4.45 Investment costs are considered in terms of a common price base of 2002 for comparison with forecast. For comparison with the benefits, overall costs are expressed in terms of present value, termed Present Value Cost (PVC).

Investment Costs

4.46 The investment cost is the cost to Highways England of constructing the scheme and purchasing any land. The forecast scheme cost has been taken from the EAR PCF stage 5 update. It was clearly stated in the EAR that the forecast cost, excluding historic costs is £416.8m in 2006 Q2 prices, undiscounted. This value is then adjusted to get the final forecast cost of £334.84m in 2002 market prices, undiscounted. The total cost of the combined scheme which was approved by the roads minister in November 2009 was £461m including historic costs, budget contingency and programme risk provision.

4.47 A comparison between the forecast and outturn investment cost is presented in **Table 4-9.**

Table 4-9– Summary of Investment Costs

Forecast Cost		Outturn Cost		% Difference
EAR PCF Stage 5 in 2006 Q2 prices	£416.80m	As spent costs in 2004-2014 years and prices	£326.66m	-
Costs in £m 2002 prices, undiscounted	£334.84m	Costs in £m 2002 prices, undiscounted	£247.56m	-35%

4.48 It can be seen from **Table 4-9** that the outturn cost is lower than forecast cost by 35%.

Maintenance, Operating and Refresh Costs

4.49 After completion of construction, the M1 HSR Improvement Scheme was forecast to incur additional costs in the form of maintenance of the additional equipment, operational costs and technology refresh costs over the 60 year appraisal period. These ongoing costs would increase annually in line with GDP growth per capita. The forecast maintenance costs presented in **Table 4-10** have been taken from the EAR PCF stage 5 update over the 60 year appraisal period.

Table 4-10 – Forecast Maintenance Costs

£m 2002 prices and values	
Operating/ Refresh costs for VSL equipment	£111.41m
Operating and Maintenance costs for Junctions	£0.23m
Total Operation, Maintenance and Refresh costs	£111.64m

4.50 For this evaluation, these costs are still almost entirely in the future and no evaluation has been done of maintenance costs to date. It will therefore be assumed that the outturn maintenance costs are the same as forecast.

Present Value Costs (PVC)

4.51 A cost benefit analysis of a major scheme requires all the costs to be considered for the whole of the appraisal period and they need to be expressed on a like-for-like basis with the benefits. This basis is termed Present Value. Present Value is the value today (or at a set consistent date) of an amount of money in the future. In cost-benefit analysis, values in differing years are converted to a standard base year by the process of discounting giving a present value.

4.52 Following current Treasury Green Book guidance, calculation of the present value entails the conversion to market prices, then discounting by year. The calculation uses a rate of 3.5% for the first 30 years and 3% thereafter.

4.53 The total Present Value of Cost (PVC) is made up of the following costs converted to present value:

- Investment costs – construction.
- Do Minimum costs
- Maintenance, Operating and Refresh costs

- Changes to indirect tax revenues.

4.54 PVC was taken from the EAR PCF stage 5 update as £64.54m. This is the 2002 costs, expressed in market prices discounted at the annual rate of 3.5%. The outturn costs are presented likewise.

4.55 Allowance has been made for costs that would otherwise be incurred under a 'Do-Minimum' scenario – i.e. if no scheme option is chosen. These costs have been classed as 'Do-Minimum' maintenance costs, and are deducted from the Scheme cost. It is assumed same as forecast as no evaluation has been done for this. In addition, the scheme itself would incur ongoing maintenance costs, such as operating costs and equipment refreshment. These costs have not been considered as part of the evaluation and are assumed to be the same as forecast.

4.56 **Table 4-11** shows the total of the present value costs.

Table 4-11 – Summary of Forecast and Observed Present Value Costs

Present Value Costs (£m, 2002 prices and values)	Forecast	Outturn
Investment costs (Construction)	£291.12m	£222.32m
Do Minimum costs	-£21.14m	
Maintenance, Operating and Refresh cost	£111.64m	
Indirect Tax impact as cost	-£317.08	-£52.35
Total	**£64.54m**	**£260.47m**

Benefit Cost Ratio (BCR)

4.57 The Benefit Cost Ratio (BCR) is used as an indicator of the overall value for money of the scheme. It is the comparison of the benefits (PVB) and costs (PVC) expressed in terms of present value. For the purpose calculating the BCR, the forecast and outturn costs have been discounted to 2002 using the standard discount rate of 3.5% and converted to market prices.

4.58 Schemes with a BCR greater than one have greater benefits than costs; hence they have a positive Net Present Value (NPV). The higher the BCR, the greater the benefits relative to the costs.

4.59 At the time of scheme appraisal, Treasury guidance was to include indirect tax as a cost. However, the most recent guidance on indirect tax impacts is to include these as a benefit, rather than a reduction in cost. This means that when a scheme leads to increase fuel consumption and hence increase tax revenue, the PVB is increased rather than the PVC being decreased **Table 4-12** below presents the BCR calculated by the original appraisal approach as well as according to current methodology.

Table 4-12 – Forecast vs. Reforecast Outturn BCR

All costs in £m 2002 prices and values	Indirect Tax impact as Cost		Indirect Tax impact as Benefit	
	Forecast	Outturn	Forecast	Outturn
PVB	£229.11m	-£345.22m	£546.18m	-£292.87m
PVC	£64.54m	£260.47m	£381.62m	£312.82m
NPV	£164.56m	-£605.69m	£164.56m	-£605.69m
BCR	**3.55**	**-1.33**	**1.43**	**-0.94**

4.60 **Table 4-12** shows that the net present value (NPV) forecast was £164.56m, however based on outturn calculations the NPV is negative this is mainly due to the outturn journey time impact. It means that the costs outweigh the benefits.

4.61 The outturn assessment of a negative overall PVB, regardless whether indirect tax is included in the benefits or in the costs results in the outturn BCR assessments being all negative.

4.62 It should be noted that the BCR ignores non-monetised impacts. In scheme appraisals, the impacts on wider objectives must be assessed but are not monetised. The evaluation of the environmental, accessibility and integration objectives is covered in the following sections.

Wider Economic Impacts

Forecast

4.63 The HSR AST for this scheme stated that 'the scheme would give rise to an estimated additional 700 full time jobs'. The forecast impact of the scheme was 'Neutral'. The junctions AST noted that 'no significant effects were identified on employment levels in the Luton and Dunstable Regeneration area' and recorded a forecast impact of Neutral for wider economic impacts.

Evaluation

4.64 The M1 motorway has a key function in providing strategic connectivity between London and the Midlands and the North for people and freight. A large proportion of the wider benefits come from the changes to the transport system allowing improved access to higher productivity areas for employment such as Milton Keynes and Luton. Although the impacts cannot be quantified, it can be inferred that the scheme has facilitated wider economic benefits.

4.65 The Dunstable and Houghton Regis housing development area is included in the Regional Spatial Strategy and is located to the north of Dunstable. Houghton Regis is currently a medium sized town of approximately 17,000 residents, an increase of 2% between 2001 and 2011, and around 7,300 properties.

4.66 The Milton Keynes South Midlands (MKSM) is one of the largest growth areas. A key facilitator in delivering increased numbers of housing and jobs in the area is a transport infrastructure that can cope with these growth plans.

4.67 The M1 J10 to 13 scheme along with the completed M1 Junction 6a to 10 widening scheme and the planned A5-M1 Dunstable Northern Bypass scheme will provide increased capacity which should enable the growth plans to be realised whilst maintaining and improving the performance levels of the M1.

4.68 In the absence of a full evaluation into the possible wider impacts of the M1 junction 10 to 13 scheme, this evaluation is in agreement with the appraisal's assessment of 'neutral'.

Key Points - Economy

Benefits

- The outturn journey time disbenefits of -£211.03m are significantly lower than the forecast benefits. The small benefit seen at the junctions is dwarfed by the large disbenefit seen for the M1 mainline.
- No safety benefits can be attributed to the scheme at this stage.
- The disbenefit from vehicle operating costs is less than forecast, due to lower traffic than forecast, and more efficient speeds.
- Overall, the outturn monetary benefits are negative, compared to the large forecast benefits of £629.29m.

Costs

- The outturn investment cost is lower than forecast cost by 35%
- The outturn reforecast of the impact of the scheme on indirect tax revenue as a costs is lower than forecast. This is due to the fact that the forecasts assumed higher background traffic growth resulting in greater changes to indirect tax, whereas one year after the observed traffic growth is lower than forecast.

Benefit Cost Ratio

- Taking indirect tax as a benefit, the scheme achieves a negative BCR of -0.94 due to the lower than forecast journey time benefits, meaning that the costs outweigh the benefits.

Wider Economic Impacts

- In the absence of a full evaluation into the possible wider impacts of the M1 junction 10 to 13 scheme, this evaluation is in agreement with the appraisal's assessment of 'neutral' for both elements of the scheme.

5. Environment

Introduction

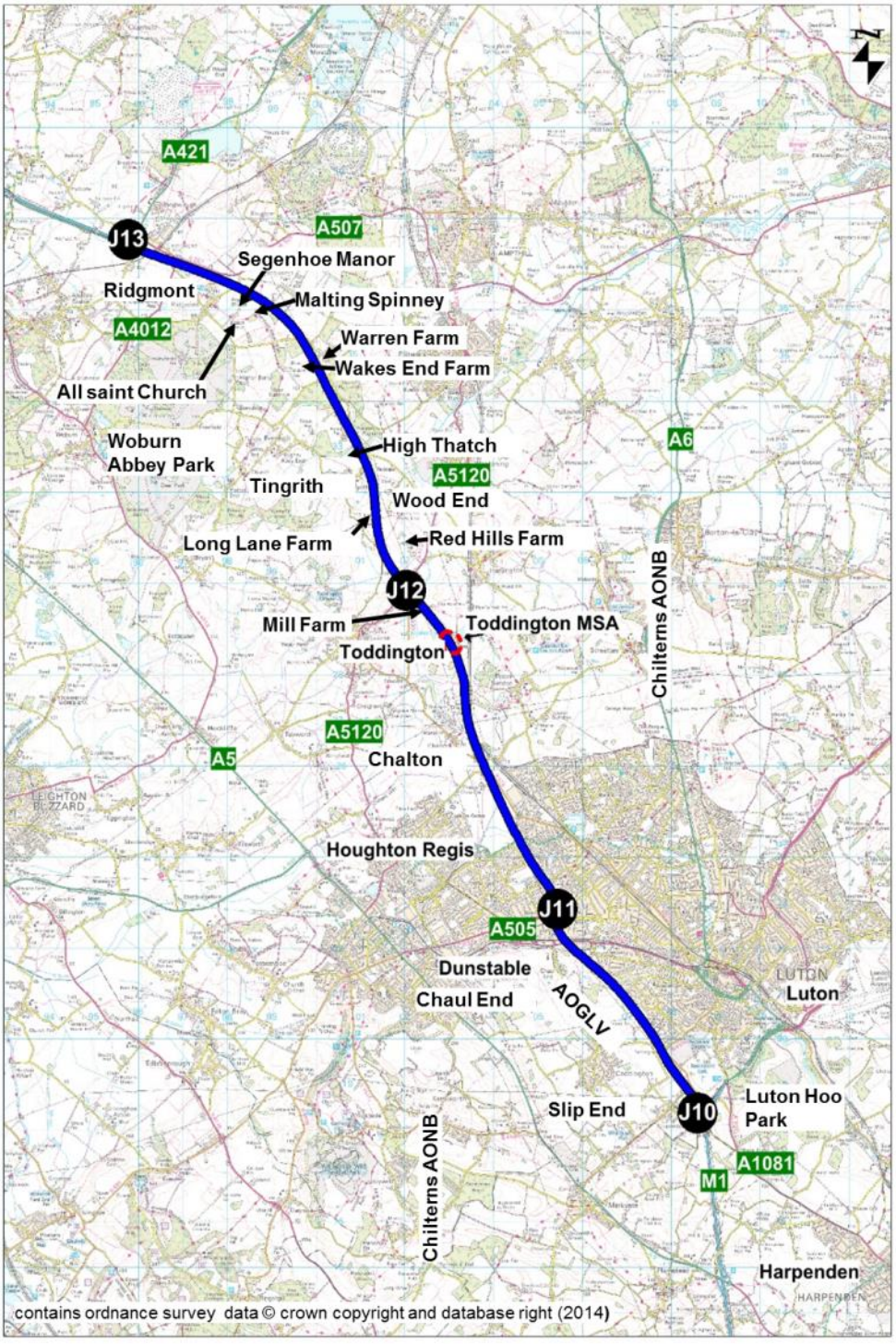
5.1 The environmental appraisal reporting of the M1 J10 to 13 HSR and J11 and 12 improvements treat schemes as being two separate entities, with separate ASTs and a separate environmental assessment report (EAR)/ environmental statement (ES).

5.2 The two schemes are closely linked, and the ES for the junction improvements states that "*The M1 Junction 10 to 13 HSR Scheme will improve journey time reliability and safety by reducing congestion, accidents and traffic conflicts. However, the benefits of the M1 Junction 10 to 13 HSR Scheme will not be fully successful whilst there is the potential for increases in delays at Junctions 11 and 12. The M1 Junction 11 and 12 Improvements would increase capacity at these two junctions and would maximise the benefits from hard shoulder running. This would also improve safety*."

5.3 Highways England originally developed these two elements as one scheme, as shown in the previous sections. However the junction improvement element required some land take, and a public inquiry was needed. As a result, the scheme was split in two, enabling the HSR element to be constructed whilst the public inquiry was underway for the junction element, and two sets of appraisal documents were produced. After the public inquiry, the two schemes were constructed concurrently, and for the purposes of POPE, the two schemes have been assessed together. The schemes opened at the same time – December 2012. This section documents the evaluation of the impacts of the schemes on the environmental sub-objectives.

5.4 A key location plan is provided below which serves to identify locations of sites mentioned within this chapter. (**Figure 5.1**).

Figure 5.1 – Key Location Plan – Scheme locations referenced in Environment Chapter



Difficulties in Evaluation

5.5 POPE has encountered difficulties in evaluation due to a lack of available information. In particular there is very little information available on the HSR scheme – no EAR and no scheme design or environmental drawings have been provided. This has meant the exact scope, baseline and predicted effects of the scheme are unclear. It also makes evaluation of the J11 and 12 junction improvements more difficult, as the ES for the junction improvements, which has been made available to POPE, assumes that the HSR scheme is already in place in the do-minimum scenario.

5.6 Therefore, the evaluation of the HSR scheme within this chapter is based primarily on the AST and TAG worksheets. It should be noted that the AST was produced in September 2009 but the only worksheets made available to POPE were produced in April 2012, once construction had already started, in Project Control Framework stage 6. The TAG worksheets have not been reported in detail here; however where the worksheets have highlighted specific impacts (i.e. not 'neutral') on specific receptors that are not already reflected in the AST, these have been evaluated, provided there is sufficient information available to identify that receptor.

5.7 The level of detail that could be expected at OYA is therefore lacking and the FYA report will need to evaluate the scheme in greater detail, assuming that key documents are available then.

Scheme Objectives

5.8 The ES for the J11 and 12 Junction Improvements notes that the Client Scheme Requirements for the junctions 10-13 scheme had a number of environmental objectives (in addition to those for traffic and safety) which were relevant to the Junction Improvements scheme including the following:

- Mitigate the detrimental environment effects of the scheme where technically feasible and economic to do so
- Not worsen the air quality within the Luton Air Quality Management Area (AQMA)
- Not exceed EU air quality limit values
- Not worsen the severance of local thoroughfares for Non-Motorised Users (NMUs)
- Support local and regional development plans and government policy

Key Facts

J10 to 13 HSR

5.9 Implementation of the HSR scheme between J10 and J13 included installation of:

- 58 new overhead steel gantries, ranging in size from 38m to 67m, and three new cantilever signs.
- 387 electronic signs and signals, including 67 of the latest matrix signs (fourth generation), with the ability to display pictograms as well as text and two of the (third generation) driver information panels that are larger than previous variants and carry information on road conditions.
- 33 Emergency Roadside Telephones
- 30 Emergency Refuge Areas (ERAs)
- 296 CCTV cameras to monitor the hard shoulder and ERAs
- 1076 loops beneath the road surface to monitor traffic flow and speeds
- Replacement of lighting where necessary (full length already lit)
- Resurfacing of hard shoulder and a section of the M1 through Luton with low noise surface
- Installation of noise barriers
- Associated earthworks and retaining walls

5.10 It is understood that landscape planting was also undertaken for the scheme.

5.11 The HSR scheme included the gantries and signage required for the J11 and 12 Junction Improvements.

J11 and 12 Junction Improvements

J11

5.12 The form of the junction would remain largely as existing, with no changes to over bridges, but would become fully signalised. Other key works would include:

- Widening of slips roads
- Localised widening of A505 Dunstable Road on entry to the roundabout
- Signalised pedestrian crossings across slip roads
- Land take and demolition of non-residential property to widen the northbound diverge slip road (all other land within highway boundary)
- New retaining walls between slip roads and mainline
- New signage on A505
- Drainage from increased pavement area via a filter drain or other Sustainable Drainage Systems (SUDS) using the existing or modified drainage system
- Lighting replaced where necessary (junction already fully lit)
- Limited landscape planting/ seeding

J12

5.13 The junction would form a new signalised, cloverleaf junction to the north of the existing junction, together with the construction of a new bridge to take the A5120 Harlington Road over the M1. The northbound slip roads would form a staggered cross roads arrangement at the junction of the slip road, A5120 and B579. The southbound slip roads would form a T-junction arrangement with the A5120. Key components include:

- Demolition of existing over bridge
- Demolition of a non-residential property (Keltonstone Recycling)
- Widening of slip roads
- Widening of the existing A5120 on approaches to the junction
- Revision of B579 to configure into the new junction
- Paved NMU route provided on the new A5120 over bridge
- Diversion of a footpath (FP34) under a new agricultural access underbridge
- Extension of an existing culvert and underbridge
- Signage on the A5120 approaches to the junction
- Full lighting scheme (existing junction already lit)
- New kerb drainage and construction of attenuation ponds with pollution containment ditches
- Landscape planting and seeding including species rich grassland, hedgerows and woodland

Data Collection

5.14 The following documents have been used in the environmental evaluation part of this study:

J10 to 13 HSR

- AST, September 2009
- TAG Worksheets, April 2012

J11 and 12 Junction Improvements

- AST, September 2009
- TAG Worksheets, April 2012
- ES (single volume) and Non-Technical Summary (NTS), December 2009
- Archaeological Evaluation of Land Adjacent to M1 Junction 12, February 2011
- Public Inquiry Outline Statement of Case, April 2010
- Inspector's Report, August 2010

Combined Schemes

- Landscape Management and Maintenance Plan, June 2013

5.15 Some HSR scheme information was available in the J11 and 12 Improvements ES and on the Highways England project website.

5.16 A full list of the background information requested and received to help with the compilation of this report is included in the **Appendix C**.

Site Inspections

5.17 A site visit was undertaken on September 6th and September 8th 2014 and the photographs included in this report were taken at this time. The ES for the junction improvements did not include photomontages; however viewpoint photographs were available in the ES and have been used for comparison in this report.

Consultations

5.18 **Table 5-1** lists the organisations contacted regarding their views on the impacts they perceive the road scheme has had on the environment, and whether they feel that the mitigation measures implemented have been effective. The consultation requests presented both the junction improvements and HSR as a single scheme.

Table 5-1 – Summary of Environmental Consultation Responses

Organisation	Field of Interest	Comments
Environment Agency	Water	Response received and reported in water quality section
Natural England	Biodiversity	Response received and reported in biodiversity section
English Heritage	Archaeology	Response received and reported in cultural heritage section
Hertfordshire County Council	General	No response received
Central Bedfordshire Council	General	No response received
Luton Borough Council	General	Comments and data provided on air quality and noise.

Chilterns AONB	Landscape	Response received and reported in landscape section. Overall the impacts of the scheme were as expected.
Flamstead Parish Council	General	No response received
Slip End Parish Council	General	Commented that overall the environmental impacts are as expected. Other comments noted in the air quality, noise, landscape, biodiversity, water quality and cultural heritage sections.
Hyde Parish Council	General	No response received
Caddington Parish Council	General	No response received
Chalton Parish Council	General	No response received
Toddington Parish Council	General	Comments received on variable speed limits which are reported, comments also reported in journey ambience section.
Westoning Parish Council	General	No response received
Tingrith Parish Council	General	No response received
Flitwick town Council	General	No response received
Eversholt Parish Council	General	No response received
Steppingley Parish Council	General	The hard shoulder running during peak times seems to work well and there were no adverse comments on this particular aspect of the scheme. Other comments related to J11 and J12 relate to transport and are reported in pervious section. Comments also reported in the journey ambience section.
Ridgemont Parish Council	General	No response received
Hushborne Crawley Parish Council	General	No response received

Animal Mortality

5.19 The Managing Agent Contractor (MAC) has been consulted with regard to animal mortality figures between J10 and 13. Data was provided from 2011. Details of fencing design have not been made available to POPE so the data cannot be usefully interrogated. This should be revisited at FYA stage when fencing details are known.

Traffic Forecasts and Evaluation

5.20 Three of the environmental sub-objectives (noise, local air quality and greenhouse gases) are directly related to traffic flows. No new environmental surveys are undertaken for POPE and an assumption is made that if the observed level of traffic is in line with forecasts, then it is likely that local noise and air quality are as expected. A single traffic model exists for both the HSR and Junction Improvements schemes.

Table 5-2 – Forecast 2005 Two-Way ADT v Observed OYA ADT

Location/ Link	Total ADT				
	Observed Before (2005)	Observed (OYA)-2014	Forecast Growth (TFR)-2014	Difference between observed and forecast	Percentage Difference (%) between Observed and forecast
J10-11	140,139	145,143	186,700	-41,557	-29%
J11-12	130,830	133,654	169,600	-35,946	-27%
J12-13	127,550	129,044	156,750	-27,706	-21%

Table 5-3 – Forecast 2005 Two-Way HGVs v Observed OYA HGVs

Location/ Link	ADT HGVs				
	Observed Before (2005)	Observed (OYA)	Forecast Growth (TFR)	Difference between observed and forecast	Percentage Difference (%) between Observed and forecast
J10-11	26,726	24,094	33,401	-9,306	-39%
J11-12	25,950	23,696	30,340	-6,643	-28%
J12-13	25,097	23,065	28,035	-4,971	-22%

Noise

Forecast

AST – J10 to 13 HSR

5.21 The AST stated that for design year 2028, the adoption of HSR would result in a negligible decrease in the number of people annoyed by traffic noise in the study area when compared to the corresponding do-minimum scenario. This would be as a result of a combination of the enhanced barrier scenario to the M1 and changes in traffic flows on road links outside the scheme corridor with the scheme in place.

5.22 Number of properties experiencing noise levels > 68dB LAeq, 18h: Do Minimum 1307; Do Something 1049.

AST – J11 and 12 Junction Improvements

5.23 The AST stated that for design year 2029, the adoption of the scheme would result in a negligible decrease in the number of people annoyed by traffic noise in the study area when compared to the corresponding do-minimum scenario.

5.24 Number of properties experiencing noise levels > 68 dB LAeq,18h: Do Minimum, 192; Do Something, 213. Challney High School, immediately to the north-east of J11 would experience a negligible decrease in noise levels as a result of the scheme. Luton and Dunstable Hospital, to the west of J11, would experience a negligible decrease in noise levels as a result of the scheme, except for the western facades fronting on to Lewsey Road, which would experience a negligible increase in noise levels. The only non-residential receptor in the vicinity of J12 is Poplars Nursery to the north-east on Harlington Road. These premises would experience a negligible decrease in noise levels as a result of the scheme.

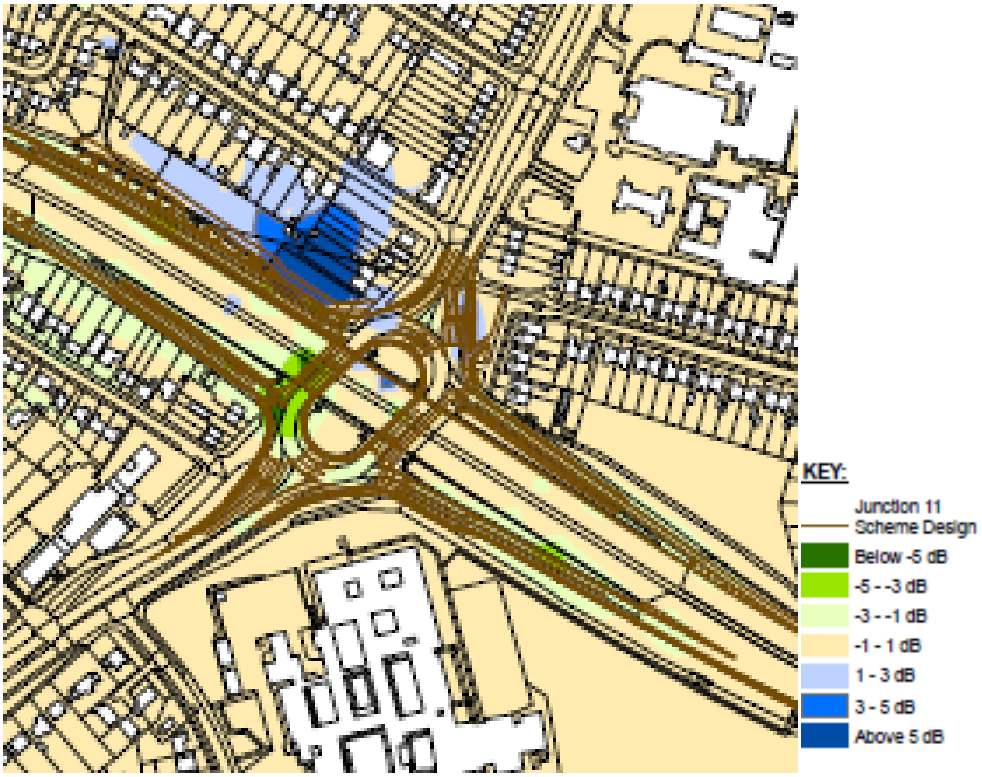
Environmental Statement – J11 and 12 Junction Improvements

5.25 The ES stated that:

- The junction improvements scheme would increase by 127 people annoyed by traffic noise in 2014 compared to the do-minimum. 126 of these were associated with J11 and only one with J12. There would be no perceptible change (≥1dB change) to the other sensitive, non-residential receptors (schools, churches, community centres, hospitals and nursing homes) in the study area.
- Noise increases in the study area were generally expected to be negligible around J11 with the exception of a small number of properties adjacent to the northbound off-slip.
- Significant noise increases associated with J11 would largely relate to the demolition of Keltonstone Recycling, which provided noise shielding for properties on Dunstable Road and Derby Road. The rear façade of two properties on Dunstable Road would experience a noise increase of above 5dB, two would experience noise increases of between 2 and 3 dB, and five would experience noise increases of between 1 and 2 dB.
- The 2029 do-minimum and do-something assumed the M1 between J10 and 13 would be fully surfaced with low noise surfacing.
- In the long term, the ES predicted that, overall, there would be a reduction of 7 people annoyed by traffic noise with the scheme compared to the 2029 do-minimum, which would be considered a neutral effect. There would be a moderate decrease in noise to the north and south of J12.
- Two properties – 667 Dunstable Road and 4 Wyndham Road, both in Luton – might qualify for treatment under the Noise Insulation Regulations due to increase in noise.
- The scheme junction improvements would be surfaced with low noise road surface.
- No specific acoustic barriers were specified beyond those proposed for the HSR scheme.

5.26 **Figure 5.2**, below illustrates the increase in noise levels due to the demolition of Keltonstone recycling, which provided screening to residential properties.

Figure 5.2 – Extract from J11 Difference Contours – Do Something 2029 minus Do Minimum 2029



5.27 The ES concluded that there would be an overall increase in people annoyed by the junction improvements scheme in 2014, but that this would reduce in the future (2029) on the assumption that the whole of the M1 between J10 and 13 would be surfaced with low noise surfacing.

Consultation

5.28 Luton Borough Council provided information on a noise complaint on Eldon Road, Luton (near J11) in 2013. The complaint relates to adequate provision of noise barriers as part of the HSR scheme and is currently unresolved. However noise monitoring has been undertaken at the property, which shows a reduction of 0.6dB with the schemes. Changes in noise of <1dB are generally not perceptible to humans. In the interim, Highways England has confirmed that the barrier had been installed as expected.

5.29 Slip End Parish Council, which is located near J10, stated that mitigation measures had been implemented as expected and that the there was no evidence of changes in noise levels as a result of the schemes.

Evaluation

5.30 **Figure 5.3** below shows the property on Dunstable Road that the ES stated would experience >5dB increase in noise, largely due to the demolition of the Keltonstone building. Acoustic barriers have been provided adjacent to the property – and on Wyndham Road (illustrated in photo view 11D in **Appendix D**) – but it is not known whether these properties received noise insulation as a result of the scheme, as the ES suggested they might.

Figure 5.3 – Property adjacent to J11 on Dunstable Road

5.31 Acoustic barriers are apparent at various locations throughout the scheme between J10 and 13; however the lack of design information and as built drawings for the HSR scheme, in particular, means that it cannot be confirmed that noise mitigation (acoustic barriers and low noise surfacing) has been implemented as expected or that impacts are as expected. Further study is required at FYA.

5.32 Based on available traffic data for the M1, traffic flows have increased only slightly since before the scheme (2005) and are significantly lower than predicted in 2014. Observed 2014 HGV movements are less than 2005 levels, and significantly down on predicted levels. A percentage difference of >20% less traffic has been recorded between all links of the M1 between J11 and

13 when compared to predicted 2014 levels, with flows particularly lower than expected between junctions 10 and 12. The same can be said for HGV movements. This is likely to mean that the noise levels of the scheme are lower than was predicted with regard to traffic movements, particularly between junctions 10 and 12, and therefore, the overall scheme – HSR and junction improvements – is better than expected with regard to noise. It is not known whether mitigation has been implemented as expected and so further study is required at FYA to fully understand the noise impacts of the scheme.

Table 5-4 – Summary of Noise Evaluation

Origin of Assessment	Summary of Predicted Effects	Assessment
AST – J10 to 13 HSR	For the Scheme design year 2028, the adoption of HSR results in a negligible decrease in the number of people annoyed by traffic noise in the study area when compared to the corresponding Do minimum scenario. This is a result of a combination of the enhanced barrier scenario to the M1 and changes in traffic flows on road links outside the Scheme corridor with the Scheme in place. Number of properties experiencing noise levels > 68dB LAeq, 18h: Do Minimum 1307; Do Something 1049.	11,204 properties experience an increase in noise level. 1,558 properties experience no change in noise level. 9,933 properties experience a decrease in noise level. (ranked as Neutral) NPV of noise proposal = +£7,909,909
EST – J10 to 13 HSR	Assuming all noise mitigation has been implemented as expected, significantly lower than expected traffic and HGV flows on the M1 has meant that noise impacts are likely to be lower than expected. Further study of mitigation measures is required at FYA.	Better than expected based on available traffic data, but further study of mitigation required at FYA.
AST – J11 and 12	For the Scheme design year 2029, the adoption of the Scheme results in a negligible decrease in the number of people annoyed by traffic noise in the study area when compared to the corresponding Do minimum scenario. Number of properties experiencing noise levels > 68 dB LAeq,18h: Do Minimum, 192; Do Something, 213. Challney High School, immediately to the north-east of J11 will experience a negligible decrease in noise levels as a result of the Scheme. Luton and Dunstable Hospital, to the west of J11, will generally experience a negligible decrease in noise levels as a result of the Scheme, except for the western facades fronting on to Lewsey Road, which will experience a negligible increase in noise levels. The only non-residential receptor in the vicinity of J12 is Poplars Nursery to the north-east on Harlington Road. These premises will experience a negligible decrease in noise levels as a result of the Scheme. (a negligible change in noise level is defined as less than 1 dB)	736 properties experience an increase in noise level. 3011 properties experience no change in noise level. 1980 properties experience a decrease in noise level. (ranked as Neutral) NPV of noise proposal = +£0.226 m
EST – J11 and 12	Assuming all noise mitigation has been implemented as expected, significantly lower than expected traffic and HGV flows on the M1 has meant that noise impacts are likely to be lower than expected. Further study of mitigation measures is required at FYA.	Better than expected based on available traffic data, but further study of mitigation required at FYA.

5.33 EST scores for both schemes are the same due to the shared traffic data.

Local Air Quality

Forecast

AST – J10 to 13 HSR

5.34 The AST stated that the area near J11 has been declared an Air Quality Management Area (AQMA) for NO2 (nitrogen dioxide) by Luton Borough Council, and comprises 431 dwellings. An AQMA has also been declared in Dunstable based on a predicted 40ug/m3 contour. With the HSR option with 50mph speed limit through the Luton AQMA as necessary and 3 Highways Agency (as in place at the time) owned properties on Leagrave High St being excluded from residential use, the predicted baseline exceedance of the annual mean nitrogen dioxide limit value would be worsened at one property on Leagrave High Street. There would also be one new exceedance of the air quality limit value predicted for 179 Leagrave High St. Predicted baseline exceedences would be removed at 2 properties on Withy Close and 1 in Dunstable and 3 further properties would have an existing exceedance improved. All properties outside the AQMA but within 200m of the scheme would experience air quality levels within UK Air Quality Objectives.

AST – J11 and 12 Junction Improvements

5.35 The AST for the junction improvements stated that the new junction scheme road alignment is likely to change the route of traffic within the study area. The scheme will cause a worsening in local air quality relative to baseline conditions at 3294 properties and an improvement of 2056 properties lying within 200m of the proposed Scheme. The area near J11 had been declared an AQMA for NO2 by Luton BC, by 2014 there would only be one relevant receptor that the limit value was still predicted to be exceeded at. The Scheme would result in an imperceptible improvement in the margin of exceedance of the annual mean limit value for nitrogen dioxide at the only exceeding property.

Environmental Statement – J11 and 12 Junction Improvements

5.36 The ES stated that:

- At most receptors within the study area, the impact of the junction improvements scheme on annual mean concentrations of nitrogen dioxide were expected to be small or imperceptible in magnitude.
- Receptors located alongside roads that would experience an increase in traffic would also experience an increased exposure in annual mean concentrations of NO2 and the greatest benefits would be experienced at receptors close to Toddington Lane near J12 due to reduced traffic flows.
- Within the Luton AQMA the scheme would cause annual mean concentrations of nitrogen dioxide to change by less than 1 µg/m3 at any receptor.
- Some properties in the Luton AQMA (on Leagrave High Street) were predicted to experience an exceedance in NO2 limits values in the do-minimum scenario. With the scheme, the predicted reduction of annual mean concentrations at receptors at these receptors was considered to be imperceptible in magnitude.
- At receptors that would achieve the limit values with or without the scheme, the small to imperceptible impact on local air quality at most receptors was considered to represent a negligible effect over all.

5.37 The ES concludes that the junction improvements scheme would result in a small (0.2 % or less) increase in total emissions of pollutants from the affected surrounding roads and new link road compared to baseline in 2014 and in 2029, as reductions in emissions per kilometre, due to increased average speeds, would be outweighed by the effect of an increase in total vehicle

kilometres travelled. The magnitude of the increase would represent a negative effect of minor significance.

5.38 Overall, the J12 improvement scheme effects on properties within the Luton AQMA were considered to be negligible overall.

Consultation

5.39 Luton Borough Council responded with regard to air quality, stating that they "measure air quality at a number of locations near to the M1 motorway. The results for nitrogen dioxide from the continuous analyser and the 4 diffusion tubes near junction 11 all show an increase in annual mean concentrations in 2013 when compared with 2012 (and in most cases, 2011 also)". They also provided a draft air quality progress report, which confirmed this.

5.40 Although the data show an increase in NO2, this increase has only been shown across a relatively short period of time and it is not possible to determine whether there is a trend or whether the increase relates to the scheme. Further data across a longer timescale is required to draw any conclusions, as the increase shown could be as a result of climatic factors. Further study should be undertaken at FYA stage.

5.41 Slip End Parish Council, which is located near J10, stated that there was no evidence of changes in air quality as a result of the schemes.

Evaluation

5.42 Based on available traffic data for the M1, traffic flows have increased only slightly since before the scheme (2005) and are significantly lower than predicted in 2014. Observed 2014 HGV movements are less than 2005 levels, and significantly down on predicted levels. A difference of >1000 fewer vehicles a day has been recorded between all links of the M1 between J11 and 13 when compared to predicted 2014 levels. HGV movements are thousands less per day than predicted (a difference of 200 HGV movements a day might constitute a change in air quality), between all links. This is likely to mean that the air quality impacts of the scheme are less than expected for both the HSR and junction improvements due to less vehicle emissions.

5.43 However, this is not supported by the air quality data provided by Luton Borough Council, which show a decrease in air quality since scheme opening. The data may be influenced by other emission sources or climatic factors, and should therefore be considered again at FYA, when a clearer pattern may emerge.

Table 5-5 – Summary of Air Quality Evaluation

Origin of Assessment	Summary of Predicted Effects	Assessment
AST – J10 to 13 HSR	The area near J11 has been declared an Air Quality Management Area (AQMA) for NO2 by Luton BC, and currently comprises 431 dwellings. An AQMA has also been declared in Dunstable based on a predicted 40ug/m3 contour. With the HSR option with 50mph speed limit through the Luton AQMA as necessary and 3 HA owned properties on Leagrave High St being excluded from residential use, the predicted baseline exceedance of the annual mean nitrogen dioxide limit value would be worsened at one property on Leagrave High Street. There is also one new exceedance of the air quality limit value predicted for 179 Leagrave High St. Predicted baseline exceedences would be removed at 2 properties on Withy Close and 1 in Dunstable and 3 further properties would have an existing exceedance improved. All properties outside	Assessment Score: PM10 = +164; NO2 = +120

	the AQMA but within 200m of the scheme experience air quality levels within UK Air Quality Objectives.	
EST – J10 to 13 HSR	M1 traffic flows and HGV numbers are significantly lower than expected, meaning the scheme is likely to have a lower effect on air quality than expected.	Likely to be better than expected based on traffic flows
AST – J11 and 12	The new junction scheme road alignment is likely to change the route of traffic within the study area. The Scheme will cause a worsening in local air quality relative to baseline conditions at 3294 properties and an improvement of 2056 properties lying within 200m of the proposed Scheme. The area near junction 11 has been declared an Air Quality Management Area (AQMA) for NO2 by Luton BC, by 2014 there is only one relevant receptor that the limit value is still predicted to be exceeded at. The Scheme would result in an imperceptible improvement in the margin of exceedance of the annual mean Limit Value for nitrogen dioxide at the only exceeding property.	PM10: +95 NO2: +274
EST – J11 and 12	M1 traffic flows and HGV numbers are significantly lower than expected, meaning the scheme is likely to have a lower effect on air quality than expected.	Likely to be better than expected based on traffic flows

5.44 EST scores for both schemes are the same due to the shared traffic data.

Greenhouse Gases

5.45 The assessment of the impacts of transport schemes on emissions of greenhouse gases is one of the environment sub-objectives. WebTAG notes that carbon dioxide (CO_2) is considered the most important greenhouse gas which is therefore used as the key indicator for the purposes of assessing the impacts of transport options on climate change. Changes in CO_2 levels are considered in terms of equivalent tonnes of carbon released as a result of the scheme. Carbon emissions are therefore estimated for the DS and DM scenarios using forecast and observed OYA data.

Forecast Greenhouse Gases

5.46 The HSR AST predicted an increase in carbon on emissions of 13,288 tonnes across the traffic model study area (shown in Figure 2.9 of the traffic chapter), which can be explained by the forecast increase in vehicle flows and speeds. The junctions AST forecast a very small increase in carbon of 433 tonnes.

5.47 The HSR AST states that “the Scheme would result in a net dis-benefit due to the additional vehicle kilometres travelled”

Evaluation

5.48 Given that the AST forecast covers a wide area, a re-forecast of carbon emissions for the DM and DS scenarios has been calculated using current DMRB guidance. Observed carbon emissions were calculated using the same methodology for the DM and DS scenarios, using flow and speed data collected for this study. **Table 5-6** presents the results of this exercise.

Table 5-6 – Reforecast and Outturn Carbon Emissions (Carbon tonnes/year)

	Reforecast	Observed
Do Minimum/Counterfactual(based on before)	116,964	111,336
Do-Something/Post opening	143,019	111,492
Net Difference	**26,055 (22%)**	**156(0%)**

5.49 **Table 5-6** shows that observed carbon emissions have seen little change between the DM and DS scenarios, equivalent to 156 tonnes of carbon, where as in the re-forecast the carbon emissions showed an increase between DM and DS of 22%, equivalent to 26,055 carbon tonnes. The forecast carbon emissions are much higher than the observed due to higher forecast flows, and higher travel speeds. Observed traffic flows, whilst increasing, have not seen the increase forecast, and as shown in the traffic chapter, speeds have decreased, and therefore traffic is traveling at a more fuel efficient speed.

5.50 It should be noted that this calculation only considers the impact on the mainline M1, and does not take into account any reassignment of traffic from other routes, which would possibly mean increased distances for rerouting traffic, and possibly higher speeds on alternative routes such as the A5 which has seen slight reductions in traffic post opening.

Landscape

Forecast

AST – J10 to 13 HSR

5.51 The AST stated that the scheme involved relatively minor amendments to the existing M1 corridor/infrastructure other than the addition of gantries and that minimal loss of screening vegetation would be offset by mitigation planting such that the overall impact on landscape would be neutral by Year 15.

5.52 The landscape TAG worksheets also stated that that the proposals would have a neutral effect upon the Chilterns Area of Outstanding Natural Beauty (AONB) and negligible impacts to Areas of Great Landscape Value (AGLV).

5.53 There would be a slight adverse effect at High Thatch (as this is a listed building the evaluation is undertaken in the cultural heritage section of this report).

AST – J11 and 12 Junction Improvements

5.54 The AST stated landscape was not applicable to J11.

5.55 At J12 the existing motorway was noted to have had a significant local adverse effect on landscape character although the junction is set within a wider landscape of high quality. Impacts on the adjacent landscape would be largely indirect and mitigation woodland planting, associated with the realigned slip roads, would more fully integrate the junction into the landscape. The overall effect would be neutral.

Environmental Statement – J11 and 12 Junction Improvements

5.56 The ES stated that:

- The area around J11 and 12 encompasses the Landscape Character Areas (LCAs) of Chilterns chalk escarpment (covering an area beyond the south of J10, J11 and to the north of Luton), Bedford and Cambridge Claylands and gently undulating arable landscape (in the vicinity of J12), and the Bedfordshire Greensand Ridge (a narrow

escarpment characterised by deciduous and coniferous woods, heath and pasture, which lies just north of J12). The wider landscape around J11 was considered to be of low quality. At J12 the wider landscape was assessed as being of high quality to the west and medium to the east.

- Junction 11 lies within the urban context of Luton. Surrounding landscape in the wider area was not expected to be affected due to the distance from J11 and the low magnitude of change associated with the existing M1. J11 was said not to affect landscape character (it is therefore covered only briefly within this section and discussed in more detail in the townscape section).
- The Chilterns AONB lies within the study area for both junctions but its landscape character was not expected to be affected by the scheme.
- The existing J11 and J12 were noted to already have a visual impact upon adjoining property and an influence on landscape; however junction works would have an increased impact due to loss of vegetation, increased junction footprint and introduction of taller lighting columns. The ES considered representative viewpoints for J12 (see below), which are discussed in this section. The visual effects associated with J11, being of an urban setting, are discussed in the Townscape section of this report. Before and OYA photo views are presented in **Appendix D**.

5.57 Scheme mitigation measures would aim to integrate the scheme into the existing landscape by minimising loss of existing landscape features and increasing planting. Key measures included:

- Retain existing vegetation where possible
- Integrate and screen junctions and structures with planting
- Screen residential properties where appropriate with planting
- Screening derived from noise fences
- Use of indigenous and ecologically appropriate plant material
- Use of high-pressure sodium lamps with high cut-off beams and flat-glass lanterns to minimise spread of light

5.58 Use of planting types to promote wildlife and native grass seed from local sources.

- For J12 the proposals would include a large amount of woodland planting to integrate the junction into the local landscape and reduce visual impacts on residential properties and footpaths.

5.59 Planting at J11 and 12 would include the following:

Table 5-7 – Summary of Planting at Junctions 11 and 12

Landscape Component	J11	J12
Amenity Grassland	✓	✓
Grassland with Bulbs	✓	×
Species Rich Grassland	×	✓
Woodland/ woodland edge	✓	✓
Linear Belts of Shrubs and Trees	✓	✓
Ornamental Shrubs	✓	×
Native Hedgerows with Trees	✓	✓
Reed Beds	×	✓
Marsh and Wet Grassland	×	✓

5.60 The ES concluded that overall the junction improvements would have a slight beneficial effect on landscape at year 15.

Consultation

5.61 Slip End Parish Council, which is located towards J10, and close to the Chilterns AONB commented that the scheme had not had an effect on landscape character, the AONB, the settling of nearby settlements, public rights of way and other landscape features. They also commented that the materials and finishes to structures associated with the scheme are in line with expectations and that environmental mitigation, including vegetation retention and new planting, earthworks and screening barriers have been “well done!”

5.62 The Chilterns AONB responded with regard to landscape, stating that the scheme impacts on character and quality of local landscape were as expected, materials and finishes to structures were appropriate and mitigation measures have been implemented as expected.

5.63 They had no comments to make with regard to scheme lighting.

Evaluation

Landscape Character

5.64 The existing M1 already dominates the study area and the HSR scheme draws more attention to it. The HSR scheme has introduced new vertical elements into the landscape, predominantly in the form of gantries, lighting, retaining walls and acoustic barriers (although it is understood that there were a large number of existing acoustic barriers). Where the M1 is in cutting the impacts of the HSR scheme are limited, but in more open landscapes these elements are much more visible and make the M1 a more prominent feature in the landscape, even if only slightly. Much of the M1 corridor has pylons running parallel to it and in these areas it is considered that the impacts of the HSR scheme are less apparent, due to the large, existing vertical elements in the landscape.

5.65 The full extents of the HSR scheme and predicted impacts of the HSR scheme are not fully known due to a lack of available information and a full evaluation is not possible at this stage. Further assessment required at FYA.

5.66 **Figure 5.4** below illustrates new gantries and signage implemented by the HSR scheme, between J12 and 13. New lighting is also evident. The M1 was already lit, and it is understood that the HSR scheme has replaced lighting where necessary with more directional, but taller lighting, which would have a potentially adverse night time effect compared to existing lighting.

5.67 As with much of the M1 corridor, existing pylons and the existing M1 are already a prominent feature in the landscape.

Figure 5.4 – New gantries and lighting north of J10 near Slip End

5.68 **Figure 5.5** illustrates the HSR scheme in an open landscape where the scheme is on a slight embankment. In more rural areas, where pylons are not already a landscape feature, the HSR scheme draws more attention to the existing M1 due to the new gantries and signage. The embankment has been planted, and tree shelters were noted across various sections of the HSR scheme between J10 and 13, but it is too soon after planting for this mitigation to provide any screening or landscape integration at OYA.

Figure 5.5 – View of HSR scheme from Long Lane, north of J12

5.69 The AST and worksheets for HSR suggested that there would be no or a negligible impact by the scheme on designated landscapes including the Chilterns AONB. POPE also considers this to be the case, due the existing prominence of the M1 in the landscape and the distance of these areas of value from the M1 route corridor. Photo view 11E in **Appendix D** shows before and after views from within the AGLV, close to the edge of the Chilterns AONB, to the south west of Luton, between J10 and 11. This illustrates the small overall change in view as a result of the scheme.

Figure 5.6 – Mitigation planting at J12 with weed-free circles (Dunedin in background)

5.70 At J12 the ES expected that a vast amount and wide range of mitigation planting and seeding would be undertaken, and evidence gathered during the site visit suggests that this has been implemented and the planting is generally well maintained. The Landscape Management and Maintenance Plan confirms that a maintenance programme is in place for the scheme. However, in other areas there are shelters knocked over and prevalent growth of noxious weeds, as illustrated in **Figure 5.7**, below. This photograph also shows larger stock, which has been planted around the junction to give a more immediate impact.

Figure 5.7 – Noxious weed growth and planting of larger stock trees

5.71 **Figure 5.8** below helps to demonstrate the scale of J12's large footprint. A significant amount of planting has been undertaken, which should establish in the longer term to help integrate the junction into the local landscape. Two mature trees have also been retained by the scheme, within the loop of the southbound slip road, and these give an idea of what mitigation planting might achieve in the future.

Figure 5.8 – Large scale planting, tree retention and earthworks within loop of southbound slip

Visual Impact

Table 5-8 – Impacts at representative viewpoints – J12 – based on ES Table 8.11

Viewpoint	Nature of Impact	Significance		OYA Evaluation
		Year 1	Year 15	
12A: A5120 Harlington Road	Limited visibility of vehicles and lighting columns associated with the east side slip road.	Negligible adverse	Neutral	Better than expected. Lighting installed as expected, but the J12 works did not affect landtake at Poplars nursery as was predicted.
12B: Dunedin	Reduce magnitude of visibility of vehicles as a result of realignment of the A5120 carriageway away from the property and retention of an intervening hedge.	Moderate beneficial	Substantial beneficial	As expected. Busy carriageway moved away from property and new mitigation planting, including hedgerows, implemented as screening.
12C: Hillside Farm	Views of increased urbanisation through structures/highway/loss of garden in Year 1 only partially mitigated by Year 15.	Substantial adverse	Moderate adverse	As expected. Views significantly altered by major junction works and will not be fully mitigated with maturation of landscape planting.
12D: Footpath 35	Embankments & traffic of the west-side slip roads visible in the Middle-ground in Year 1 but screened by planting in Year 15.	Moderate adverse	Slight adverse	As expected. New junction is much more apparent, with embankments, gantries and lighting columns visible. Screening planting should reduce impacts over time.
12E: Mill Farm	Foreground field Reinstated some impact from lighting columns on the improved A5120.	Slight adverse	Slight adverse	As expected for J12 works, with new lighting columns visible. Cumulative impacts also experienced due to visibility of new gantries on M1 mainline.
12F: M1 Overbridge	Very limited visual impact from the scheme – increased views of lighting columns in Year 1 and Year 15.	Neutral	Neutral	As expected. Close views of the M1 are not significantly altered.
12G: Toddington	Very low Year 1 impact derived from additional lighting columns in daytime. Mitigated by planting by Year 15.	Slight adverse	Neutral	As expected. Impacts are minimal given the long distance to the motorway. Long views of new lighting columns and gantries possible.

5.72 From a visual impact perspective it is not known whether the HSR scheme has had the impacts predicted before construction. However for the junction improvements, it is considered that the visual impacts associated with J12 are as expected, with the exception of viewpoint 11A, which was predicted a slight adverse impact at year 1. POPE concludes that the impact from this viewpoint is in fact neutral, as can be demonstrated by the comparison figures for viewpoint 11A in **Appendix D**. It appears that the scheme design assessed in the ES varies slightly to that

actually constructed (although as built drawings are not available to confirm this) and impacts to the area around photo view 11A near Poplars Nursery, were avoided.

5.73 The cumulative effect of the HSR and J12 improvements is most noticeable in the areas close to the junction. The property Dunedin, which is in the background in Figure 5.6, above, will realise cumulative effects as it has benefited from movement of the A5120 away from it as part of the J12 works, but also has gantries visible to it due to the HSR scheme. The cumulative assessment in the Junction Improvements ES does not specifically assess this effect so it's not possible to say whether the impact is as expected. The effects of both schemes are also noticeable near Mill Farm, as illustrated by the viewpoint comparisons of 12E in **Appendix D**, where lighting and signage from J12 are visible as well as gantries and signage along the M1, as implemented by the HSR scheme.

Table 5-9 – Summary of Landscape Evaluation

Origin of Assessment	Summary of Predicted Effects	Assessment
AST – J10 to 13 HSR	The Scheme involves relatively minor amendments to the existing M1 corridor/infrastructure other than addition of gantries. Minimal loss of screening vegetation would be offset by mitigation planting such that overall impact on landscape would be neutral by Year 15.	Neutral
EST – J10 to 13 HSR	The scheme appears to be implemented as expected but mitigation planting is still too small to provide any screening, and the exact scale of mitigation planting or retention of existing vegetation is not fully understood. The introduction of gantries and signage, in particular, into the landscape is considered to have a slight adverse impact at OYA, but this may reduce to neutral by Year 15. Impacts not fully understood due to lack of available information.	Worse than expected at OYA. Further study required at FYA.
AST – J11 and 12	At Junction 12 the existing motorway has had a significant local adverse effect on landscape character although the junction is set within a wider landscape of high quality. Impacts on the adjacent landscape would be largely indirect and mitigation woodland planting, associated with the realigned slip roads, would more fully integrate the junction into the landscape. Landscape not applicable to Junction 11.	Neutral
EST – J11 and 12	Junction 12 has a large scheme footprint and has had a significant effect on local landscape, in an area of high landscape value. Impacts on areas of high landscape value including the Chilterns AONB and AGLV in the wider area are considered not to be affected by the scheme. The implementation of a large amount of new lighting and the layout of the large junction make it prominent in the landscape. Although it appears mitigation has been implemented as expected, no landscape benefits are yet to be realised from this. As planting matures it should help to integrate the junction into the landscape.	Worse than expected at OYA.

Townscape

Forecast

AST – J10 to 13 HSR

5.74 The AST stated that the scheme would require no land take. The existing motorway corridor had a negative and dominating effect upon the townscape, and whilst the scheme would add to the

infrastructure, principally through gantries, the overall magnitude of change would be small. The overall effect would be slight adverse.

AST – J11 and 12 Junction Improvements

5.75 The AST stated that townscape was not applicable to J12.

5.76 J11 is located in a low quality urban townscape. The scheme could be fully integrated into the townscape and might deliver some townscape benefits with appropriate design derived from a more planned treatment of planting and hard surfacing. The overall effect of the junction improvement would be slight beneficial.

Environmental Statement – J11 and 12 Junction Improvements

5.77 The ES stated that:

- J11 lies within the urban context of Luton between Dunstable Road and Lewsey Farm and Leagreave. These areas predominantly comprise post-war housing from the 60s and 80s. The streets were said to be largely devoid of vegetation, but houses that backed onto the existing M1 were largely screened by mature vegetation and noise barriers. Pylons run through the housing estates and parallel to the M1. Dunstable Hospital lies close to the west of J11. To the east of J11 lies Challney School and associated playing fields and north of here, Leagrave Primary school and its playing fields, which also back onto the M1. To the north of here there are also a number of 15 story residential tower blocks in this area. There are some areas of allotments and open space further away from J11, which are often dominated by pylons. The area was noted to be interspersed with commercial, industrial, recreational and educational uses, set tightly against the motorway which passed through the area on sections of both embankment and cutting.
- J12 does not lie within an urban context (J12 is discussed in more detail in the landscape section of this report).
- At J11 the roundabout and slip roads would be remodelled to improve the characteristics of the junction and integrate better into the urban environment. There would be some loss of existing vegetation adjacent to the M1, but landscape proposals would focus on providing a more consistent treatment and effective visual barrier to slip roads and the A505 Dunstable Road.
- Keltonstone Recycling, adjacent to J11 would be demolished as a result of the scheme, leading to increased visibility of J11 from properties on Derby Road.
- Scheme mitigation measures would aim to integrate the scheme into the existing townscape by minimising loss of existing landscape features and increasing planting and include the same measures set out in the landscape section of this report, with the addition of large individual trees at J11 to provide immediate mitigation and create a higher quality, designed setting. However, there would be loss of vegetation within the highway boundary to the rear of Belper Road and locally along the southbound exit slip road adjacent to Challney High School. To both the west and east of the junction on both the north side and south side of the A505 Dunstable Road the Scheme would involve localised removal of trees/shrubs affecting the setting of properties and requiring appropriate mitigation through replacement planting.
- The existing J11 and J12 were noted to already have a visual impact upon adjoining property and an influence on townscape. The ES considered representative viewpoints for J11 (see below), which are discussed in this section. The visual effects associated with J12, being of a more rural nature, are discussed in the Landscape section of this report.

5.78 The ES concluded that there would be little change to the existing townscape context except for locally around J11. There would be a neutral impact at Year 1 and slight beneficial impact on townscape by Year 15. The works would cause little change to the character of the area. The demolition of the Keltonstone paper recycling facility at J11 would assist in re-creating a more considered layout and appearance of the junction within the townscape.

5.79 The cumulative effects of the junction improvements with the HSR scheme were expected to be of low magnitude.

Consultation

5.80 No consultation has been received with regard to townscape.

Evaluation

5.81 Townscape Character

5.82 Impacts are generally restricted to very nearby the M1 due to restricted urban views, generally associated with Luton and Dunstable. The most visible impacts are associated with the large scale infrastructure including gantries / signage and noise barriers, although it is not fully understood which noise barriers were implemented as part of the scheme and which were existing. The extent of planting associated with the HSR scheme is also unclear, but in many cases the implementation and maturation of planting would unlikely fully mitigate the presence of large scale infrastructure and further urbanisation of the M1 corridor. Pylons in the existing landscape already exert an influence on the townscape, which detracted from the overall effect that the HSR scheme. However, there is a clear increased urbanisation of the M1 corridor for associated with the HSR scheme.

5.83 **Figure 5.9** below shows properties on Eldon Road, which back onto the M1. New gantries, lighting and signage is visible in the background, and further assessment of the impacts associated with their implementation is required to fully understand the magnitude of change to townscape character. This figure demonstrates an impact that is replicated throughout the Luton area and is representative of many residential streets.

Figure 5.9 – Gantries associated with the HSR scheme on Eldon Road near J11

5.84 It is understood that all the noise barriers were proposed under the HSR scheme, but it is not known whether these have all been implanted as expected. Around J11 it is particularly apparent that there is a consistent finish, and a general improvement in appearance compared to the existing M1. Viewpoint comparisons 11a and 11B in **Appendix D** illustrate the improvement in finishes from before the scheme and at OYA.

5.85 As described in the landscape section of this report, where new lighting has been implemented to replace existing, there could have been a potential adverse night-time effect, visually and on townscape character.

5.86 Existing vegetation has been retained where possible at J11, and this has been reinforced with large individual tree planting, as expected. However, it appears that without exception, all of this stock planted on the J11 roundabout has died, as illustrated on **Figure 5.10**, below.

Figure 5.10 – Tree retention and unsuccessful reinforcement planting at J11 roundabout

5.87 Across J11, planting has generally been undertaken as expected, with a number of trees being planted as screening as well as features. The larger stock is generally well maintained, while the screening planting is largely choked with noxious weeds, as shown in Figure **5.11** and **Figure 5.12**, below. However, the use of larger trees in planting proposals has not generally provided immediate mitigation for the loss of existing, mature vegetation, or a generally higher quality design for J11, at this stage. Removal of vegetation at J11 has generally led to an increased urbanisation of the immediate area, which may not be fully mitigated by maturation of mitigation planting.

Figure 5.11 – Well maintained new avenue planting on Dunstable Road

Figure 5.12 – Poorly maintained screening planting near northbound off slip

5.88 **Figure 5.13 Figure 5.13**, below, shows an area that looks to be wildflower seeded next to J11. Although attractive, the landscape plans show this area, and the corresponding area on the other side of the M1 on Dunstable Road, as being planted with ornamental shrubs. This is not the case on either side of the junction and so this mitigation has not been implemented as expected. Although material finishes are consistent, planting and townscape proposals have not been provided fully in line with proposals, perhaps therefore not delivering the benefits to townscape that were originally planned.

Figure 5.13 – Possible wildflower seeding on Dunstable Road

5.89 Overall, there is a loss of mature planting associated with the junction improvements, this is illustrated by the viewpoint comparisons in **Appendix D**. The ES states that to both the west and east of the junction on both the north side and south side of the A505 Dunstable Road the scheme would involve localised removal of trees/shrubs affecting the setting of properties and requiring appropriate mitigation through replacement planting. It will be some years until the planting implemented by the scheme is of a size to replace this and additional planting and maintenance is required if the original landscaping proposals are to be fulfilled and the junction improvements are to present an overall improvement to townscape.

5.90 Visual Impact

Table 5-10 – Impacts at representative viewpoints – J11 – based on ES Table 8.10

Viewpoint	Nature of Impact	Significance		OYA Evaluation
		Year 1	Year 15	
11A: A505 Dunstable Road	Some minor townscape benefit from the junction improvements, associated planting and new paving and improved lighting at opening and Year 15.	Slight beneficial	Slight beneficial	Worse than expected at year one. Although there is a consistent treatment of materials associated with the scheme, planting has not been fully successful in providing immediate mitigation.
11B: A505 Dunstable Road	Very minor townscape improvements – mainly lighting in a largely unchanged panorama.	Negligible beneficial	Negligible beneficial	There is some loss of large, mature trees, but the impacts are not considered to be significant, or beneficial.
11C: M1 southbound slip/ A505	Some improvement at Year 1 and Year 15 as a result of planting enhancements.	Negligible beneficial	Negligible beneficial	Loss of mature vegetation has led to an increased urbanisation of this view which is yet to be mitigated by establishment of planting. The M1 is more prominent than expected.
11D: M1 Northbound slip/ A505	Encroachment towards property partially but not fully offset by planting enhancements & screening.	Moderate adverse	Moderate adverse	As expected. There is loss of existing vegetation that has not been replaced. The M1 is more visible in this view, as expected.
11E: Chaul End	None	Neutral	Neutral	As expected. Views of the M1 are generally unchanged, although there is a distant view of gantries and lighting associated with the scheme.

5.91 From a visual impact perspective it is not known whether the HSR scheme has had the impacts predicted before construction due to the lack of available information. However for the junction improvements, it is considered that the visual impacts associated with J11 are generally worse than expected for the receptors listed in **Table 5-10**. This is generally due to the loss of existing mature vegetation, which has not been fully implemented, has died or is yet to mature.

5.92 As expected, there has been vegetation loss in the vicinity of Challney High School and Belper Road. Vegetation has been retained behind the school, and additional planting has been provided, although this is yet to provide any screening. The figure below illustrates that although screening vegetation has been left in place, the scheme is still very visible from the school; predominantly due to the presence of gantries, lighting and noise barriers.

Figure 5.14 – View of M1 from grounds of Challney High School, near J11

5.93 The cumulative effect of the HSR and J11 improvements is only obvious very close to the junction. Properties adjacent to the on and off slips have experienced the greatest cumulative impact as they experience changes to J11 and also sometimes experience views of gantries and lighting, as illustrated in **Figure 5.14**, above. Impacts are generally as expected, given the already dominant influence the M1 has on these properties. The property shown in the figure below also experiences both schemes. This property would have formerly been next-door to the Keltonstone Recycling building. It's arguable whether the demolition of the building has improved the visual impact on the property, as views of the M1 schemes are now visible.

Figure 5.15 – Property next to slip road on Dunstable Road with views of J11 and HSR gantries

Table 5-11 – Summary of Townscape Evaluation

Origin of Assessment	Summary of Predicted Effects	Assessment
AST – J10 to 13 HSR	The existing motorway corridor has a negative and dominating effect upon the townscape and whilst the scheme would add to the infrastructure, principally through gantries, the overall magnitude of change would be small. There would be no land take associated with the HSR scheme.	Slight adverse
EST – J10 to 13 HSR	The existing motorway corridor has a negative and dominating effect upon the townscape and the scheme introduces new, large infrastructure, which are generally visible from close to the M1. The level of change cannot be fully understood due to the lack of available information.	Further assessment required at FYA.
AST – J11 and 12	Junction 11 is located in a low quality urban townscape. At junction 11 the Scheme could be fully integrated into the townscape and may deliver some townscape benefits with appropriate design derived from a more planned treatment of planting and hard surfacing. Townscape not applicable to Junction 12.	Slight beneficial
EST – J11 and 12	Although there are negatively affected properties, the J11 works generally sought to improve the local area by integrating the M1 better into the townscape. Material finishes are generally of a high quality, but the planting implemented by the J11 works does not provide an immediate mitigating effects, and additional maintenance and planting is required to ensure the scheme integrates the junction more sympathetically into the townscape.	Worse than expected.

Cultural Heritage and Archaeology

Forecast

AST – J10 to 13 HSR

5.94 The AST stated that there would be slight adverse impacts on six archaeological sites dating from the Iron Age to the post-medieval period due to disturbance caused during earthworks repairs, ground reduction and ground works.

5.95 Visual and setting impacts on one scheduled monument of high value (Eversholt Wakes End Farm) due to gantries, would be mitigated by landscape planting. There would be a neutral effect on 3 scheduled monuments (Tingrith Wood End; Maltings Spinney Moated Site; and All Saints Church ruins, Segenhoe).

5.96 Setting impacts on two Grade II listed buildings of medium value (Mill Farm; and Redhills Farm) would be mitigated by landscape planting.

5.97 Overall the scheme would have a slight adverse effect on cultural heritage.

5.98 As referenced in the landscape section of this report, there was a predicted slight adverse effect on High Thatch listed building. The TAG worksheets for heritage also noted that there was a potential impact on two registered parks and gardens (Luton Hoo Park and Woburn Abbey Park).

AST – J11 and 12 Junction Improvements

5.99 The AST stated that the J11 improvements would not impact on the cultural heritage resource, resulting in a neutral effect.

5.100 At J12 the construction of the north and southbound slip road embankments, new over bridge foundations and associated landscaping would have slight adverse impacts on three archaeological sites and several isolated finds scatters dating from the Neolithic to the post-medieval periods.

5.101 Negligible impacts on settings of two Grade II Listed buildings were predicted at J12, and there would be direct physical impacts on two historic motorway structures of low value. There would also be a slight adverse impact caused by the construction of the new northbound access slip roads on one historic banked hedge boundary, but no impact on historic landscape.

5.102 The overall effect of the junction improvements on cultural heritage was predicted to be slight adverse.

Environmental Statement – J11 and 12 Junction Improvements

5.103 The ES stated that:

- J11 works would not affect any recorded historic landscape receptors or known archaeological assets.
- At J12 the scheme could affect three archaeological sites of medium (regional) significance as well as isolated finds of low significance. The archaeological sites comprised an Iron Age rural settlement south of Redhills Farm, a medieval rural building at Long Lane and a possible Iron Age, Roman or Medieval occupation or settlement and possible ridge and furrow. An archaeological mitigation strategy to undertake recording or measures for preservation in situ would mitigate the impacts where they could not be avoided, meaning an overall slight adverse effect.
- With regard to historic buildings, there would be no impacts on historic building receptors due to the J11 works due to restricted, urban views.

- At J12, Toddington Interchange Overbridge and Redhills Farm underbridge, both part of the original M1 infrastructure and of low historic value would be affected by the scheme. The former being demolished (a major effect) and the later extended (slight adverse).
- The settings of Redhills Farm and Mill Farm, Grade II listed buildings would be slightly adversely affected by the works at J12 at year 15. At Redhills Farm there were existing views of the M1, but these would be brought closer to the property due to the junction works which would also cause removal of a screening belt of vegetation. The setting of Mill Farm would be affected principally by lighting columns associated with the junction works. Impacts would be mitigated by landscape planting.
- There would be no effects to the conservation areas (Toddington and Harlington) in the vicinity of J12, which were said to be outside the scheme's zone of visual influence.
- At J12 the scheme would cause the removal of a low value bank with a hedge on top (slight adverse effect) – part of the historic landscape – but no other recorded historic landscape receptors would be affected by the junction works.

5.104 Cumulatively, with the HSR scheme, the ES stated that it would be unlikely there would be further loss of archaeological resource, but there would be additional visual and lighting impacts on Redhills Farm and Mill Farm due to the HSR scheme.

Consultation

5.105 Due to time and resource constraints English Heritage (EH) was unable to assess the actual impacts on designated heritage assets along the route. EH pointed out that as well as the heritage assets close to J12, there are a number of others in similar or closer proximity to the HSR scheme including:

- Tingrith Conservation Area
- Ridgmont Conservation Area
- Segenhoe Manor (Grade II* listed building) and its historic parkland
- Warren Farmhouse (Grade II)
- High Thatch Tingrith (Grade II)
- Segehoe scheduled monument
- Wood End scheduled monument
- Wakes End Farm scheduled monument.

5.106 EH issued a letter to the design engineer on the 8th Sept 2009 raising similar concerns about a lack of identification of designated heritage assets associated with the scheme.

5.107 EH went on to comment that although major works were limited to J11 and 12, the hard shoulder running involves extra signage and lighting that could impact on the above heritage assets. EH hope that POPE will assess the impact on designated heritage assets along the route, rather than just around J12 (it should be noted that the consolation request letter only included details on cultural heritage taken from the Junction Improvements EIA, which is why the main focus of questioning was with regard to impacts around J12).

5.108 Where information has been available on the above receptors highlighted by EH, this has been included in the evaluation.

Evaluation

Archaeology

5.109 The archaeological impacts associated with the HSR scheme are unknown. It has not been possible to evaluate these impacts. Further study required at FYA.

5.110 For the junction improvements, archaeological investigation was carried out, as expected. An archaeological report for J12 stated that the archaeological evaluation identified a number of archaeological features within the development area, from as early as the Bronze Age through to the medieval period. The earliest of these, possibly a boundary ditch, contained pottery possibly dating to the Bronze Age or late Iron Age.

5.111 Roman activity was also recorded in the area, possibly relating to industrial and agricultural activity.

5.112 Medieval activity was also recorded. There was a cobbled surface and an adjacent slot containing burnt timber, possibly a beam slot for a former building. There was a large quantity of burnt material associated with all the cut medieval features, perhaps suggesting that the building may have burnt down. The associated medieval ditch contained a large amount of cereal grain with very few associated weed seeds or chaff, suggesting it was at a late stage in crop processing. The report considered it possible that these features form part of the remains of the small settlement known as 'Nuppings Green'.

Built Heritage

5.113 The impacts of the HSR scheme on historic environment is not fully known, but impacts would relate largely to the increase in infrastructure associated with the scheme being visible from heritage assets. The site visit confirmed the neutral effects as expected on scheduled monuments at the following locations, which are outside of the scheme's zone of visual influence:

- Wood End
- Maltings Spinney
- All Saints Church ruins.

5.114 At Segenhoe Manor – located close to All Saints Church and Maltings Spinney (between J12 and 13) – the M1 is in cutting and it is not considered that the scheme has affected the setting of the manor or its gardens.

5.115 Ridgemont conservation area lies to the north west of Segenhoe Manor and no impacts on this area were recorded during the site visit, either.

5.116 The site visit also considered that the scheme had a neutral effect on Luton Hoo (south east if J10) and Woburn Abbey (near Segenhoe Manor between J12 and 13) registered parks and gardens. These gardens are considered suitably distant from the M1 not to be affected by the scheme.

5.117 The predicted impacts on Wake's End scheduled monument are not understood, but it is possible that the scheme has had a slight adverse effect on it. **Figure 5.16** shows a view from the M1, with buildings associated with Wake's End Scheduled monument in the background. New gantries associated with the scheme are visible here, but there is also a line of pylons running adjacent to the M1 in this area which detract from the view. Warren Farmhouse listed building is also located close to the location of this photograph, and it's possible that the new gantries are visible from the property. Further study is required at FYA.

Figure 5.16 – View from M1 with Wake's End in background (left)

5.118 The HSR scheme was predicted to have a slight adverse effect on High Thatch listed building, and this was confirmed by the site visit. The building sits adjacent to the M1, between J12 and 13 and traffic has moved closer to it as a result of the HSR. New sections of noise barrier are also visible from the property.

Figure 5.17 – High Thatch, adjacent to the M1, with visible noise barrier

5.119 Tingrith conservation area lies close to High Thatch, but further from the M1. The predicted impacts on this receptor are not known and it was not mentioned in the AST, but the site visit suggested a slight adverse effect on the conservation area. Gantries and signage associated with the HSR scheme are visible from the fringes of the conservation area, as illustrated in **Figure 5.18**. Further study required at FYA

Figure 5.18 – View towards M1 from edge of Tingrith conservation area

5.120 There were no impacts predicted on the historic environment as a result of the J11 works, and other than archaeology, there are potential impacts on listed buildings at J12, associated with the junction works and the HSR scheme. The predicted impacts to Long Lane Farm listed building are not known, but the HSR scheme is visible from here, just to the north of J12, as illustrated in **Figure 5.19**. The M1 is at grade and on slight embankment as it passes this asset and new gantries are visible. Further study required at FYA.

Figure 5.19 – View towards M1 near Long Lane Farm listed building

5.121 Redhills Farm and Mill Farm listed buildings are situated close to J12 and slight adverse effects were predicted to them. These impacts are considered to be as expected, although access could not be made to Redhills Farm. The property is well screened by vegetation, but it is possible that the junction works, in particular the lighting associated with it, are visible. At Mill Farm both the junction works and HSR scheme are visible. Photo view 12E in **Appendix D**, adjacent to Mill Farm, shows the comparative views before and after the scheme. Lighting, signage and vehicles using the junction are visible, as are gantries and lighting along the mainline of the M1.

5.122 The full impacts of the HSR scheme on the historic environment are not fully understood due to lack of available information, Establishment of landscape planting will help to reduce impacts over time.

Table 5-12 – Summary of Heritage Evaluation

Origin of Assessment	Summary of Predicted Effects	Assessment
AST – J10 to 13 HSR	Slight adverse impacts on six archaeological sites dating from the Iron Age to the post-medieval period due to disturbance caused during earthworks repairs, ground reduction and ground works. Visual and setting impacts on 1 Scheduled Monument of High value (Eversholt Wakes End Farm) due to gantries, mitigated by landscape planting. Neutral effect on 3 further Scheduled Monuments (Tingrith Wood End; Maltings Spinney Moated Site; and All Saints Church ruins, Segenhoe). Setting impacts on 2 Grade II listed buildings of Medium Value (Mill Farm; and Redhills Farm) would be mitigated by landscape planting.	Slight adverse
EST – J10 to 13 HSR	Impacts to archaeology are unknown but unlikely to be significant due to the restricted footprint of the scheme within the soft highway estate. Impacts on built heritage assets are considered to be as expected based on information made available, and generally relate to visual impacts of new highway infrastructure including gantries and lighting. Further study, however, is required at FYA.	As expected based on available information, but further study required at FYA.
AST – J11 and 12	The Junction 11 improvements would not impact on the cultural heritage resource resulting in a Neutral effect. At Junction 12 the construction of the north and southbound slip road embankments, new overbridge foundations and associated landscaping would have slight adverse impacts on three archaeological sites and several isolated finds scatters dating from the Neolithic to the post-medieval periods. Negligible impacts on settings of two Grade II Listed buildings. Direct physical impacts on two historic motorway structures of low value. No impact on historic landscape. There would also be a slight adverse impact caused by the construction of the new northbound access slip roads on one historic banked hedge boundary.	Slight adverse
EST – J11 and 12	No impacts due to J11 works, as expected. Impacts associated with archaeology and listed buildings (Redhills Farm and Mill Farm) at J12 are as expected, and should be mitigated over time as landscape planting matures.	As expected

Biodiversity

Forecast

AST – J10 to 13 HSR

5.123 The AST stated that there would be no direct loss of habitat within statutory designated sites or County Wildlife Sites (CWSs) as a result of the HSR scheme. There would be slight adverse impacts on undesignated woodland and hedgerows and scrub habitat in the soft estate, no significant effects on watercourses or ponds, and no significant adverse effects on grassland and arable habitats or scarce arable flora.

5.124 Slight adverse impacts were predicted on bats, reptiles, terrestrial great crested newt due to general disturbance effects and permanent land take from existing soft estate that would not be replaced by an equivalent area of new habitat creation.

5.125 Proposed woodland habitat replacement represented an improvement in habitat quality but was unlikely to have reached sufficient maturity by year 15 to have fully mitigated for loss of mature vegetation and its value for bats in particular.

5.126 The overall effect of the HSR scheme on biodiversity would be slight adverse.

AST – J11 and 12 Junction Improvements

5.127 The AST stated that the J11 improvements would not have any direct or indirect effects on biodiversity, resulting in a neutral effect. The J12 improvements would result in indirect effects on the River Flit tributary and River Flit CWS and direct effects on Poplars Nursery CWS due to land take resulting in slight adverse effects and moderate adverse effects respectively. No direct adverse effects were anticipated for protected fauna within the scheme. It was considered unlikely that the proposed woodland and tree planting would have matured by 15 years after opening so the slight adverse effects were likely to remain.

Environmental Statement – J11 and 12 Junction Improvements

5.128 The ES stated that:

- J11 would not have any notable ecological impacts with limited loss to the highway soft estate. Ecological issues generally related to the more rural J12 with loss of arable fields, hedgerows (mainly species poor) and habitats associated with the soft estate including semi-improved grassland and scrub and semi-mature trees.
- No statutory designated habitats would be affected by the scheme. Poplars Nursery CWS would lose a small area (~0.1ha) of neutral grassland and the River Flit CWS would be indirectly affected due to works associated with Redhill Brook, a tributary. There would be a 12m loss of open-channelled watercourse, due to the culverting of Redhill Brook.
- No protected species would be directly affected by the proposals, although there might be some foraging habitat lost for badgers, slight loss of reptile habitat and barn owl might experience an increased risk to vehicle strike. This would be mitigated by dense planting at the edges of the works to prevent the barn owls low flight path into roads. Badger fencing would be used across the J12 scheme. By year 15 impacts on protected species were expected to be fully mitigated.
- No mitigation would be required for water vole, otter or amphibians, including great crested newt; however there would be a net benefit to amphibians due to increased planting and creation of marsh/ wet grassland and otters due to use of oversized culverts and mammal ledges in the design of J12.
- Habitat losses would be mitigated through provision of landscaping works including an increased area of species rich grassland and hedgerows. Overall there would be a slight loss in broadleaved woodland habitat.
- Monitoring and management would be undertaken of the various ecological mitigation measures 15 years after the scheme construction.

5.129 The ES concluded that the junction improvements scheme would have an overall slight adverse effect on biodiversity at Year 15.

Consultation

5.130 Consultation was received from Natural England, which confirmed the scheme did not have impacts upon any statutory designated habitats.

Evaluation

5.131 For the HSR scheme the impacts on ecology are not known to POPE at OYA. Further study is required at FYA to understand the impacts of the HSR scheme on ecology and whether mitigation was undertaken as expected.

5.132 For J11, impacts on biodiversity, as expected were limited to a small loss of highway soft estate, which was mitigated with additional planting. As expected the key biodiversity effects relate to J12 works.

5.133 As discussed in the landscape section of this report, the final junction layout for J12 appears to be different to that assessed in the ES and AST. The slight adverse effect on Poplars Nursery CWS is considered to actually be neutral, though confirmation should be sought at FYA when as built plans should be available. Photo view 11A in **Appendix D** demonstrates no change to an area that was predicted to be affected by the J12 improvements.

5.134 Habitat loss, otherwise, is generally as expected for the scheme, with mitigation also being implemented as expected, with large areas of landscape planting and seeding, including species rich grassland and marsh/ wet areas associated with new attenuation ponds, which have established particularly well for a OYA scheme, as illustrated in **Figure 5.20**, below. These areas would have had a beneficial effect, as predicted, on amphibians.

Figure 5.20 – Establishment of wet/ marshy areas at J12

5.135 Oversized culverts have also been implemented as expected, although mammal ledges do not appear to have been provided, as illustrated in **Figure 5.21,** below. The full benefits to otters may not therefore have been realised. Indirect impacts on the River Flit CWS associated with the culverting of Redhill Brook are considered to be as expected. Culverts were shown to be overgrown in places and flow was very low; however this was consistent with sections of the watercourse untouched by the scheme, and therefore is not considered to be an issue.

Figure 5.21 – Oversized culvert at J12 – Redhill Brook

5.136 An overall increase in embankments and slopes across the scheme should provide favourable habitats for reptiles, and dense landscape planting has been provide to help deflect barn owls away from the carriageways, as shown in various figures in the landscape section of this report. However, this will take some time to establish to provide adequate protection. No barn owl deaths have been recorded by the MAC along the M1 between J10 and 13, before or after construction of the scheme.

5.137 Badger fencing was shown to be present across the scheme at J12, as illustrated in **Figure 5.22**. One badger death was recorded between J12 and 13, post scheme opening.

Animal mortality

- J10 to 11 – no incidents recorded
- J11 to 12 – one fox mortality in 2014
- J12 to 13 – one deer in 2011, one deer in 2012 and one badger in 2013.

Figure 5.22 – Example of Badger fencing at J12

5.138 Overall, it is considered that the ecological effects are as expected at OYA for the junction improvement schemes, although predicted impacts to one CWS appear to have been avoided by scheme redesign, which is better than expected. Mitigation has been implemented as expected, and the wetland areas in particular are establishing very well. Impacts to protected species appear to be very limited, as expected. However, mammal ledges were not recoded during the site visit, as expected, and the effects of the scheme on otter may therefore be worse than expected. No data has been made available with regard to monitoring of ecological aspects associated with either scheme, and this should be sought at FYA.

5.139 It has not been possible to evaluate the impacts of HSR at OYA and this should be reconsidered at FYA if baseline information becomes available.

Table 5-13 – Summary of Biodiversity Evaluation

Origin of Assessment	Summary of Predicted Effects	Assessment
AST – J10 to 13 HSR	No direct loss of habitat within statutory designated sites or County Wildlife Sites. Slight adverse impacts on undesignated woodland and hedgerows and scrub habitat in the soft estate. No significant effects on watercourses or ponds. No significant adverse effects on grassland and arable habitats or scarce arable flora. Slight adverse impacts on bats, reptiles, terrestrial great crested newt due to general disturbance effects and permanent landtake from existing soft estate that would not be replaced by an equivalent area of new habitat creation. Proposed woodland habitat replacement represent an improvement in habitat quality but is unlikely to have reached sufficient maturity by year 15 to have fully mitigated for loss of mature vegetation and its value for bats in particular.	Slight adverse
EST – J10 to 13 HSR	Very limited available at OYA. However, assuming impacts were restricted to the highway soft estate, and were limited to discrete areas such as gantry footings and retaining walls, impacts should be as expected. Further study required at FYA.	As expected, based on available information, but further study required at FYA.
AST – J11 and 12	The Junction 11 improvements would not have any direct or indirect effects resulting in a Neutral effect. The Junction 12 improvements would result in indirect effects on the River Flit tributary and River Flit CWS and direct effects on Poplars Nursery CWS due to land take resulting in slight adverse effects and moderate adverse effects respectively. No direct adverse effects are anticipated for protected fauna within the Scheme. It is unlikely that the proposed woodland and tree planting will have matured by 15 years after opening so slight adverse effects are likely to remain.	Slight adverse
EST – J11 and 12	Impacts to Poplars Nursery CWS avoided, therefore better than expected. Other impacts as expected, which relate to loss of habitat at J12 and culverting of a tributary to the River Flit. Limited impacts to protected species, as expected.	As expected

Water Quality and Drainage

Forecast

AST – J10 to 13 HSR

5.140 The AST stated that risks to surface watercourses would be slightly increased compared to the existing situation due to increased traffic flows, more efficient delivery of runoff to receiving watercourses and potential for reduced infiltration. Risks to groundwater would correspondingly be slightly decreased compared to the existing situation due to the replacement of the existing leaking drainage system. The overall effect of the HSR scheme on the water environment was predicted to be slight adverse.

AST – J11 and 12 Junction Improvements

5.141 The AST stated that additional road drainage due to increased pavement at J11 would be attenuated in oversized pipes or suitable attenuation method, and there would therefore be no increase in discharge flows to the surface watercourse. Routine road runoff from J11 would be directed through a treatment system before discharge to Leagrave Stream, resulting in a neutral effect. The predominantly piped drainage followed by treatment would reduce the risk to the

watercourse, and would afford a high degree of protection to underlying groundwater resources within the groundwater Source Protection Zone.

5.142 Attenuation of road drainage at J12 in attenuation ponds would provide some treatment and improvement of runoff quality. The impact on water quality at J12 was considered to be neutral. There would be an extension of one existing culvert and construction of one new culvert at J12, which it was anticipated would have no adverse impacts to flood risk.

5.143 Overall the junction improvements were predicted to have a neutral effect on the water environment.

Environmental Statement – J11 and 12 Junction Improvements

5.144 The ES stated that:

- The construction of the junction improvements would not exacerbate flooding and there would be a neutral effect on groundwater quality and flow.
- With regard to surface water, at J11 run-off would pass through a vortex grit separator and filter trench or other compact system based on SUDS principles and discharge into a ditch leading to the Leagrave Stream. Spillage containment measures already existed.
- At J12, surface water would be collected in a number of attenuation ponds within the loops of the slip roads, with pollution control to manage spills implemented.
- One watercourse, Redhill Brook, would be culverted by the J12 works.

5.145 The ES concluded that the junction improvements would have an overall neutral effect on the water environment.

5.146 No cumulative effects were expected in synergy with the HSR scheme.

Consultation

5.147 The Environment Agency responded with regard to water quality, providing water quality data for nearby watercourses. They considered the combined attenuation/ treatment ponds and accidental spillage containment areas upstream of the inlets of the balancing ponds should significantly reduce the risk of pollution to watercourses receiving runoff from the motorway during normal rainfall and accidental spillage conditions. The retention of existing pollution containment ditches constructed in 2005 should also provide a further reduction in the risk of any accidental spillage reaching any receiving any watercourse.

5.148 The water data received, in the vicinity of J11 at Lee at Leagrave, showed no noticeable change in water quality between 2010 and 2014.

Evaluation

5.149 Due to a lack of availability of as built plans, it cannot be confirmed whether the drainage of the HSR and junction improvements scheme have been implemented as expected. However, the site visit confirmed that, at J12, attenuation ponds and pollution control was implemented as expected, as illustrated by **Figure 5.23**, below, which shows spillage control measures, and **Figure 5.20** in the biodiversity section of this report, which illustrates one of a number of well-established attenuation ponds at J12.

5.150 The Environmental Agency data suggest no worsening in water quality, but the data were not recorded directly from outfalls associated with the M1, and so the effects of the scheme cannot be confirmed using these data.

5.151 Culverting of Redhill Brook has been completed, as expected.

Figure 5.23 – Spill control at J12

5.152 Impacts on the water environmental are considered to be as expected, but further clarification should be sought at FYA when as built drawings should be available.

Table 5-14 – Summary of Water Quality and Drainage Evaluation

Origin of Assessment	Summary of Predicted Effects	Assessment
AST – J10 to 13 HSR	Risks to surface watercourses slightly increased compared to the existing situation due to increased traffic flows, more efficient delivery of runoff to receiving watercourses and potential for reduced infiltration. Risks to groundwater would correspondingly be slightly decreased compared to existing due to replacement of existing leaking drainage system.	Slight adverse
EST – J10 to 13 HSR	Confirmation of implementation of drainage is required by as built plans. Assuming works have been carried out then impacts should be as expected	As expected, based on available information, but further study required at FYA.
AST – J11 and 12	Additional road drainage due to increased pavement at J11 to be attenuated in oversized pipes or suitable attenuation method, hence no increase in discharge flows to surface watercourse. Routine road runoff from J11 would be directed through a treatment system before discharge to Leagrave Stream resulting in a neutral effect. The predominantly piped drainage followed by treatment reduces risk to watercourse, and affords a high degree of protection to underlying groundwater resources within the groundwater Source Protection Zone. Attenuation of road drainage at J12 in attenuation ponds would also provide some treatment and improvement of runoff quality. Impact on water quality at J12 is considered to be neutral. Extension of one existing culvert and construction of one new culvert at J12, with no adverse impacts to flood risk anticipated.	Neutral
EST – J11 and 12	J12 drainage, attenuation and spill control appears to be implemented as expected on J12, and planting is establishing well. As built drawings are required to confirm other mitigation has been implemented.	As expected

Physical Fitness

Forecast

AST – J10 to 13 HSR

5.153 The AST stated that the existing non-motorised user (NMU) routes were to be retained and there would be no impact on community or recreational usage of the NMU network. The overall effect of the scheme would be neutral.

AST – J11 and 12 Junction Improvements

5.154 The AST stated that signalised pedestrian crossings would be incorporated into J11, and that this should improve facilities for NMUs and would not affect journey times.

5.155 The existing NMU facilities on J12 over bridge were said to be un-useable, and improvements would allow for a dedicated footway on the south side of the junction, thereby facilitating a pedestrian route across the bridge. Footpath 34 would require diversion with an increase in journey length of about 130m; however this was considered unlikely to affect the level of usage, which was said to be low.

5.156 Overall the junction improvements would have a slight beneficial effect on physical fitness.

Environmental Statement – J11 and 12 Junction Improvements

5.157 The ES stated that:

- The junction improvement would not have any permanent severance of NMU crossings over the M1 at either J11 or 12. However, NMUs would have to cross an increased number of lanes due to the junction improvements.
- At J11 permanent diversion of the footways across the slip roads would be insignificant in terms of increased journey length. Phased signal crossings would be provided, providing a large beneficial improvement for potentially vulnerable NMUs accessing the nearby school or hospital.
- At J12 FP34 would be diverted by 130m, but was little-used and not a key access to any community facilities.
- FP35 would be improved with a signalised crossing at J12.
- The blocked footpath along the existing J12 overbridge would be reinstated for NMUs.

5.158 The ES concluded that overall, at both junctions 11 and 12 the improvements would be moderately beneficial.

Consultation

5.159 No responses were received with regard to non-motorised users.

Evaluation

5.160 All NMU measures have been implemented as expected for the junction improvements scheme, and there are no impacts on NMUs associated with the HSR scheme.

5.161 At J12 FP35 has been diverted through new and extended underbridges, as shown in the figure below. This has increased the length of the footpath, as expected.

Figure 5.24 – FP35 diversion through J12, also providing farm access

5.162 Other measures at J12 have been implemented, including signalisation of a number of crossings. **Figure 5.25** below shows the new overbridge footpath/cycleway crossing the M1, which has reduced severance across Harlington Road, where there was a previously blocked NMU access. Overall at J12 there has been an improvement for NMUs through provision of safer, signalised crossings and dedicated footways.

Figure 5.25 – New access provided across J12 overbridge, Harlington Road

5.163 **Figure 5.26** shows one of the signalised junctions at J11. NMUs now need to cross three lanes of traffic, rather than the two before the junction improvements, however, signalised junctions provide safe crossing points.

Figure 5.26 – Signalised crossing across 3-lane slip road at J11

5.164 Overall, the slight to moderate benefits to NMUs predicted by the AST and ES have been achieved for the junction improvements, with no effects associated with the HSR scheme.

Table 5-15 – Summary of Physical Fitness Evaluation

Origin of Assessment	Summary of Predicted Effects	Assessment
AST – J10 to 13 HSR	Existing non-motorised user routes to be retained. No impact on community or recreational usage of the NMU network.	Neutral
EST – J10 to 13 HSR	No impacts on NMUs, as expected.	As expected
AST – J11 and 12	Signalised pedestrian crossings to be incorporated into J11 should improve facilities for non-motorised users and would not affect journey times. Existing NMU facilities on J12 overbridge currently un-useable; improvements would allow for dedicated footway on south side, thereby facilitating pedestrian route across bridge. FP34 would require diversion with increase in journey length of about 130m, however considered unlikely to affect level of usage, which is currently low.	Slight beneficial
EST – J11 and 12	Lengthening of one, little used footpath at J12 has an adverse effect, but overall at J11 and 12 there is an improvement for NMUs through provision of safe, signalised junctions and dedicated foot and cycleways.	As expected

Journey Ambience

5.165 The journey ambience sub-objective considers traveller care (facilities and information), traveller views and traveller stress (frustration, fear of potential accidents and route uncertainty).

5.166 Traveller care is concerned with the quality of the journey as affected by the provision of facilities and information along the route. This includes the number and type of facilities and en-route information, together with their spacing and quality.

5.167 Traveller views are defined as the extent to which travellers, including drivers, are exposed to different types of scenery, which the route passes through. The assessment considers landscape character and potential views, good or bad, along the route.

5.168 Driver stress is defined in the Design Manual for Roads and Bridges (DMRB) as “the adverse mental and physiological effects experienced by drivers traversing a road network”. Driver stress

is affected by a number of factors including; road layout and geometry, surface riding characteristics, junction frequency, traffic speed and flow per lane characteristics. Collectively these factors can induce feelings of discomfort, annoyance, frustration and fear in drivers resulting in physical and emotional tension, which detracts from the value and safety of the journey. The extent of stress induced in individual drivers differs greatly due to their level of skill, experience, temperament, knowledge of the route and state of heath. Driver stress has the following components:

Forecast

AST – J10 to 13 HSR

5.169 The AST stated that the scheme would have a slight adverse effect on travellers' views due to the provision of gantries but a beneficial effect on driver stress due to improved signage. Driver stress would remain in the large category, due to the high traffic flows; however the AST noted that the standard appraisal method was not targeted at appraising HSR technology schemes.

5.170 The overall effect of the scheme on journey ambience was considered to be large beneficial.

AST – J11 and 12 Junction Improvements

5.171 At J11 the AST stated that by Year 15 there would be a slight beneficial effect derived from improved townscape and enhanced traveller experience both on the M1 and the A505 Dunstable Road. Scheme operation would have a beneficial effect on driver stress due to improved traffic flow and improved capacity at J11.

5.172 At J12 there would be adverse impacts on travellers' views due to the loss of mature vegetation together with embankments and landform associated with the junction. There would be a "beneficial effect on driver stress due to improved traffic flow and extensive signage leading to reduced fear of potential accidents and improved capacity at Junction 12" [sic].

5.173 The overall effect of the junction improvements scheme on journey ambience would be large beneficial.

Environmental Statement – J11 and 12 Junction Improvements

Traveller Care – Assessment of Effects

5.174 The ES did not assess traveller care.

Traveller Views – Assessment of Effects

5.175 Around J11, existing views were noted to be urban and generally restrictive, with large numbers of noise barriers. J12 was more rural in nature with intermittent and some more open views for travellers on the M1, but the junction was aid to be more urbanised along the A5120 Harlington Road. The ES noted that removal of mature vegetation at J11 would affect driver views. At J12 the visual impact on drivers would be greater. It was not stated whether this was a benefit or adverse effect.

Driver Stress – Assessment of Effects

5.176 Existing levels of driver stress on the M1 near J11 and 12 relate to:

- High traffic volumes and congestion (frustration, fear of accidents)
- Merging and diverging traffic for J11 and 12 and Toddington Motorway Service Area (MSA) (frustration, uncertainty, fear of accidents)
- Delays at junctions (frustration)

- A high proportion of HGVs and gradient rises between J11 and 10, causing HGVs to pull into lane two (fear of accidents).
- Poor visibility on slips at J11 and Harlington Road approach at J12 (uncertainty)

5.177 The ES stated that the HSR scheme should reduce congestion and therefore driver stress. The improved slip roads associated with the junction improvements, at both J11 and 12 and improved length of weaving distance for the MSA should reduce driver stress. New signage would help to reduce uncertainty.

5.178 The ES and ASTs concluded that improvements at J11 and J12 would have a large beneficial effect on journey vehicle travellers.

Table 5-16 – Summary of Vehicle Travellers

HSR = J10 to 13 HSR
JNC = J11 and 12 improvements

Factor	Sub-factor	Better	Neutral	Worse
Traveller Care	Information	HSR/ JNC		
	Facilities		HSR/JNC	
Travellers' Views	Views from the Road		JNC	HSR
Traveller Stress	Frustration	HSR/JNC		
	Fear of accidents	HSR/JNC		
	Route uncertainty	HSR/JNC		
	DMRB assessment	HSR/JNC		
Overall Score		JNC/HSR		

Consultation

5.179 Toddington Parish Council (near J12) stated that the scheme had improved traffic and has provided a safer junction with the A5120 and significantly reduced queuing at peak times at J12. They also noted that they felt the speed limit reductions and use of hard shoulder associated with the HSR scheme were used inappropriately, and caused some drivers to undertake others adhering to the limits. They also felt that this risks motorists ignoring limits when there might be a hazard ahead.

5.180 Steppingly Parish Council (located between J12 and 13) stated that the hard shoulder running during peak times seems to work well and there were no adverse comments on this particular aspect of the scheme. However, with regard to J12 "There was concern expressed about the whole of the design of this junction and it was considered that it added nothing to the safety of the M1. In particular the entry lane to the M1 going south is far too short and ends suddenly. This has now become something of a black spot and a target for some 'cash for crash' insurance

frauds with vehicles deliberately stopping suddenly and causing a following vehicle to collide. One member of the Council had direct experience of this."

5.181 "Approaching the junction from the direction of Flitwick there is confusion for drivers unfamiliar with the area as counter-intuitively one turns north to go south. Yes there are signs but some confusion and hesitancy still occurs presenting a potential safety hazard. The multiple sets of traffic lights which the layout seems to necessitate is also confusing for some drivers. The exit from the M1 from the South is also more awkward than previously and seems to have added nothing to road safety as is evidenced by the north-bound closure of the M1 a few days ago following a multiple crash in the vicinity of the service station and this exit ramp."

5.182 Steppingly Parish Council also noted that they "raised their concerns about some of these issues at a meeting with the design consultants before the work started as part of the consultative process but our comments and concerns were ignored or discounted."

Evaluation

Traveller Care – Assessment of Effects

5.183 The HSR and junction improvements have improved traveller care through provision of additional signage and driver information. The HSR scheme in particular has improved the level of information available to drivers through variable message signage, as illustrated in **Figure 5.27**, below.

Traveller Views – Assessment of Effects

5.184 At J11, the improved junction layout and more integrated townscape associated with the works has improved traveller views. At J12, more open views are now possible along the slips and Harlington Road, but views are generally of motorway infrastructure and do not represent an improvement. This is as expected. Views should improve at both junctions as landscape and townscape planting establishes.

5.185 Views along the M1 itself, associated with the HSR scheme have reduced as a result of the scheme due to the increased amount of highway furniture that is now visible – gantries, signs, retaining walls, acoustic barriers, etc. – as demonstrated in the figure below.

Figure 5.27 – HSR – Improved signage and driver information, but more visual clutter

Driver Stress – Assessment of Effects

5.186 As detailed in the safety section of this report, collisions have increased on the mainline M1, although cannot be confidently attributed to the scheme with limited data available. No change

is reported for collision numbers at the junctions, although severity of collisions has reduced. Fear of collisions should have reduced due to improved lane merges associated with J11 and 12 and Toddington MSA, as well as controlled speed limits. However, the consultation response from Toddington Parish Council suggests that use of the hard shoulder and restricted speeds "inappropriately" may lead to increased fear of accidents. Steppingly Parish Council also highlight there is a perceived increase in accident numbers and fear of accidents associated with the junction 12 improvements.

5.187 Traffic flow and journey time analysis shown earlier in this report shows that congestion has not improved as a result of the HSR scheme, and so has not led to an improvement in driver frustration or fear of accidents associated with congestion as was expected. J11 and 12 improvements have, though, reduced congestion on the link roads, meaning reduced levels of frustration. This is backed up by consultation from Toddington Parish Council.

5.188 Provision of additional signage and information, mainly associated with the HSR scheme, has improved route certainty for users of the M1, as should have improved merges and junction layouts associated with the J11 and 12 junction improvements. New junction layouts and improved signage at J11 and 12 should have also improved route certainty. However, this is not backed up by Steppingly Parish Council with regard to J12, who state that the junction layout is confusing.

Table 5.17 - Summary of Journey Ambience Evaluation

Traveller Factor		AST Score	OYA evaluation
Views – HSR		Worse	Increased visual clutter associated with new highway infrastructure reduces quality of traveller views, as expected.
Views – JNC		Neutral	Improvements in townscape at J11 but worsening of views due to reduced vegetation and views of the large junction at J12 give an overall neutral score, as expected.
Driver Stress – HSR	Frustration	Better	Congestion has not reduced as a result of the HSR scheme, so benefits to driver frustration associated with congestion have not been realised. Worse than expected.
	Fear of Accidents		Fear of accidents will not have reduced as much as expected due to still high levels of congestion. Better driver information and speed restrictions should have benefits, however. Worse than expected.
	Route Uncertainty		Improved signage and information for drivers should have improved route certainty. As expected.
Driver Stress – JNC	Frustration	Better	Reduced congestion at junctions has reduced driver frustration. As expected.
	Fear of Accidents		New junction layouts and reduced congestion should have reduced fear of accidents. However, local perceptions suggest fear of accidents is still high. As expected.
	Route Uncertainty		Increased signage and generally improved layouts and merges associated with both junctions. Local perceptions suggest J12 layout is confusing. As expected.
Care – HSR		Neutral	No change, as expected.
Care – JNC		Neutral	No change, as expected.
Summary Score		**Large beneficial**	**Benefits are perhaps not as great as expected due to poorer than expected results with regard to congestion associated with the HSR scheme. Local perceptions of J12 suggest benefits are not as good as they might be.**

Key Points – Environment

Noise

- Assuming appropriate mitigation in place, noise impacts are likely to be less than expected due to lower traffic and HGV flows than expected. Confirmation on the noise mitigation proposals and as built for HSR is required.

Local Air Quality

- Air quality impacts are likely to be less than expected due to lower traffic and HGV flows than expected.

Greenhouse Gases

- Post opening it can be seen that the scheme has had little impact on carbon emissions, compared to a re forecast 22% increase, based on the M1 mainline flows and speeds only.

Landscape and Townscape

- Landscape and townscape proposals have largely been implemented as expected for the junction improvements. For J12, impacts are potentially worse than expected for J12 due to immaturity of planting at OYA stage. For J11, landscaping treatments have not been fully implemented as expected, and failure of stock and poor maintenance has meant that overall benefits to townscape have not been achieved at OYA. HSR impacts not fully understood.

Biodiversity

- Limited biodiversity effects at J11 due to urban nature of setting and small scheme footprint. No significant biodiversity impacts at J12, but some loss of habitats. Net gain of hedgerows and species rich grassland but net loss of broadleaf woodland. No direct impacts to protected species. HSR impacts not fully understood.

Cultural Heritage

- Impacts are as expected with regard to the junction improvements at J11 and 12. However, impacts associated with HSR are not fully understood.

Water

- Overall neutral effect of junction improvement proposals on drainage. Proposals at J12 appear to be implemented as expected. Details of drainage at J11 and associated with HSR scheme to be confirmed at FYA.

Physical Fitness

- General improvement for NMUs due to the junction improvements through provision of dedicated footways and signalised junctions.

Journey Ambience

- General improvements to journey ambience, but benefits not as great as expected due to poorer than expected journey times associated with the M1. Local perceptions of route uncertainty and fear of accidents at J12 are worse than expected.

6. Accessibility and Integration

6.1 This chapter evaluates the impact of the scheme in terms of the accessibility and integration objectives; comparing qualitative forecast assessments from the scheme AST with post-opening findings and analysis of policy objectives.

Accessibility

6.2 The accessibility objective is concerned with how the scheme has affected the ability of people in different locations to reach different types of facility, using any mode of transport. The accessibility objective consists of three sub-objectives. These are:

- Option values;
- Access to the transport system; and
- Severance

Option Values

6.3 Option values, as defined in webTAG, relate to the availability of different transport modes within the study area, even if they are not used. For example, a car user may value a bus service along their route even if they never used it because they have the option of another mode should their car become unavailable.

6.4 Access to the transport system is influenced by access to a private car and proximity to a public transport service.

Forecast

6.5 The HSR AST states that: “Scheme is concerned with motorway improvements and is unlikely to affect transport options” resulting in a neutral score. The junction improvements AST also noted that the impact of the scheme would be neutral.

Score: Neutral

Evaluation

6.6 It is considered that the AST forecast is valid and that no further evaluation would reveal any changes to option values connected to the scheme.

Access to the Transport System

6.7 WebTAG states that access to the transport system is strongly influenced by the two key variables introduced at the start of this section, i.e. access to a private car and proximity to a public transport service.

Forecast

6.8 Both scheme ASTs state that the: “Scheme is concerned with motorway improvements and is unlikely to affect access to the transport system”

Score: Neutral

Evaluation

6.9 The scheme appraisal gave a rating of neutral as there were no changes in the supply of transport infrastructure. No further consideration has been given to this sub objective, as POPE agrees that

there has been no change to either access to the private car, or proximity to the public transport system as part of the scheme. The score of neutral is therefore upheld.

Severance

6.10 Community severance refers to the degree to which movement and activities within the community are affected by the presence of a major road or other transport link, and particularly the degree of separation of residents from the facilities and services they use within their community.

Forecast

6.11 The HSR AST states: "No changes to journey lengths for pedestrians accessing community facilities' and therefore scores the impact as neutral. The junctions AST notes that the improvements at J11 would be improved by the provision of signalised pedestrian crossings and improved pedestrian access at the overbridge at J12.

Score: Mainline: Neutral Junctions: Moderate Beneficial

Evaluation

6.12 A site visit conducted in 2014 confirmed the implementation of all elements of the scheme as expected.

6.13 All NMU measures have been implemented as expected for the junction improvements scheme, and there are no impacts on NMUs associated with the HSR scheme.

6.14 At M1 J12 has been diverted through new and extended under bridges, as shown in the **Figure 6.1** below. This has increased the length of the footpath, as expected.

Figure 6.1 Diversion through J12, also providing farm access

6.15 **Figure 6.2** below shows the new overbridge footpath/cycleway crossing the M1 at J12, which has reduced severance across Harlington Road, where there was a previously blocked NMU access. Overall at J12 there has been an improvement for NMUs through the provision of safer, signalised crossings and dedicated footways.

Figure 6.2 New access provided across J12 over bridge, Harlington Road

6.16 **Figure 6.3** shows one of the signalised junctions at J11. NMUs now need to cross three lanes of traffic, rather than the two before the junction improvements, however, signalised junctions provide safe crossing points.

Figure 6.3 Signalised crossing across 3-lane slip road at J11

6.17 Overall, the AST forecast of 'moderate beneficial' is considered valid for the junctions scheme, with no effects associated with the HSR scheme resulting in agreement with the neutral assessment.

Integration

6.18 The integration objective consists of two main elements:

- Interchange with other transport modes: how the scheme assists different modes of transport in working together and the ease of people moving between them to choose sustainable transport choices; and
- Land Use Policy and Other Government Policies: how the scheme integrates with local land use and wider government objectives.

Transport Interchange

6.19 The transport interchange objective relates to the extent to which the scheme contributes towards the Government objective of improving transport interchange for passengers and freight.

Forecast

6.20 Both scheme ASTs states that the: “Scheme is concerned with motorway improvements and is unlikely to affect passenger/ freight interchange”

Score: Neutral

Evaluation

6.21 With regard to highway schemes, this sub-objective will only be applicable in certain cases where an interchange between different modes forms part of the scheme, such as a park and ride facility; therefore neither element of the scheme has an impact on this sub-objective, therefore it has been scored neutral, as expected.

Land Use Policy and Other Government Policies

6.22 This section looks at the scheme in relation to national, regional and local level land use and development policies.

Forecast – Mainline improvements

6.23 Regarding land use policy, the HSR AST states: “The Scheme constitutes permitted development in accordance with The Town and Country Planning (General Permitted Development Order) 1995, amended 2006, as the improvements are either within the boundaries of the highway or on land outside but immediately adjoining the highway boundary. No permanent land take required. Very special circumstances exist to justify locating mitigation measures within Green Belt land. Scheme is supported by development plan and accords with national transport policy objectives”

Score: Neutral

6.24 Regarding other government policies, AST states: “While the Scheme has some environmental impacts, these are minor and would be appropriately mitigated, in line with relevant policy. The acknowledged wider benefits arising from improvements to this section of M1 corridor are considered, on balance, to outweigh any negative impacts that are likely to arise”

Score: Beneficial

Forecast – Junction improvements

6.25 Regarding land use policy, the AST stated ‘The Scheme would contribute to improvements in accessibility to various development areas. Scheme aims to minimise environmental impacts but would require some land take from Green Belt and from best and most versatile agricultural land.’

Score: Neutral

6.26 Regarding other government policies, AST states: “The scheme would improve the efficiency of the road network, thereby enabling journey times to decrease, reducing congestion, improving safety and facilitating business efficiencies. These improvements would contribute to economic growth and housing developments in the vicinity of the M1 corridor. Whilst the scheme would improve accessibility to employment, retail and leisure facilities, dependency on the car would not be lessened.”

Score: Neutral

Evaluation

6.27 An evaluation of the impact of the scheme in relation to local, regional and national policy is contained in **Table 6-1.**

The impact of the junction scheme is neutral as expected for landuse and other government policies. The impact of the mainline improvements is scored as neutral, as expected for land use. However, the impact of the scheme on other government policies is considered to be neutral, worse than expected as the anticipated improvements in journey times and safety have not materialised, and therefore do not outweigh the expected negative impacts of the scheme.

Table 6-1 Relevant Policy Objectives and Scheme Impacts

	Policy / Document	Relevant Policy Objective / Reference	Relevant Scheme Impacts	Alignment?
Local Policies	**LTP 2 Luton (2006-2011)**	The LTP2 period provides the opportunity to take the first step in delivering the vision set out in the 2020 Transport Strategy. As such, our LTP2 objectives are consistent with those set out in the longer term 2020 Transport Strategy and are designed to meet the transportation needs of the conurbation as it exists now and the wider needs of the Luton and Southern Bedfordshire Growth Area. In developing them we have paid particular attention to the outcomes of public consultation, the data analysis underpinning the LTP2 and the local issues emerging from the regional strategies and the government's shared priorities. The LTP2 objectives provide clear direction for the 2006-2011 period. They are to: • Improve the safety of the travelling public, especially children and those in vulnerable and disadvantaged groups; • Reduce dependency on the private car; • Increase the choice of transport available to all; • Make services (health, education, employment, leisure and shopping) more accessible so that people have a real choice about when and how they reach them; • Sustain a thriving local economy whilst minimising the impact of transport on the environment; • Improve the efficiency of the transport network; • Manage congestion levels and accommodate future growth, through the short term provision of effective alternatives to the private car and by the controlled management of demand in the longer term; and • Improve the use of the existing transport network through effective management and maintenance.	The scheme has not had a beneficial impact on safety, although the additional capacity and monitoring capabilities enable there to be less disruption in the event of a collision. Journey times and journey time reliability has generally not improved, therefore not assisting network efficiency objectives. The improvement at theJ11 and J12 have improved journey times for local traffic accessing the M1 at these junctions, helping to improve the efficiency of the local transport network.	Partial
	LTP 2 Bedfordshire (2006-2011)	This includes seven objectives, three of which are priority objectives ('preparing for growth', 'developing the economy' and 'managing assets'). These objectives shape the strategy and delivery programme and will provide an essential guide to the progress The priority objectives relate to the following issues: • Preparing for growth; • Developing the economy; and • Managing transport assets • Managing congestion • Accessibility • Safer travel • Air quality and the environment	The lack of improvement in journey times or reliability at peak times indicates that the scheme has not contributed to managing congestion for M1 traffic. However, improvements are seen at each of the upgraded junctions, therefore benefitting some users. The scheme has not resulted in an improvement in safety, although the addition of CCTV monitoring is likely to improve driver experience whilst on the M1. The additional capacity provided by the extra lane usage will assist in preparing for growth, assuming that lane utilisation can be addressed.	Partial
Regional Policy	**East of England Regional Spatial Strategy (2008, Revision)**	The overall aims of the RSS were: • To realise the economic potential of the region and its people. • To improve and conserve the regions environment. The objectives of the regional transport strategy were to: • Manage travel behaviour and the demand for transport to reduce the rate of road traffic growth and ensure the transport sector makes an appropriate contribution to reducing greenhouse gas emissions. • Enable the provision of the infrastructure and transport services necessary to support existing communities and development proposed in the spatial strategy. • Improve access to jobs, services and leisure facilities.	The scheme has provided additional capacity to help reduce congestion, but has had no beneficial impact on reducing journey times. The scheme has shown an increase in traffic post opening, indicating that the scheme has not supported the objective to manage travel behaviour.	Partial
National Policy	**The Future of Transport: a Network for 2030**	The Strategy builds on the progress that had already been made since the implementation of the 10 year plan for transport. This plan extended out to 2014-2015 but strategy also looks even further ahead, at the challenges we face over next 20-30 years. • The Strategy is built around three themes: • Sustained investment; • Improvements in transport management; and • Planning ahead. The main goal is to provide a road network that provides a more reliable and free-flowing system for motorists, other road users and businesses, where travellers can make informed choices about how and when they travel, and so minimise the adverse impact of road traffic on the environment and other people.	The scheme has helped to improve access to the M1 for local areas, although the expected journey time savings have not materialised for mainline traffic. The investment in this scheme supports other schemes that will follow, eventually providing a wider upgraded and freeflowing network.	Partial

Key Points – Accessibility and Integration

Accessibility

- It is considered that the AST rating of neutral for the Option Values, Severance and Access to the Transport System sub-objectives is appropriate given the outturn impact of the scheme.

Integration

- The scheme has not had an impact on the provision of public transport interchange, as expected.
- The scheme integrates with some objectives set out in regional policies however the lack of improvement seen in reliability and journey times for most users hinders some objectives. The scheme's impact on Land Use and Other Government Policies is therefore considered to be neutral as expected for both schemes, but worse than expected for other government policies for the mainline scheme.

7. Appraisal Summary Table & Evaluation Summary Table

Appraisal Summary Table

7.1 The AST is a brief summary of the main economic, safety, environmental and social impacts of a highway scheme **Table 7.1** and **Table 7.2** presents the two ASTs for the scheme.

7.2 The AST presents a brief description of the scheme, a statement detailing the problems that the scheme planned to address, and makes an assessment of the scheme's predicted qualitative and quantitative impacts against the following objectives:

- **Environment** – an estimate of the impact of the scheme on factors such as noise, local air quality, landscape, biodiversity, and water;
- **Safety** – measured reduction in the number and severity of accidents and qualitative assessment of impacts on security;
- **Economy –** Estimated impact of the scheme upon journey times, vehicle operating costs, scheme costs, journey time reliability and wider economic impact;
- **Accessibility** – A review of scheme impact upon access to the public transport network, community severance, and non-motorised user impact; and
- **Integration** – A description of how a scheme is integrated with wider local planning, regional and national policy objectives.

Evaluation Summary Table

7.3 The EST was devised for the POPE process to record a summary of the outturn impacts against the objectives, compared to the predictions in the AST.

7.4 Drawing on the results presented in this report, **Table 7.3** and **Table 7.4** presents the two ESTs for the scheme. An assessment of each of the objectives at the FYA stage is given. Where possible, the format of the EST mirrors the appearance and process of the AST to enable direct comparison between the two.

Table 7.1 – Appraisal Summary Table (AST) – M1 J10 – J13 HSR Scheme (22/09/09) Version 3

M1 HSR Junctions 10 to 13		**Description: Provision of technology scheme with Hard Shoulder Running on four lanes at times of congestion, between J10 and J13. The Scheme is wholly within the existing highway boundary and includes addition of: driver information signs; speed limit signs; emergency refuge areas; hard should running if necessary; and new congestion and incident management systems.**	**Problems: Motorway operating over capacity, resulting in congestion, queues and delays at peak times**	**Present Value of Costs to Public Accounts £23.1M**
OBJECTIVE	SUB-OBJECTIVE	(a) QUALITATIVE IMPACTS	(b) QUANTITATIVE ASSESSMENT	
ENVIRONMENT	Noise	For the Scheme design year 2028, the adoption of HSR results in a negligible decrease in the number of people annoyed by traffic noise in the study area when compared to the corresponding Do minimum scenario. This is a result of a combination of the enhanced barrier scenario to the M1 and changes in traffic flows on road links outside the Scheme corridor with the Scheme in place. Number of properties experiencing noise levels > 68dB LAeq, 18h: Do Minimum 1307; Do Something 1049.	Total population in assessment = 53560 Do Minimum = 6583 people annoyed Do Something = 6474 people annoyed Change in population annoyed (year 15) = -109	11,204 properties experience an increase in noise level. 1,558 properties experience no change in noise level. 9,933 properties experience a decrease in noise level. (ranked as Neutral) NPV of noise proposal = +£7,909,909
	Local Air Quality	The area near J11 has been declared an Air Quality Management Area (AQMA) for NO_2 by Luton BC, and currently comprises 431 dwellings. An AQMA has also been declared in Dunstable based on a predicted 40ug/m^3 contour. With the HSR option with 50mph speed limit through the Luton AQMA as necessary and 3 HA owned properties on Leagrave High St being excluded from residential use, the predicted baseline exceedance of the annual mean nitrogen dioxide limit value would be worsened at one property on Leagrave High Street. There is also one new exceedance of the air quality limit value predicted for 179 Leagrave High St. Predicted baseline exceedences would be removed at 2 properties on Withy Close and 1 in Dunstable and 3 further properties would have an existing exceedance improved. All properties outside the AQMA but within 200m of the scheme experience air quality levels within UK Air Quality Objectives.	PM_{10}: 9,339 properties "losers"; 0 properties negligible change; 7,099 properties "winners" NO_2: 9,344 properties "losers"; 0 properties negligible change; 7,094 properties "winners"	Assessment Score: PM_{10} = +164; NO_2 = +120
	Greenhouse gases	The Scheme would result in a net dis-benefit due to the additional vehicle kilometres travelled.	Total change in carbon emissions for Scheme opening year = +13,288 Tonnes Total change in carbon emissions for whole appraisal period = +1,172,708 Tonnes	NPV: - £36 984,000
	Landscape	The Scheme involves relatively minor amendments to the existing M1 corridor/infrastructure other than addition of gantries. Minimal loss of screening vegetation would be offset by mitigation planting such that overall impact on landscape would be neutral by Year 15.		Neutral
	Townscape	The existing motorway corridor has a negative and dominating effect upon the townscape and whilst the scheme would add to the infrastructure, principally through gantries, the overall magnitude of change would be small. There would be no land take associated with the HSR scheme.	N/A	Slight Adverse
	Heritage or Historic Resources	Slight adverse impacts on six archaeological sites dating from the Iron Age to the post-medieval period due to disturbance caused during earthworks repairs, ground reduction and groundworks. Visual and setting impacts on 1 Scheduled Monument of High value (Eversholt Wakes End Farm) due to gantries, mitigated by landscape planting. Neutral effect on 3 further Scheduled Monuments (Tingrith Wood End; Maltings Spinney Moated Site; and All Saints Church ruins, Segenhoe). Setting impacts on 2 Grade II listed buildings of Medium Value (Mill Farm; and Redhills Farm) would be mitigated by landscape planting.	N/A	Slight Adverse
	Biodiversity	No direct loss of habitat within statutory designated sites or County Wildlife Sites. Slight adverse impacts on undesignated woodland and hedgerows and scrub habitat in the soft estate. No significant effects on watercourses or ponds. No significant adverse effects on grassland and arable habitats or scarce arable flora. Slight adverse impacts on bats, reptiles, terrestrial great crested newt due to general disturbance effects and permanent landtake from existing soft estate that would not be replaced by an equivalent area of new habitat creation. Proposed woodland habitat replacement represent an improvement in habitat quality but is unlikely to have reached sufficient maturity by year 15 to have fully mitigated for loss of mature vegetation and its value for bats in particular.	N/A	Slight Adverse
	Water Environment	Risks to surface watercourses slightly increased compared to the existing situation due to increased traffic flows, more efficient delivery of runoff to receiving watercourses and potential for reduced infiltration. Risks to groundwater would correspondingly be slightly decreased compared to existing due to replacement of existing leaking drainage system.	N/A	Slight Adverse
	Physical Fitness	Existing non-motorised user routes to be retained. No impact on community or recreational usage of the NMU network.	Number of cyclists and pedestrians making journeys of more than 30 minutes as a result of the scheme = 0	Neutral
	Journey Ambience	The Scheme would have a slight adverse effect on travellers' views due to the provision of gantries but a beneficial effect on driver stress due to improved signage. Driver stress would remain in the large category, due to the high traffic flows, however the standard method is not targeted at appraising HSR technology schemes.	N/A	Large Beneficial
SAFETY	Accidents	Accident analysis over 60 years includes forecasts changes in traffic flows on local roads within the area of traffic impact. The quantitative assessment assumes that the controlled motorway would deliver accident rate improvements of 15% and that these savings would be countered by forecast increases in traffic on the motorway. It is expected that HSR would further improve the accident rate, i.e. by more than assumed for the quantitative assessment, particularly on the motorway in the area of Junction 11. The improved layout at Junction 12 would mitigate the traffic impact of short weaving lengths between the south facing slip roads at Junction 12 and the Toddington Motorway Service Area.	Number of Personal Injury Accidents saved: -785 Casualties: Deaths: 1.8; Serious : -10.8; Slight: -1,062	PVB: -£3.97M
	Security	Activity on the motorway would be monitored by CCTV system. Emergency refuge areas monitored and controlled		Large positive
ECONOMY	Public Accounts	Appraisal based upon 60-year period. 2006 Q2 construction prices are discounted to a 2002 present value year in 2002 market prices (£millions). Capital investment out-turn costs of £415 million (2006 Q2) supplied by HA in Feb 2009. Technology renewal costs (estimated to be £26.45M) would be incurred every 15 years. Do-minimum costs of £21.14M (discounted 2002 market price) would have been incurred in the no-scheme case.	Investment costs: £340.1M Indirect tax revenue: £317.0M	PVC: £23.1M
	Business Users & Providers	Assessment based upon central growth forecasts over a 60-year period, in 2002 market prices, discounted to a 2002 present value year. Appraisal includes benefits of improving Junctions 11 and 12 which are an integral part of the Scheme to deliver user benefits.	N/A	PVB: £337.0M
	Consumer Users	Assessment based upon central growth forecasts over a 60-year appraisal period, in 2002 market prices, discounted to a 2002 present value year. Appraisal includes benefits of improving Junctions 11 and 12, which are an integral part of the Scheme to deliver user benefits.	N/A	PVB: -£61.5M
	Reliability	Assessment based upon central growth forecasts over a 60-year appraisal period, in 2002 market prices, discounted to a 2002 present value year. Reliability calculation undertaken using INCA in Nov 2008.	N/A	PVB: £238.3M

	Wider Economic Impacts	Scheme would give rise to an estimated additional 700 full time jobs.	N/A	Neutral
ACCESSIBILITY	Option Values	Scheme is concerned with motorway improvements and is unlikely to affect transport options.	N/A	Neutral
	Severance	No changes to journey lengths for pedestrians accessing community facilities.	No change	Neutral
	Access to the Transport System	Scheme is concerned with motorway improvements and is unlikely to affect access to the transport system.	N/A	Neutral
INTEGRATION	Transport Interchange	Scheme is concerned with motorway improvements and is unlikely to affect passenger/ freight interchange.	N/A	Neutral
	Land Use Policy	The Scheme constitutes permitted development in accordance with The Town and Country Planning (General Permitted Development Order) 1995, amended 2006, as the improvements are either within the boundaries of the highway or on land outside but immediately adjoining the highway boundary. No permanent landtake required. Very special circumstances exist to justify locating mitigation measures within Green Belt land. Scheme is supported by development plan and accords with national transport policy objectives.	N/A	Neutral
	Other Government Policies	While the Scheme has some environmental impacts, these are minor and would be appropriately mitigated, in line with relevant policy. The acknowledged wider benefits arising from improvements to this section of M1 corridor are considered, on balance, to outweigh any negative impacts that are likely to arise.	N/A	Beneficial

Table 7.2 – Appraisal Summary Table (AST) – M1 Junction 11 & 12 Improvements (16/11/2009) (PCF Stage 3, Version 3)

M1 J11 & 12 Improvements		**Description: Improvements to Junction 11 and 12 involving widened slip roads and signalised junction layout at Junction 11, and new slip road and junction overbridge arrangement at Junction 12** **QUALITATIVE IMPACTS**	**Problems J11 and 12 experience heavy congestion particularly at peak times, with queues extending back along the existing slip roads and along side road approaches at J12. Queues also cause stationary traffic on the M1 and there is sub-standard weaving distance on the M1 mainline between the Toddington Motorway Service Area northbound merge slip and the northbound diverge slip for Junction 12.** **QUANTITATIVE ASSESSMENT**	**Present Value of Costs to Public Accounts £43.92M** **ASSESSMENT**
OBJECTIVE	SUB-OBJECTIVE			
ENVIRONMENT	**Noise**	For the Scheme design year 2029, the adoption of the Scheme results in a negligible decrease in the number of people annoyed by traffic noise in the study area when compared to the corresponding Do minimum scenario. Number of properties experiencing noise levels > 68 dB LAeq,18h: Do Minimum, 192; Do Something, 213. Challney High School, immediately to the north-east of J11 will experience a negligible decrease in noise levels as a result of the Scheme. Luton and Dunstable Hospital, to the west of J11, will generally experience a negligible decrease in noise levels as a result of the Scheme, except for the western facades fronting on to Lewsey Road, which will experience a negligible increase in noise levels. The only non-residential receptor in the vicinity of J12 is Poplars Nursery to the north-east on Harlington Road. These premises will experience a negligible decrease in noise levels as a result of the Scheme. (a negligible change in noise level is defined as less than 1 dB)	Total population in assessment = 13516 Do Minimum = 1878 people annoyed Do Something = 1872 people annoyed Change in population annoyed (year 15) = -5	736 properties experience an increase in noise level. 3011 properties experience no change in noise level. 1980 properties experience a decrease in noise level. (ranked as Neutral) NPV of noise proposal = +£0.226 m
	Local Air Quality	The new junction scheme road alignment is likely to change the route of traffic within the study area. The Scheme will cause a worsening in local air quality relative to baseline conditions at 3294 properties and an improvement of 2056 properties lying within 200m of the proposed Scheme. The area near junction 11 has been declared an Air Quality Management Area (AQMA) for NO_2 by Luton BC, by 2014 there is only one relevant receptor that the limit value is still predicted to be exceeded at. The Scheme would result in an imperceptible improvement in the margin of exceedance of the annual mean Limit Value for nitrogen dioxide at the only exceeding property.	PM_{10}: 3294 properties "losers"; 0 properties negligible change; 2056 properties "winners". NO_2: 3294 properties "losers"; 0 properties negligible change; 2056 properties "winners"	PM_{10}: +95 NO_2: +274
	Greenhouse gases	The assessment is based on the TUBA output reported in the Economic Appraisal undertaken in September 2009 for the assessment year of 2014. The Scheme would result in a net increase of emissions due to the additional vehicle kilometres travelled.	Total change in carbon emissions for Scheme opening year = +433 T Total change in carbon emissions for whole appraisal period = +7922T	NPV: £0.079 m
	Landscape	At Junction 12 the existing motorway has had a significant local adverse effect on landscape character although the junction is set within a wider landscape of high quality. Impacts on the adjacent landscape would be largely indirect and mitigation woodland planting, associated with the realigned slip roads, would more fully integrate the junction into the landscape. Landscape not applicable to Junction 11.	N/A	Neutral
	Townscape	Junction 11 is located in a low quality urban townscape. At Junction 11 the Scheme could be fully integrated into the townscape and may deliver some townscape benefits with appropriate design derived from a more planned treatment of planting and hard surfacing. Townscape not applicable to Junction 12.	N/A	Slight Beneficial
	Cultural Heritage	The Junction 11 improvements would not impact on the cultural heritage resource resulting in a Neutral effect. At Junction 12 the construction of the north and southbound slip road embankments, new overbridge foundations and associated landscaping would have slight adverse impacts on three archaeological sites and several isolated finds scatters dating from the Neolithic to the post-medieval periods. Negligible impacts on settings of two Grade II Listed buildings. Direct physical impacts on two historic motorway structures of low value. No impact on historic landscape. There would also be a slight adverse impact caused by the construction of the new northbound access slip roads on one historic banked hedge boundary.	N/A	Slight Adverse
	Biodiversity	The Junction 11 improvements would not have any direct or indirect effects resulting in a Neutral effect. The Junction 12 improvements would result in indirect effects on the River Flit tributary and River Flit CWS and direct effects on Poplars Nursery CWS due to land take resulting in slight adverse effects and moderate adverse effects respectively. No direct adverse effects are anticipated for protected fauna within the Scheme. It is unlikely that the proposed woodland and tree planting will have matured by 15 years after opening so slight adverse effects are likely to remain.	N/A	Slight Adverse
	Water Environment	Additional road drainage due to increased pavement at J11 to be attenuated in oversized pipes or suitable attenuation method, hence no increase in discharge flows to surface watercourse. Routine road runoff from J11 would be directed through a treatment system before discharge to Leagrave Stream resulting in a neutral effect. The predominantly piped drainage followed by treatment reduces risk to watercourse, and affords a high degree of protection to underlying groundwater resources within the groundwater Source Protection Zone. Attenuation of road drainage at J12 in attenuation ponds would also provide some treatment and improvement of runoff quality. Impact on water quality at J12 is considered to be neutral. Extension of one existing culvert and construction of one new culvert at J12, with no adverse impacts to flood risk anticipated.	N/A	Neutral
	Physical Fitness	Signalised pedestrian crossings to be incorporated into J11 should improve facilities for non-motorised users and would not affect journey times. Existing NMU facilities on J12 overbridge currently un-useable; improvements would allow for dedicated footway on south side, thereby facilitating pedestrian route across bridge. FP34 would require diversion with increase in journey length of about 130m, however considered unlikely to affect level of usage, which is currently low.	N/A	Slight Beneficial
	Journey Ambience	At Junction 11 by Year 15 there would be a slight beneficial effect derived from improved townscape and enhanced traveller experience both on the M1 and the A505 Dunstable Road. Scheme operation would have a beneficial effect on driver stress due to improved traffic flow and improved capacity at Junction 11. At J12 there would be adverse impacts on travellers' views due to the loss of mature vegetation together with embankments and landform associated with the junction. Beneficial effect on driver stress due to improved traffic flow and extensive signage leading to reduced fear of potential accidents and improved capacity at Junction 12.	N/A	Large beneficial
SAFETY	**Accidents**	Accident assessment has been undertaken using the M1 Local Area Model and COBA. The number of personal injury accidents (PICs) saved relates to the whole road network within the Local Model Area. Values are for a 60-year appraisal period.	PICs saved 500 Casualties saved - Fatal: 21, Serious: 109, Slight: 676	PVB £33.0m
ECONOMY	**Security**	Security of road users would not be changed by the improvements Appraisal based upon a 60-year period. Capital investment outturn costs of £71.8 million (2006 Q2) were supplied by the HA (at time of request) in October 2009. The 2006 Q2 construction prices and expenditure profile are discounted to a 2002 present value year in 2002 market prices (£ millions).	Central Govt PVC £43.92m, Local Govt PVC £0.0m	Neutral PVC £43.92m
	Public Accounts			

	Transport, economic efficiency: business users and transport providers	The appraisal was derived using the M1 Local Area Model and the TUBA Program for a 60-year period. Values are 2002 market prices discounted to a 2002 present value year (£ millions).	Business Users PVB £62.7m, Transport Providers PVB £0.0m	PVB £62.7m
	Transport, economic efficiency: Consumers	The appraisal was derived using the M1 Local Area Model and the TUBA Program for a 60-year period. Values are 2002 market prices discounted to a 2002 present value year (£ millions).	Consumer Users PVB £53.2m	PVB £53.2m
	Reliability	Traffic control system can be configured to be more responsive to incidents. A monetised reliability benefit cannot be evaluated.		Neutral
	Wider Economic Impacts	An Economic Impact Assessment has been undertaken. No significant effects were identified on employment levels in the Luton and Dunstable Regeneration Area		Neutral
ACCESSIBILITY	**Option Values**	Junction improvements would affect car and bus modes only. Transport services would not be changed. Slight beneficial assessment for pedestrians and cyclists.	N/A	Neutral
	Severance	Route through J11 currently well used by pedestrians and cyclists. J11 improvements includes improvements by the provision of signalised pedestrian crossings. Route through J12 poorly used but an important community link. Provision of improved pedestrian facilities across new Toddington overbridge would reduce severance	N/A	Moderate Beneficial
	Access to the Transport System	Scheme is concerned with motorway junction improvements and is unlikely to affect access to the transport system	N/A	Neutral
INTEGRATION	**Transport Interchange**	Scheme is concerned with motorway junction improvements and is unlikely to affect passenger/freight interchange	N/A	Neutral
	Land Use Policy	Scheme would contribute to improvements in accessibility to various development areas. Scheme aims to minimise environmental impacts but would require some land take from Green Belt and from best and most versatile agricultural land.	N/A	Neutral
	Other Government Policies	The Scheme would improve the efficiency of the road network, thereby enabling journey times to decrease; reducing congestion improving safety; and facilitating business efficiencies. These improvements would contribute to economic growth and housing development in the vicinity of the M1 corridor. While the Scheme would improve accessibility to employment, retail and leisure facilities, dependency on the car would not be lessened.	N/A	Neutral

Table 7.3 – Evaluation Summary Table (EST) – M1 J10 – J13 HSR Scheme

EVALUATION SUMMARY TABLE M1 J10-J13 HSR Scheme				
OBJ	**SUB-OBJECTIVE**	**QUALITATIVE IMPACTS**	**QUANTITATIVE IMPACT**	**ASSESSMENT**
Environment	**Noise**	Assuming all noise mitigation has been implemented as expected, significantly lower than expected traffic and HGV flows on the M1 has meant that noise impacts are likely to be lower than expected. Further study of mitigation measures is required at FYA.	-	Better than expected based on available traffic data, but further study of mitigation required at FYA.
	Local Air Quality	M1 traffic flows and HGV numbers are significantly lower than expected, meaning the scheme is likely to have a lower effect on air quality than expected.	-	Likely to be better than expected based on traffic flows
	Greenhouse Gases	Observed carbon emissions show no change in carbon emissions when the M1 mainline is considered, compared to a reforecast of an increase of 22%. This is mainly due to lower than expected traffic flow increases, and a decrease in speed on the mainline.	Covering a wide area as per the AST the results in tonnes of carbon per year: DM Reforecast = 116,964 DS Reforecast = 143,019 Difference = +26,055 (22%) DM Observed = 111,336 DS Observed = 111,492 Difference = 156 (0%)	Better than expected
	Landscape	The scheme appears to be implemented as expected but mitigation planting is still too small to provide any screening, and the exact scale of mitigation planting or retention of existing vegetation is not fully understood. The introduction of gantries and signage, in particular, into the landscape is considered to have a slight adverse impact at OYA, but this may reduce to neutral by Year 15. Impacts not fully understood due to lack of available information.	-	Worse than expected at OYA. Further study required at FYA.
	Townscape	The existing motorway corridor has a negative and dominating effect upon the townscape and the scheme introduces new, large infrastructure, which are generally visible from close to the M1. The level of change cannot be fully understood due to the lack of available information.	-	Further assessment required at FYA.
	Heritage of Historic Resources	Impacts to archaeology are unknown but unlikely to be significant due to the restricted footprint of the scheme within the soft highway estate. Impacts on built heritage assets are considered to be as expected based on information made available, and generally relate to visual impacts of new highway infrastructure including gantries and lighting. Further study, however, is required at FYA.	-	As expected based on available information, but further study required at FYA.
	Biodiversity	Very limited available at OYA. However, assuming impacts were restricted to the highway soft estate, and were limited to discrete areas such as gantry footings and retaining walls, impacts should be as expected. Further study required at FYA.	-	As expected, based on available information, but further study required at FYA.
	Water Environment	Confirmation of implementation of drainage is required by as built plans. Assuming works have been carried out then impacts should be as expected	-	As expected, based on available information, but further study required at FYA.
	Physical Fitness	No impacts on NMUs, as expected.	-	As expected
	Journey Ambience	Benefits are perhaps not as great as expected due to poorer than expected results with regard to congestion associated with the HSR scheme. Local perceptions of J12 suggest benefits are not as good as they might be.	-	Large Beneficial
Safety	**Accidents**	At the OYA stage there is an observed increase in collisions along the mainline M1, however as the result is not statistically significant, it cannot be directly linked to the scheme. . As such the monetised safety impact is reforecast to be £0m.	-	Too early to conclude
	Security	The provision of CCTV cameras and direct emergency call access to operators at the emergency refuge areas increases security for users.	-	As expected (Large Positive)
Economy	**Public Accounts**	Outturn construction costs were lower than forecast, and changes to indirect tax were also lower than forecast.	Reforecast PVC based on OYA study: £260.47m	Worse than expected
	TEE	The scheme has not achieved in journey time saving which has resulted in the TEE benefits much lower than that forecast.	Outturn Journey time benefits : -£240.34m for M1 Mainline traffic	Worse than expected
	Reliability	The standard deviation of journey times results provide sufficient evidence to conclude that the scheme has not achieved its objective of reducing congestion along the scheme section.	-	-
	Wider Economic Impacts	This scheme, along with other improvements on the M1 and surrounding key routes is likely to enable further growth, but no quantifiable impacts can be directly linked to this scheme.	No quantitative assessment of the impact on wider economic benefits has been made.	As expected (Neutral)
Accessibility	**Option Values**	No impact on option values	-	As expected (Neutral)
	Severance	The scheme has not affected the provision of infrastructure.	-	As expected (Neutral)
	Access to the Transport System	No direct change in public transport provision as a result of the scheme.	-	As expected (Neutral)
Integration	**Transport Interchange**	With regard to highway schemes, this sub-objective will only be applicable in certain cases where an interchange between different modes forms part of the scheme, such as a park and ride facility; therefore the scheme has no impact on this sub-objective.	-	As expected (Neutral)
	Land Use Policy	Scheme required no landtake, therefore considered to have limited impacts.	-	As expected (Neutral)
	Other Government Policies	The improvements in journey times and safety do not outweigh the expected negative impacts of the scheme.	-	Worse than expected (Neutral)

Table 7.4 – Evaluation Summary Table (EST) – M1 Junction 11 & 12 Improvements

EVALUATION SUMMARY TABLE M1 Junction 11 & 12 Improvements				
OBJ	**SUB-OBJECTIVE**	**QUALITATIVE IMPACTS**	**QUANTITATIVE IMPACT**	**ASSESSMENT**
Environment	**Noise**	Assuming all noise mitigation has been implemented as expected, significantly lower than expected traffic and HGV flows on the M1 has meant that noise impacts are likely to be lower than expected. Further study of mitigation measures is required at FYA.	-	Better than expected based on available traffic data, but further study of mitigation required at FYA.
	Local Air Quality	M1 traffic flows and HGV numbers are significantly lower than expected, meaning the scheme is likely to have a lower effect on air quality than expected.	-	Likely to be better than expected based on traffic flows
	Greenhouse Gases	A small increase was forecast with the scheme. No detailed forecast flows and speeds were available therefore no outturn calculation has been made for the junctions. It is likely however that the impact of the scheme would be as expected for the junctions, if not slightly better than expected.	-	As expected
	Landscape	Junction 12 has a large scheme footprint and has had a significant effect on local landscape, in an area of high landscape value. Impacts on areas of high landscape value including the Chilterns AONB and AGLV in the wider area are considered not to be affected by the scheme. The implementation of a large amount of new lighting and the layout of the large junction make it prominent in the landscape. Although it appears mitigation has been implemented as expected, no landscape benefits are yet to be realised from this. As planting matures it should help to integrate the junction into the landscape.	-	Worse than expected at OYA.
	Townscape	Although there are negatively affected properties, the J11 works generally sought to improve the local area by integrating the M1 better into the townscape. Material finishes are generally of a high quality, but the planting implemented by the J11 works does not provide an immediate mitigating effects, and additional maintenance and planting is required to ensure the scheme integrates the junction more sympathetically into the townscape.	-	Worse than expected.
	Heritage of Historic Resources	No impacts due to J11 works, as expected. Impacts associated with archaeology and listed buildings (Redhills Farm and Mill Farm) at J12 are as expected, and should be mitigated over time as landscape planting matures.	-	As expected
	Biodiversity	Impacts to Poplars Nursery CWS avoided, therefore better than expected. Other impacts as expected, which relate to loss of habitat at J12 and culverting of a tributary to the River Flit. Limited impacts to protected species, as expected.	-	As expected
	Water Environment	J12 drainage, attenuation and spill control appears to be implemented as expected on J12, and planting is establishing well. As built drawings are required to confirm other mitigation has been implemented.	-	As expected
	Physical Fitness	Lengthening of one, little used footpath at J12 has an adverse effect, but overall at J11 and 12 there is an improvement for NMUs through provision of safe, signalised junctions and dedicated foot and cycleways.	-	As expected
	Journey Ambience	Benefits are perhaps not as great as expected due to poorer than expected results with regard to congestion associated with the HSR scheme. Local perceptions of J12 suggest benefits are not as good as they might be.	-	Large Beneficial
Safety	**Accidents**	At the OYA stage there is no statistical evidence that the scheme has had an impact on safety within the study area. As such the monetised safety impact is reforecast to be £0m. It is noted that in the first year after opening, there has been no serious or fatal collisions at either junction.	-	Too early to conclude
	Security	The scheme did not affect the provision of security facilities.	-	As expected (Neutral)
Economy	**Public Accounts**	Outturn construction costs were lower than forecast, and changes to indirect tax were also lower than forecast.	Reforecast PVC based on OYA study: £260.47m,	Worse than expected
	TEE	The scheme has resulted in some journey time benefits, although not to the level forecast.	Outturn Journey time benefits : -£29.30m - junctions	Worse than expected
	Reliability	Journey time reliability is likely to have improved slightly, however journey times on some sections has worsened, possibly related to traffic conditions on the mainline.	-	-
	Wider Economic Impacts	This scheme, along with other improvements on the M1 and surrounding key routes is likely to enable further growth, but no quantifiable impacts can be directly linked to this scheme.	No quantitative assessment of the impact on wider economic benefits has been made.	As expected (Neutral)
Accessibility	**Option Values**	No impact on option values.	-	As expected (Neutral)
	Severance	At J12 there has been an improvement for NMUs through the provision of safer, signalised crossings and dedicated footways.	-	As expected (Moderate Beneficial)
	Access to the Transport System	No direct change in public transport provision as a result of the scheme.	-	As expected (Neutral)
Integration	**Transport Interchange**	With regard to highway schemes, this sub-objective will only be applicable in certain cases where an interchange between different modes forms part of the scheme, such as a park and ride facility; therefore the scheme has no impact on this sub-objective.	-	As expected (Neutral)
	Land Use Policy	The scheme is within the boundaries or the highway or on land outside but immediately adjoining the highway boundary.	-	As expected (Neutral)
	Other Government Policies	There has been limited improvement in journey times and safety, and some poor landscaping impacts.	-	As expected (Neutral)

8. Conclusions

8.1 To conclude this report, this section summarises how the scheme is meeting its specified objectives.

Scheme Specific Objectives

8.2 **Table 8.1** presents an evaluation of the scheme's objectives using the evidence presented in this study.

Table 8.1 – Success against Scheme Objectives

Objective	Has the scheme objective been achieved?	
Junctions: Improve traffic and safety problems	Journey speeds for most movements through each junction have improved, with the best savings seen at J12. Some routes do seem to have seen a small disbenefit, which may be due to the introduction of more traffic signals to control traffic, and the redesign of slip roads resulting in slightly longer distances to travel. Overall, a benefit is seen at J12, with limited impacts seen at J11.	✓
	The number of collisions at the junctions does not appear to have improved post opening, although severity has improved. It is noted however that this is based on a small sample size, particularly post opening, and no firm conclusions can be drawn.	Too early to conclude at this stage
Junctions: Improve journey reliability	Journey times at the junctions have generally improved, although there is still variability between the journey times experienced in the peaks compared to interpeak periods. Some of the issues noted for journey times on the mainline M1 may be having a detrimental impact on the junctions in some periods.	Partial
Junctions: Reduce fatalities, casualties and incidents	Observed changes in collisions show that the scheme has had limited impact on the number of collisions at the junctions post opening. However, the upgraded junctions do appear to have had an impact on the severity of collisions, as no serious or fatal collisions have been recorded post opening based on the information used in this report. It is noted however that this is based on a small sample size, particularly post opening, and no firm conclusions can be drawn. No incident information has been considered as part of this evaluation.	Too early to conclude at this stage.
Junctions: Reduce congestion and queuing at junction 11 and 12	Journey speeds for traffic using the junctions has generally improved, indicating that queuing and congestion has reduced, particularly at peak times. Local traffic also benefits, as savings are seen, particularly for A5120 traffic at J12.	✓

Mainline: Reduce congestion and improve journey time reliability	Journey times have increased post opening, and journey time reliability information is inconclusive. The improvements seen at the junctions may have helped reduce queuing back onto the mainline. The increase in journey times is due to a combination of; the inefficient use of the hard shoulder, an increase in flows, particularly in the peak periods, and excess use of lower speed limits, particularly towards the south of the scheme.	✗
Mainline: Reduce the frequency of accidents	The number of collisions has increased post opening, although the change cannot be directly linked to the scheme based on one year of data. The collision rate (when increased traffic is taken into account) has also increased, suggesting that the scheme has had limited impacts on safety at OYA.	Too early to conclude at this stage
Mainline: Reduce driver stress	Increased signage and driver information should have reduced driver stress, however there is no information to suggest that congestion and safety have improved to help reduce driver stress.	Partial

Appendices

Appendix A. Tables and Figures in this Report

Tables

Figures

Appendix B. Glossary

Terms	Definition
AADT	**Annual Average Daily Traffic**. Average of 24 hour flows, seven days a week, for all days within a year.
Accessibility	Accessibility can be defined as 'ease of reaching'. The accessibility objective is concerned with increasing the ability with which people in different locations, and with differing availability of transport, can reach different types of facility.
ADT	**Average Daily Traffic**. Average daily flows across a given period.
AGLV	**Areas of Great Landscape Value**
AONB	**Area of Outstanding Natural Beauty**
AQMA	**Air Quality Management Area**
AST	**Appraisal Summary Table**. This records the impacts of the scheme according to the Government's five key objects for transport, as defined in DfT guidance contained on its Transport Analysis Guidance web pages, WebTAG.
ATC	**Automatic Traffic Count**
AAWT	**Annual Average Weekday Traffic**. As AADT but for five days (Monday to Friday) only.
AWT	**Average Weekday Traffic**. As ADT but for five days (Monday to Friday) only.
BBC	**Bedford Borough Council**
BCR	**Benefit Cost Ratio**. This is the ratio of benefits to costs when both are expressed in terms of present value i.e. PVB divided by PVC.
COBA	**Cost Benefit Analysis**. A computer program which compares the costs of providing road schemes with the benefits derived by road users (in terms of time, vehicle operating costs and accidents), and expresses the results in terms of a monetary valuation. The COBA model uses the fixed trip matrix unless it is being used in Accident-only mode.
CWS	**County Wildlife Sites**
DfT	**Department for Transport**
Discount Rate	The percentage rate applied to cash flows to enable comparisons to be made between payments made at different times. The rate quantifies the extent to which a sum of money is worth more to the Government today than the same amount in a year's time.
Discounting	Discounting is a technique used to compare costs and benefits that occur in different time periods and is the process of adjusting future cash flows to their present values to reflect the time value of money, e.g. £1 worth of benefits now is worth more than £1 in the future. A standard base year needs to be used which is 2002 for the appraisal used in this report.
DM	**Do Minimum**. In scheme modelling, this is the scenario which comprises the existing road network plus improvement schemes that have already been committed.
DMRB	**Design Manual for Roads and Bridges**
DS	**Do Something**. In scheme modelling, this is the scenario detailing the planned scheme plus improvement schemes that have already been committed.
EA	**Environment Agency**
EAR	**Economic Assessment Report**
EERM	**East of England Regional Model**
EH	**English Heritage**
ES	**Environmental Statement**
EST	**Evaluation Summary Table**. In POPE studies, this is a summary of the evaluations of the TAG objectives using a similar format to the forecasts in the AST.
ERA	**Emergency Refuge Areas**
FYA	**Five Year After**

Terms	Definition
HA	**Highways Agency**. An Executive Agency of the DfT, responsible for operating, maintaining and improving the strategic road network in England. As of 1st April 2015, now known as Highways England and is independent of DfT.
Halogen Data	**Halogen Data** is held by the Highways Agency and can be downloaded for the message screens displayed on overhead gantries forming part of a managed motorway scheme.
HCC	**Hertfordshire County Council**
HGV	**Heavy Goods Vehicle**
HSR	**Hard Shoulder Running**
INCA	**Incident Cost Benefit Assessment** can be used to estimate the benefits of reduce delay and travel time variability caused by unforeseen incidents that reduce capacity such as breakdowns, accidents and debris on the carriageway and major disruptions such as spillages.
KSI	**Killed or Seriously Injured**. KSI is the proportion of casualties who are killed or seriously injured and is used as a measure of accident severity.
LAM	**Local Assignment Model**
LCA	**Landscape Character Areas**
LBC	**Luton Borough Council**
LNS	**Low Noise Surfacing**
MAC	**Managing Area Contractor** Organisation normally contracted in 5-year terms for undertaking the management of the road network within a HA area.
MIDAS Data	MIDAS data is held by the Highways Agency which contains lane by lane traffic flows and speeds
MVKM	**Million Vehicle Kilometres**
NMU	**Non-Motorised User**. A generic term covering pedestrians, cyclists and equestrians.
OYA	**One Year After**
PCF	**Project Control Framework**
PIC	**Personal Injury Collisions**
POPE	**Post Opening Project Evaluation**. The before and after monitoring of all major highway schemes in England.
Present Value	**Present Value**. The value today of an amount of money in the future. In cost benefit analysis, values in differing years are converted to a standard base year by the process of discounting giving a present value.
PVB	**Present Value Benefits**. Value of a stream of benefits accruing over the appraisal period of a scheme expressed in the value of a present value.
PVC	**Present Value Costs**. As for PVB but for a stream of costs associated with a project
Smart Motorway	Referred to previously as “managed motorways”: A motorway which uses technology to vary speed limits in response to driving conditions. These smart motorways make the hard shoulder available to traffic. This could be permanently or at particularly busy times of the day.
STATS19	A database of injury accident statistics recorded by police officers attending accidents.
TEE	**Transport Economic Efficiency**
TEMPRO	**Trip End Model Program**. This program provides access to the DfT's national Trip End Model projections of growth in travel demand, and the underlying car ownership and planning data projections.
TRADS	**Traffic Flow Data System**. Database holding information on traffic flows at sites on the strategic network.
UK	**United Kingdom**
VMSL	**Variable Mandatory Speed Limits**

Terms	Definition
WebTAG	DfT's website for guidance on the conduct of transport studies at http://www.webtag.org.uk/

Appendix C. Information requested for Environmental section

Requested Information	Response
Environmental Statement	Received for junction improvement works only
Environmental Assessment Report	(for HSR scheme) Not received
AST	Received for both schemes
Any amendments/ updates/addendums etc to the ES or any further studies or reports relevant to environmental issues. Have there been any significant changes to the scheme since the ES.	Not received for either scheme
'As Built' drawings for landscape, ecological mitigation measures, drainage, fencing, earthworks etc. Preferably electronically or on CD.	Not received for either scheme
Copies of the Landscape/Ecology Management Plan or Handover Environmental Management Plans	Not received.
Contact names for consultation	Not received
Archaeology - were there any finds etc. Have any Archaeological reports been written either popular or academic and if so are these available?	Received for junction improvements scheme. Unlikely to exist for HSR scheme.
Have any properties been eligible for noise insulation?	Information not received
Have there been any Part 1 Claims regarding noise, air quality or lighting? Have any post opening surveys been undertaken?	Information not received
Has any post opening survey or monitoring been carried out e.g. for ecology/biodiversity or water quality and if so would copies of the reports be available?	No information received for either scheme.
Animal Mortality Data	Information provided by MAC.
Any publicity material	None received.
Pre scheme Non Motorised User (NMU) Audit or Vulnerable User Survey	Received.
Copy of NMU post opening survey	Not received.
Employers Requirements Works Information - Environment sections	Not received.
Health and Safety File – Environment sections	Not received.
Construction Environment Management Plan (CEMP)	Not received.
Landscape and Ecology Aftercare Plan (LEAP) and / or Landscape Management Plan (LMP)	Landscape management plan received for junction improvements scheme only. Incomplete appendices
Handover Environmental Management Plan (HEMP)	Not received.
The Road Surface Influence (RSI) value of any low noise surface installed	Not received.
Has the scheme received any environmental awards	Unknown.

Appendix D. Photographic Record of Scheme

Photomontage Comparison Views

Photoview 11A - before

Photoview 11A – OYA

Photoview 11B – before

Photoview 11B – OYA

Photoview 11C – before

Photoview 11C – OYA

Photoview 11D – before

Photoview 11D – OYA

Photoview 11E – before

Photoview 11E – OYA

Photoview 12A – before

Photoview 12A – OYA

Photoview 12B – before

Photoview 12B – OYA

Photoview 12C – before

Photoview 12C – OYA

Photoview 12D – before

Photoview 12D – OYA

Photoview 12E – before

Photoview 12E – OYA

Photoview 12F – before

Photoview 12F – OYA

Photoview 12G – before

Photoview 12G – OYA