Post Opening Project Evaluation

M6 Junction 10a – 13 Smart Motorway

One Year After

August 2017

Notice

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 M6 junctions 10a-13 smart motorway scheme consists of the introduction of enhanced on-road technology to manage traffic flow between junctions 10a-11a and conversion of the hard shoulder for use as a permanent traffic lane between junctions 11a and 13. The main aims of scheme are to **reduce congestion** and **improve the reliability of journeys**.

This report assesses how the scheme was performing within its first year of operation. This forms part of a longer-term evaluation which reviews performance over five years. During this time, the study was not able to robustly assess the scheme's benefits due to limitations with the traffic data. We are reviewing the data quality as part of preparations for the longer-term evaluation.

Where it has been possible to undertake analysis, the indications are showing reduced journey times for customers travelling southbound. However, the evaluation cannot confidently conclude that this is the result of the scheme without all of the traffic data being available.

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. The evaluation indicates that the average number of personal injury collisions has reduced within the first year of the scheme and we will continue to assess this as part of the ongoing evaluation.

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 M6 Junction 10a to Junction 13 (J10a-13) Smart Motorway scheme is a Highways England major scheme located in the West Midlands and forms part of the strategic motorway network, connecting major conurbations in the north of the country, the Midlands, London and the channel ports in the south. The scheme opened to traffic in February 2016 and consists of two main elements to provide additional capacity and control of the highway as follows:

- ***Controlled Motorway*** – introduction of enhanced on-road technology to manage traffic flow between J10a-11a.
- ***All Lane Running*** – conversion of the hard shoulder for use as a permanent traffic lane between J11a and J13.

This report presents an interim review of the post opening impact of the scheme. During this evaluation, examination of traffic flows on the scheme section highlighted potential issues with the validity of post opening flows.

The scheme forecast an increase in traffic flows on all scheme sections post opening. However, comparisons between pre-and post-observed data show large decreases on the scheme sections. – with the knowledge that count technology was changed upon completion of the scheme (from inductive loop counters to radar) POPE suggests that inaccurate counts may be causing artificially lower post-opening observed traffic flows at OYA.

Objectives

Objective M6 J10a – J13 Highway Investment Board paper (August, 2013)	**Has the objective been achieved?**
Improve currency and quality of information provided to road users	✓
Support local development plans	**Too early to conclude**
To reduce congestion	**N/A**
Improve journey time reliability	**N/A**
To improve road safety on the strategic road network (including road workers)	✓
To minimise the environmental impact, enhancing the environment where appropriate	✓
To provide better information for drivers using the strategic road network	✓

Summary of Scheme Impacts

Traffic Volumes

- Analysis of traffic flows on the M6 scheme section appear to show that traffic has decreased post opening – this has led POPE to believe that there may be an issue with undercounting post opening and therefore this information has not been included in this report.

- Limited conclusions can be drawn from mainline traffic flow analysis due to poor data availability across the entirety of the scheme.

- On the local roads around the scheme, despite changes in traffic flows showing lower increases than background traffic growth at almost half of the sites, it is not possible to conclude that this is a result of re-routing to the scheme due to poor data availability across the scheme section.

Journey Times

- Journey time data shows a slight increase in post-scheme opening average journey times for the northbound direction and decreases in journey times heading southbound.

- Despite the overall benefit shown by observed journey time data, POPE cannot be sure that this journey time benefit is a result of the scheme based upon the traffic data available.

Operation of Smart Motorway

- On an average weekday on the controlled motorway section of the scheme VMSL are not in use either direction during the AM peak and are only in use during the PM peak southbound for approximately 10% of the hour. VMSL across M6 J10a-11 are in use for the highest proportion during the interpeak period, however they remain unused for the majority of the time period.

- VMSL across the ALR section of the scheme are not in use often, and are not in use higher than approximately 20% of any individual hour of the day.

- VMSL across the ALR section of the scheme are in operation for a higher proportion of time heading northbound as opposed to southbound. Northbound from Junction 12-13, VMSL are in use for approximately 20% of the hour across the period from 14:00 to 17:00, constituting the highest continued usage of VMSL across the scheme.

- Speeds across the scheme are consistent and lane one is utilised well across the ALR section of the scheme.

Reliability

- Reliability across the scheme in all directions and time periods has remained similar.

- The most noteworthy change in reliability is shown in the AM peak heading southbound, where the extreme journey times have reduced, indicating that the slowest times taken to travel through the scheme section are now quicker.

Accuracy of Forecasts

- Journey times across the scheme were forecast to decrease heading northbound but increase slightly in the southbound direction. Observed journey times were not in line with forecasts and exhibit a larger benefit (which cannot be attributed to the scheme at this point).

- Due to the low post-opening observed data, forecasts for this scheme seem to have overestimated the traffic that would be using the scheme in the opening year and forecast levels of growth between the without scheme and with scheme scenarios have not occurred on most scheme sections and junctions.

Safety

Collisions

- Post opening, an annual saving of 11.6 collisions is observed on the scheme section. Despite the decrease in the number of collisions, there is an increase in the severity of collisions post opening. No fatal collisions have been recorded in the first twelve months of operation, however there has been an increase in serious collisions.
- Significance testing found the increase in collisions is significant at the 95% confidence level and hence is at this stage be linked to the scheme implementation.

Forecast vs. Outturn Collision Rate Savings

- With the background changes in collisions accounted for, both the scheme extent and the ALR section have seen a higher reduction in collisions than 15% (the forecast estimate) during the opening year, at 42% and 39% respectively.

Environment

- Noise, Air Quality and Carbon have not been fully assessed at this stage due to the reliance on traffic flow data.
- Landscape and visual amenity effects are considered worse than expected at this OYA stage as the slight beneficial visual impacts expected from the removal of a gantry have not been realised for receptors in Great Saredon or on Malthouse Lane, Saredon Mill, and the Landscape mitigation measures do not yet appear to have been fully implemented. The impacts on townscape are as expected.
- There is no reason to consider that the operational impacts of the scheme on heritage are anything other than as expected at this stage, although mitigation measures designed to screen and reduce visual impacts on key assets do not appear to have been fully implemented.
- Habitat: Effects are considered worse than expected at this OYA stage, as the mitigation proposals do not yet appear to have been fully implemented. Species: Impacts on Badgers and all species considered in the appraisal are considered likely to be as expected, although further evidence is required to confirm.
- There is no evidence to suggest that the overall effect of the scheme on water quality and drainage is anything other than what would be expected.

Summary of Scheme Economic Performance

Benefits

- The monetised outturn benefits have not been presented here due to the traffic issues previously noted. Where a calculation has been made, this is included in the main report.

Cost

- The investment cost of building the scheme was £91.3 million in 2010 prices (not discounted), which is 6% less than forecast.

Benefit Cost Ratio (BCR)

- An outturn BCR has not been calculated at the OYA stage as the full range of benefits cannot be evaluated in full due to traffic volume queries on the mainline scheme section.

1. Introduction

Background

1.1. The M6 junction 10a-13 Smart Motorway (SM) is a Highways England major scheme which opened to traffic in February 2016. The scheme forms part of a wider strategy to relieve congestion on the highway network near to Birmingham through the implementation of SM, which involves the use of technology to control speed limits on motorways and conversion of the hard shoulder into a running lane for traffic.

1.2. This report presents a One Year After (OYA) opening evaluation of the whole scheme between J10a and J13, and has been prepared as part of the Highways England Post Opening Project Evaluation (POPE) programme. The purpose of this report is to present the initial impacts of the scheme during the OYA opening period.

1.3. This POPE study compliments the Twelve Month M6 J10a-13 SMALR Monitoring Report.

Scheme Location

1.4. The M6 forms part of a key strategic route through the West Midlands which connects the M1 at Rugby, with the North West (Manchester, Liverpool and Preston). Junction 10a to 13 of the M6 forms a 16.3km link, approximately 20km (12.4m) north-west of Birmingham. The scheme section of the M6 is part of Route E5 of the Trans-European Network of Roads[1]. The main alternative to the M6 is the M6 Toll, which joins the M6 at Junction 3 and at Junction 11a.

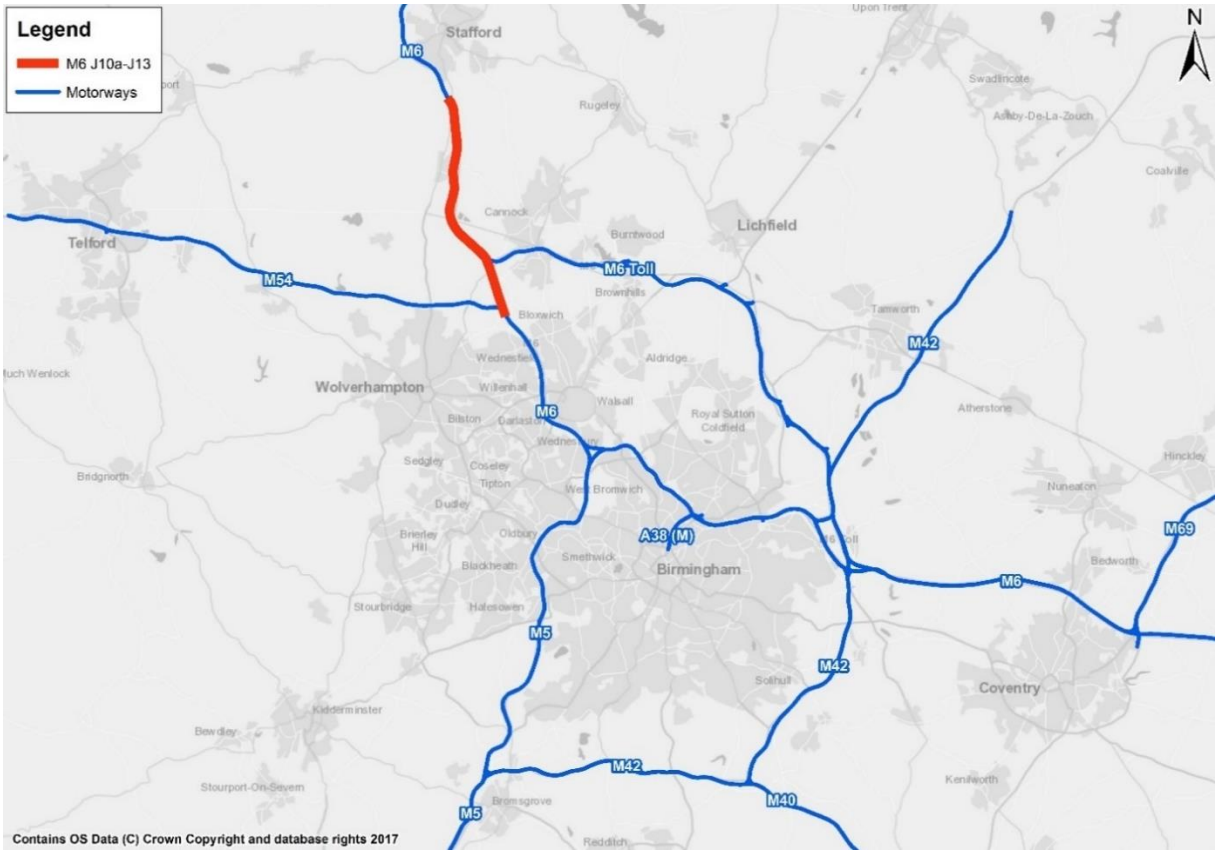
- Junction 10a provides access to the M54 (towards Telford and Shrewsbury), an important route for traffic travelling from the West Midlands towards mid and north Wales. In March 2011, construction of the Junction 8 to 10a Managed Motorway scheme was completed.
- Junction 11 forms a grade separated roundabout with the A460 and A462 Warstone Road. The A460 serves Wolverhampton to the south and Cannock to the north. The A462 Warstone Road is a local road that connects with several small conurbations in the West Midland such as; Essington, Willenhall and Shortheath.
- Junction 11a is the interchange between the M6 and the northern terminus of the M6 Toll. The M6 Toll is a 43km stretch of six-lane motorway that provides an alternate route to the M6 between Junction 3A (Coleshill Interchange) in the south and Junction 11a.
- Junction 12 is a standard grade separated roundabout providing access to and from the A5, which links Cannock to the east and Telford to the west.
- Junction 13 is a grade separated roundabout that connects with the A449. The A449 northbound at Junction 13 forms a key route into Stafford Town Centre. The A449 southbound at Junction 13 provides access to the small town of Penkridge.

1.5. The geographical location of the scheme in relation to the local region and surrounding highway network is shown in Figures 1-1 and 1-2, respectively.

[1] https://ec.europa.eu/transport/themes/infrastructure/ten-t-guidelines/maps_en

Figure 1-1 Scheme Location (Local)

Figure 1-2 Scheme Location (Regional)



Scheme Context

1.6. Nationally, the M6 is a key artery providing a direct motorway link between the major regions in the north of the country, the Midlands, London and the channel ports in the south. The route is also a major inter urban strategic route connecting Coventry, Birmingham and Manchester.

1.7. Although positioned across a largely rural section of the M6, the scheme links locally to several urban areas at both Junction 10a and Junction 13. These urban areas include; Wolverhampton, Walsall, Cannock and Stafford.

Reasons for Scheme

1.8. The Highways Investment Board (HIB) paper (August, 2013) for this scheme notes that prior to the scheme *"Flow breakdown and congestion can occur at any time of the working day and any day of the week."* The result being that this section of the M6 offers poor journey time reliability, imposing a significant burden to business. The following transport-related details were also noted in the Highways Investment Board Paper:

- This section of the M6 carried up to 120,000 vehicles per day (on the busier section north of Junction 11), with up to 22% of those vehicles being HGVs.
- A significant proportion of the HGVs were noted to be larger vehicles, which exacerbates their impact on the operation of the M6.

Description of Scheme

1.9. The scheme includes the M6 motorway between Junctions 10a -13. The route section is approximately 16.5km (10.3 miles).

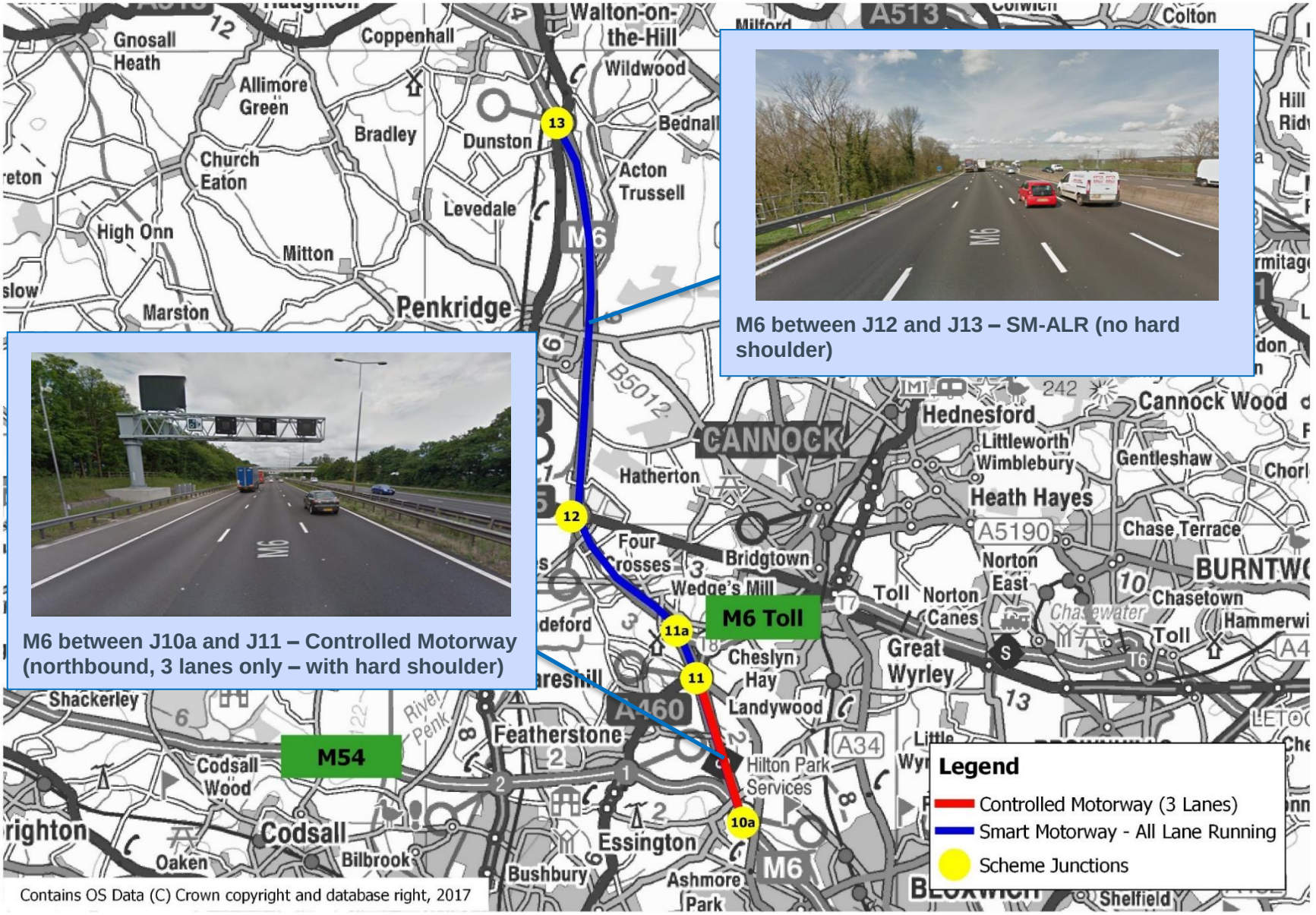
1.10. The M6 J10a to J13 SM scheme involved two distinct sections:

- M6 Junction 10a to Junction 11a: has the benefit of Controlled Motorway (CM) technology, but the hard shoulder was not converted into a running lane, leaving three lanes for traffic in each direction.
- M6 Junction 11a to Junction 13: Smart Motorway – All Lane Running (SM-ALR) i.e. the hard shoulder was converted into a permanent running lane leaving 4 lanes for traffic in each direction and Variable Mandatory Speed Limits (VMSL) are able to be implemented to help manage traffic flows.

1.11. SM-ALR refers to controlled four lane carriageways with no hard shoulder provision. This is supported by technology in the form of Motorway Incident Detection and Automatic Signalling (MIDAS) traffic detection and traffic control. The signs and signals can be controlled by operators and by automatic algorithms for Congestion Management (CM) and Queue Protection (QP). Emergency Refuge Areas (ERA) are available for broken down vehicles.

1.12. The layout of the scheme is shown in Figure 1-3:

Figure 1-3 Scheme Layout



Nearby Schemes

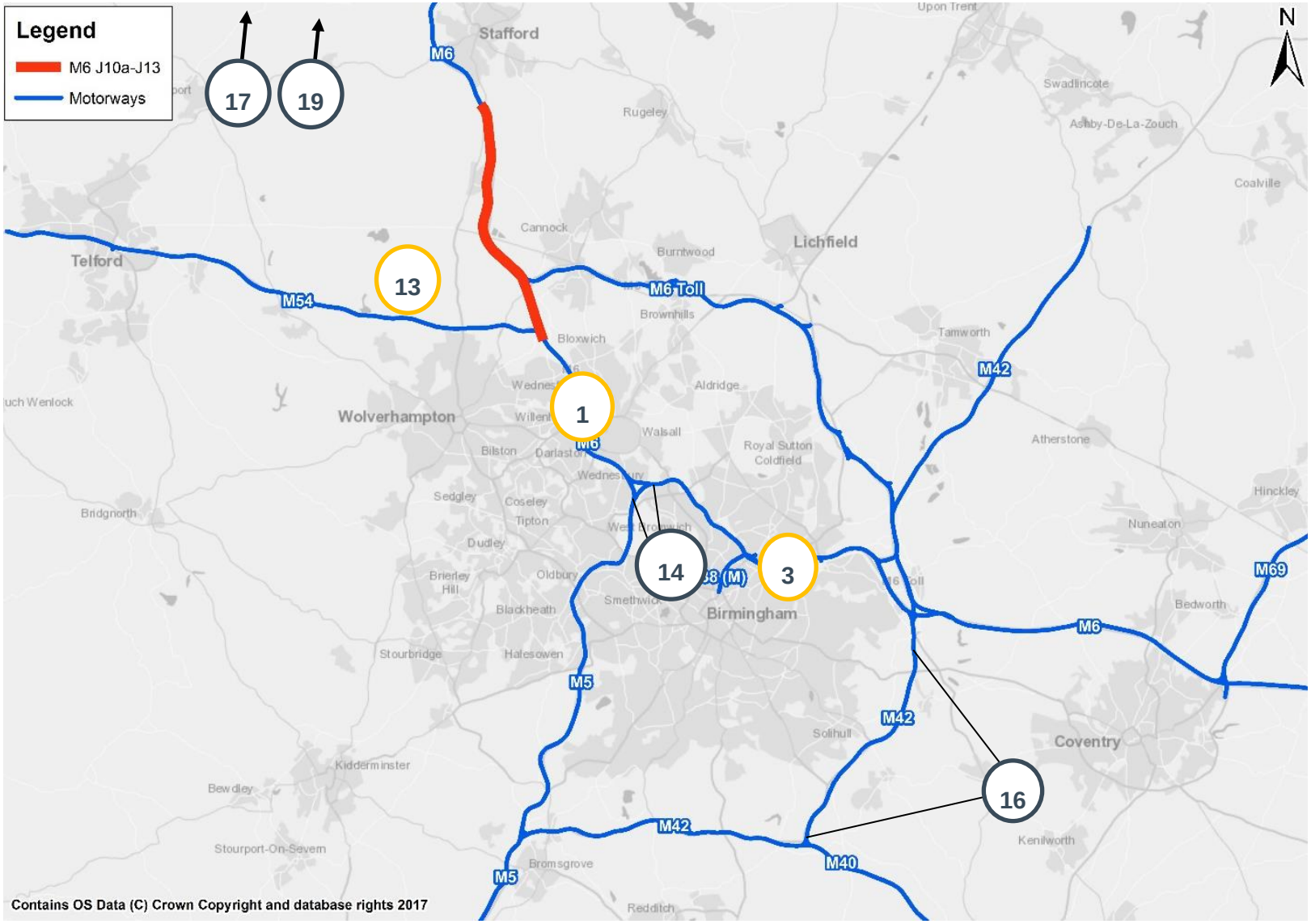
1.13. There are several Highways England network improvements which are noted to have been implemented near to the scheme, a full list of which are provided in Appendix A. A focused list of Highways England network improvements immediately relevant to this POPE study are summarised in Table 1-1. It is important to understand the impact that these schemes may have had on the data collection for this evaluation. The locations of these schemes are shown in Figure 1-4.

1.14. The construction and opening of these schemes will have an impact on the operation of M6 J10a-J13. The traffic management in place during the construction of the neighbouring schemes may affect the impact of M6 J10a-J13, whereas increased capacity up and downstream of the scheme may increase traffic flows and scheme utilisation. The influence of these schemes will be considered in additional detail in **Chapter 2** of this report.

Table 1-1 Nearby Schemes

	Scheme	Description/Impact on Traffic	Start of Construction	Scheme Opening
1	BBMM2 (M6 Junction 8 to 10a)	Managed Motorway implemented between junction 8 to 10a.	April 2009	March 2011
3	BBMM3 (M6 Junction 5 to 8)	Smart Motorway implemented between junction 5 to 8, including M5 link roads.	January 2012	April 2014
13	A449 Improvements	Resurfacing of the carriageway on the A449 from A449/A5 Gailey Roundabout to M54 Junction. The safety barriers will also be upgraded. A fully signposted diversion route will be in place using M6 Junction 11/12	January 2017	Complete June 2017
14	M6 northbound (Junction 7 and 8)	Structural repairs to damaged concrete and waterproofing on northbound carriageway. Work taking place in hard shoulder and lane one to minimise disruption. Overnight and weekend closures of slip roads and main carriageway. Enforced stepped speed limit from 70mph, to 50mph and 40mph through the work area, with fully signposted diversions between Junction 7 and 8.	February 2017	Completed April 2017
17	M6 Whitgreave Lane overbridge maintenance	Essential maintenance was carried out on the bridge, resulting in full closure of the bridge overnight. Diverted through Junction 14.	February 2017	Completed
19	M6 J16-19 Smart Motorway	Improving the M6 motorway between junction 16 (Crewe) and junction 19 (Knutsford) by making it a smart motorway.	December 2015	March 2019

Figure 1-4 Nearby Scheme Locations



Objectives

1.15. The scheme objectives are summarised below from the M6 J10a – J13 Highway Investment Board paper (August, 2013):

1) Improve currency and quality of information provided to road users;

2) Support local development plans;

3) To reduce congestion;

4) Improve journey time reliability;

5) To improve road safety on the strategic road network (including road workers);

6) To minimise the environmental impact, enhancing the environment where appropriate; and

7) To provide better information for drivers using the strategic road network.

Scheme History

1.16. The strategic case for providing additional capacity on the M6 J11a-19 was examined in the West Midlands to North West Multi-Modal Study. This recommended widening the motorway, generally to four lanes, as part of a wider strategy which also included public transport and demand management measures. In more recent years, however, proposals to widen the physical extents of motorways have been curtailed, with SM schemes becoming the preferred option for increasing route capacity. In developing a new roads programme as part of the Spending Review in 2010, the Coalition government looked to identify those schemes that offered the best investment. Whilst the M6 J10a-13 scheme was considered to be a good scheme that addressed a clear problem, it was identified for potential construction in future spending review periods because of fiscal constraints.

1.17. However, in the Autumn Statement (2011) the Government announced investment of over £1bn to tackle areas of congestion and improve the national road network. Subsequently the Government announced that construction of two additional managed motorway schemes would start before 2015, one of which was the M6 J10a-13. A brief history of the key events in the development of the scheme is provided in Table 1-2.

Table 1-2 Timeline of M6 J10a-13 Scheme

Date	Event
March 2002	The strategic case for providing additional capacity on the M6 J11a-19 was examined in the West Midlands to North West Multi-Modal Study.
October 2010	In developing a new roads programme as part of the Spending Review in 2010, the Coalition government looked to identify those schemes that offered the best investment. The M6 J10a-13 scheme was identified as a scheme that addressed a clear problem, it was identified for potential construction in future spending review periods because of fiscal constraints.
November 2011	The government announced the investment of over £1bn to tackle areas of congestion and improve the national road network, announcing the construction of two additional managed motorway schemes would start before 2015, one of which was the M6 J10a-13.
November 2012	M6 J10a-13 one of four schemes announced in the 2012 Autumn Statement to be piloted for accelerated delivery.
2013	8-week consultation period which closed on 30th August.
October 2013	Start of construction
February 2016	Scheme opened

Overview of Post Opening Project Evaluation

1.18. 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 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 Section 8.

1.19. 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 Section 8.

1.20. 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;
- Expectations of reasons for differences between forecast and outturn impacts; and
- 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

1.21. 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 on the scheme area and surrounding roads. It also covers journey times on the scheme section.
- 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 – Social Impacts Evaluation. This section contains a review of the scheme impacts on; physical activity, journey quality, affordability, access to services, severance and option values.
- Section 7 – Conclusions. This section summarises the main findings of this study against the key objectives.
- Section 8 – 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.

1.22. There are also several appendices listed below as follows:

- Appendix A – Highways England network improvement schemes local to M6 J10a-13
- Appendix B – HIB Paper Objectives (Full)
- Appendix C – Interpeak MIDAS Analysis
- Appendix D – Environmental Background Information
- Appendix E – Photographic Record of Scheme
- Appendix F – Glossary
- Appendix G – List of Tables and Figures

2. Traffic Evaluation

Introduction

2.1. This section examines traffic data from several sources to provide a pre-and post-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 attributed to the scheme.

2.2. During the course of this evaluation, concerns over the validity of traffic flow data on the M6 has been noted. These are detailed in the relevant section, and where necessary, in the supplementary technical note.

2.3. This section is structured as follows:

- A summary of the **traffic data sources** used;
- A description of **national, regional and local background changes in traffic** to provide a 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; and
- An **evaluation of key differences between the forecasts and outturn impacts** of the scheme in terms of traffic flows and journey times to identify whether traffic flow changes are as expected.

Traffic Data Sources

Traffic Count Data

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

- Permanent count data obtained from the TRADS/Webtris[2] database for count locations on Highways England's network.
- Permanent and temporary count data provided on the West Midlands SPECTRUM count database[3] for pre-and post-scheme periods.
- Permanent and temporary count data provided by the Local Transport Authority (LTA) Staffordshire County Council (SCC) for pre-and post-scheme periods.
- Commissioned count data (temporary), to cover post-scheme periods.

2.5. The details of the traffic count data sites used in this evaluation and their source are shown in Table 2-1.

[2] *TRADS/Webtris is Highways England website containing traffic flow data from automatic traffic counts on Highways England's strategic network.*

[3] *SPECTRUM is a database of traffic count data collected within the West Midlands and maintained by Mott MacDonald at the time of this report.*

Table 2-1 Traffic Count Sites

Source	Site Reference	Description
Highways England Count Data	1	M6 J10 – 10a
	2	M6 J10a – 11
	3	M6 J11 – 11a
	4	M6 J11a – 12
	5	M6 J12 – 13
	6	M6 J13 – 14
	7	A5 Watling Street, Gailey
	8	A5 Watling Street, Four Crosses
SPECTRUM	9	A449 Stafford Road (South of M54)
Staffordshire	10	A34 Cannock Road, Brocton
	11	A460 Cannock Road, Westcroft
	12	A460 Cannock Chase
	13	A460 Cannock Road, Shareshill
	14	A462 Warstone Road
	15	A51 Stafford Road, Lichfield
	16	A449 Moss Pit, Stafford
	17	A449 Wolverhampton Road, Dunston
	18	A51 Rugeley Bypass, Rugeley
	19	A449 Stafford Road, Coven
	20	A460 Lodge Lane, Middlehill
	21	A460 Cannock Road, Wedges Mills
	22	A5 Watling Street, Gailey
	23	A518 Newport Road, Stafford
Commissioned Traffic Counts	10	A34 Cannock Road, Brocton
	11	A34 Cannock Road, Westcroft
	12	A460 Cannock Chase
	13	A460 Cannock Road, Shareshill
	14	A462 Warstone Road
	15	A51 Stafford Road, Lichfield
	16	A449 Moss Pit, Stafford
	21	A460 Cannock Road, Wedges Mills

Journey Time Data

2.6. Satellite navigation[4] data for the M6 J10a –13 has been used to determine if there has been a change in average journey times and speeds and whether the distribution of journey times has changed since the scheme opened. Journey times for March 2012 (before opening) have been compared to March 2017 (after opening). This analysis is only carried out across the AM, IP and PM Peak periods, therefore the overnight works carried out along the scheme section throughout March 2017 did not affect these flows.

Halogen Data

2.7. Halogen data is available from Highways England and can be downloaded from the message screens displayed on overhead gantries forming part of a SM scheme. The data can be used to determine when, and for how long, the hard shoulder was open for traffic (not applicable to this scheme) and the different speed limits in place as part of the variable speed limit (queue protection) used on SMs. This analysis is only carried out across the AM, IP and PM Peak periods, therefore the overnight works carried out along the scheme section throughout March 2017 did not affect these flows.

Motorway Incident Detection Automated Signalling (MIDAS) Data

2.8. MIDAS technology forms part of the operation of Smart Motorway schemes. Data is available from Highways England and provides lane by lane traffic flows and speeds. This data along with the settings from the overhead gantries, obtained from Halogen data (e.g. whether Variable Mandatory Speed Limit in operation) can provide additional insight into the operation of the SM. As MIDAS and Halogen data form part of the technology of SMs, it is not possible to undertake pre-and post-scheme analysis using this data, but it does help inform the evaluation of the performance of the scheme. This analysis is only carried out across the AM, IP and PM Peak periods, therefore the overnight works carried out along the scheme section throughout March 2017 did not affect these flows.

Background Changes in Traffic

2.9. Historically in POPE reports, the ‘before’ counts have been factored to take account of background traffic growth so they are directly comparable with the ‘after’ counts. However, considering the recent economic climate, which has seen widespread reductions in motor vehicle travel in the United Kingdom (UK) since 2008, it is no longer deemed appropriate to use this method of factoring ‘before’ counts to reflect background changes in traffic. Instead, recent POPE studies have taken a more considered approach to assess changes near the scheme, within the context of national, regional and locally observed background changes in traffic.

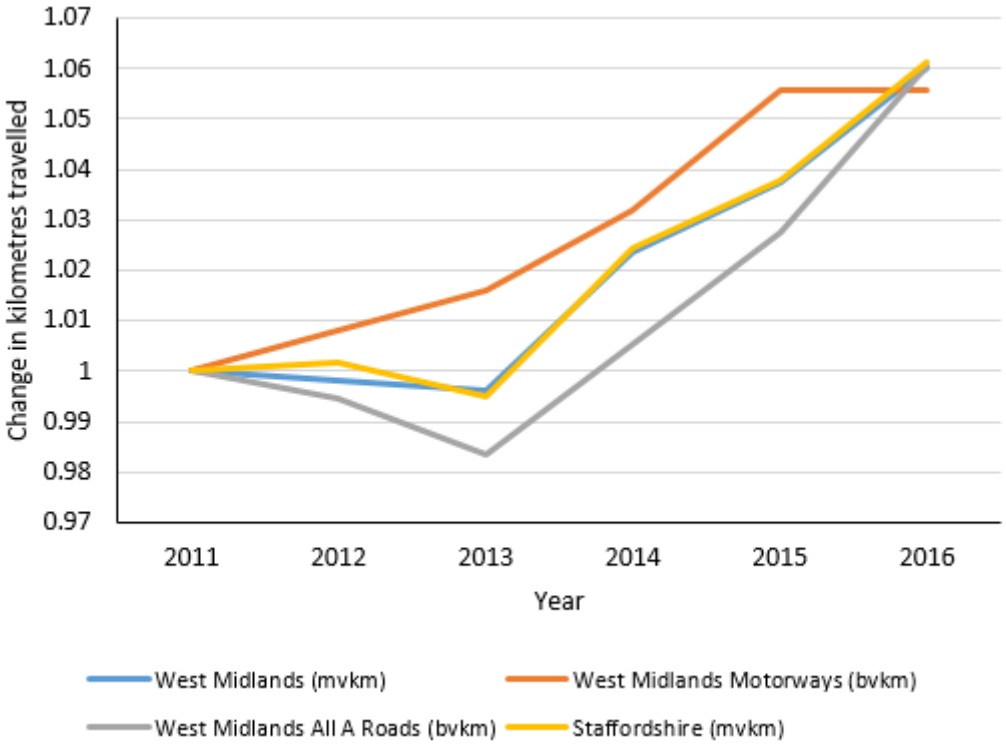
National, Regional and Local Trends

2.10. The DfT produces observed annual statistics for all motor vehicles by local authority and road type. The change in vehicle kilometres travelled between 2011 (before the start of construction) and 2016 (the latest available) is in shown in Figure 2-1 for:

- Motorways in the West Midlands (regional trends);
- All roads and ‘A’ roads in the West Midlands (regional trends); and
- All roads in Staffordshire (local trends).

[4] Motorists who use satellite navigation devices have the option to voluntarily allow anonymous data about their journeys to be collected and use to provide a range of services, including the analysis of historic journey times along specific routes.

Figure 2-1 Regional and Local Trends (kilometres travelled)



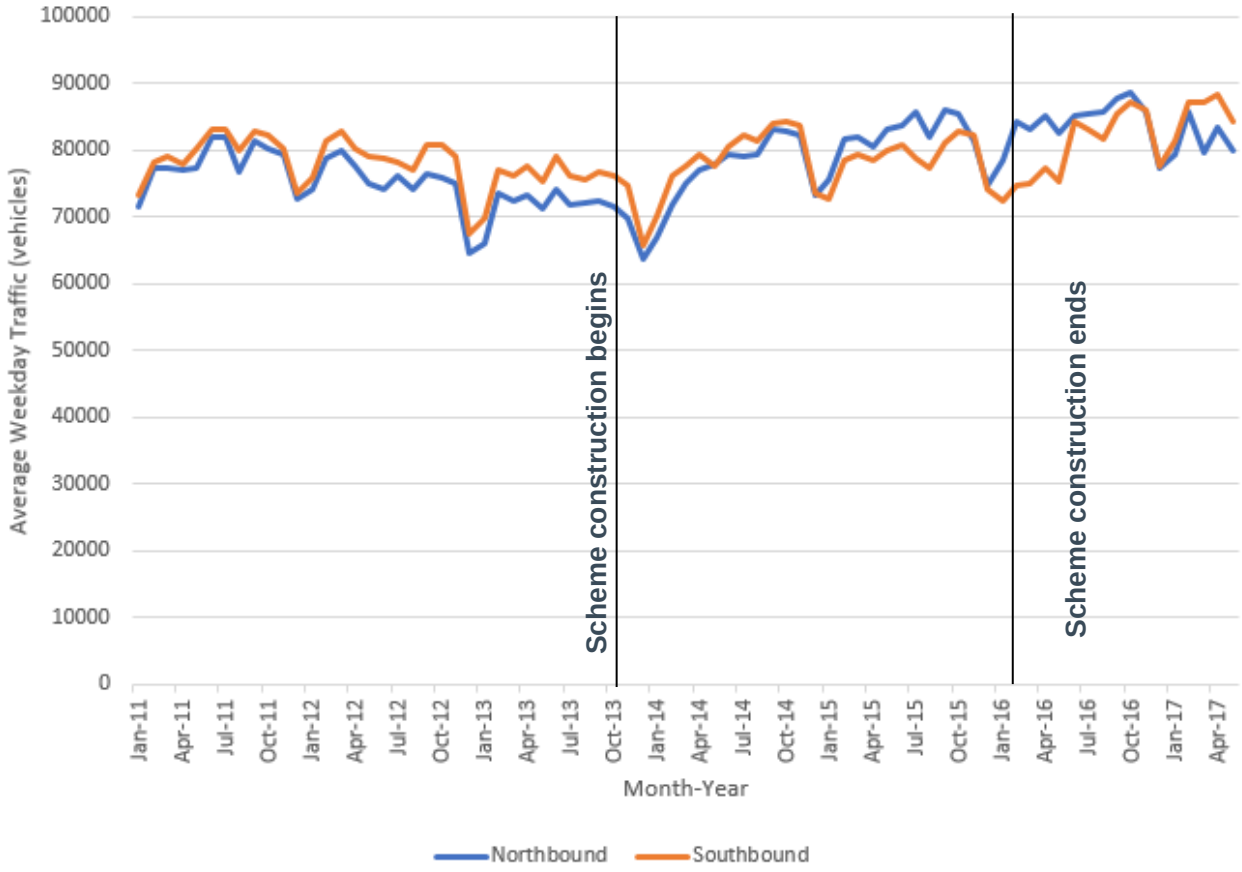
2.11. The results in Figure 2-1 show:

- Between 2011 and 2016, vehicle kilometres travelled on motorways in the West Midlands increased by approximately 6%. During the same time, the number of vehicle kilometres travelled increased on all roads in the West Midlands and all roads in Staffordshire, also by 6%.
- On A roads in the West Midlands, vehicle kilometres travelled reduced between 2011 and 2013 by around 2% before increasing by approximately 2% between 2013 and 2014. Following 2014, vehicle kilometres travelled on A roads in the West Midlands increased by a further 6% to show an overall increase between 2011 and 2016 of approximately 6%.

Long Term Traffic Trends

2.12. To establish the degree of change that can be attributed to the scheme, changes in yearly traffic flows on the mainline sections since the scheme opened are considered against the wider context of background changes shown in Figure 2-1. POPE would normally consider the year on year change in traffic flows from before the scheme opened to after scheme opening for the scheme sections. However, due to limited data availability across the scheme between mid-2013 and 2016 (through the construction period) and the construction period for M6 J16-19 SM scheme; it has only been possible to present long term AWT for the M6 J4a-5 (January 2011 to May 2017). The monthly AWT for the M6 J4a-5 is presented in Figure 2-2:

Figure 2-2 Monthly AWT M6 J4a-5



2.13. The results show that changes in traffic levels between before and after periods are largely in line with the trends shown in Figure 2-1. The changes in flows across the mainline scheme sections are compared against the 6% increase in flows observed across motorways in the West Midlands. Figure 2-2 shows a slight dip in AWT flows in 2013, followed by an increase between 2014 and 2017. Figure 2-2 also shows that AWT flows on the M6 northbound and southbound are largely similar and that traffic flows were largely unchanged during the scheme construction period.

Conclusions on Background Growth

2.14. The analysis of background traffic changes show regional and local trends on all roads between 2011 and 2016 have increased by around 6%. None of the traffic flows presented in this report have been adjusted to reflect background traffic growth and it is therefore important to keep in mind any increase in flows of up to 6% may be due to the background increases rather than changes brought about by the scheme itself.

Traffic Volume Analysis

2.15. This section of the report uses several data sources mentioned earlier in this section to inform the before and after analysis of changes in traffic volumes and journey times on key routes, to understand whether changes may be attributed to the scheme. To complete this evaluation, both motorway and non-motorway flows were considered. Only observed changes on non-motorway links are included in this report due to concerns over the accuracy of flows on the motorway. This information is included in a separate technical note.

Hourly Distribution of Flows on Scheme Sections

2.16. Due to the concerned noted above, this information is not included in this report, however is provided (where available) for the scheme sections in the associated technical note.

Traffic flow changes on local roads

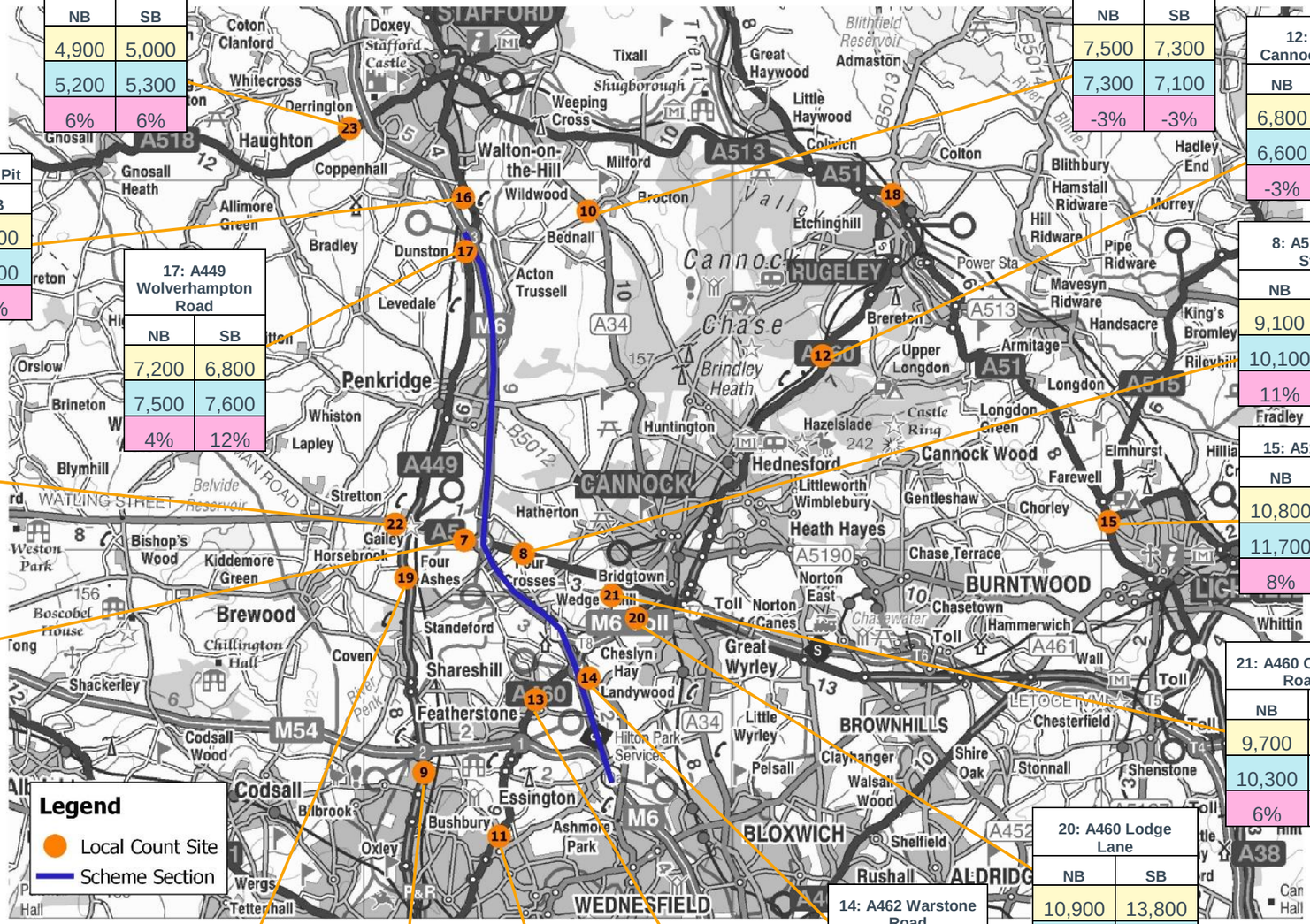
2.17. Traffic flows on the local network are shown in Figure 2-3 and the key points to note are:

- Observed changes in traffic flows show lower increases than background traffic growth at almost half of the sites, although there is not particular pattern in the distribution of traffic growth across the wider local area.
- Traffic growth south of the M54 at sites 9 and 11 (A449 Stafford Road and A460 Cannock Road) have experienced increases in traffic at or above local background growth. This suggests that post-opening, the M54 has become a more attractive route for traffic heading to and from the north of Wolverhampton.
- Traffic either side of junction 11, at site 13 and 14 is varied. With traffic on the A460 increasing above local background levels, whereas traffic on the A462 has decreased – particularly in the southbound direction.
- Traffic either side of junction 12, at site 7 and 8 has (in general) seen growth above local background levels.
- Traffic either side of junction 13, at site 16 and 17 has also (in general) seen growth above local background levels.
- It is interesting to note that site 10 (A34 Cannock Road) which is in direct competition with the M6 J10a-13 as a route between Cannock and Stafford, has seen decreases in traffic flow in both directions.
- Note that site number 18 was excluded due to poor data availability.
- Despite changes in traffic flows showing lower increases than background traffic growth at almost half of the sites, it is not possible to conclude that this is a result of re-routing to the scheme due to poor data availability across the scheme section.

Heavy Goods Vehicle Traffic

2.18. Analysis of HGV traffic is completed through vehicle classification by length, in which a HGV is classed as a vehicle over 6.6m in length. Due to inconsistent HGV data through the scheme, the scheme section HGV classification is not sufficiently accurate and cannot be analysed on this occasion. However, long term HGV trends are available between M6 J4a-5 in both directions. Analysis has shown that long-term HGV AWT has followed a similar trend to general traffic, in that there is a slight reduction in HGV traffic in 2013 but a consistent growth between 2014 and 2017.

Figure 2-3 Change in AWT flows on local roads since scheme opening



23: A518 Newport Road	
NB	SB
4,900	5,000
5,200	5,300
6%	6%

10: A34 Cannock Road	
NB	SB
7,500	7,300
7,300	7,100
-3%	-3%

12: A460 Cannock Chase	
NB	SB
6,800	6,800
6,600	6,600
-3%	-3%

16: A449 Moss Pit	
NB	SB
8,700	8,500
9,800	9,300
13%	9%

17: A449 Wolverhampton Road	
NB	SB
7,200	6,800
7,500	7,600
4%	12%

8: A5 Watling Street	
NB	SB
9,100	9,800
10,100	10,600
11%	8%

22: A5 Watling Street	
NB	SB
7,200	8,000
8,500	8,600
18%	8%

15: A51 Stafford	
NB	SB
10,800	10,900
11,700	14,000
8%	28%

7: A5 Watling Street	
WB	EB
9,100	8,600
9,400	9,800
3%	14%

21: A460 Cannock Road	
NB	SB
9,700	8,200
10,300	9,400
6%	15%

19: A449 Stafford Road	
NB	SB
9,300	8,900
9,200	8,800
-1%	-1%

9: A449 Stafford Road	
NB	SB
15,500	16,700
16,600	18,600
7%	11%

11: A460 Cannock Road	
NB	SB
7,500	8,400
9,600	8,900
28%	6%

13: A460 Cannock Road	
NB	SB
13,300	13,100
14,600	15,100
10%	15%

14: A462 Warstone Road	
NB	SB
5,700	8,000
5,500	7,300
-4%	-9%

20: A460 Lodge Lane	
NB	SB
10,900	13,800
12,700	13,900
17%	1%

Forecasting Accuracy

2.19. This section compares the observed traffic impacts of the scheme to the traffic changes forecast in the scheme appraisal. Before comparing the forecast traffic impacts to the observed impacts, it is necessary to understand the appraisal approach and key assumptions underpinning the appraisal, as this may assist in explaining any potential differences between the forecast and observed impacts.

Traffic Modelling Approach and Forecast Assumptions

2.20. The details of the traffic modelling and forecast assumptions are taken from the M6 J10a – 13 Managed Motorway, Traffic Forecast Report (May, 2013). The M6 J10a-J13 multi-modal transport model contains all the principal traveller responses to policies or schemes, it allows the demand forecasting procedure to produce demand for the corresponding model years 2015, 2021, 2031 based on the growth factors from the base year (extracted from NTEM v6.2).

2.21. The detailed highway and PT assignment (supply) models operate on origin-destination (OD) matrices. The PT models represent the average hour for the following three time periods:

- AM Peak Hour (08:00 – 09:00)
- Inter Peak Hours (10:00 – 16:00)
- PM Peak Hour (17:00 – 18:00)

2.22. In addition to the M6 capacity improvements, the model considers other improvement schemes as they might provide time savings and other potential rerouting opportunities – changing the traffic pattern currently observed on the network and thus impacting the M6 on demand. The schemes included were sourced from Local Authority websites, Regional Funding Allocation progress letters published by the DfT and some proposed metro link service extension. Table 2-2 provides a summary of the relevant schemes included in the DM forecast scenario, the DS scenario is the same as the DM scenario but includes the M6 J10a-13 SM scheme.

Table 2-2 Progress of assumed schemes 2016

Assumed schemes in 2016	Status (July 2017)
M5 Junction 5 Improvement Scheme	Completed spring 2017
M6 Birmingham Box Phase 3 Managed Motorways (M6 J5-8 SM scheme)	Completed 2014
M54 to M6/M6 (Toll) Link Road	Not Completed (Planned TBC Route option consultation December 2015)
M6 Junction 13-19 Managed Motorway	M6 Junctions 16-19 Smart Motorway In progress – Work started December 2015, due to finish March 2019. Junction 13-15 Smart Motorway is planned start 2018 end by 2022.
M6 Junction 10 remodelling	Not completed (work was expected to start during 2017)
A452 Chester Road Access Improvements	Completed October 2015
A45 Coventry Road Improvements near Birmingham Airport	Completed late 2015
A45/A46 Tollbar End Improvement	Completed December 2016
HS2	Not Completed
Birmingham New Street Station	Completed September 2015

Forecast vs. Observed Traffic Flows

2.23. Forecast traffic flows are provided in Appendix E of the M6 J10a-13 Traffic Forecast Report (TFR) as AADT flows for each of the model scenarios described above (2012, DM 2015, DS 2015, DM 2021, DS 2021, DM 2031 and DS 2031).

2.24. In line with previous sections, this comparison with observed information has not been presented in this report due to concerns over accuracy of flow data on the M6. This information is included in the linked technical note.

Journey Time Evaluation

2.25. This section considers the impact on journey times following the implementation of the scheme.

2.26. Journey time analysis is considered in the following stages:

- Analysis of pre-and post-scheme average journey time and speed along the scheme.
- A comparison of journey time reliability before and after the scheme opened.

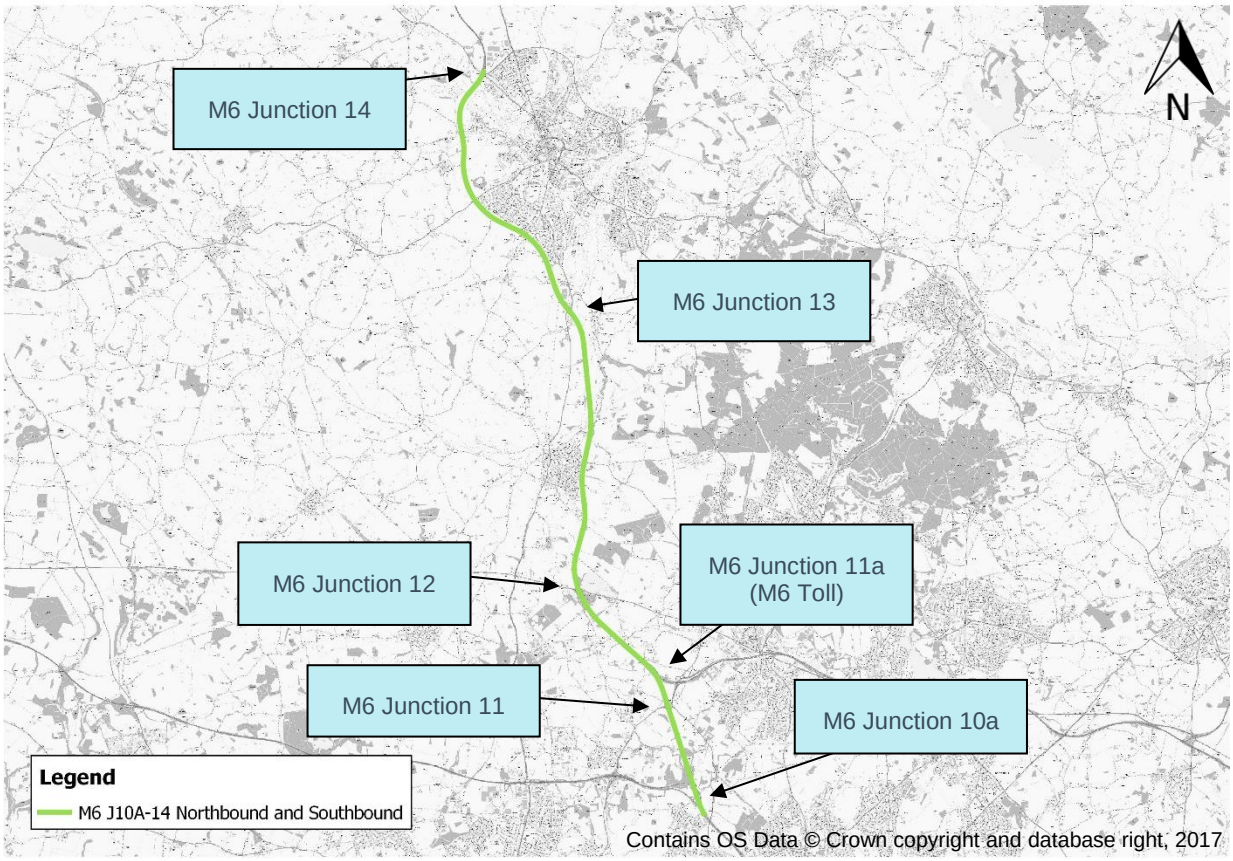
2.27. The journey time periods evaluated are in line with the M6 J10a-J13 multi-modal transport as follows and covered the calendar periods March 2012 (pre-scheme) and March 2017 (post-scheme). Note: the results represent average journey times over the period to be directly comparable with average journey times forecast.

- Weekdays AM Peak (08:00 – 09:00)
- Weekdays Inter Peak (10:00 – 16:00)
- Weekdays PM Peak (17:00 – 18:00)

2.28. Other time periods have also been considered:

- Weekday AM Shoulder Peak (07:00 – 08:00)
- Weekday PM Shoulder Peak (16:00 – 17:00)
- Other Low Flow (09:00 – 10:00 and 18:00 – 19:00)
- Weekday Overnight (19:00 – 07:00)

Figure 2-4 Journey Time Route



Observed Journey Times

2.29. Pre-construction and post average opening journey time information has been obtained from satellite navigation data. This section analyses the change in journey times and speeds along the route shown in Figure 2-4. The journey time route has been extended beyond the scheme to enable an understanding of changes on the adjacent section.

2.30. Table 2-3 and Table 2-4 show the pre-scheme and post-scheme average journey times along the M6 J10a-14 and the observed journey time savings northbound and southbound respectively. The differences in journey times are colour coded based on an increase in journey times of more than 10 seconds (red), reduction in journey times of more than 10 seconds (green) and a 10 second or less change in journey times (yellow).

Table 2-3 Change in journey times following scheme opening (northbound)

	Pre-scheme (mm:ss)			Post-scheme (mm:ss)			Difference (s) (% change)		
	AM	IP	PM	AM	IP	PM	AM	IP	PM
M6 J10a – J13	08:56	09:37	09:07	09:14	09:35	08:59	+00:18 (3%)	-00:02 (0%)	-00:08 (-1%)
M6 J13 – J14	04:50	04:56	05:02	05:47	05:41	05:05	+00:57 (20%)	+00:45 (16%)	+00:03 (1%)
M6 J10a – J14	13:46	14:32	14:09	15:01	15:15	14:04	+01:15 (7%)	+0:44 (5%)	-00:05 (-1%)

Table 2-4 Change in journey times following scheme opening (southbound)

	Pre-scheme (mm:ss)			Post-scheme (mm:ss)			Difference (s) (% change)		
	AM	IP	PM	AM	IP	PM	AM	IP	PM
M6 J10a – J13	11:36	10:08	10:42	10:07	09:33	09:30	-01:29 (-13%)	-00:35 (6%	-01:12 (-11%)
M6 J13 – J14	04:49	04:55	05:25	04:56	05:03	04:56	+00:07 (2%)	+00:08 (3%)	-00:29 (-9%)
M6 J10a – J14	16:25	15:03	16:07	15:03	14:36	14:26	-01:22 (-8%)	-00:27 (-3%)	-01:41 (-10%)

2.31. The results in Table 2-3 and Table 2-4 show an increase in average journey times across the M6 J10a-14 in the northbound direction and a decrease in the southbound direction.

2.32. However, the tables also show that changes in journey time are not distributed evenly across the route analysed (M6 J10a-14). Indeed, the tables show that in both directions the M6 J13-14 is the worst performing link, producing the large increases in journey time northbound and small decreases in journey time southbound.

2.33. The results in Table 2-3 and Table 2-4 also show that when assessing the scheme only, there has been a negligible increase in post-opening journey time northbound (+8 seconds) and a large decrease in journey times southbound (-3 minutes and 30 seconds).

2.34. Figure 2-5 and Figure 2-6 present a journey time comparison in seconds by section between pre-and post-opening periods across the M6 J10a-14, in each direction and for all the time periods.

Figure 2-5 M6 J10a - 14 northbound journey time comparison

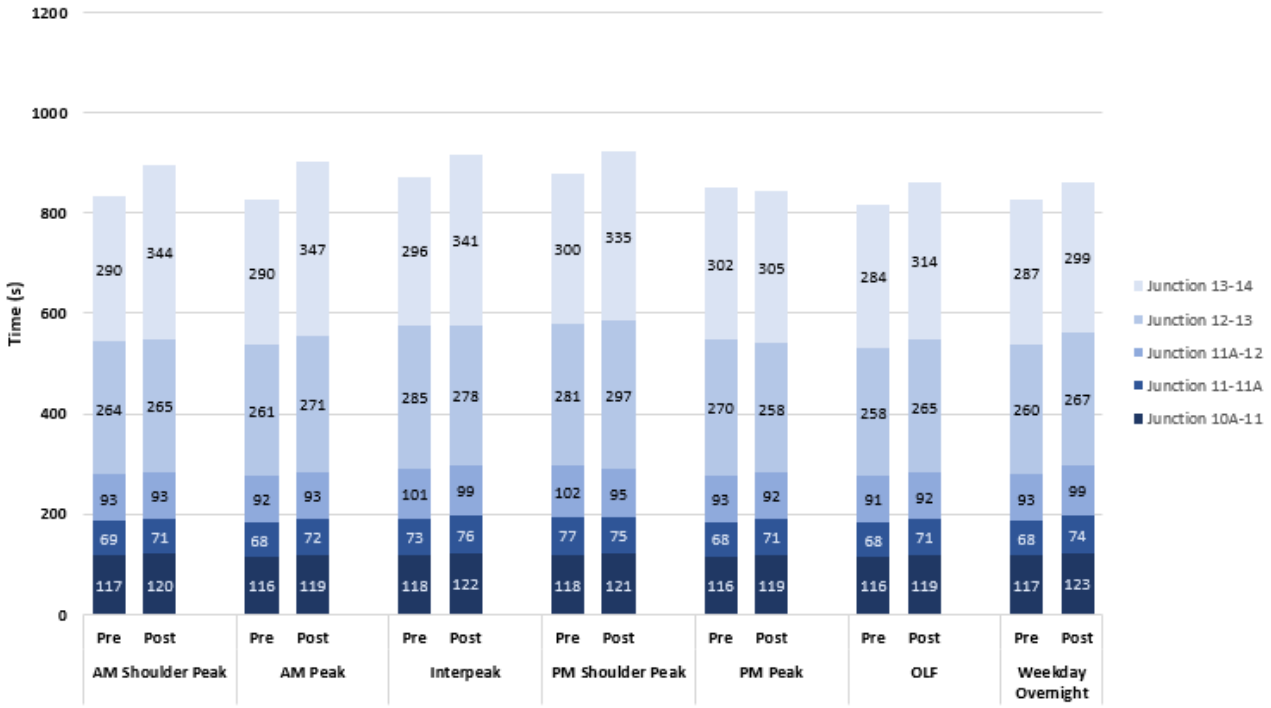
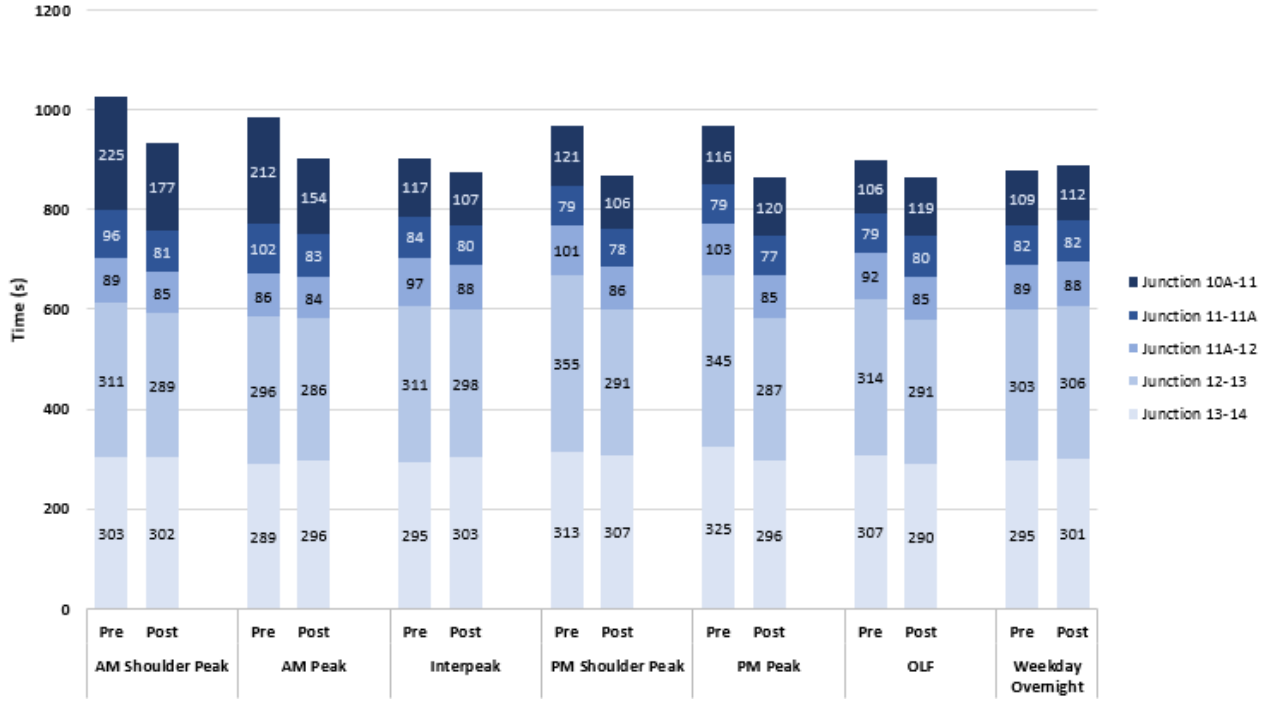


Figure 2-6 M6 J10a - 14 southbound journey time comparison



2.35. The following more detailed observations can be made from Figure 2-5 and Figure 2-6:

- Across the route from the M6 J10a-13, average journey times have decreased during the AM peak and PM peak periods by 6 seconds and 1 minute and 56 seconds respectively.
- The largest single average journey time change over the whole scheme is in the PM peak southbound, with an average journey time saving of 1 minutes and 41 seconds.

Figure 2-6 shows that the total decrease in average journey time for the PM peak southbound is split largely across the M6 Junction J12-13 and 13-14 where there are savings of 58 seconds and 31 second respectively. Figure 2-5 shows that during the PM peak in the northbound direction, journey time changes are split more evenly across the sections

- Across the route from the M6 J10a-14, average journey times have decreased during the AM peak by a total of 6 seconds. There is a time saving in AM peak southbound direction of 1 minutes and 21 seconds. Figure 2-6 shows that the total decrease in average journey time for the AM peak southbound is not split evenly across the three scheme sections. The largest journey time saving is between M6 J10a-11 which is 58 seconds and J11-11a which is 19 seconds decrease. The other junctions have time changes of less than 10 seconds. There is a journey time increase of 1 minute and 15 seconds in the northbound direction, Figure 2-5 shows that this increase is not split evenly across the route. J13-14 has the largest proportion increase in journey time of 57 seconds.

2.36. In summary, the journey time changes between pre-and post-scheme opening suggest that overall the scheme has benefitted average journey times southbound, and had limited impact northbound. However, in line with comments made previously POPE cannot be sure that this journey time change is a result of the scheme based upon the traffic data available.

2.37. Table 2-5 shows average speeds (kph) before and after the scheme opened for the same calendar and time periods used to assess journey times.

Table 2-5 Change in average speeds (kph) following scheme opening

		Pre-scheme (kph)			Post-scheme (kph)			Difference (kph)		
		AM	IP	PM	AM	IP	PM	AM	IP	PM
M6 J10a – J14 (NB)	M6 10a-11	107	105	107	104	101	103	-3	-3	-3
	M6 J11-11a	115	108	115	110	104	111	-6	-4	-4
	M6 J11a – 12	111	102	110	109	101	109	-2	+7-	0
	M6 J12-13	108	99	105	103	101	109	-5	+7	+5
	M6 J13-14	105	103	101	89	89	100	-17	-13	0
M6 J14 – J10a (SB)	M6 J14-13	106	104	96	104	102	104	-3	-2	+8
	M6 J13-12	104	100	90	109	104	108	+4	+4	+18
	M6 J12 – 11a	105	93	87	106	101	105	+1	+9	+18
	M6 J11a-11	90	95	101	99	101	104	+10	+6	+3
	M6 11-10a	51	92	95	75	99	93	+24	+7	-2

A negative difference indicates a reduction in average speeds and difference figures may not total due to rounding.
The route average has been calculated from the original data and is not an average of the section by section results.

2.38. Table 2-5 shows that in most cases (e.g. M6 J10a – 11 northbound in the AM peak period) average speeds in the post-scheme period have remained within less than 10kph of the pre-scheme speed. Pre-scheme southbound between J11a and J10a had some of the lowest speeds pre-scheme, however, these have increased by the greatest amount (e.g. J10a-11 AM peak increased by 24kph). This is also the same with the PM peak southbound between J12 and 13. This suggests that on sections where congestion was evident before scheme, the

extra running lane has had a positive impact on the operational performance. The following key points are also shown in Table 2-5:

- Average speeds in the AM peak have increased across all links in the southbound direction apart from the M6 J14-13.
- Average speeds in the AM peak have decreased across all links in the northbound direction.
- Average speeds in the PM peak have remained similar across all links in both directions. Apart from J13-11a southbound, the average speed has increased by 18 seconds in the PM peak period for each junction.
- Average speeds in the interpeak have remained within 10kph of the pre-scheme speeds for all links in both directions apart from the J13-14 which has decreased by 13 seconds.
- M6 J13-14 northbound has had the largest decrease in average speeds across all time periods.
- The largest observed increase in average speed (M6 J11-10a, AM peak, +24kph) occurred on the section and time period which reported the slowest average speed pre-scheme (M6 J11-10a, AM, 51kph). This indicates that the scheme has been successful in increasing average speed where there are increases to be made.

2.39. Table 2-5 presented pre-and post-scheme average speeds across the specified sections from one point to another. The journey time results have been interrogated in more detail to identify average journey speed changes along the whole route. These changes in average speeds along the scheme section are shown in Figure 2-7 and Figure 2-12 to and the results by time period are reported below:

- Average speeds in the AM peak have improved in the southbound direction. Average speeds in the AM peak southbound direction have increased from around 50kph (extremely low) to 70kph between the M6 J11-10 and J13-12 in the PM peak. Average speeds across the rest of the scheme OYA remain similar. Average speeds in the AM peak northbound have reduced from over 100kph to 80-90kph between the M6 J13-14, the rest of the scheme OYA has remained similar.
- Average speeds are higher across the scheme in the southbound direction during the interpeak period for the whole route. During the interpeak period northbound there have been negligible changes to speeds across the scheme section and a decrease in speed for the M6 J13-14 link.
- Across the scheme section during the PM peak there have been negligible increases in speed in the northbound direction and large increases in speed (around 20kph) in the southbound direction. The M6 J13-14 during the PM peak has seen no change in speed in either direction.

2.40. The changes in observed speeds cannot be attributed to the scheme at this point due to POPE not being confident in the accuracy of the post-scheme opening traffic data.

Figure 2-7 Average speed M6 J10a-14 NB AM peak (08:00 - 09:00)

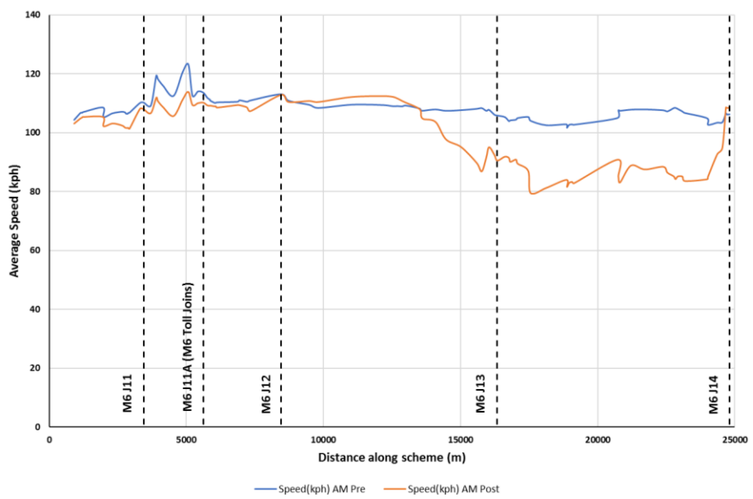


Figure 2-8 Average speed M6 J10a-14 NB interpeak (10:00-16:00)

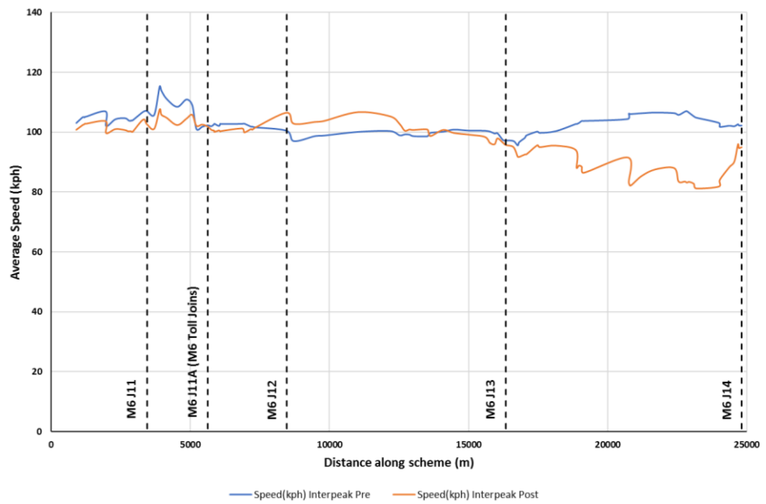


Figure 2-9 Average speed M6 J10a-14 NB PM peak (17:00-18:00)

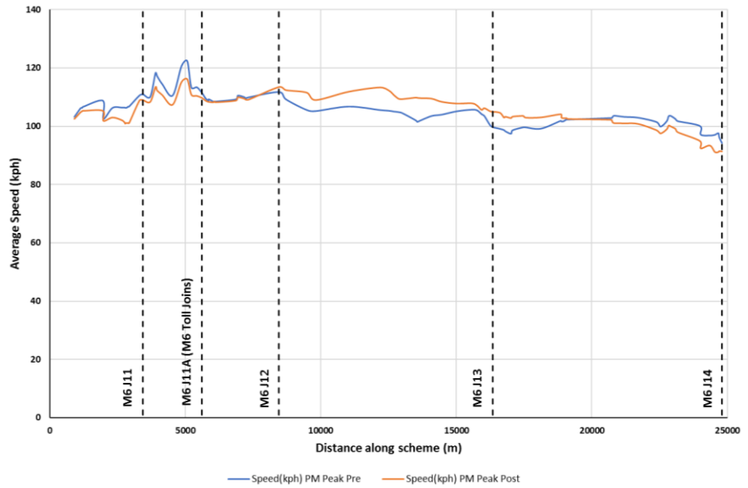


Figure 2-10 Average speed M6 J10a-14 SB AM peak (08:00 - 09:00)

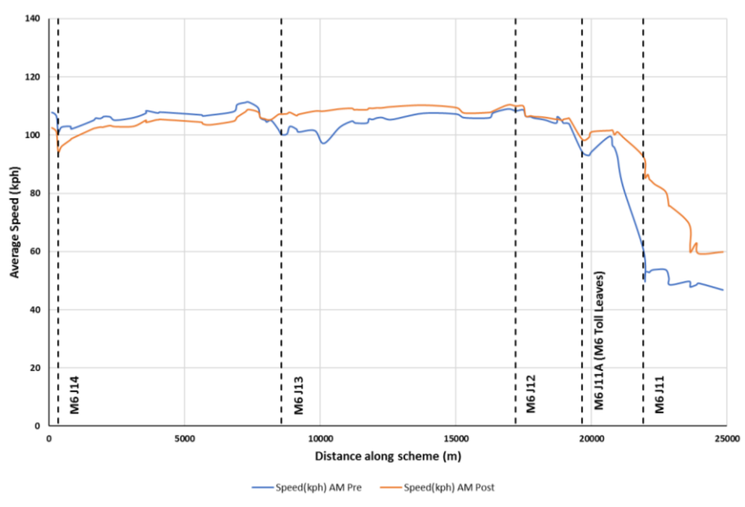


Figure 2-11 Average speed M6 10a-14 SB interpeak (10:00-16:00)

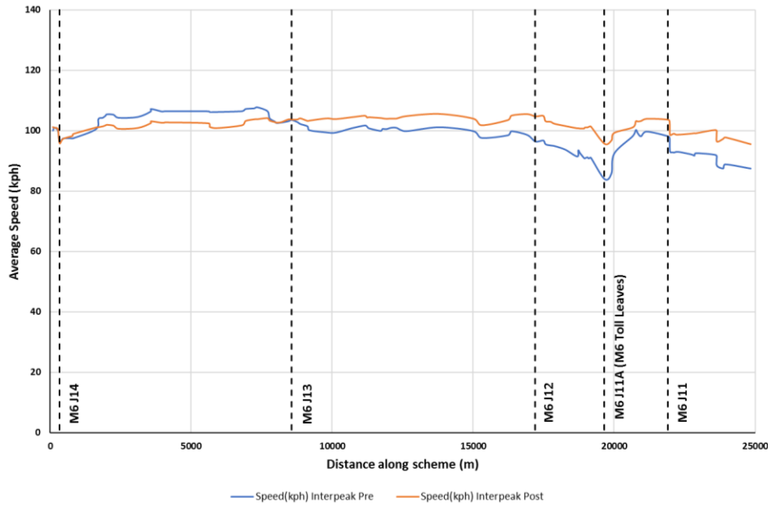
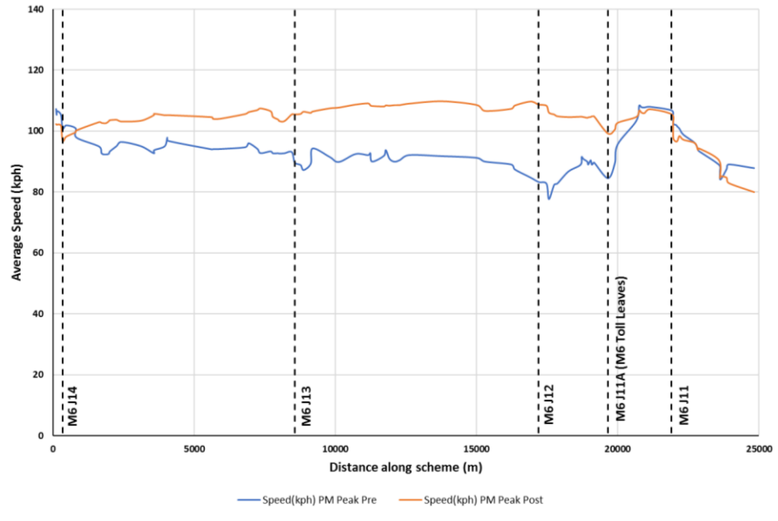


Figure 2-12 Average speed M6 J10a-14 SB PM Peak (17:00-18:00)



Forecast vs. Observed Journey Times

2.41. The M6 J10a-13 Managed Motorway Traffic Forecasting Report (May, 2013) contains details on the forecast impact of the scheme on journey times following scheme opening. The forecasts are given for the appraised DM and DS scenarios for each of the previously outlines time periods AM, Interpeak and PM. Based on the information made available in these reports, it has been possible to make a like for like comparison against observed changes in journey times following scheme opening with forecast changes.

2.42. The tables below provide a comparison between the observed and forecast scheme impact on average network travel times (s) for the modelled OYA (2017). The results are shown in comparison with observed pre-and post-opening changes, for northbound and southbound in Table 2-6 and Table 2-7 respectively:

Table 2-6 Forecast and Observed scheme impact on average travel times (northbound)

	2017 DM JT (s)			2017 DS JT (s)			Change in 2017 JT (DS-DM) (s)		
Link	**AM**	**IP**	**PM**	**AM**	**IP**	**PM**	**AM**	**IP**	**PM**
M6 J10a-11	02:04	02:07	02:07	02:04	02:07	02:07	0 (0%)	0 (0%)	-0 (0%)
M6 J11-11a	01:11	01:12	01:20	01:09	01:10	01:11	-3 (-4%)	-3 (-4%)	-9 (-12%)
M6 J11a-12	01:22	01:23	01:32	01:18	01:19	01:21	-3 (-4%)	-3 (-4%)	-11 (-12%)
M6 J12-13	05:12	05:07	05:41	04:53	04:52	05:02	-19 (-6%)	-15 (-5%)	-39 (-11%)
Total	09:49	09:49	10:40	09:24	09:28	09:41	-25 (-4%)	-21 (-4%)	-59 (-9%)
	Observed Pre			**Observed Post**			**Change in Observed JT (Post-Pre) (s)**		
M6 J10a-11	01:56	01:58	01:56	01:59	02:02	01:59	3 (3%)	3 (3%)	3 (2%)
M6 J11-11a	01:08	01:13	01:08	01:12	01:16	01:11	4 (6%)	3 (4%)	2 (3%)
M6 J11a-12	01:32	01:41	01:33	01:33	01:39	01:32	1 (1%)	-1 (-1%)	0 (0%)
M6 J12-13	04:21	04:45	04:30	04:31	04:38	04:18	10 (4%)	-7 (-2%)	-13 (-5%)
Total	08:56	09:37	09:07	09:14	09:35	09:00	18 (3%)	-2 (0%)	-8 (-1%)

Table 2-7 Forecast and Observed scheme impact on average travel times (southbound)

	2017 DM JT (s)			2017 DS JT (s)			Change in 2017 JT (DS-DM) (s)		
Link	**AM**	**IP**	**PM**	**AM**	**IP**	**PM**	**AM**	**IP**	**PM**
M6 J12-13	05:25	05:27	05:23	05:04	05:06	05:03	-21 (-6%)	-21 (-6%)	-20 (-6%)
M6 J11a-12	01:18	01:20	01:19	01:16	01:17	01:16	-3 (-3%)	-3 (-4%)	-3 (-3%)
M6 J11-11a	01:09	01:10	01:09	01:06	01:07	01:07	-2 (-3%)	-3 (-4%)	-2 (-3%)
M6 J10a-11	02:09	02:18	02:12	02:10	02:19	02:12	1 (1%)	1 (1%)	0 (0%)
Total	10:01	10:15	10:03	09:36	09:49	09:38	-25 (-4%)	-26 (-4%)	-25 (-4%)
	Observed Pre			**Observed Post**			**Change in Observed JT (Post-Pre) (s)**		
M6 J12-13	04:56	05:11	05:45	04:46	04:58	04:47	-10 (-3%)	-13 (-4%)	-57 (-17%)
M6 J11a-12	01:26	01:37	01:43	01:24	01:28	01:25	-1 (-2%)	-9 (-9%)	-18 (-17%)
M6 J11-11a	01:42	01:24	01:19	01:23	01:20	01:17	-19 (-19%)	-4 (-5%)	-1 (-1%)
M6 J10a-11	03:32	01:57	01:56	02:34	01:47	02:00	-58 (-27%)	-9 (-8%)	4 (4%)
Total	11:36	10:08	10:42	10:07	09:33	09:30	-89 (-13%)	-35 (-6%)	-72 (-11%)

2.43. Table 2-6 and Table 2-7 show that journey times across the scheme were forecast to decrease heading northbound but increase slightly in the southbound direction, they also show that observed journey times are not in line with forecasts. The key points on journey time forecasting accuracy are:

- Decreases in journey time were expected across all three forecast time periods when heading through the scheme northbound – 25, 21 and 59 second decreases for the AM, IP and PM peaks respectively. However, it is also shown that these forecast decreases were not split evenly across the scheme links, for example the M6 J12-13 was expected to decrease journey times by just 19, 15 and 39 seconds across each three time periods AM, IP and PM respectively (a large proportion of the overall time savings).

- Southbound through the scheme, decreases in journey times were also expected in all three time periods – 25, 26 and 25 seconds in the AM, IP, PM peaks respectively. As with northbound, the forecast decreases in journey time were split unevenly across the scheme links e.g. M6 J12-13 was forecast to save 21, 21 and 20 seconds in the AM, IP and PM peaks respectively. Table 2-7 shows that in comparison with forecasts, observed decreases in journey times are actually larger than expected at 89, 35 and 72 seconds across all three time periods AM, IP and PM respectively.

- Journey time forecasts do not match observed journey time data. Observed data shows that northbound there has been a slight increase in journey time during the AM peak and lesser savings during the IP and PM peaks than forecast. Observed data shows that southbound there has been large decreases in average journey time throughout all peak periods, where there were expected lesser decreases.

2.44. The forecast was derived from modelling which was based on traffic flow predictions which cannot be verified or compared by observed post-scheme data due to poor availability, therefore (in line with the traffic section of this report) limited conclusions can be confidently inferred in relation to observed journey times compared to forecast savings.

Operation of the Smart Motorway

2.45. Analysis of the operation of how smart motorway is operating based on data as recorded in HALOGEN data (formerly Highways Agency Logging Environment).

2.46. Halogen Data has been downloaded for March 2017 to maintain consistency with the traffic and journey time data used in this report. The halogen data has been used:

- To determine how much on average different speed limits were in place during the peak periods on all sections of the scheme.

2.47. Halogen data points have been taken from roughly the centre of each junction. The speed limits set by VMSL can vary along a scheme section of carriageway and therefore the speed analysis is relevant to the chosen gantry location, however the following analysis is appropriate for the full length of each section.

2.48. The peak periods used in this analysis are the same as those used in the journey time analysis section. As we have shown previously, there seems to be a slight worsening in some time periods and large improvements southbound through the scheme, in order to understand these impacts further it is necessary to investigate the impact that VMSL are having across the scheme.

Controlled Motorway

2.49. Figure 2-13 and Figure 2-14 show the Halogen data for the CM section of the scheme in both directions, recording the proportion of the time which different speed limits settings were in place during the peak periods.

Figure 2-13 M6 J10a – 11 northbound – weekday VMSL limit proportions

Figure 2-14 M6 J10a – 11 southbound – weekday VMSL limit proportions

Figure 2-15 M6 J12 – 13 northbound – weekday VMSL limit proportions

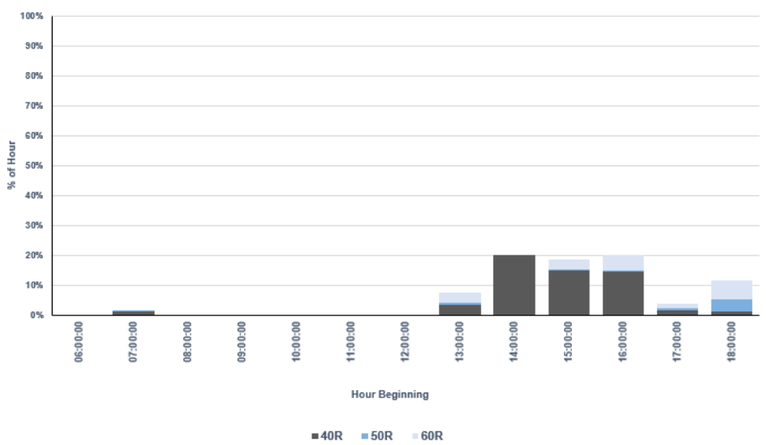
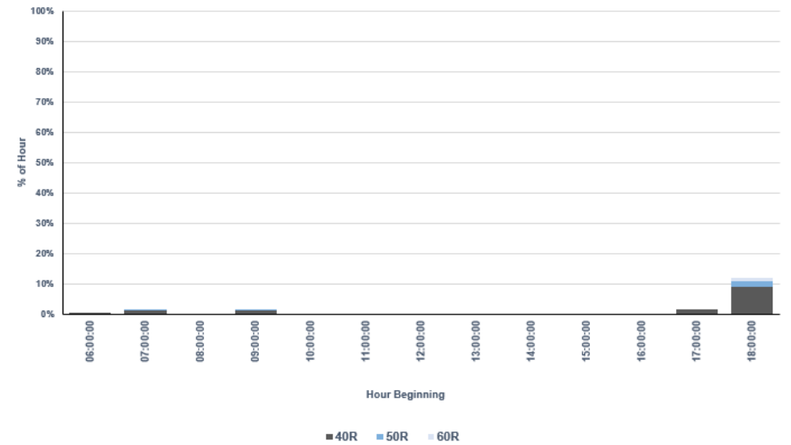


Figure 2-16 M6 J12 – 13 southbound – weekday VMSL limit proportions



2.50. Figure 2-13 and Figure 2-14 show the VMSL operation through M6 J10a-11 northbound and southbound respectively. VMSL are not in use at all during the AM peak across M6 J10a-11 and are only in use during the PM peak southbound for approximately 10% of the hour. VMSL are in use for the highest proportion during the interpeak period, however they are still not in use for the for the majority of the time period. Figure 2-13 and Figure 2-14 also show the different speed limits applied during the time which VMSL were in use. During the PM peak VMSL are set at 60mph, 50mph and 40mph equally across the 10% of the period they are in use.

All Lane Running

2.51. Figure 2-15 and Figure 2-16 show a summary of the Halogen data for the ALR section of the scheme (M6 J11-13) displaying the proportion of the time which different speed limits were in place during the peak periods.

2.52. Figure 2-15 and Figure 2-16 show the VMSL operation for the M6 J12-13 (in both directions), as with the CM section VMSL across the ALR section of the scheme are not in use often, and are not in use higher than approximately 20% of any individual hour of the day.

2.53. Figure 2-15 and Figure 2-16 show that VMSL are in operation for a higher proportion of time heading northbound through the scheme as opposed to southbound. Northbound from Junction 12-13, VMSL are in use for approximately 20% of the hour across the period from 14:00 to 17:00, constituting the highest continued usage of VMSL across the scheme.

2.54. Unlike the CM section of the scheme, VMSL across the ALR section are set at 40mph for a high proportion of the time that they are in use which may indicate congestion.

Flows and Speeds by Lane: MIDAS Data Analysis

2.55. In addition to traffic flow, journey time and halogen analysis presented in this chapter, additional analysis has been undertaken to understand the journey time and speed changes following scheme opening.

2.56. Although this data draws heavily on flow data and may not be accurate, it still gives an understanding of how the speed and flow by lane (proportion) varies along the scheme. This should not be used to interpret traffic flows from.

AM Peak

2.57. During the AM peak travelling northbound there has been a slight increase in journey times and both increases and decreases in the average speed across the scheme. During the all peak periods heading southbound there has been a decrease in journey times. VMSL are not in use often during AM peak in either direction.

2.58. MIDAS data has been used to provide flows (Figure 2-17 and Figure 2-18) and speeds (Figure 2-19 and Figure 2-20) by lane for the scheme during the AM peak. It should be noted that Lanes 1 and 2 are mainline lanes where ALR is in operation. Analysis of MIDAS data on the M6 J10a – 13 during the AM peak shows:

- Across the ALR section of the scheme, lane one is (in general) utilised more heading southbound. Use of lane one is particularly high and increases heading southbound towards M6 J12.
- Speeds across the route northbound and southbound are relatively consistent, with the highest speeds in both directions coming between the M6 J12-13.

Figure 2-17 AM flow northbound (08:00 – 09:00) M6 J10a - 13

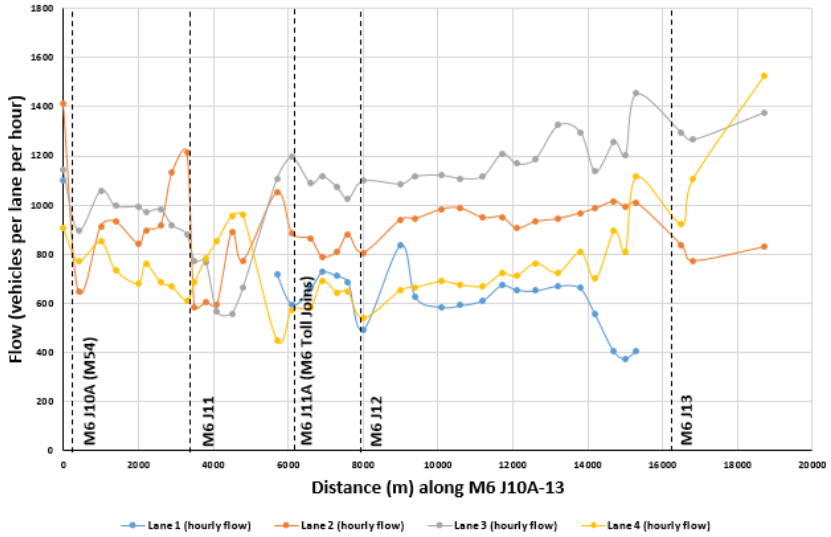


Figure 2-18 AM flow southbound (08:00 – 09:00) M6 J10a - 13

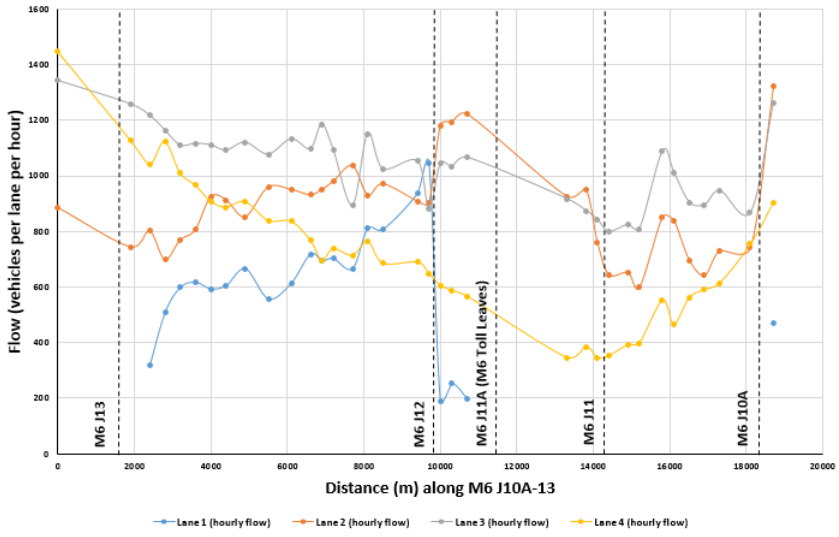


Figure 2-19 AM speed northbound (08:00 – 09:00) M6 J10a - 13

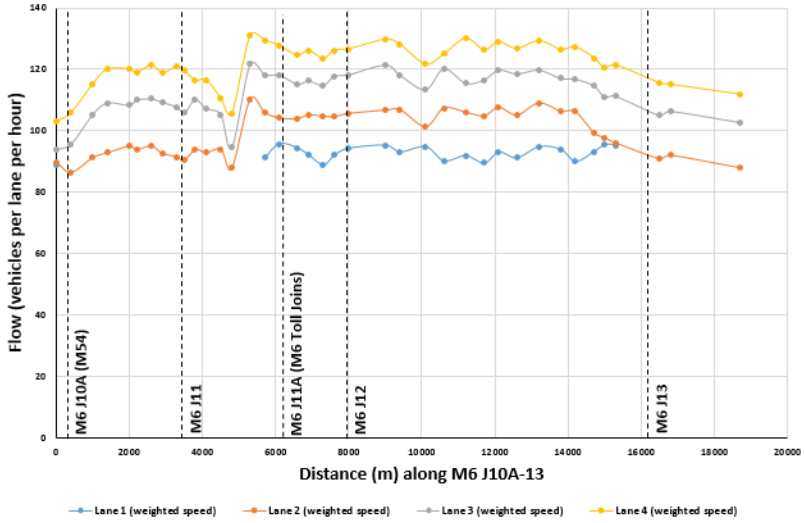
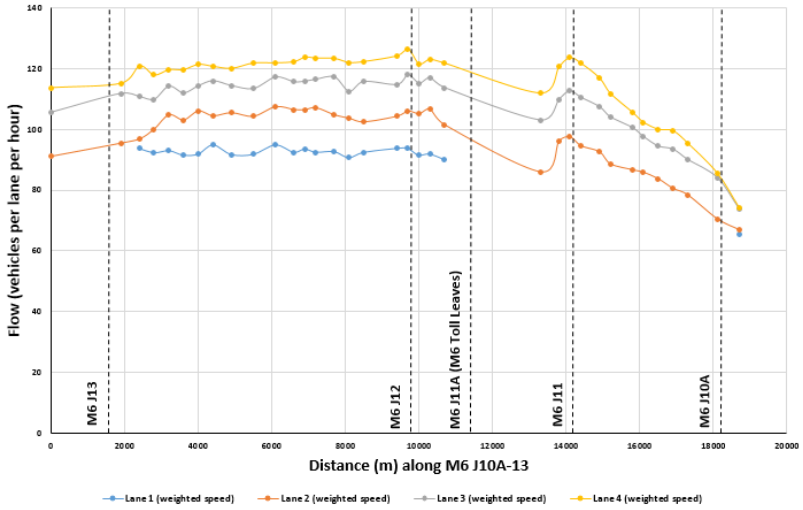


Figure 2-20 AM speed southbound (08:00 – 09:00) M6 J10a - 13



Interpeak

2.59. Southbound through the scheme, average speeds were around 60mph during the interpeak period and when VMSL are in operation (approximately 20% of the time), they are set at 60mph thus having limited impact on average speeds. Midas data has been analysed for the IP (as shown in Appendix C), the results show that speeds are consistent in both directions and utilisation of lane one is lower than during the AM and PM peak periods.

PM Peak

2.60. During the PM peak, northbound there has been a negligible increase in average journey time, southbound there has been a large saving in average journey time. VMSL are not in use often during PM peak in either direction, however they are utilised the most (20% of each hour) during the period from 14:00-17:00 heading northbound.

2.61. MIDAS data has been used to provide flows (Figure 2-21 and Figure 2-22) and speeds (Figure 2-23 and Figure 2-24) by lane for the scheme during the AM peak. It should be noted that Lanes 1 and 2 are mainline lanes where ALR is in operation. Analysis of MIDAS data on the M6 J10a – 13 during the PM peak shows:

- As with the AM peak, across the ALR section of the scheme lane one is utilised more heading southbound and use of lane one increases heading southbound towards M6 J12.
- Speeds across the route northbound and southbound are relatively consistent, with the highest speeds in both directions coming between the M6 J12-13.

Figure 2-21 PM flow northbound (17:00 – 18:00) M6 J10a - 13

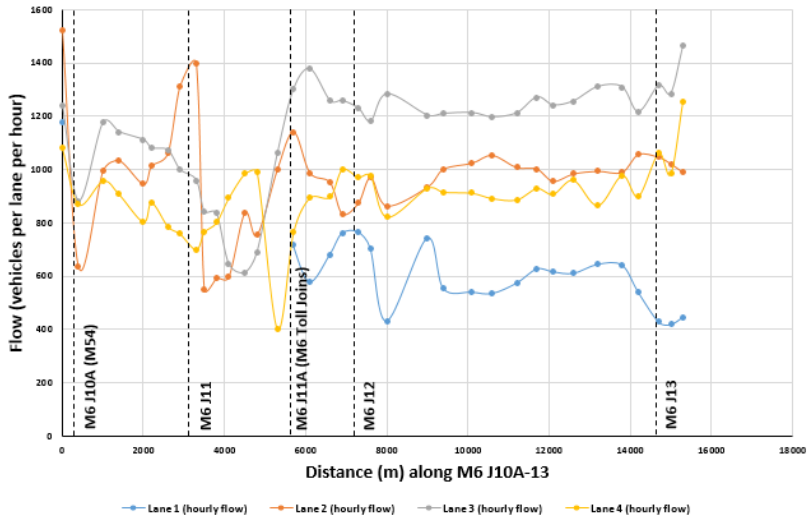


Figure 2-22 PM flow southbound (17:00 – 18:00) M6 J10a - 13

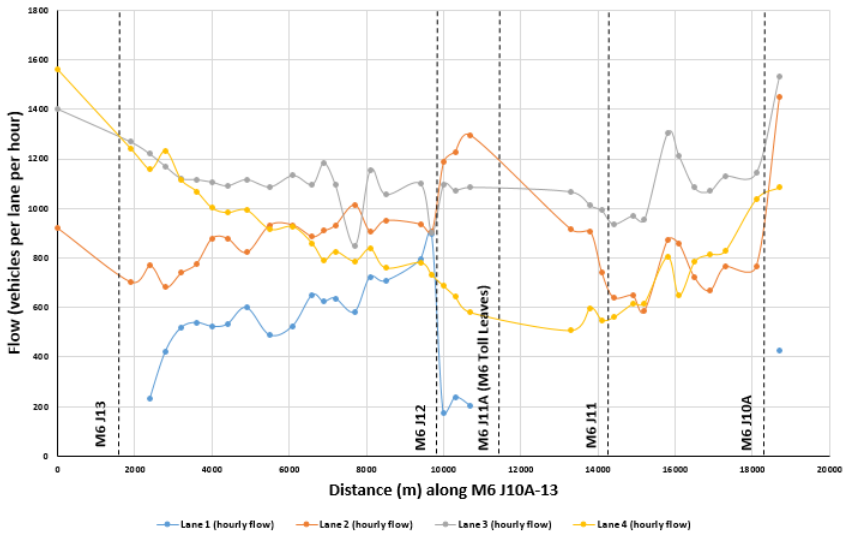


Figure 2-23 PM speed northbound (17:00 – 18:00) M6 J10a - 13

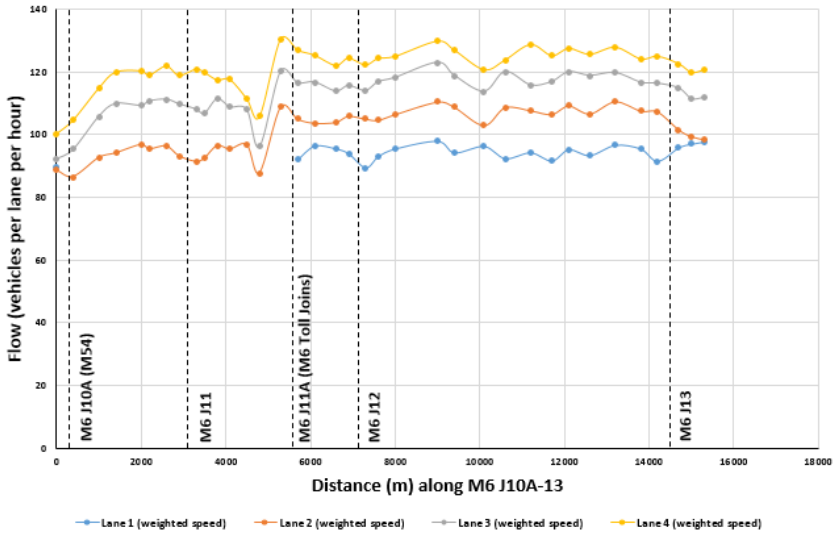
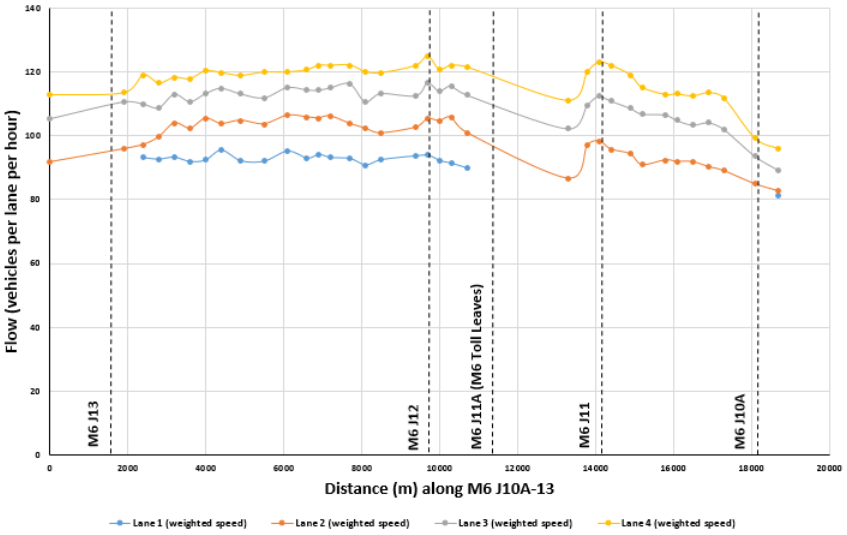


Figure 2-24 PM speed southbound (17:00 – 18:00) M6 J10a - 13



Journey Time Reliability

2.62. The reliability sub-objective includes the impact of the scheme on incidents and day to day journey time variability. Although average journey times are mixed on the M6 J10a-14 after opening, a key objective for these sections is to improve driver experience by reducing journey time reliability. This section assesses this objective.

2.63. Variability is the extent to which journey times vary from the expected average journey time on any day or time period. This distribution of journey times is considered to be a good indication of how much journey times vary. Evaluation of this was undertaken using the satellite navigation data to show the distribution of journey times before and after the scheme opened.

2.64. The distributions of the journey times are shown in Figure 2-25 and Figure 2-26 and the key points are:

- In the northbound direction, the inter-quartile journey time range (difference between the 75th and 25th percentile) during the AM peak has remained very similar, indicating reliability has been unaltered in this time period. Extreme journey times (95th percentile) have also remained very similar in northbound direction during the AM peak. In the southbound direction, whilst the inter-quartile range has reduced slightly. The extreme 95th percentile has reduced, indicating that the slowest times taken to travel through the scheme section are now quicker.
- In the inter-peak period, the inter-quartile journey time range during the interpeak has remained similar, suggesting that reliability has been unaltered as a result of the scheme during this period. There has been slight reduction in the extreme journey times (95th percentile) in both directions.
- During the PM peak, the inter-quartile range through the scheme has remained similar in both directions, suggesting that reliability is unchanged as a result of the scheme. The extreme journey times for both directions have remained similar indicating that reliability has remained unchanged.

Figure 2-25 Journey time reliability M6 J10a-14 northbound

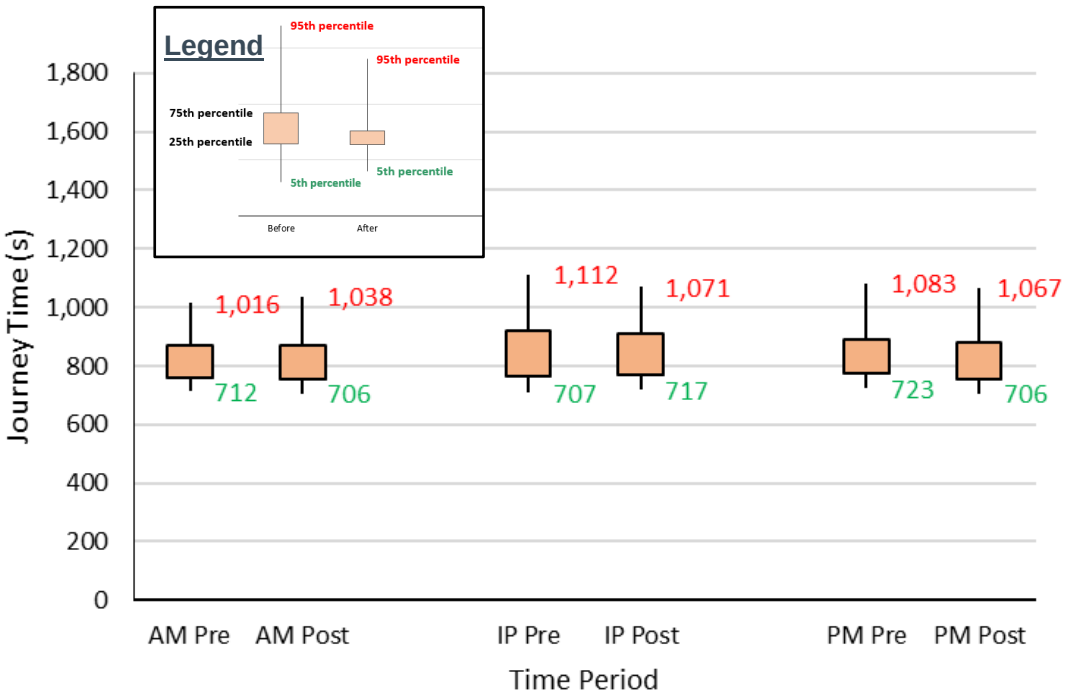
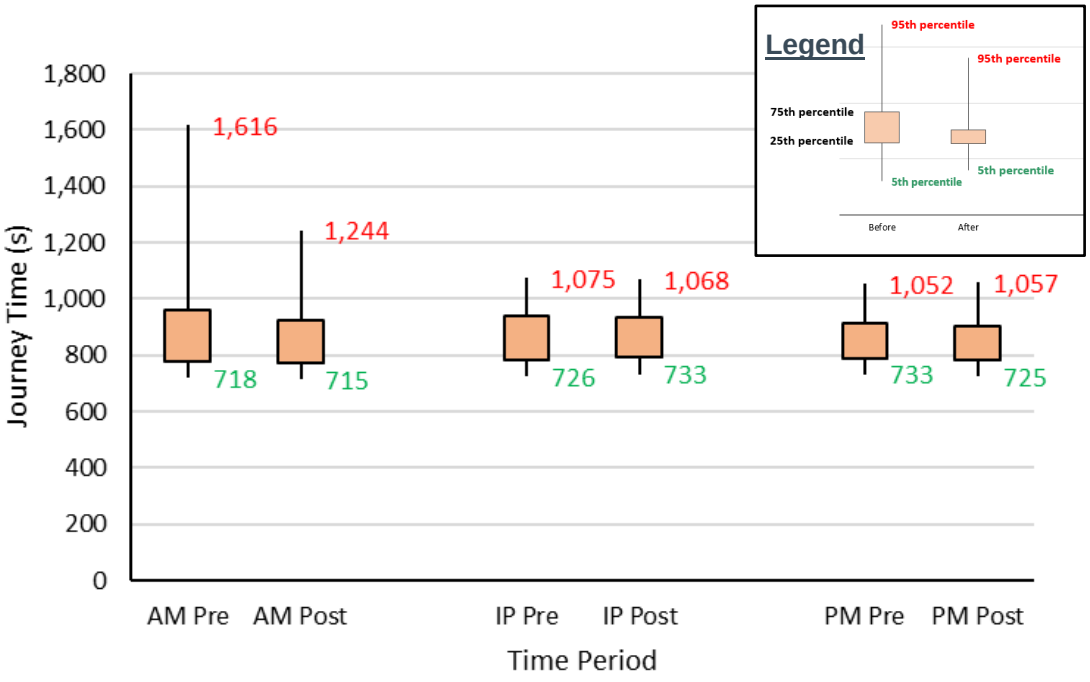


Figure 2-26 Journey time reliability from the M6 J10a-14 southbound



Traffic Impacts - Key points

Traffic Flow impacts

- Traffic flows on the mainline scheme section have not been assessed due to concerns over accuracy of data.
- Despite changes in traffic flows on local routes showing lower increases than background traffic growth at almost half of the sites, it is not possible to conclude that this is a result of re-routing to the scheme due to poor data availability across the scheme section.

Traffic Flow Forecasting

- The scheme forecast an increase in traffic flows on all scheme sections post opening. However, comparisons between pre-and post-observed data show large decreases on the scheme sections. – with the knowledge that count technology was changed upon completion of the scheme (from inductive loop counters to radar) POPE suggests that inaccurate counts may be causing artificially lower post-opening observed traffic flows at OYA.

Journey Times

- Journey time data shows slight increases in post-scheme opening average journey times for the northbound direction and decreases in journey times heading southbound.
- Despite the overall benefit shown by observed journey time data, POPE cannot be sure that this journey time benefit is a result of the scheme based upon the traffic data available.

Journey Time Forecasting

- Journey times across the scheme were forecast to decrease in both directions. Observed journey times are lower than forecast northbound and southbound (which cannot be attributed to the scheme at this point due to issues with flow data).

Operation of Smart Motorway

- Across the CM section of the scheme VMSL are not in use either direction during the AM peak and are only in use during the PM peak southbound for approximately 10% of the hour. VMSL across M6 J10a-11 are in use for the highest proportion during the interpeak period, however they remain unused for the for the majority of the time period.
- VMSL across the ALR section of the scheme are not in use often and are in operation for a higher proportion of time heading northbound as opposed to southbound. Northbound from Junction 12-13, VMSL are in use for approximately 20% of the hour across the period from 14:00 to 17:00, constituting the highest continued usage of VMSL across the scheme.
- Speeds across the scheme are consistent and lane one is utilised well across the ALR section of the scheme.

Reliability

- Reliability across the scheme in all directions and time periods has remained similar.
- The most noteworthy change in reliability is shown in the AM peak heading southbound, where the extreme journey times have reduced, indicating that the slowest times taken to travel through the scheme section are now quicker.

3. Safety

Background

3.1. This chapter considers the impact of the scheme in terms of its level of success in reducing collisions.

3.2. The Environmental Assessment Report (July 2013) stated that 'the scheme should address the transport and safety problems identified on the M6 between Junctions 10a and 13 with the aim of reducing the number and severity of accidents per vehicle-kilometre', although the Economic Assessment Report (May 2013) states that 'the total accident benefits generated by the scheme are small'.

3.3. To assess the scheme's impact on collisions, this chapter analyses the change in personal injury collisions (PICs) occurring in the three-year pre-construction period, and the one year post-opening period. Evaluation of the scheme's impact on personal security has been undertaken using observations made during a site visit.

Data Collection

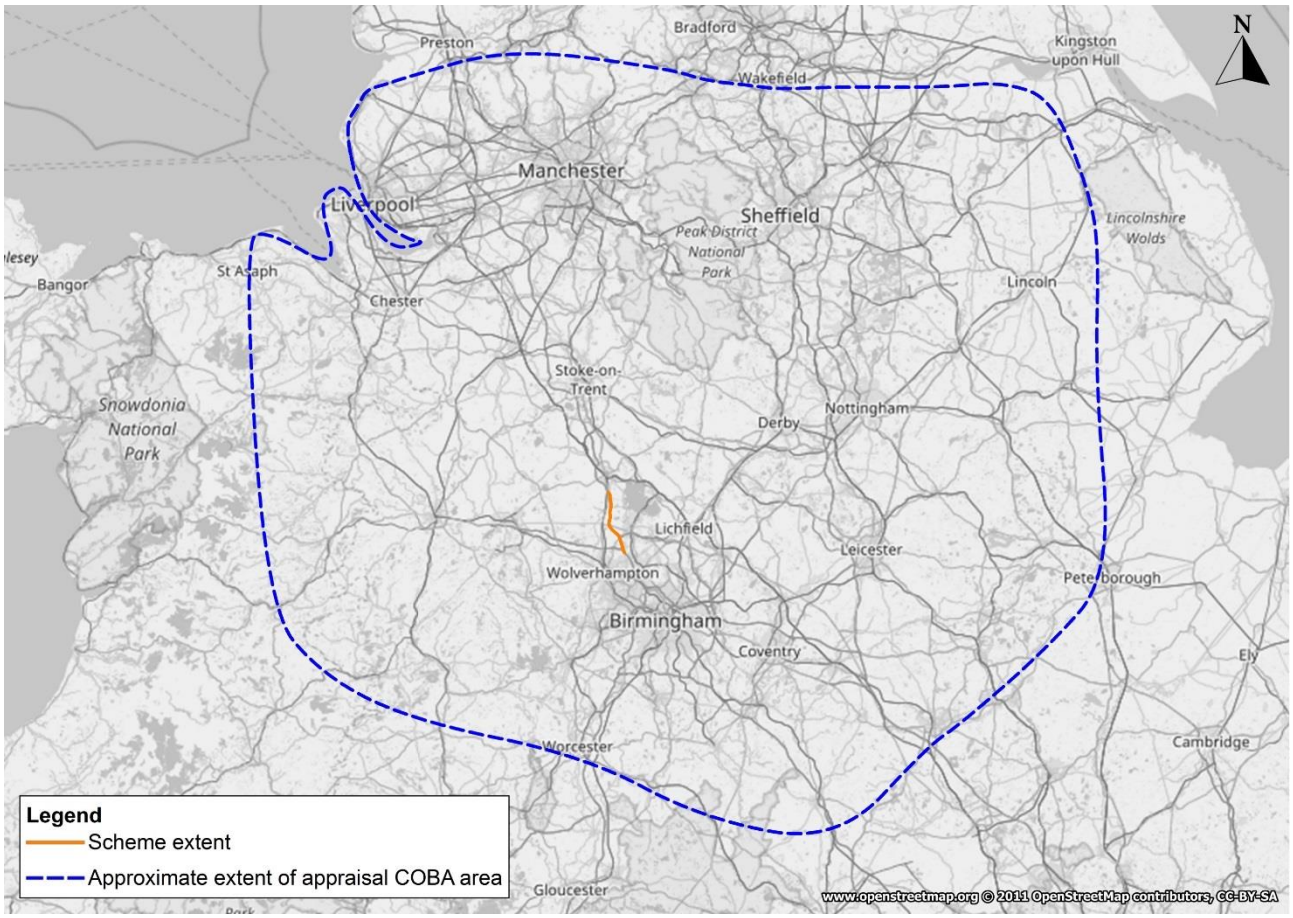
Forecast

3.4. For the purposes of assessing the scheme's impact on PICs at the appraisal stage, forecasts were produced for the number of PICs the scheme was expected to save, together with the associated numbers of casualties and the monetary benefit of the savings. This chapter concerns PIC numbers, with the economic impact of the change in PICs evaluated later in the Economy section of this report.

3.5. It has not been possible to obtain the scheme's Cost Benefit Analysis (COBA) model files for this evaluation. Therefore, information on the forecast safety impact of the M6 junction 10a to junction 13 scheme have been taken from the scheme's Economic Assessment Report (May 2013) and the AST (May 2013). Within these appraisal documents, the forecast saving is calculated over the scheme appraisal period of 60 years, and they do not contain forecast PIC savings for the opening year.

3.6. In the scheme's Economic Assessment Report (May 2013), the COBA model covered the approximate area shown in Figure 3-1.

Figure 3-1 Approximate COBA model area used for PIC forecasts



Observed

3.7. Collisions by their nature include a random element and are somewhat unpredictable events. To ensure that the scheme is the only known change, pre-scheme PIC data has been obtained for the most recent three years prior to construction rather than using the more outdated data used in the Economic Assessment Report (May 2013), which covered the years 2006-2010. PIC data has been obtained from Staffordshire Police covering the following time periods:

- Pre-scheme: 1 November 2010 – 31 October 2013 (3 years)
- Post-scheme: 1 March 2016 – 28 February 2017 (1 year)

3.8. Between the pre-scheme datasets and the post-scheme datasets, the system for police collision reporting changed from STATS19 to the Collision Recording And Sharing (CRASH) system. With the transition to the CRASH system, there has been a change in the classification of the severity of collisions. While in the STATS19 system casualties were classified as 'slight', 'serious' or 'fatal', the CRASH system includes the additional categories for serious casualties; 'less serious', 'moderately serious' and 'very serious'. The methodology of classifying casualties to a severity level has been altered, meaning that the casualty severities in the pre-scheme and post-scheme periods may not be directly comparable. This should be taken into account when interpreting the safety data in this chapter.

3.9. It is considered that the COBA area used for the appraisal (see Figure 3-1) is too wide for evaluation, as observed PIC data covering this area would also be impacted by changes occurring elsewhere on the road network, meaning that it would be problematic to decipher which safety changes were resulting from the scheme itself. Within this evaluation, the whole scheme extent is first considered, from junction 10a to junction 13 including the mainline and slip roads but excluding the gyratory at junctions. The second area considered is the scheme

section that has become All Lane Running (ALR), between M6 junction 11a to junction 13 only, also excluding the gyratory at junctions.

Collision Numbers

3.10. This section analyses the observed changes in PICs following the scheme's implementation, including investigation into the changes in the number of PICs and associated casualties as well as whether there has been any change in the relative severity.

Background Collision Reduction

3.11. It is widely recognised that, for over a decade, there has been a year-on-year reduction in the number of PICs on the roads, even against a trend of increasing traffic volumes during much of that period. The reasons for the reduction are wide-ranging and include improved safety measures in vehicles and reduced numbers of younger drivers. Consideration of this background trend is needed when considering the changes in PIC numbers in the scheme area in the pre-scheme and post-scheme periods. If the scheme had not been built, PIC numbers in the area are still likely to have been influenced by wider trends and reduced.

3.12. The numbers of PICs in this area in the years before and after the scheme was built are compared. Although the net change is primarily associated with the scheme, this background reduction is considered. The best way to do this is to assume that, if the scheme had not been built, the number of PICs on the roads in the study area would have dropped at the same rate as they did nationally during the same time period[5]. This gives what is known as a counterfactual scenario. A comparison can then be made between this data for the counterfactual 'without scheme' scenario on a like-for-like basis and the observed post-opening data which is the 'with scheme' scenario.

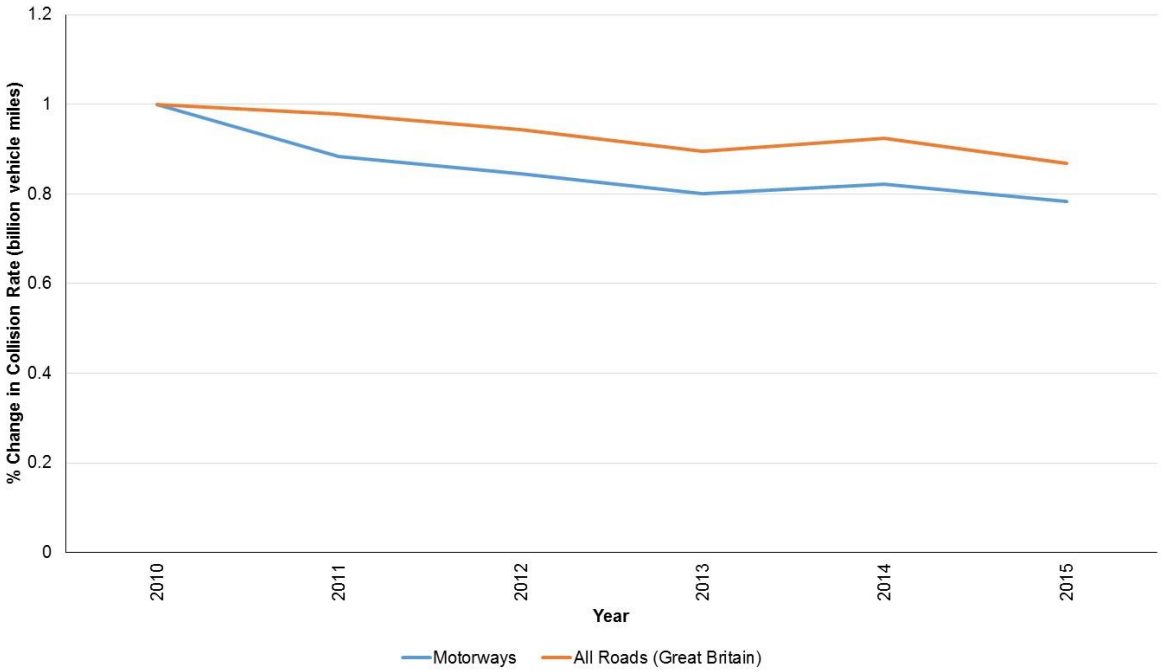
3.13. The difference between the numbers of PICs in these two scenarios can then be attributed to the scheme rather than the wider national trends. This result will inform the calculation of monetised safety benefits achieved by the scheme as discussed in the Economy chapter of this report.

3.14. The counterfactual rate would ordinarily be based on a comparison of the background reduction between the pre-construction period (November 2010 – October 2013) and the one year after period (March 2016 – February 2017). However, at the time of this evaluation, DfT national collision data is not available from 2016 onwards, and therefore the counterfactual has been based on the background reduction in collisions between the pre-construction period and 2015.

3.15. Figure 3-2 illustrates the changes in collision numbers by road type between 2010 and 2015.

[5] National trend data sourced from DfT table RAS10002

Figure 3-2 Trends in PICs over time



Evaluation of collision numbers and severity along the scheme extent

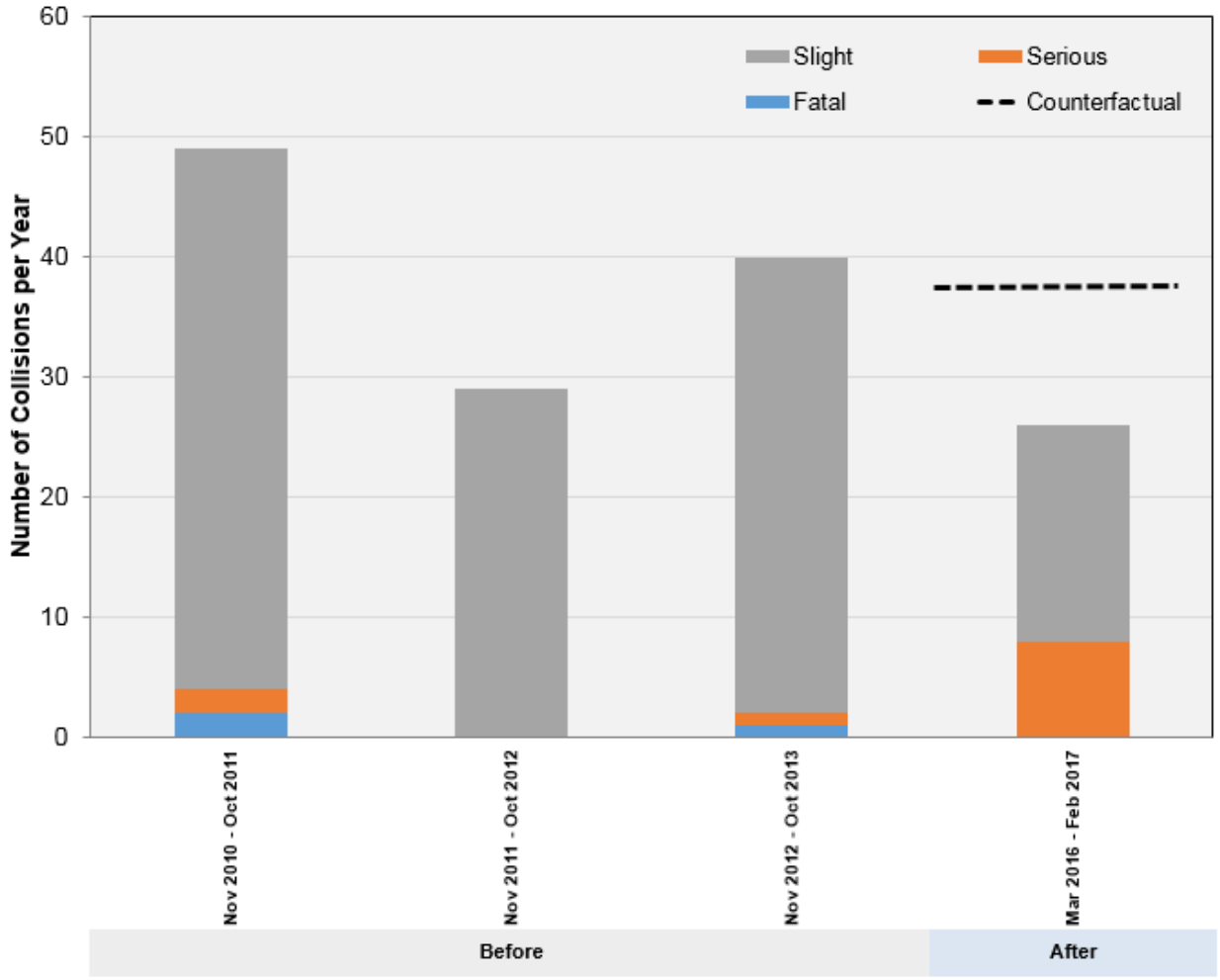
3.16. An evaluation of pre-scheme and post-scheme PIC numbers by year for the scheme extent is shown in Table 3-1 and Figure 3-3. The severity of a PIC is defined by the most serious injury occurred. As noted in paragraph 3.8, the classification methodology for PIC severity has altered between the pre-scheme and post-scheme datasets, meaning they may not be directly comparable.

Table 3-1 Number of PICs by severity along the scheme extent

Period	Time Period		Collision Severity			Total	Annual Average
	From	To	Fatal	Serious	Slight		
Pre-scheme	1 Nov 2010	31 Oct 2011	2	2	45	49	39.7
	1 Nov 2011	31 Oct 2012	0	0	30	30	
	1 Nov 2012	31 Oct 2013	1	1	38	40	
Application of counterfactual 0.95							**37.7**

Period	From	To	Fatal	Very Serious	Moderately Serious	Less Serious	Slight	Total	Annual Average
Post-scheme	1 Mar 2016	28 Feb 2017	0	0	0	6	16	22	22.0
Annual Saving									**15.7**

Figure 3-3 Number of PICs by severity along the scheme extent



3.17. Table 3-1 and Figure 3-3 show that:

- The average number of PICs recorded along the scheme extent post-opening was 15.7 PICs per year, which is a 58% decrease when compared to the 'without scheme' counterfactual rate (accounting for the background reduction in PICs over time) at 37.7 PICs per year. This suggests that the scheme has had a clear beneficial effect on the frequency of PICs along the scheme extent.
- Pre-scheme, there was an annual average of 1 fatal collision, while during the post-scheme period there were none.
- Pre-scheme there was an annual average of 1 serious collision. There were 6 collisions within the one year after scheme opening period that were classified as 'less serious'. However, as noted in paragraph 3.8, the methodology for classifying the severity of collisions has changed between the pre-scheme and post-scheme safety data, and so these severity levels may not be directly comparable.

Evaluation of collision numbers and severity along the ALR scheme section

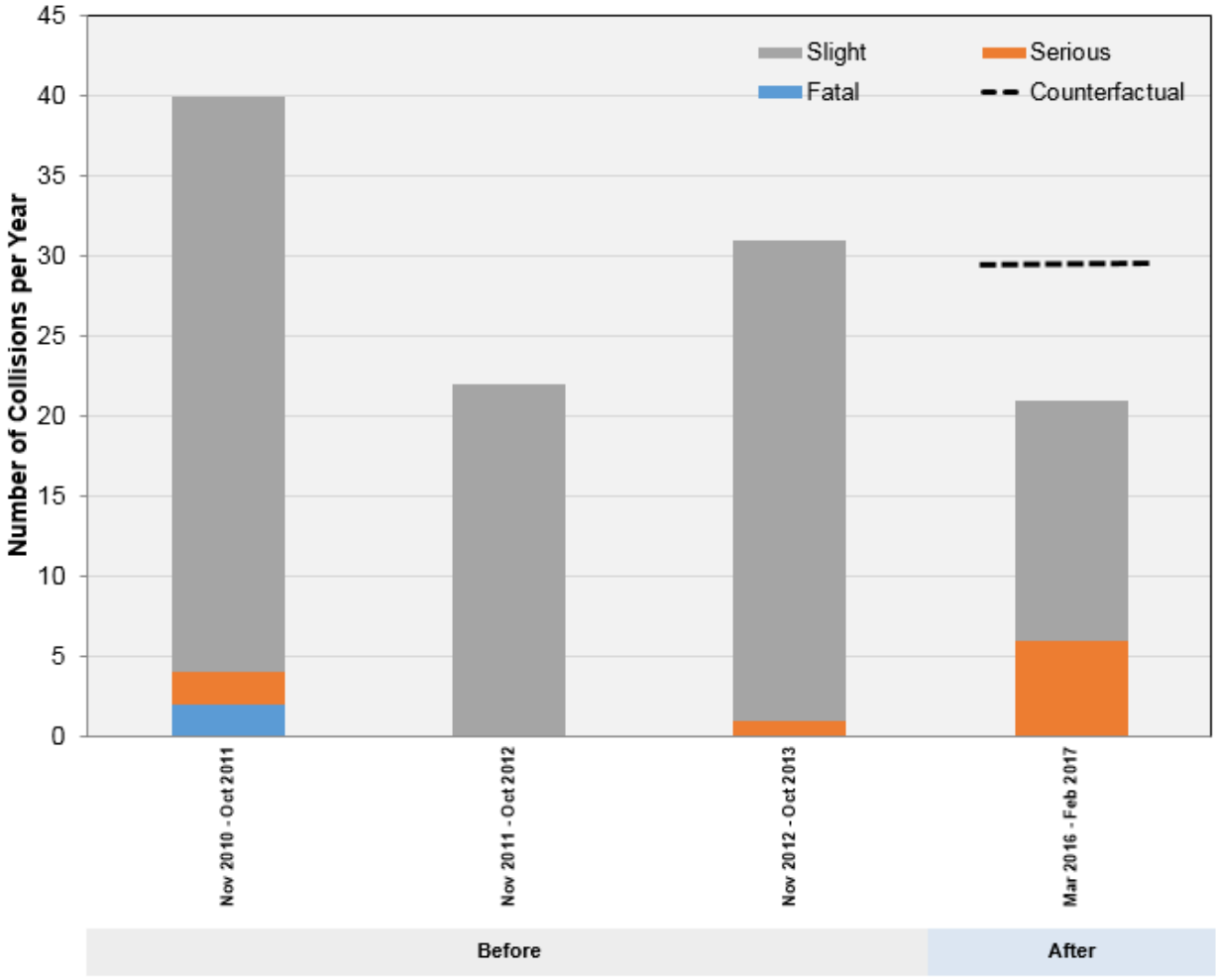
3.18. Table 3-2 and Figure 3-4 provide an evaluation of the pre-scheme and post-scheme collision number by year for the ALR section of the scheme.

Table 3-2 Number of PICs by severity along the ALR scheme section

Period	Time Period		Collision Severity			Total	Annual Average
	From	To	Fatal	Serious	Slight		
Pre-scheme	1 Nov 2010	31 Oct 2011	2	2	36	40	31.3
	1 Nov 2011	31 Oct 2012	0	0	23	23	
	1 Nov 2012	31 Oct 2013	0	1	30	31	
Application of counterfactual 0.95							29.8

Period	From	To	Fatal	Very Serious	Moderately Serious	Less Serious	Slight	Total	Annual Average
Post-scheme	1 Mar 2016	28 Feb 2017	0	0	0	5	13	18	18.0
Annual Collision Saving									11.8

Figure 3-4 Number of PICs by severity along the ALR scheme section



3.19. Table 3-2 and Figure 3-4 show that:

- The average number of PICs recorded post opening was 18.0 per year along the ALR section of the scheme, which is a 40% decrease when compared to the 'without scheme' counterfactual rate (accounting for the background reduction in collisions over time), at 29.8 PICs per year. This suggests that the scheme has had a clear beneficial effect on the frequency of PICs along the ALR section of the scheme.

- The annual average of fatal collisions was 0.67 per annum pre-scheme, while there were none recorded in the one year post-scheme period.
- Between the pre-scheme and post-scheme periods, the number of serious collisions was 1 collision per year. In the post-scheme period, there were 5 collisions with a 'less serious' severity level. However, due to the change in the severity classification methodologies between pre-scheme and post-scheme, these may not be directly comparable (see paragraph 3.8).

Evaluation of collision severity index

3.20. The collision severity index is the ratio of the number of collisions classed as serious or fatal compared to the total number of collisions. A summary of the pre-scheme and post-scheme opening collision severity indices by year is shown in Table 3-3, firstly for the full scheme extent (M6 junction 10a to junction 13) and secondly for the ALR section only (M6 junction 11a to junction 13).

3.21. However, when interpreting this it should be noted that the classification system for casualty severities changed between the pre-scheme and post-scheme data, and therefore these are not necessarily directly comparable (see paragraph 3.8).

Table 3-3 Collision and Casualty Severity Index

Period	Scheme Extent	ALR Section
	Average Collision Severity Index	Average Collision Severity Index
Pre-scheme	5%	5%
Post-scheme	27%	28%

3.22. Across both the scheme extent and the ALR section of the scheme, the proportion of serious and fatal collisions compared to slight accidents has substantially increased since scheme opening.

Fatalities and Weighted Injuries

3.23. The change in collisions discussed previously does not consider the severity of collisions. To analyse this, we now present the fatalities and weighted injuries metric which is a combined measure of casualties based on the numbers of fatal, serious and slight casualties. The FWI for the three years before and the one year after period are shown in Table 3-4. Again, when interpreting this table, the change in methodology for classifying the severity of collisions should be considered.

3.24. To take into account the increased traffic on the M6 and for comparison with other schemes, we also try to present the FWI rate per billion vehicle kilometres (bvkm). In this case, due to concerns over the accuracy of the post opening traffic flows, this has not been calculated at this stage. It should be noted that these figures do not account for changes in the background reduction in casualties.

Table 3-4 FWI on scheme extent

Period	FWI/collision	FWI/year
Before	0.046	1.84
After	0.038	0.84

3.25. Table 3-4 shows that the seriousness of collisions has reduced slightly post-opening. While the proportion of serious collisions has increased, the proportion of fatal collisions has reduced which is reflected in this result.

Statistical Significance of Change in Collision Numbers

3.26. In order to determine whether the changes in collision numbers observed between pre-scheme are statistically significant, Chi-Square tests have been undertaken. This test uses the before (counterfactual) and after numbers of collisions to establish whether the changes are significant or likely to have occurred by chance.

3.27. For both the scheme extent and the ALR section in isolation, the test showed that we can be 95% confident that the change in collision numbers did not occur by chance and therefore that the change is a direct impact of the scheme.

Forecast versus Outturn Collision Numbers

3.28. The forecast safety benefits for this scheme were derived from COBA. For the area included in the COBA assessment is shown in Figure 3-1, the Economic Assessment Report (May 2013) and AST (May 2013) included a small 60 year saving forecast of 34 collisions. There is also no opening year forecast available.

3.29. As earlier discussed, the whole area covered by the COBA model during the appraisal has not been assessed this evaluation because observed collision data covering this area would be impacted by changes elsewhere on the network, and it would be problematic to decipher whether changes in safety have directly resulted from the scheme.

3.30. The Economic Assessment Report (May 2013) noted that the forecast collision saving is small, with the below explanation:

"This is believed to be a consequence of the length of induced trips generated by the scheme. The scheme results in increased flows along the significant lengths of motorway in addition to the stretch covered by the scheme, thus generating an increased number of accidents along these road sections. This induced increase in accidents across the wider motorway network nearly balances with the reduction in accidents between Junction 10a and 13 as a result of the scheme"

3.31. As the COBA model files could not be obtained this evaluation, it has not been possible to separate the forecast opening year saving for the scheme extent itself from the wider COBA area to make a direct comparison with the outturn saving detailed in this chapter. However, it should be acknowledged that there may have been an increase in collisions on the wider network due to induced traffic.

3.32. The forecast of a saving of 34 collisions across the 60-year appraisal period for the COBA area included a breakdown of collision severity. It was forecast that fatal collisions would reduce by 2 collisions, that slight collisions would reduce by 35 collisions, but that serious collisions would increase by 5 collisions. When looking at the outturn opening year collision savings for the scheme extent only (see Table 3-1), there has been a reduction in fatal and slight collisions, but an increase in serious collisions which aligns with the forecast trend. However, as noted previously (see paragraph 3.7), the classification methodology has changed between the pre-scheme and post-scheme data and therefore the severities between datasets may not be directly comparable.

3.33. In the Economic Assessment Report (May 2013), it was noted that guidance[6] states that until long-term data of the impact on ALR schemes is available, a 15% reduction in PICs compared

[6] HA IAN 164/12 – Revision 1, paragraph 3.1.4

to the Do-Minimum should be assumed if variable speed limits are introduced with the scheme. This 15% reduction was therefore applied for the scheme extent during the appraisal. While there is no opening year forecast available, both the scheme extent and the ALR section have seen a higher reduction in PICs than 15% during the opening year, at 42% and 39% respectively.

Collision Rates

3.34. 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 traffic growth. Due to the concerns around the validity of the post opening traffic flows on the M6, these have not been included in this report, but are covered in the linked technical note.

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 scheme appraisal stated that a ‘neutral’ impact was expected for Security, with the AST noting that security was ‘not considered to be relevant to a managed motorway scheme. No additional security improvements were proposed by the Scheme.

Observed

3.38. As shown in Figure 3-5, CCTV cameras and Emergency Refuge Areas have been provided in line with the scheme. Overall, the impact of the scheme is considered to be ‘neutral’, as expected.

Figure 3-5 Additional CCTV cameras and emergency refuge areas

Key Points – Safety

Collisions

- Evaluation of collision numbers between the pre-and post-scheme periods show a reduction in total collisions. However, the results show an increase severity index across the scheme between the pre-and post-scheme periods. Post opening, no fatal collisions have been recorded
- Significance testing found the increase in collisions is significant at the 95% confidence level and hence is at this stage be linked to the scheme implementation.

Forecast vs. Outturn Collision Rate Savings

- For the M6 J10a-13 scheme guidance taken states that until long-term data of the impact on ALR schemes is available, a 15% reduction in PICs compared to the Do-Minimum should be assumed if variable speed limits are introduced with the scheme.
- With the background changes in collisions accounted for, both the scheme extent and the ALR section have seen a higher reduction in PICs than 15% during the opening year, at 42% and 39% respectively.

Personal Security

- The impact of the scheme on personal security is scored as neutral (as forecast in the AST). The outturn score is balanced between the loss of hard shoulder provision, but additional installation of CCTV cameras, Emergency Refuge Areas and Smart Motorway provision.

4. Economy

Introduction

4.1. The purpose of this chapter is to evaluate how the scheme is performing against the economy objective which is defined in WebTAG as:

"To support sustainable economic activity and achieve good value for money".

4.2. The economy sub-objectives are:

- 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 benefits wider economic impacts.

4.3. Scheme appraisal consists of an economic assessment 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 and vehicle operating costs).
- Collisions costs (saving related to number and severity of collisions).
- Costs to users due to delays during construction and future maintenance periods.
- Cost of building the scheme and;
- Cost of operating the scheme over its lifetime.

4.4. This section provides a comparison between the outturn costs and benefits and the forecast economic impact, as well as considering the wider economic impacts of the scheme. Outturn journey time and safety economic impacts are based on analysis presented in Chapters 2 and 3.

Sources

4.5. The following information has been used to inform the economic assessment in this chapter:

- M6 Junctions 10a to 13 Managed Motorway Economics Assessment Report (EAR) (May, 2013)
- Highway Investment Board (Paper 26) M6 J10a-13 Accelerated Delivery Managed Motorway Pilot Scheme – Construction Phase Budget (August, 2013)
- M6 Junction 10a to 13 Managed Motorway WebTAG (Appraisal Summary Table) Report (May, 2013)
- Observed impacts on traffic and safety as noted in previous chapters.
- Outturn cost from the Regional Finance Manager

4.6. Forecast benefits are presented for a 60-year appraisal period based on a 2016 opening year. All monetary values are presented in this chapter are in 2010 market prices, discounted, unless otherwise stated.

Forecast Present Value Benefits

4.7. The appraisal of this scheme considered the economic impact in terms of present value. A summary of the predicted scheme impacts from the EAR is shown in Table 4-1.

Table 4-1 Economic impact of scheme - Present Value Benefits

Benefit	Forecast £m (EAR)	Evaluate?	Evaluation Approach
Journey Times	268.9	Yes	Represents a considerable proportion of the overall scheme benefits. Outturn journey time impacts in opening year can be calculated using observed changes in vehicles hours and forecasts.
Vehicle Operating Costs (VOC)	-87.5	Yes	Outturn impact of VOC can be calculated based on changes in fuel consumption monetised to calculate a proxy outturn reforecast value of VOC.
User Charges	-61.5	No	Evaluation is outside of the remit of POPE; therefore, outturn is assumed as forecast.
Construction Delay	-26.7	No	Evaluation is outside of the remit of POPE; therefore, outturn is assumed as forecast.
Maintenance Delay	-6.5	No	Evaluation is outside of the remit of POPE; therefore, outturn is assumed as forecast.
Operating Costs (private toll revenue)	107.0	No	Evaluation is outside of the remit of POPE; therefore, outturn is assumed as forecast.
Safety	1.2	Yes	Safety impact monetised as shown to be statistically significant.
Carbon Benefits	-24.2	Yes	Ratio between forecast and outturn opening year carbon impact used to calculate 60 year reforecast
Noise Impact	-2.5	No	Very small proportion of the overall scheme impacts. Assumed as forecast.
Air Quality	-1.7	No	Very small proportion of the overall scheme impacts. Assumed as forecast.
Indirect tax impact as a benefit	71.2	Yes	Calculate outturn change in fuel consumption and use ratio against forecast change to reforecast 60-year benefit.
Total PVB	237.6		
Reliability	189.4	No	INCA model was not provided to POPE and hence no recalculation can be made
Adjusted PVB	427.0		

Evaluation of journey time benefits

Forecast

4.8. Transport Economic Efficiency (TEE) benefits for this scheme were forecast using the Department for Transport's (DfT's) TUBA (Transport Users Benefit Analysis) program, which considers change in:

- **Time for Link Transit and Junction Delay** – the time on each affected link both before and after opening, weighted by vehicle flows and the delays at junctions; and
- **Vehicle Operating Costs (VOC)** – Reflects fuel and other operating costs calculated by a change in total distance travelled on the affected links, but also considering vehicle speeds.

4.9. TUBA modelling was based on the benefits in a wide area, but this evaluation focuses on the routes where changes can be most clearly identified as being linked to this scheme. There are three groups of users that were identified as measurably benefiting from the scheme which are:

- Those users of the M6 between J10a-13 travelling northbound and southbound.

4.10. The TUBA modelling forecast that the scheme would deliver TEE benefits of £268.9 million (2010 prices, discounted to 2010) over the 60-year appraisal period, comprising of circa £268.9 million of journey time benefits and a change in vehicle operating costs of circa £87.5 million.

Evaluation

4.11. In order to assess the impact of the scheme on journey time benefits, vehicle hour savings would need to be calculated for vehicles using the improved M6. Any uncertainty about traffic flows can have a significant impact on this calculation, and therefore until the issues around post opening traffic flows have been resolved, no attempt to calculate vehicle hours has been made.

Evaluation of safety benefits

Forecast safety benefits

4.12. The forecast safety benefits for this scheme were derived from COBA (which also monetises the benefits), with the findings detailed in the scheme's Economic Assessment Report (May 2013) and the AST (May 2013). A 60 year saving of 34 collisions was forecast across the 60 year period, translating into a monetary benefit of £1.16 million (2010 prices, discounted to 2010).

4.13. The COBA model covered in the 60 year forecast is presented in the safety chapter. As discussed in the safety chapter, the whole COBA area has not been replicated in this evaluation because as it covers a substantially wider area than the scheme extent, it would be problematic to determine which changes in collisions are directly related the scheme.

4.14. The methodology for the evaluation of the outturn of the economic value of benefits requires an opening year collision saving. However, it has not been possible to attain an opening year forecast because the scheme's COBA model has not been obtained. Therefore, a proxy opening year forecast for the scheme extent has been calculated to compare with the outturn savings. In the Economic Assessment Report (May 2013), it was noted that guidance states that a 15% reduction in collisions compared to the Do-Minimum should be assumed if variable speed limits are introduced with a scheme, and that this was therefore applied to the scheme extent during the appraisal. This 15% reduction has been applied to the observed pre-scheme collision numbers to create a proxy value for this evaluation.

4.15. The POPE methodology for the evaluation of the outturn economic value of safety benefits is based on the comparison of observed and forecast collision changes at the POPE evaluation stage (in this case one year after opening). This is then combined with the assumption that the observed safety impact at this stage can be taken as indicative of that over the whole 60 year appraisal period.

4.16. Monetisation of safety savings is calculated by:

- Calculating the net difference between the forecast opening year saving and the opening year observed collision savings.
- Monetising the net difference using the PAR method which values collisions by road type and enables capitalisation over 60 years based on expected traffic growth.
- Calculating the 60 year outturn benefits for the whole area by combining the forecast from COBA (for the whole study area) with the outturn assessment of the net difference.

4.17. Table 4-2 presents the predicted collisions savings, compared to the outturn savings along the scheme extent. All values are in 2010 prices, discounted to 2010.

Table 4-2 Comparison of forecast and re-forecast collision benefits

Forecast	Proxy opening year collision saving (scheme extent)	(a)	6.0
	60 year monetary benefits (whole COBA area)	(b)	£1,163,774
Outturn	Opening year collision saving (scheme extent)	(c)	11.4
	Difference from forecast	(d) = (c) – (a)	5.4
	Collision value in opening year	(e)	£97,721
	60 year benefits of difference in opening year collisions	(f) = (d) x (e) x factors	£26,036,096
	60 year monetary benefits (whole COBA Area)	(f) + (b)	£27,199,870

4.18. In Table 4-2, the re-forecast 60 year monetary safety benefits are substantially higher. However, as earlier noted, for the forecast, the monetary benefit is based on a wide COBA area while the outturn collision savings are based on the scheme extent only. The Economic Assessment Report (May 2013) notes that while collisions were anticipated to reduce on the M6 between junctions 10a and 13, collisions would be expected to increase on roads elsewhere due to induced traffic. This somewhat explains the monetary difference between forecast and outturn opening year collisions, and there may be further changes across the wider the network. Having said this, the proxy opening year collision saving on the scheme extent, based on a 15% reduction of collisions in line with the guidance described in the Economic Assessment Report (May 2013), at 6.0 collisions, is substantially lower than the outturn saving of 11.4 collisions.

4.19. It should be noted that this takes no account of any changes outside of the scheme area (either increases or decreases) and therefore this assessment may be an overestimation of benefits due to the disparity of areas considered.

Vehicle Operating Costs and Indirect Tax

4.20. These are both heavily dependent on traffic flows and hence have not been calculated at this stage.

Other monetised benefits

User Charges

4.21. Changes to the motorway on section J10a to 13 was expected to trigger some local rerouting. This resulted in increased travel distance in the widening scenario, leading to increased vehicle operating costs and increased usage of the M6 Toll as shown by the negative user charges benefits.

Carbon Benefits

4.22. The scheme was forecast to increase carbon emissions due to extra traffic expected with the scheme. This increase results in a negative monetary benefit which was calculated using DEFRA's Emissions Factor Toolkit.

Further benefits used in Adjusted BCR

Reliability

4.23. The scheme appraisal estimated the reliability benefits for the scheme which is the monetisation of the unpredictable variation of journey times.

4.24. Benefits of delays and travel time variability costs relating to incidents were examined using INCA. The appraisal used INCA (INcident Cost Benefit Assessment) version 4.2 for estimating the benefits of reduced delay and travel time variability (TTV) caused by unforeseen incidents that reduce capacity, such as collisions, 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. The forecast INCA benefit was not however included in the overall benefits for the purpose of calculating the BCR. This is in line with the WebTAG guidance which states that the monetised reliability benefits should not be included in the overall Analysis of Monetised Costs and Benefits (AMCB).

4.25. The reliability sub-objective of this scheme was appraised using INCA (Incident Cost Benefit Appraisal) which forecast a benefit over 60 years of £189.1m (2010 prices).

4.26. It is not possible to evaluate reliability using data on observed incidents before and after the scheme was built because the nature of the smart motorway means that recording of incidents has much improved. Clearly a basic assessment of the data would show more incidents being recorded through the smart motorway technology than that recorded by more manual means before opening. It was also not possible to evaluate the outturn reliability benefit by re-running INCA as the model was not obtained for POPE.

Scheme costs

4.27. There are two aspects to the cost of the scheme examined here. Firstly, the investment cost of building the scheme, then the wider and long term costs considered on the same basis as the benefits (Present Value) to enable a Benefit Cost Ratio to be calculated.

Investment Cost

4.28. The investment cost is the construction costs including Land and property costs, Preparation and supervision costs; and Allowance for risk and optimism bias. The August 2013 HIB paper stated that the Expenditure Profile of the construction budget was £102.2m including construction phase budget, advance works and historic costs. The final target cost due November 2013 not obtained for this study. This costs was the central/most likely estimate, based on a start of works in September 2013.

4.29. For comparison with the outturn costs on an equivalent basis, this was converted to 2010 prices (without discounting) assuming that the costs where supplied in 2013 prices, as presented in Table 4-3 using GDP deflators from the WebTAG data book.

4.30. The outturn investment costs for building this scheme as of June 2017, have been obtained from the Regional Finance Manager at Highways England covering the period 2008 – 2019. For the purpose of comparison between forecast and actual, and with other major schemes, these prices have also been converted to 2010 prices. This figure can then be compared with the forecast cost on a comparable basis. These figures are shown below in Table 4-3.

Table 4-3 Investment Cost of Scheme (£million, 2010 prices, not discounted)

Forecast	Outturn	Difference
96.8	91.3	-6%

4.31. This shows that the outturn investment cost was 6% below the central forecast.

Present Value Costs (PVC)

4.32. For comparison with the benefits, overall costs are expressed in terms of present value, termed Present Value Cost (PVC). 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 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.

4.33. Following current Treasury Green Book guidance, calculation of the present value entails the conversion to market prices, then discounting by year. This uses a rate of 3.5% for the first 30 years and 3% thereafter. Note that the base year used here is 2010, as used in the scheme forecasts and as in current guidance.

4.34. Appraisal of this scheme included the following types of cost:

- Investment costs: before and during construction; and
- Operational costs of the smart motorway during the 60 years after opening.

4.35. Note that when this scheme was appraised, the impact on Indirect Tax revenues during the 60 years after opening was included as part of the benefits in accord with then current guidance, rather than as part of the costs. It has likewise been treated as a benefit in this report.

Operational Costs

4.36. Operational costs of the scheme were assessed in the EAR in line with guidance in IAN 164/12. It covers expenditures relating to the following aspects of the smart motorway:

- Day-to-day running and operation of the smart motorway
- Enforcement costs including police
- Capital costs of renewal. This is the costs over 60 years of the maintenance and renewal of the technology and associated infrastructure.

4.37. Note that this is distinct from Vehicle Operating Costs (VOC) which is the impact on the costs to road users, and is considered as part of the benefits assessment above. As these relate to future costs, for the purposes of this report operational costs have been assumed to be as forecast.

Summary of PVC

4.38. The investment costs shown in Table 4-3 have been converted to present value through discounting to 2010 and applying the market price adjustment. No reassessment of the operating costs has been made as at this stage; the assumptions made in the appraisal are still considered to hold true.

4.39. The HIB paper used a PVC figure of £118m without a breakdown into investment and operating costs, thus we have assumed a recalculated PVC based on the unchanged operational costs and the re-calculated investment cost.

4.40. **Table 4-4** shows the total of the costs expressed in terms of present value.

Table 4-4 Summary of Present Value Costs (PVC)

£m 2010 prices and values	Forecast	Outturn
Investment Costs	102.9	97.1
Operational Costs (as stated in EAR)	30.7	30.7
Total PVC	**133.6**	**127.8**

Wider Economic Impacts

Forecast

4.41. The AST stated that scheme would have no impact on any Regeneration Areas so the assessment of the impact was neutral while the EAR did not include the wider economic impacts.

Evaluation

4.42. At the OYA stage it is too soon to measure any impact from the scheme upon employment furthermore, due to poor data availability although there is an observed journey time saving it is not possible at this time to determine whether this is a result of the scheme. Therefore, at this stage an evaluation of the wider economic impacts relating to the scheme is not possible.

Economic Impacts - Key points

Benefits

- Due to concerns over traffic flow data on the scheme section, no recalculation has been made at this stage as it may present an inaccurate picture of the impact of the scheme.

Costs

- The investment cost of building the scheme was £91.3 million in 2010 prices (not discounted), which is 6% less than forecast.

BCR

- An outturn BCR has not been calculated at the OYA stage as the scheme cannot be evaluated in full due to poor data availability on the mainline scheme section.

5. Environment

Introduction

5.1. The M6 between Junctions 10a and 13 is approximately 16.5km long, and is a strategic route that carries high volumes of heavy goods and other vehicles between the West Midlands, Greater Manchester and beyond. In 2013, congestion and unreliable journey times were being experienced at busy periods, and total traffic flows were predicted to continue to grow over time.

5.2. The scheme commences south of Junction 10a (marker post 203/0, chainage 2,970) and ends at Junction 13 (marker post 219/9, chainage 19,975).

5.3. The scheme would be implemented within the existing highway boundary and was designed to make best use of the existing infrastructure and where possible, stay within the extents of the existing paved area. This would include the modification of the existing verge kerb and gully edge drainage detail. The only additional paved areas to be created by the scheme would be the Emergency Refuge Areas (ERA's).

5.4. The key features and assumptions of the MM-ALR scheme as part of the detailed design were:

- Emergency Refuge Areas - Three ERA's northbound, and four ERA's southbound, each separate from gantries.
- Gantries –22 new gantries to support Electronic Message signs, and Closed Circuit Television (CCTV) cameras.
- The carriageway – No additions to the paved width.
- Earthworks - Some gantry and ERA locations would require steepened slopes; no retaining solutions would be required.
- Lighting –Currently unlit between Junctions 12 and 13, but with lighting at the top of the junction slip roads; no additional lighting was to be installed.
- Safety barriers – The existing central reserve steel safety barrier would be retained. Additional lengths of safety barrier would be provided at the verge with existing verge safety fence retained where possible.
- Drainage, pollution control and spillage containment – New drainage works were to be provided, and would be associated with ERA's and where the existing provision had been assessed as insufficient.
- Hard shoulder profiles and drainage – At three locations where adverse cambers existed, the former hard shoulder profile would be changed. In such cases, surface water was to be diverted to the central carriageway drainage, rather than to the edge of the carriageway.
- Cable ducts – New communications and power cables would be installed within ducts, offset approximately 2m from the edge of the carriageway. Existing trough routes were to be abandoned.
- Construction compounds – Although unidentified at the time of the EnAR, the EnAR noted that an existing indoor location would be sought to facilitate electrical testing of equipment for installation. The Contractor was to use agricultural land within the vicinity of Junction 11 or Junction 12 as site compound/ compounds. No permanent land-take would be required.
- Noise barriers – New noise barriers would be provided where justified by the noise assessment.
- Disturbance to verges – It was assumed that due to drainage, ducting, safety barrier, and carriageway works, a linear area of soft verge of approximately 3m width from the edge of

carriageway would be subject to disturbance along the entire route, both northbound and southbound.

Assessment

5.5. The Environmental Assessment Scoping Report prepared in September 2012 (URS 2012) concluded that the Scheme was not likely to result in significant environmental effects, and therefore a statutory Environmental Impact Assessment (EIA) would not be required. However, it was identified that further simple and detailed level assessments were required for several topics.

5.6. A non-statutory EIA for the Scheme was undertaken, and reported on in an Environmental Assessment Report (EnAR) that was published in 2013. For each of the environmental sub-objectives considered by the EnAR, the evaluation in this chapter assesses the environmental impacts predicted by the Scheme's Appraisal Summary Table (AST) and EnAR against those observed One Year After (OYA) opening.

5.7. In the context of the AST and EnAR forecasts and using evidence collected at the OYA stage, this chapter presents:

- A record of any significant changes to the Scheme that have taken place since publication of the EnAR.
- An evaluation of the effectiveness of the mitigation measures implemented as part of the scheme.
- A summary of key impacts against all ten environmental WebTAG sub-objectives.

Data Collection

5.8. The following documents/ data have been used in the compilation of this environmental chapter of the OYA report:

- Environmental Assessment Report Volumes 1 and 2 (July 2013)
- Appraisal Summary Table (September 2013)
- Environmental Constraints drawings (September 2013)
- Landscape Mitigation drawings (April 2015)
- As-built site clearance drawings (October 2015)
- Handover Environmental Management Plan (June 2016)

5.9. A list of the background information specifically requested and received to help with the compilation of this report is included in Appendix D.

Site Visit

5.10. As part of the OYA evaluation, a site visit was undertaken in June 2017. The visit included the taking of photographs to provide a photographic record of the Scheme and to provide comparison views with selected EnAR photomontages – these are shown in Appendix E.

Consultation

5.11. Statutory environmental bodies, County, Borough/ District and other relevant organisations were contacted as part of the OYA evaluation regarding their views on the impacts they perceive the Scheme has had on the environment; while individual responses will be explained in full and addressed under the relevant sub topic in this chapter. A summary of the received Consultation responses is shown in Table 5-1.

Table 5-1 Summary of Environmental Consultation Responses

Organisation	Field of Interest	Comments at OYA
Natural England	Biodiversity & Landscape	Did not respond to the invitation to provide feedback.
Environment Agency	Water	Did not respond to the invitation to provide feedback.
Staffordshire County Council	General	Provided responses for rights of way and historic environment.
South Staffordshire District Council	General	Did not respond to the invitation to provide feedback.
Stafford Borough Council	General	Did not respond to the invitation to provide feedback.
Walsall Metropolitan District Council	General	Did not respond to the invitation to provide feedback.
Cannock Chase District Council	General	Commented on air quality and biodiversity.
Lichfield District Council	General	Did not respond to the invitation to provide feedback.
Tamworth Borough Council	General	Did not respond to the invitation to provide feedback.
East Staffordshire Borough Council	General	Did not respond to the invitation to provide feedback.
Newcastle Under Lyme Borough Council	General	Did not respond to the invitation to provide feedback.
Staffordshire Moorlands District Council	General	Did not respond to the invitation to provide feedback.

Animal Mortality

5.12. The Area 9 Asset Support Contractor has also been contacted about animal mortality figures, but no information has been provided.

Traffic Forecast Evaluation

5.13. Three of the environmental sub-objectives (noise, local air quality, and greenhouse gases) are directly related to traffic flows. No new noise or air quality surveys are undertaken for POPE and an assumption is made that the level of traffic and the level of traffic noise and local air quality are related.

5.14. The EnAR noted that congestion and unreliable journey times were being experienced on the M6 between J10a and 13 at busy periods, and that traffic was predicted to continue to grow over time.

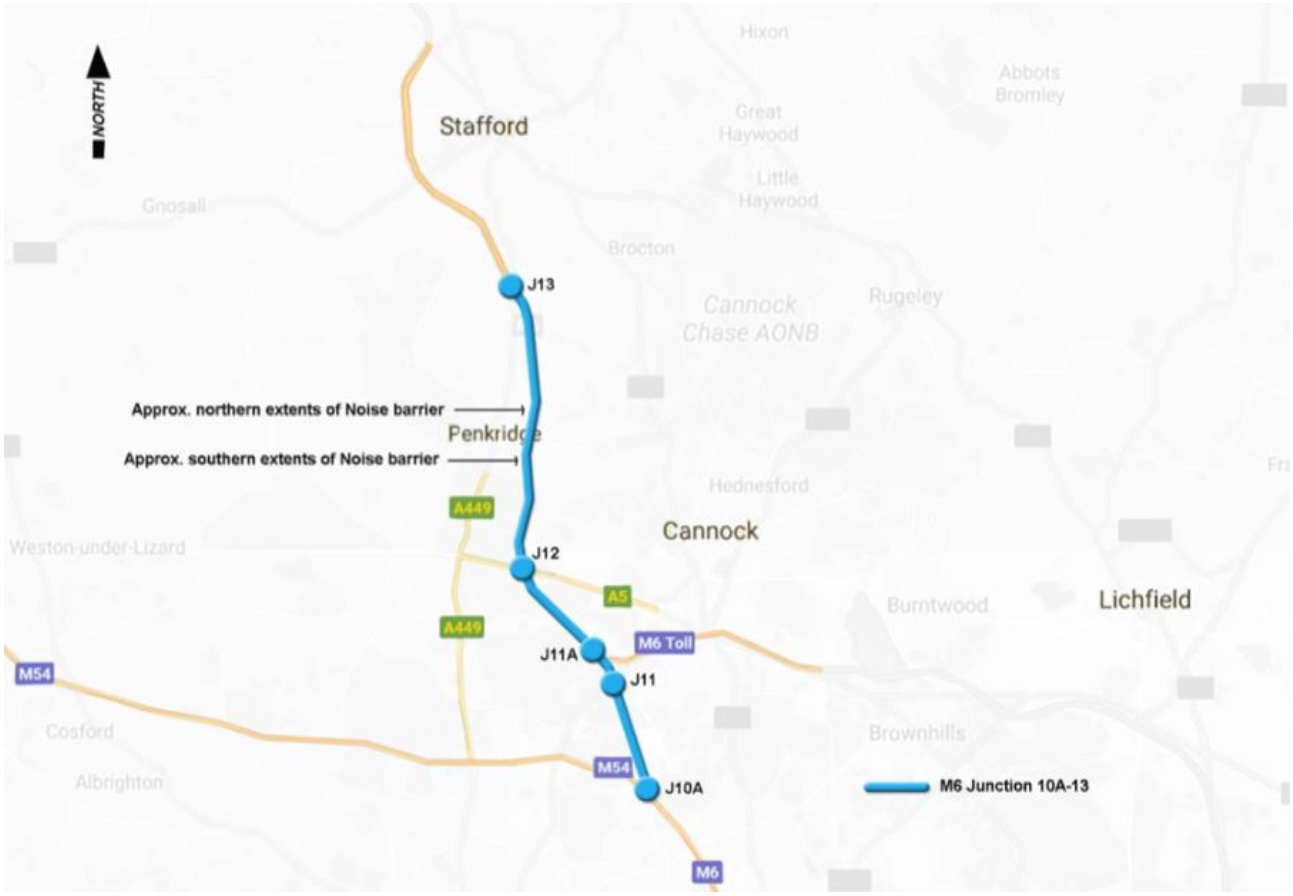
5.15. Due to concerns about traffic flow data, this information hasn't been included here.

One Year After Environmental Assessment

5.16. Included in this section is a summary of statements from the AST and ES evaluations which have been included to provide the context for the OYA evaluation.

5.17. The key environmental features that are discussed in this chapter are shown in Figure 5-1.

Figure 5-1 – Key Environmental Features



Noise

Forecast

Appraisal Summary Table

5.18. The AST stated that residential properties that would be affected by the scheme included those within the settlements of Acton Trussell, Dunston, Penkridge, Calf Heath, Great Saredon, Little Saredon and Essington. There were 10 schools and no hospitals within 1 km of the scheme. In the long term, a negligible adverse effect was predicted at all the non-residential sensitive buildings and 99% of residential properties in the 600m study area.

5.19. A total of 35 residential properties were identified as likely to qualify under the Noise Insulation Regulations.

5.20. Overall, the AST expected that the Scheme would have a slight adverse impact on receptors.

Environmental Assessment Report

5.21. The EnAR concluded that in the short term, a negligible adverse effect was predicted at 13 of the 14 identified non-residential sensitive buildings, and for 85% of residential properties within the 600m study area, with only seven properties predicted to experience a minor (1.0-2.9 dB) increase in noise. 12% of residential properties were expected to experience no change in the short-term, and less than 3% were expected to experience a negligible or minor reduction in traffic noise. The clear majority of properties expected to experience a short-term reduction in noise were located in Penkridge, the benefit deriving from the proposed 3m noise barrier.

5.22. In the long-term, a negligible adverse effect on the noise climate was predicted for all the non-residential sensitive buildings, and for 99% of the residential properties in the 600m study area.

5.23. A total of 35 residential properties were identified as likely to qualify under the Noise Insulation Regulations.

Consultation

5.24. No responses to consultation requests were received.

Evaluation

5.25. The Handover Environmental Management Plan (HEMP) confirmed that a preliminary Noise Insulation Regulations (NIR) assessment undertaken to support the EnAR had identified 35 residential properties that were likely to qualify under the NIR.

5.26. The HEMP also noted that Highways England were to commission a NIR assessment to confirm how many and which properties were eligible for noise insulation and that no later than 6-months post Scheme opening, a map/ list of eligible properties was to be produced and a notice published to state that the documents were available for public view. The properties identified and to be included within the NIR assessment were stated in the HEMP as:

- 22 properties near Calf Heath
- 1 property on Gailey Lea Lane, north of junction 12
- 4 properties near Penkridge, 2 to the east and 2 to the west of the M6
- 8 properties off Teddesley Road and Lower Drayton Lane, to the north east of Penkridge.

5.27. The NIR assessment was not available for the purposes of this evaluation.

5.28. Regarding road surfacing, the EnAR assumed that there would be no change from the existing road surfacing conditions within the assessment years. The existing M6 along the scheme, including entry/ exit slip-roads and the adjacent sections of the M54 and M6 Toll within the 1km study area, are all currently Low Noise Surfacing (LNS). As part of the scheme, the hard shoulder of the M6 to be utilised as a running lane was assumed to be re-surfaced with LNS. All other roads in the study area were assumed to be standard Hot Rolled Asphalt (HRA).

5.29. No information confirming the Road Surface Index (RSI) value of the resurfaced hard shoulder has been received for evaluation by this study, and no high-speed RSI values have been made available. As such, any noise reduction properties of the installed surfacing remain unconfirmed.

5.30. The site visit observed that an acoustic barrier, approximately 3m high, has been provided as expected at Penkridge (illustrated by Figure 5-2), where the closest properties to the M6 at this location were noted by the EnAR to have been designated as an Important Area and First Priority Location in the noise action planning process.

Figure 5-2 Acoustic barrier northbound carriageway – as viewed from the B5012 Cannock Road overbridge at Penkridge

5.31. Noise from a flow of road traffic is generated by both vehicles' engines and the interaction of tyres with the road surface. The traffic noise level at a receptor, such as an observer at the roadside or residents within a property, is influenced by several factors including traffic flow, speed, composition (% HGV), gradient, type of road surface, distance from the road and the presence of any obstructions between the road and the receptor.

5.32. An assumption is made by POPE methodology that noise levels will be as expected if observed traffic flows are within 25% more or 20% less than predicted.

5.33. Although POPE methodology would normally take HGV/ speed data into account when evaluating traffic noise, no comparisons between HGV/ speed data have been made due to technical limitations of the traffic counting at sites through the scheme.

5.34. No assessment has been made as to the impact of the scheme on noise due to concerns over traffic data.

Local Air Quality

Forecast

Appraisal Summary Table

5.35. The AST stated that two Air Quality Management Areas (AQMA's) were within 200m of the scheme:

- Woodbank – declared for exceedances of an annual mean objective for nitrogen dioxide (NO_2)
- Bur snips – no receptors within 200m of the scheme or affected routes

5.36. The AST also stated that regional emissions of particulates (PM10) were predicted to increase by 0.6 tonnes per annum (pa) in the opening year, and that regional emissions of generic oxides of nitrogen (NOX) were predicted to increase by 18.6 tonnes pa.

5.37. The qualitative AST assessment stated that air quality was made worse at one receptor across the scheme, where concentrations were predicted to be more than the air quality limit value in both the with and without scheme scenarios in the opening year. A small change in NO2 of +1.3 µg/m³ was predicted at one receptor, increasing the predicted concentrations from 43.5 µg/ m³ to 44.9 µg/ m³ between the with and without scheme scenarios.

5.38. No overall qualitative assessment of the impact of the Scheme on Local Air Quality was provided.

Environmental Assessment Report

5.39. The EnAR concluded that there were sensitive receptors identified within 200m of the proposed scheme and affected roads:

- There were two AQMA's identified within 200m of the proposed scheme and affected roads, only one of which contained receptors within 200m of the scheme and affected roads.
- There was one designated ecosystem within 200m of the scheme routes or affected roads, the Doxey and Tillington Marshes Site of Special Scientific Interest (SSSI), which was anticipated to have imperceptible changes to its NO_X climate.
- The public NO2 exposure predictions at the identified sensitive receptors along the scheme route and affected roads suggested that in 2015, air quality would meet annual mean air quality objective values and European Union Limit Values at most locations.
- At locations which were not currently meeting air quality objectives, changes in air quality were concluded to be generally imperceptible and unlikely to be observable within the normal variations of annual mean NO2 concentrations.
- There was only one location where NO2 concentrations were anticipated to be greater than the air quality objective for NO2. A small change was predicted at this location, and the change in concentration was expected to be greater than imperceptible.
- Air quality was also expected to meet 1-hour NO2 in all locations but one, both with and without the scheme, and annual average PM10 and 24-hour PM10 air quality objectives were expected to be met at all receptors with or without the scheme. No changes in the numbers of days or hours exceeding short-term objectives were anticipated.
- The scheme was rated as High Risk for compliance with the EU Directive, due to a small increase in concentration along one link of 1 µg/m³, However, as the scheme would not result in a compliant zone becoming non-compliant, nor would it delay Defra's date for achieving compliance or increase the road length predicted to be in exceedance, it was suggested that no Air Quality Action Plan (AQAP) would be necessary.

5.40. Overall, the air quality effects during operation were not considered to be significant for the Scheme.

Consultation

5.41. The Cannock Chase District Council (CCDC) commented as follows:

- Within CCDC boundaries, air quality management areas exist along the A5 Watling Street in the southern area of the district. This abuts an AQMA in Wedges Mills, South Staffordshire.
- The direct impact of the M6 scheme is most likely to be seen on the A5 Watling Street, which together with the M6 Toll provides an alternative route to the M6. Air quality monitoring is undertaken at various sensitive locations on the A5, notably in the Bridgtown area. Raw data for 2016 does not significantly differ from the preceding 3 years. However, a single year's worth of data may not be representative. Therefore, initial results can tentatively indicate that the M6 scheme has had a neutral impact on the AQMAs on the A5 in this district.
- The longer-term implications may be more significant. Business growth along the A5 consists largely of warehouses and distribution depots, which are attracted strategically by the road infrastructure, including the M6. As these businesses become established they are likely to have an air quality impact on the AQMAs.

Evaluation

5.42. Regarding the Consultation response from CCDC, it is agreed that the available air quality monitoring data from the sensitive locations on the A5 Watling Street (crossing J12) does indeed suggest that the Scheme may not have had an impact on the AQMA's at this stage.

5.43. An assumption is made by POPE methodology that local air quality will be as expected if observed traffic flows are within 10% more or 10% less than predicted..

5.44. Although POPE methodology would normally take HGV/ speed data into account when evaluating air quality, no comparisons between HGV/ speed data have been made due to technical limitations of the traffic counting at sites through the scheme.

5.45. Based on the information presented in this evaluation, no assessment has been made due to concerns over the accuracy of traffic flow data.

Greenhouse Gases

Forecast

5.46. The scheme was expected to result in an increase in carbon due to increased traffic flows in the study area. EnAR Regional Air Quality section forecast an opening year impact using DMRB of 4,821 additional tonnes of CO2. This equates to an additional 1,315 tonnes of carbon.

Outturn

5.47. To facilitate a like for like comparison of forecast and outturn carbon impacts, an evaluation method consistent with that in the forecast is used. In the case of this scheme, no detailed breakdown of the traffic data used to calculate the forecast figure above was available. To create a like-for-like, forecast figures for traffic and journey times have been used to create forecasts along the M6 improved by the scheme which can be compared with observed data for the same links. To capture the varying impact during the differing time periods, emissions have been calculated by time periods.

5.48. Due to the concern over post opening traffic flows, this approach has not yet been undertaken as it may provide a misleading picture.

Landscape and Townscape Effects

Forecast

Appraisal Summary Table

Landscape

5.49. The AST stated that the Scheme area comprised a gently undulating, predominantly agricultural landscape, and included the market town of Penkridge and urban fringe development in the south of the scheme. The introduction of gantries and ERA's, along with some loss of vegetation, was predicted to cause "…localised increased intrusion to the landscape character and visual amenity would be slight, with a slight beneficial effect near Rodbaston Lock from increased screening from mitigation".

5.50. Overall, the AST predicted the impact of the scheme on Landscape to be slight adverse.

Townscape

5.51. The AST stated that the Scheme would not have an impact on townscape and as such, was not considered further; overall, the impact of the scheme on Townscape was stated as neutral.

Environmental Assessment Report

Landscape Impacts

5.52. The EnAR stated that the scheme could have potential direct and indirect effects on landscape character arising from:

- Minor removal of vegetation within the motorway
- New gantries and modification of existing signs/gantries resulting in intensification of highway infrastructure
- Increase to four operational lanes increasing perception of the volume/density of traffic
- Indirect effects on landscape character areas and types within the study area
- Increased influence of the motorway through intensification of highway infrastructure and density of traffic

5.53. The EnAR confirmed that the landscape setting had the following characteristics:

- moderate to low landscape quality and value
- moderate to low sensitivity to the scheme
- high capacity to accommodate the scheme
- locally low tranquillity

5.54. The variation discussed above was stated to be due to the changes across the Study Area from the heavily urban fringe and highway influenced areas between Junction 10a to the north of Great Saredon to the open landscape of the River Penk valley to the south of Junction 13.

5.55. Overall, the effects on landscape character in Year 1 of operation were expected to remain moderately significant in the Riparian Alluvial Lowlands Landscape Character Type (LCT) and the Ancient Clay Farmlands LCT (Sub type: Farmlands), due to the presence of highways infrastructure, but would decline to slight adverse/ neutral for the other LCT's along the majority of the scheme.

Visual Impacts

5.56. For 23 representative viewpoints agreed with Staffordshire County Council, visual baselines and visual impacts were assessed for the construction phase, and for year 1 and year 15 of the operational phase.

5.57. During operation, the significance of visual impact was expected to be moderate in Year 1 at just three locations, Viewpoint 2 (PRoW No 2, Acton Moat Bridge), Viewpoint 12 (Sabrina Way), and Viewpoint 17 (Rodbaston Lock).

5.58. For two locations in the vicinity of Great Saredon, a slight beneficial effect on visual amenity was expected in Year 1 arising from removal of an existing gantry; Viewpoint 9 (Malthouse Lane, Saredon Mill), and Viewpoint 18 (Great Saredon).

5.59. At Viewpoint 17 (Rodbaston Lock) there was expected to be a slight beneficial effect on visual amenity by Year 15, derived from increased screening of the motorway.

5.60. For the 18 other viewpoints, the significance of effect during Year 1 was expected to be either slight (10 viewpoints), or neutral (8 viewpoints).

Townscape

5.61. The EnAR did not include Townscape in its assessment.

Consultation

5.62. No responses to consultation requests were received.

Evaluation

Landscape impacts

5.63. Regarding the landscape effects during Year One of Operation on the LCT's along the Scheme that were predicted by the EnAR, the impacts have been reviewed by a combination of desk studies and a site visit and it is considered by POPE that there is no reason to consider that the assessment of the impacts stated by the EnAR are anything other than valid:

- The moderate impacts on the Riparian Alluvial Lowlands LCT and the Ancient Clay Farmlands LCT (Sub type: Farmlands) are considered likely to be as expected at this stage, due to the presence of increased highway infrastructure (primarily in the form of gantries) and the intensification of the effect arising from four-lane running on either side of the carriageway.
- The (variously) neutral to slight impacts on the other LCT's is also likely to be as expected at this stage, due to the degree of topographical/ vegetative screening and the absence of publicly accessible locations in close proximity to the scheme.

Visual impacts

5.64. The visual impacts predicted by the EnAR during Year One of Operation on the 23 representative viewpoints agreed with Staffordshire County Council have also been reviewed by a combination of desk studies and a site visit.

5.65. Regarding the predicted moderate adverse visual impacts, it is considered by POPE that there is no reason to consider that the EnAR assessment is anything other than valid:

- Viewpoint 2 (PRoW No 2, Acton Moat Bridge): As expected, gantries are readily apparent against a backdrop of roadside vegetation, as are vehicular movements. The carriageway surface is not visible, so the 8-lane extent of the motorway corridor has not increased the visual impact when compared with the baseline situation.

- Viewpoint 12 (Sabrina Way): As expected, there has been no impact from the increase in the surface area of the motorway, although vehicular movements are marginally closer and can be viewed across eight lanes rather than six. The constituent elements of the view have not changed, and the overall balance of features and elements comprising the view has not been altered.

- Viewpoint 17 (Rodbaston Lock): As expected, the presence of highway infrastructure has increased, and is prominent in the views from the lock. Other elements of the Scheme have not added to the baseline visual impact, although vehicles using the former hard shoulder are marginally closer to the viewpoint. While the screening function of the proposed mitigation planting would not be effective at this OYA stage, as discussed below the planting proposals do not yet appear to have been fully implemented - it is therefore suggested that this be re-evaluated at FYA.

5.66. Regarding the predicted slight adverse to neutral visual effects, these are as expected – please refer to Appendix E for further details.

5.67. Regarding the predicted slight beneficial impacts however, for reasons unknown to POPE it can be seen from the photographic record of the Scheme (found in Appendix E) that the concrete gantry (G18E) has not been removed and the expected, slight beneficial visual impacts resulting from its removal have not been realised; as such, these impacts are considered to be worse than expected. In all other respects, however, the impact of the Scheme is as expected at these locations:

- Viewpoint 9 (Malthouse Lane, Saredon Mill): The widened carriageway is not visually apparent from this location.

- Viewpoint 18 (Great Saredon): The slight increase in proximity of vehicular movements to Great Saredon is not significant given the relative distance involved.

Townscape Impacts

5.68. The AST stated that the Scheme would not have an impact on Townscape, and Townscape was not assessed in the EnAR.

5.69. No further evaluation has been undertaken, as no changes from the AST regarding Townscape were identified during the site visit.

Mitigation

5.70. Where landscape and visual impacts were identified in the EnAR, mitigation measures, including the retention of existing vegetation, were incorporated into the Scheme design to avoid, minimise, or reduce potentially adverse impacts.

5.71. Based on the As-built Site Clearance drawings and observations made during the OYA site visit, it is considered that existing vegetation has been retained wherever possible, and that this vegetation continues to provide a landscape framework for the motorway corridor as expected - please refer to Appendix E where selected EnAR photomontages and OYA comparison views illustrate the extents of the retained vegetation from a number of viewpoints at varying distances from the Scheme.

5.72. Where vegetation was not able to be retained, mitigation measures comprised reinstatement planting as identified in the EnAR, a discussion of which follows.

Handover Environmental Management Plan

5.73. The HEMP stated that it was primarily concerned with the strategy for future maintenance and management of the soft estate by Highways England's Asset Support Contract (ASC) Agent for a period of 5 years following issue of the Maintenance Certificate.

5.74. Regarding the landscape planting and aftercare period, the HEMP stated that the responsibility for the aftercare had been transferred to the ASC providers, who:

- Had been awarded the contract to undertake the landscape planting for the Scheme and as such, held the guarantees for stock replacement due to any failures;
- Had been issued with the Series 3000 Specification (Landscape and Ecology) and the landscape design plans prior to the works being awarded; and
- Were responsible for developing a Landscape Management Plan (LMP) to cover the landscape maintenance (including mitigation for any ecological constraints) in accordance with the Series 3000 Specification.

5.75. While the LMP was not included in the HEMP (or available to POPE for the purposes of this evaluation), the Series 3000 Specification was appended to the HEMP for reference.

5.76. The HEMP listed the details of all the landscape and environmental Elements and their Functions constructed as part of the Scheme, and included all maintenance requirements, including timescales, to achieve and maintain those Functions, and the methods and criteria for monitoring compliance.

5.77. The Function of the majority of the Landscape planting was stated in the HEMP as primarily Visual Amenity (with a secondary Function of Landscape Integration), and it was noted that Landscape maintenance was to be undertaken during the five-year maintenance period by the ASC in accordance with the Series 3000 Specification.

Amenity Grassland

5.78. The HEMP stated that:

- Grassland establishment/ species should be appropriate to the location and intended maintenance regime, the sward of which should be evenly graded and uniformly coloured to cover at least 95% of the relevant area. The species mix should contain a maximum of 10% herb species, with no scrub.
- In terms of timescales, all Amenity Grass Areas shown on Landscape design drawings was to be sown at end the of the construction period, and full cover should have been established in year 1 of the maintenance period, with remedial works undertaken where required.
- Grassland was to be managed by high frequency cutting to ensure that the sward did not exceed a height of 250mm, including cutting and spraying around all street furniture.
- Routine maintenance was to comprise spot treatment of undesirable species and hand pulling of ragwort (where required). Total weed control was to be applied around all hard-standings and infrastructure, and litter, rubbish, and detritus was to be removed.
- Monitoring was to be cyclical and in accordance with the Network Management Manual to identify self-set scrub species and to inform management as required

5.79. Regarding Figure 5-3, the areas of new grassland visible from publicly accessible locations were observed during the site visit to be generally:

- Evenly graded, uniform in colour, covering not less than 95% of the relevant area, and not exhibiting scrub
- Fully covered and established throughout the relevant areas
- Maintained, with areas around street furniture/ highway infrastructure clear of vegetation
- Tidy and litter free

5.80. The site visit was unable to confirm the proportion of herb species in the mix or the height of the (maintained) sward in the relevant areas, and no information was made available to POPE regarding any remedial works that may have been undertaken.

5.81. The site visit found the areas of grassland (and the road corridor generally) to be free of noxious weeds, although occasional instances of ragwort infestation were noted (as illustrated by Figure 5-3). The scale of the observed colonies and highly sporadic nature of individual plants is considered to indicate that while this particular weed is broadly under control at the time of writing, ongoing management and maintenance in accordance with the interim HEMP will be required to exclude the plant from grassland areas in the long-term. It should be noted that localised occurrences similar to those observed during the site visit are likely to remain evident throughout the scheme in locations where ragwort can be found on adjacent land outside the highway boundary.

5.82. It is therefore considered that the Environmental Functions of the areas of new grassland, i.e. Visual Amenity and Landscape Integration, are likely to be broadly as expected at this stage.

Figure 5-3 Areas of new amenity

5.83. Areas of new amenity grassland generally appear to have established well, are generally tidy and litter free, and appear to be receiving maintenance operations as prescribed (left). Verges are generally free of noxious weeds, although sporadic ragwort plants were observed on occasion (right, just at the top of the embankment)

Planting Plots

5.84. The site visit observed little evidence of mitigation planting having been undertaken at locations where planting plots should have been able to be observed from publicly accessible locations.

5.85. Representative instances where planting was proposed by the landscape mitigation drawings, but where the site visit observed that no planting had been undertaken, are illustrated by Figure 5-4 and Figure 5-5.

Figure 5-4 Lack of planting

5.86. The landscape mitigation drawings indicate that a Waterside Mix (30% Alder, 20% Oak, 20% Blackthorn, 15% Birch, & 15% Hazel at 1,500mm centres in single species groups of five to ten of 60-90cm high transplant stock) should be planted just south of Micklewood Lane, along the embankment of the northbound carriageway near Gantry G37N (pictured); it can be seen that the planting has not been implemented.

Figure 5-5 Lack of tree planting

5.87. The landscape mitigation drawings indicate that eleven Individual Trees of Oak, Beech (both 425-600cm high rootballed stock), and Alder (150-175 cm high rootballed stock) should be planted just north of Gailey Lea Lane, along the embankment of the northbound carriageway around and to the north of Gantry G33N (pictured); the trees have not been planted.

5.88. The single instance where planting was observed by the site visit to have been undertaken at the location indicated by the landscape mitigation drawings is illustrated by Figure 5-6, below. While the condition of the plant stock and the constituent species of the planting mix were not able to be confirmed (a Linear Belt of Trees & Shrubs was proposed), individual protective plant spirals, as specified in the Series 3000 Specification (and appended to the HEMP), were observed.

Figure 5-6 Protective plant spirals

5.89. While not clear from the main picture (left), it can be seen from the enlarged view (right) that individual protective plant spirals in accordance with the Series 3000 Specification are present (the broadly vertical grey line in the lower right quarter of the enlarged picture, highlighted).

5.90. Despite there being no target plant coverage within a specific time period being stated by the HEMP, given that the planting proposals have apparently not yet been fully implemented at this OYA stage can only mean that any Visual Amenity or Landscape Integration functions of the planting are also not developing as would be expected.

5.91. That said, it is possible that planting plot implementation is a work in progress that is due to be completed in the 2017/ 2018 planting season (although this was not able to be confirmed by POPE). If this is the case, it is considered that as planting would only have been delayed by a season or two, such a delay would be unlikely to materially affect the environmental Functions of the planting plots by design year, subject to ongoing management and maintenance in accordance with the HEMP; consideration should therefore be given to re-evaluating this aspect of the Scheme at FYA to establish whether landscape mitigation has been fully implemented, and whether the planting plots are on track to fulfil their environmental functions by the design year.

Agreements with Private Landowners

5.92. The HEMP stated that a commitment was made between Highways England and the owner/ tenant of a residential property in Penkridge to the planting of three tall conifers on the property boundary to help shield views of a gantry. The HEMP also noted that there was no formal agreement between the property owner/ tenant and Highways England, and that Highways England's commitment was limited to the supply and planting of the trees only (i.e. without any commitment to on-going maintenance).

5.93. Neither the desktop study nor the site visit undertaken as part of this evaluation could confirm whether this planting had been carried out or not.

Summary

Landscape

5.94. Whilst the majority of the landscape and visual effects of the Scheme are as expected, the slight beneficial visual impacts expected to result from the removal of the concrete gantry (G18E) have not been realised for receptors in Great Saredon or on Malthouse Lane, Saredon Mill; the visual impacts of the Scheme are considered to be neutral (i.e. slightly worse than expected) at these locations.

5.95. There is no evidence to suggest that the amenity grassland areas are not being maintained as specified by the HEMP, and it is considered that they have generally established and are performing in line with expectations throughout the scheme.

5.96. Landscape mitigation measures do not appear to have been fully implemented and are consequently not on track to perform the environmental Functions for which they were intended. While this aspect of the Scheme is therefore considered to be worse than expected at this OYA stage, there is no reason why the mitigation proposals would not be able to perform as expected by design year, subject to the implementation of the planting proposals during the 2017/ 2018 planting season and the ongoing management and maintenance thereof in accordance with the HEMP.

5.97. Overall, it is therefore concluded that the landscape and visual amenity effects of the Scheme are worse than expected at this OYA stage, as mitigation measures do not yet appear to have been fully implemented (although this could be remedied by timely and appropriate remedial action), and the slight beneficial visual impacts resulting from the removal of gantry (G18E) have not been realised).

Townscape

5.98. The townscape impacts of the scheme are neutral, as expected.

Table 5-2 Evaluation Summary: Landscape and Townscape

Sub-Objective	AST	OYA
Landscape	Slight adverse	Worse than expected
Townscape	Neutral	As expected

Heritage of Historic Resources

Forecast

Appraisal Summary Table

5.99. The AST stated that the scheme would not involve any new land-take, and that any intrusive works would be within areas of previously disturbed ground. The existing M6 formed part of

the context of the area and as such, key impacts were considered to be those which would increase existing effects of the road.

5.100. Overall, the AST assessed the impact of the Scheme on the heritage resource as slight adverse.

Environmental Assessment Report

5.101. The EnAR stated that it had assumed the Scheme would not involve any new land-take, and that any intrusive works would be within areas of previously disturbed ground. As such, physical impacts to the cultural heritage resource were expected to be limited. The assessment of effects took into consideration the value of the asset, the baseline conditions, particularly with regard to the existing M6 corridor, and the scale of the proposals.

5.102. No significant effects on the cultural heritage resource were identified. After mitigation had been considered, a total of nine neutral and four slight adverse effects were identified by the EnAR.

5.103. In accordance with the National Planning Policy Framework7, the impact on cultural heritage was not considered to be substantial.

5.104. Overall, the EnAR assessment of the effects of the Scheme on cultural heritage assets was Slight Adverse after mitigation.

Consultation

5.105. Staffordshire County Council (SCC) confirmed that "…the environmental statement was amended in the light of information provided in the SCC Environmental Advice Team response (dated 23rd November 2012) and concluded that there would be minimal direct impact and low indirect impact upon the setting of designated heritage assets or indeed upon the non-designated heritage assets within the area of the scheme." SCC agreed that the scheme appeared to have had had minimal impact upon known heritage assets within the area.

5.106. The SCC further stated that "No archaeological work was completed beyond the desk-based element associated with the preparation of the Environmental Statement." SCC confirmed that they were "yet to receive a final copy of the Historic Environment Desk-Based Assessment prepared for the scheme", and requested that "This should be forwarded to this office as soon as possible (one hard copy and a pdf version on CD-ROM) for inclusion on the Staffordshire Historic Environment Record."

Evaluation

5.107. The EnAR stated that while no specific mitigation measures were proposed for the cultural heritage resource, mitigation measures designed to avoid or reduce adverse impacts on built heritage assets were incorporated into the scheme during design development:

- New structures were located to reduce visual impacts on known heritage assets; and
- Landscape proposals were to screen key assets, and reduce impacts that would affect cultural heritage.

5.108. The EnAR assessed the significance of the effects of the Scheme on those listed features that were predicted to receive an increased impact. Assets receiving slight adverse effects at the operational phase were expected as follows:

[7] The National Planning Policy Framework sets out the Government's planning policies for England and how these are expected to be applied. It sets out the Government's requirements for the planning system only to the extent that it is relevant, proportionate and necessary to do so. It provides a framework within which local people and their accountable councils can produce their own distinctive local and neighbourhood plans, which reflect the needs and priorities of their communities.

- The direct impact of Gantries G4-26 and G4-25 on the Grade II listed Acton Moat Bridge was considered to be minor, resulting in a slight adverse significance of effect.
- The impact of Gantries G4-22, G4-24, G4-25 and G4-26 on the Grade II* listed Church of St James, Acton Trussell was considered to be minor, resulting in a slight adverse significance of effect.
- The impact of Gantries G4-22, G4-24, G4-25 and G4-26 on the Moat House scheduled monument (an asset of high value) was considered to be negligible, resulting in a slight adverse significance of effect.
- The impact of the noise barrier at Penkridge on the Grade II listed Wolgarston Farmhouse (an asset of medium value) was considered to be minor, resulting in a slight adverse effect.

5.109. The impacts of the Scheme on the Heritage resource have been reviewed by a combination of desk studies and a site visit, and regarding the predicted impacts during operation, it is considered by POPE that there is no reason to consider that the EnAR assessment is anything other than valid. In terms of the predicted slight adverse effects:

- Acton Moat Bridge: Regarding Viewpoint 2, Appendix E – as expected, the new gantries and vehicular movements are clear against a backdrop of roadside vegetation, and the visual impact on the setting of the structure has increased. Also as expected, the carriageway surface is not visible, so the new 8-lane extent of the motorway corridor has not increased the visual impact when compared with the baseline situation;
- Church of St James: Regarding Viewpoint 11, Appendix E – the nature of vegetation cover within the shallow valley of the River Penk is likely to afford filtered (winter) views towards the existing gantries. It is therefore considered that the combination of viewing distance and the retention of existing screening, as well as the nature of the impacts, are as expected;
- Moat House: Visual impacts are derived from partial visibility of the gantries on embankment through the partial intervening screening vegetation along the Staffordshire and Worcestershire Canal. The overall impact from vehicular movement, given that the highway surface is likely not visible, is considered to be similar to the baseline, as expected; and
- Wolgarston Farmhouse: The asset is located approximately 1km to the east of the M6 at Penkridge, and it is considered that the carriageway surface is unlikely to be visible from the asset, and so the visual impact of the new 8-lane extent of the motorway corridor has likely not increased when compared with the baseline situation. While the proposed noise barrier may be visible in views from the building, the significance of any impact on the asset is considered to be reduced, given the existing impacts of the carriageway, the distance involved, and the nature of the intervening vegetation

5.110. As noted in the Landscape sub-objective, above, the planting proposals (designed to screen and reduce visual impacts on key assets) do not appear to have been fully implemented and as such, are consequently not on track to perform the functions for which they were intended. While this is considered to be a failing of the Scheme (with heritage impacts consequently considered worse than expected at this OYA stage), there is no reason why the mitigation proposals would not be able to perform as expected by design year, subject to the implementation of the planting proposals during the 2017/ 2018 planting season and the ongoing management and maintenance thereof in accordance with the HEMP.

5.111. Regarding the comments received at consultation, SCC:

- As expected, there appears to have been minimal impact upon known heritage assets within the area.
- POPE is unaware of the Historic Environment Desk-Based Assessment referred to, although the document may be available for evaluation at the FYA stage when publication and deposition (or otherwise) with Staffordshire Historic Environment Record should be confirmed.

Summary

5.112. The impacts of the scheme on the Heritage resource have been reviewed by a combination of desk studies and a site visit, and it is considered by POPE that there is no reason to consider that the operational impacts of the Scheme as predicted by the EnAR are anything other than as expected at this stage.

5.113. In terms of mitigation however, the planting proposals (designed to screen and reduce visual impacts on key assets) do not appear to have been fully implemented and as such, this is considered to be a failing of the Scheme. That said, there is no reason why the mitigation proposals would not be able to perform as expected by design year subject to the implementation of the planting proposals during the 2017/ 2018 planting season, and the ongoing management and maintenance thereof in accordance with the HEMP.

5.114. The Historic Environment Desk-Based Assessment referred to by SCC in their response to consultation may be available for evaluation at the FYA stage, when publication and deposition (or otherwise) with Staffordshire Historic Environment Record should be confirmed.

5.115. Overall, it is therefore concluded that while the effects of the Scheme on heritage assets are worse than expected at this OYA stage, this could be remedied by timely and appropriate remedial action.

Table 5-3 Evaluation Summary: Heritage and Historic Resources

Sub-Objective	AST	OYA
Heritage of Historic Resources	Slight adverse	Slightly worse than expected, but could be remedied by full implementation of the planting proposals.

Ecology & Nature Conservation

Forecast

Appraisal Summary Table

5.116. The AST stated that the Scheme would not have any direct or indirect impacts on any statutory designated site, and that impacts on non-statutory sites and protected species such as Badgers and Great Crested Newts (GCN's) could be adequately mitigated

5.117. Overall, the AST assessed the impact of the Scheme on biodiversity as neutral.

Environmental Assessment Report

5.118. The EnAR concluded that there would not be any significant impacts on any statutory sites, with most considered to be distant from the scheme. While it was stated that emissions modelling had included a section of the M6 toll for assessment purposes and there was a Special Area of Conservation (SAC) approximately 290m from this road, it was stated that the SAC was beyond the agreed distance for assessment of effects.

5.119. The EnAR noted that there were 15No. non-statutory designated sites within 1km of the scheme but for most part, distance and lack of any connectivity meant that no significant impacts were predicted. In the instances where there was the potential for impacts, these were stated to be small and localised, and a combination of good practice site control measures (particularly surface run-off and simple mitigation measures) would reduce the risk of any impact to insignificant.

5.120. Protected and notable species were recorded along/ adjacent to the scheme, and a habitat assessment determined areas that had the potential to support such species. For most of

these species, the risk of any effects was assessed as low and unlikely to be significant and a combination of good practice site control measures and simple mitigation measures would reduce the risk of any impact to insignificant.

5.121. Due to the limited survey and/ or access, for some species (including bats and GCN's) a risk based assessment was used. For bats, no evidence of roosts had been found but as a number of trees were identified in/ nearby work areas with low potential for roosting bats, a watching brief on any of these trees that would require felling was considered to be sufficient to comply with guidelines and legislation.

5.122. For GCN's, restricted access and seasonal survey requirements meant that a risk based assessment was more critical. The EnAR assessment used published guidance provided by Natural England and of the approximately 109 water-bodies originally identified, 28 of these were stated as representing a constraint to works should they be found to be holding a population of GCN's. This would be as a result of harm/ disturbance to individuals or small numbers of animals which whilst an offence, would not result in an adverse impact on the population status overall. Further work was proposed, and options provided to reduce the risk even further where GCN's could be present in work areas.

5.123. Overall, the potential impact of the Scheme on identified features of nature conservation value during both the construction and operational phases was stated as being limited, and no residual adverse impact was predicted provided that appropriate avoidance/ reduction/ mitigation measures were implemented. There would be a slight beneficial residual impact for Otherton Farm (resulting from the proposed wetland enhancement measures) and on Bats (resulting from the installation of bat boxes).

Consultation

5.124. No responses to consultation requests were received.

Evaluation

Statutory Designated Sites

5.125. Given the distance between the site and the proposed works, the EnAR stated that no impact on Statutory Designated Sites was foreseen, and the significance of any effect would be neutral.

5.126. No further evaluation has been undertaken, as based on the information made available to POPE this would appear to be the case.

Non-Statutory Designated Sites

5.127. Otherton Farm (south of the) Staffordshire & Worcestershire Canal Site of Biological Importance (SBI) is located alongside the north bound carriageway, and partly falls within the Highway estate boundary. Prior to the Scheme, the site comprised a strip of scrub woodland and tall herb communities between the Staffordshire & Worcestershire canal and the motorway, and a section of the canal itself. In the area of the SBI, a new gantry (G37), along with four linear slot drains and some ducting, was proposed.

5.128. The EnAR noted that there would be an adverse impact on the SBI through the loss of habitat, but did not class this habitat as being of high quality or of high nature conservation interest, stating that the area to be lost would be small. Management of the wetland area within the highways estate was expected to be beneficial for the SBI, was to be specified in the CEMP, and was to be carried out under ecological supervision.

5.129. The As-built site clearance drawings indicate that the area was cleared, as expected, and the area cited in the Landscape sub-objective, above where while grassland has established well in this area, mitigation measures (i.e. the Waterside Mix proposed for this area) does not yet

appear to have been implemented. As such, and as predicted by the EnAR, it is considered that the effect on the SBI is slight adverse without this mitigation measure.

5.130. While the CEMP may be available for the FYA evaluation, the CEMP was not available to POPE for the purposes of this OYA evaluation and as such, it has not been possible to confirm whether the expected beneficial effects to the SBI arising from wetland management operations have been realised at this stage.

5.131. Overall therefore, it is considered that any beneficial effects as a result of the Scheme are unlikely to have been fully realised for the SBI, as mitigation measures have not yet been implemented at this location. While this aspect of the Scheme is therefore considered to be worse than expected at this OYA stage, there is no reason why the expected beneficial effects may not be realised by design year, subject to the implementation of the planting proposals during the 2017/ 2018 planting season and the ongoing management and maintenance thereof in accordance with the HEMP.

Ancient Woodland

5.132. The EnAR noted that there was one ancient woodland site, Burn's Wood, (located immediately adjacent to the scheme both sides of the carriageway between Junction 10a and Hilton Park service station), where potential impacts were expected to be temporary as a result of disturbance due to ducting works undertaken within highway boundary. Mitigation was stated as seeking to avoid the felling of any trees and restricting disturbance to tree roots by adopting good working practices. However, no direct impact within the woodland boundary was expected, and the significance of any effect was expected to be neutral.

5.133. No further information was available to POPE for the purposes of this evaluation, and as such it has not been possible at this stage to confirm what, if any, impacts there might have been on Burns Wood. It therefore is suggested that this aspect could be reconsidered at FYA, when any long-term effects of root severance may be manifest, and information regarding lopping/ felling may be available.

Habitat

5.134. Except where noted for Non-Statutory Designated Sites and Ancient Woodlands, as discussed above, the EnAR provided no specific mitigation measures for the loss/ disturbance to habitats.

5.135. However, the EnAR did state that all trees adjacent to works which were to be retained should be protected from damage in accordance with BS5837:2012; no further information was available to POPE for the purposes of this evaluation, and as such it has not been possible at this stage to confirm what, if any, impacts there might have been on retained trees.

5.136. The EnAR stated that the loss of small numbers of trees and areas of scrub was to be mitigated for by judicious tree planting as part of the landscape proposals and by allowing redevelopment of scrub habitats within the soft estate. As noted in the Landscape sub-objective, above, the full range of mitigation measures do not appear to have been fully implemented as yet and while this is therefore considered to be worse than expected at this OYA stage, there is no reason why the mitigation proposals would not be able to perform as expected by design year, subject to the implementation of the proposals during the 2017/ 2018 planting season and the ongoing management and maintenance thereof in accordance with the HEMP.

5.137. Where ground was to be disturbed and where reinstatement of verges was required, the EnAR suggested that consideration should be given to the use of a species rich grass mix to promote biodiversity; as also noted in the Landscape sub-objective, grassland areas have generally established and are performing in line with expectations throughout the scheme, although the species composition of the sward remains to be confirmed.

Bats

5.138. The EnAR identified 18No. locations along the Scheme with the potential for bat roosts to be present in the mature/ semi-mature trees that could be impacted by the works. All but one of the trees potentially impacted were assessed as having low potential for roosting Bats, with one tree having medium potential. It was therefore recommended that the trees identified as having low/ medium bat roost potential should be retained wherever possible, but should be section felled in the presence of a licensed bat ecologist if they were unable to be retained.

5.139. The EnAR also stated that if, at any stage, Bats or evidence of Bats was found in a tree that could not be retained/was near the works, then a licence would be required to exclude Bats and stop up the roost, at least temporarily. Recommended mitigation was stated as providing at least two Woodcrete-type bat boxes on retained trees at the location of an existing (felled) roost, the residual effect of which was predicted to be Slight Beneficial.

5.140. The HEMP, noting that the Register of Environmental Actions & Commitments (REAC) required bat boxes to be monitored at (unspecified) intervals after installation, stated that "No bat trees were lost to the Scheme, therefore the requirement for bat boxes was not actioned".

5.141. The impact of the Scheme on Bats is therefore considered by POPE to be neutral, rather than Slight Beneficial as predicted by the EnAR, as it would appear that no trees containing bat roosts were lost as a result of construction, so no bat boxes were installed by way of mitigation. However, it should be acknowledged that while the slight beneficial effects of bat box installation have not been realised and the effects of the Scheme are technically worse than expected, this is not considered by POPE to be a failing of the Scheme.

Great Crested Newts

5.142. The EnAR predicted that only very small areas of available GCN habitat were to be temporarily or permanently lost as a result of the Scheme (less than 10% in all cases and less than 5% in most cases), and stated that there was no risk of a significant impact on the GCN population status as a whole, but rather to individual/ small numbers of animals should they be present within the work areas.

5.143. 2No. options were proposed to further reduce the risk to GCN's as part of the mitigation strategy:

- An additional period of habitat survey to ascertain the presence or otherwise of GCN's; and
- Rendering the small areas of habitat to be lost/ disturbed unsuitable prior to commencement of the works.

5.144. Based on these "*reasonable avoidance measures*", the EnAR predicted that the impact of the Scheme on GCN was likely to be neutral.

5.145. The HEMP did not mention GCN's, and no further information has been received by POPE for the purposes of this evaluation and therefore, the impact of the Scheme on the GCN population cannot be confirmed at this OYA stage, it is therefore suggested that this be re-examined at the FYA stage.

Reptiles

5.146. The EnAR stated that the small loss of habitat meant that there was no threat to any populations present, but rather to individual/ small numbers of any reptiles present in the areas to be lost/ disturbed. A method statement was stated to be provided to minimise any risk to reptiles from the work, which was to be included as part of the Construction Environmental Management Plan (CEMP) and that and if necessary, work would be carried out under the supervision of a clerk of works.

5.147. The CEMP was not available for the purposes of this evaluation and POPE cannot confirm the impact of the Scheme on reptiles at this OYA stage.

Water voles

5.148. The EnAR stated that no evidence for Water vole had been found in water-bodies that would be impacted by the Scheme, and so no detailed mitigation was provided. However, the EnAR also stated that there was a risk of affecting the species should individuals colonise areas of suitable habitat prior to work occurring, and that further Water vole surveys would be required in March 2014 at the zones identified as being at risk; should the surveys identify the presence of Water voles, then a method statement was to be agreed with Natural England.

5.149. No Water vole surveys were available for the purposes of this evaluation, and POPE is unaware of any method statement being agreed with Natural England. In the absence of evidence suggesting otherwise, although it is considered unlikely that water voles were found to be present this remains unconfirmed.

Otters

5.150. The EnAR identified two key areas where works might impact otters:

- The River Penk was noted as having been surveyed and as no Otter evidence was found, no mitigation was required at this location.
- Between Chainages 12,400-13,900, the risk of Otters being present was stated as being low. This location was to be surveyed and if Otter evidence was found, appropriate (but unspecified) avoidance/ mitigation measures would be necessary. The EnAR considered the small scale and temporary works at this location made it unlikely that a licence would be required.

5.151. No Otter surveys were available for the purposes of this evaluation, and POPE is unaware of any avoidance/ mitigation measures being implemented. In the absence of evidence suggesting otherwise, although it is considered unlikely that otters were found to be present this remains unconfirmed.

White Letter Hairstreak[8]

5.152. The EnAR identified 4No. areas (gantry locations G49 & G50) where works had the potential to have an impact on White-letter Hairstreak habitat. Elm is the only food plant of the larvae of White-letter Hairstreak and the species does not disperse widely so where elm trees were to be lost to the Scheme, the EnAR stated that replacements would be planted in the immediate vicinity.

5.153. The HEMP, noting that the REAC required reinstatement and establishment of Elm trees in accordance with a management and maintenance plan, stated that "*No Elm trees were lost to the Scheme, therefore reinstatement was not actioned*".

5.154. The impact of the Scheme on White-letter Hairstreak habitat is therefore considered by POPE to be neutral, as predicted by the EnAR, as it would appear that no Elm trees were lost as a result of construction, so no replacement planting of Elm trees by way of mitigation was required.

Hedgehogs

5.155. The EnAR stated that the small loss of habitat meant that there was no threat to any populations present, but rather to individual/ small numbers of any hedgehogs present in the areas to be lost/ disturbed. A method statement was stated to be provided to minimise any risk to Hedgehogs from the work and if necessary, work was to be carried out under the supervision of a clerk of works.

5.156. No method statement was available for the purposes of this evaluation and in the absence of evidence suggesting otherwise, it is therefore considered that while unconfirmed, there is no

[8] A dark-coloured little butterfly that spends most its life at the top of Elm trees.

reason to suppose that the impact of the Scheme on hedgehogs is anything other than as expected.

Nesting Birds

5.157. The EnAR stated that should tree and vegetation clearance need to be undertaken during the nesting season (March - September), a survey would be undertaken for nesting birds prior to any work commencing, and if any nesting birds were found at this time, an area around the nest would be marked off and no work would be undertaken within this area until such time as any young had fledged.

5.158. No further information was available to POPE for the purposes of this evaluation and in the absence of evidence suggesting otherwise, it is therefore considered that while unconfirmed, there is no reason to suppose that the impact of the Scheme on nesting birds is anything other than as expected.

Non-Native invasive species

5.159. The HEMP stated that non-native invasive species (Japanese Knotweed, Giant Hogweed, and Himalayan Balsam) had been recorded within the Scheme boundary, and that these were to be dealt with in accordance with current legislation by the ASC under their LMP.

5.160. These non-native invasive species were to be treated annually or removed as required during maintenance operations. The control method was stated in the HEMP to be an annual herbicide treatment programme, in line with the LMP, and cyclical monitoring in accordance with the Network Maintenance Manual was be undertaken to identify any further maintenance requirements.

5.161. No instances of Japanese Knotweed, Giant Hogweed, or Himalayan Balsam were noted during the site visit to publicly accessible locations, and no further information was available to POPE for the purposes of this evaluation. It is therefore suggested that this aspect be reconsidered at the FYA stage when further information may be available to confirm what control treatments have been undertaken.

Badgers

5.162. Badgers, a legally protected species, were not referred to in the EnAR but may have been discussed in another (confidential) document that has not been available to POPE for evaluation.

5.163. The Series 3000 Specification (Landscape and Ecology) that was appended to the HEMP stated that a licence would be (legally) required to close four badger sett entrances within the Scheme extents, but noted that the entrances were so close to the main sett that the creation of an alternative sett was not required. No such licence has been viewed by POPE for the purposes of this evaluation.

5.164. The HEMP also noted that the REAC required badger activity to be monitored following works in order to determine use and maintain safety for road users. While no monitoring information was available to POPE for the purposes of this evaluation, information may be available at the FYA stage and could be considered at that time.

5.165. In the absence of evidence, POPE has been unable to confirm the impact of the Scheme on Badgers and it is therefore suggested that this be re-examined at the FYA stage.

Aftercare and Landscape Management Plan

5.166. As stated by the HEMP (and detailed in the Landscape sub-objective, above), the responsibility for the aftercare (5-years) has been transferred to the ASC and as such, they are required to produce a LMP to cover the landscape (habitat) maintenance, including mitigation for notable flora and protected species. The LMP was not available to POPE for the

purposes of this study, although it may be available at the FYA stage to further inform this evaluation of the impact of the Scheme on the Ecology and Nature Conservation sub-objective.

5.167. The HEMP noted that as the habitat (i.e. the soft estate) matured, there was the potential for mobile fauna to be present at locations other than those identified by the ecological constraints plans; it was stated that any works undertaken within the landscape asset should take this into account.

5.168. The HEMP also noted that Badgers were present within the Scheme boundaries, and that any works undertaken should take account of this species and where necessary, advice should be sought from a suitably qualified ecologist as current legislation has implications for construction or preparation works undertaken in the vicinity of an active sett (according to the type of activity and distance from the sett entrance). Any works resulting in ground penetration, vibration or noise near an identified badger sett entrance(s) were noted as having the potential to disturb badgers, and the HEMP stated that advice should be sought from a suitably experienced ecologist under such circumstances and that if disturbance to an active sett was probable, then a licence may need to be obtained from Natural England before any works commenced.

Animal Mortality

5.169. No animal mortality data has been received for evaluation by this study; it is suggested that this aspect could be reconsidered at the FYA stage.

Summary

5.170. Additional documentation (such as the CEMP and LMP) may be available at the FYA stage to further inform this evaluation of the ecological impact(s) of the Scheme.

Habitat

5.171. The proposed mitigation measures (including those at Otherton Farm SBI) have yet to be fully implemented and as such, the predicted effects of the Scheme (including the beneficial effects at Otherton Farm SBI) have not been realised at this OYA stage. While this is therefore considered to be worse than expected, there is no reason why the mitigation proposals would not be able to perform as expected by design year, subject to the implementation of the proposals during the 2017/ 2018 planting season and the ongoing management and maintenance thereof in accordance with the HEMP.

5.172. Overall, it is therefore concluded that while the effects of the Scheme on habitat are worse than expected, this could be remedied by timely and appropriate remedial action

Species

5.173. Regarding the impact of the Scheme on Bats and White Letter Hairstreak habitat, no trees containing bat roosts or Elm trees were lost as a result of construction, so no bat box installation or replacement of Elm tree planting (as required by the REAC) was necessary.

5.174. Although the slight beneficial effects of bat box installation predicted by the EnAR have not been realised and the effects of the Scheme are technically worse than expected, this is not considered by POPE to be a failing of the Scheme as no trees with bat roost potential were lost to the Scheme.

5.175. Based on the evidence available, the effects of the Scheme on Badgers and all the species considered by the EnAR are therefore considered to be likely as expected, although further evidence (which may be available at the FYA stage) is required to confirm.

Table 5-4 Evaluation Summary: Biodiversity

Sub-Objective	AST	OYA
Biodiversity	Neutral	Habitat Slightly worse than expected, but could be remedied by full implementation of the planting proposals. Species Likely to be as expected, but confirmation required.

Road Drainage and the Water Environment

Forecast

Appraisal Summary Table

5.176. The AST stated that there would be a slight increase in surface runoff due to ERA's, but that there would be no change in the risk of pollution to either surface or groundwater. The AST also confirmed that work would be confined to the motorway corridor, and that the design and mitigation measures would ensure that the risk of pollution to surface and ground water would remain negligible.

5.177. The AST concluded that the Scheme would have a **neutral** impact on the water environment overall.

Environmental Assessment Report

5.178. The EnAR noted that MM-ALR Schemes did not usually alter road drainage assets and therefore the impact on water courses, flood plains and water features from such activities was neutral. It concluded that any potential impacts would be short term and may occur during the construction process.

5.179. The EnAR also concluded that while the construction of ERA's would slightly increase road run off, the impact on surface and groundwater was considered insignificant due to the existing drainage features not being altered in any way, that work would be within the confines of the motorway corridor, and that the design and mitigation measures would ensure that the risk of pollution to surface and ground water would remain negligible. Additional flow rates from ERA's were to be attenuated, and were not expected to result in any increased flow rates.

5.180. The EnAR stated that the Scheme would have **neutral** effect on the surrounding water environment.

Consultation

5.181. No responses to consultation requests were received.

Evaluation

5.182. The Scheme proposed construction of 7No. ERA's, 3No. on the north bound carriageway, and 4No. on the south bound carriageway, and the EnAR stated that each ERA would increase the impermeable surface area of the motorway by 300m² and would take the flow from the four main line lanes of the carriageway. This additional 1 in 5-year flow plus 20% for climate change would be attenuated within the proposed combined kerb and drainage unit (noted as having a high storage capacity). In essence, this meant that there would be no increase of run off flow rate to the existing outfalls.

5.183. In terms of discharge flows from the ERA's, the EnAR noted that this was expected to vary between ERA's, depending on whether they were in cut or on embankment. Those that were in cut would reconnect with the existing verge drainage, and those that were located on embankments would be discharged to existing piped and/ or toe ditches. The existing passive treatment systems were expected to allow the settling out of contaminants during infiltration.

5.184. The EnAR stated that it was assumed from HADDMS[9] and (the existing pre-Scheme) as-built drawings that the flows from these drainage assets would discharge to the River Penk, Saredon Brook, and the Staffordshire and Worcestershire canal and that existing passive treatment systems would allow the settling out of contaminants during infiltration

5.185. The EnAR considered that the potential magnitude impacts of the risks to surface and ground waters during construction were negligible, and could be addressed by implementing relevant Environment Agency Pollution Prevention Guidance and carrying out works in accordance with best practice.

5.186. The CEMP was not available to POPE for the purposes of tis evaluation and as such, any construction impacts of the Project on the water environment cannot be confirmed.

5.187. In terms of drainage operation and maintenance, the HEMP confirmed that all new built road drainage outfalls had been connected to existing ditches or existing carrier pipelines, and supplied the manufacturer's Operations and Maintenance Manual for the gate valves used as Pollution Control Devices (PCD's).

5.188. No as-built drainage drawings were available for this evaluation, and no information indicating whether any incidents that may have affected the drainage system during post-opening have been received by POPE.

5.189. All drainage facilities noted during the OYA site visit appeared to be generally clear of vegetation/ litter/ detritus, with no evidence to suggest that the facilities are unable to function in any way other than as expected.

5.190. Based on the site visit and the information provided by the EnAR and the HEMP, it is concluded that the overall effect of the scheme on water quality and drainage is likely to be **as expected,** but further detail would be required to confirm.

Table 5-5 Evaluation Summary: Water Environment

Sub-Objective	AST	OYA
Water Environment	Neutral	Likely to be as expected, but confirmation is required.

Physical Fitness

Forecast

Appraisal Summary Table

5.191. The AST did not include a Physical Fitness entry.

[9] Highways Agency Drainage Data Management System

Environmental Assessment Report

5.192. The EnAR did not include a chapter for *Pedestrians, Cyclists, Equestrians, and Community Effects* for Public Rights of Way (PRoW) and local roads used by Non-Motorised Users (NMU's) within the study area.

Consultation

5.193. SCC stated that they did not have any knowledge to suggest that the Scheme had had any impact on the local rights of way network.

Evaluation

5.194. No NMU survey has been undertaken specifically for this study, and POPE is not aware of any NMU audits or Vulnerable User Studies undertaken for the Scheme.

5.195. The combination of desk studies and the site visit undertaken as part of POPE methodology has found no reason to suppose that there have been any significant changes to NMU facilities.

5.196. While no formal Physical Fitness evaluation has been undertaken by POPE (due the lack of a Physical Fitness entry in the AST and the sub-objective not being considered by the EnAR), it is considered that based on the Consultation response received from SCC and on the available evidence, there has been no reduction or increase in the degree of severance of the PRoW network because of the Scheme.

Journey Ambience

5.197. The Journey Ambience sub-objective considers traveller care (facilities and information), traveller views (the landscape through which the traveller passes, the ability to view the landscape, and features of interest) and traveller stress (frustration, fear of potential accidents, and route uncertainty).

Forecast

Appraisal Summary Table

5.198. The AST predicted a neutral effect on travellers' views, and no change in traveller care relating to amenities. Significant improvements were predicted because of the new signage and an improved driving environment. Improvements were also predicted for traffic queuing, safety, and route certainty, and stress (caused by frustration and fear of accidents) was expected to be reduced.

Environmental Assessment Report

5.199. The EnAR considered Journey Ambience within the Effects on all Travellers topic.

5.200. The EnAR stated that there would be a minor effect on travellers' views from the road associated with the additional new gantries for traffic management, traffic management signs, and signage. The effect of vegetation removal for construction on the opening up of travellers' views was expected to be minor, and to reduce over time as screening vegetation, forming part of the landscape proposals, became (re)established.

5.201. As assessed using the stress criteria in the DMRB[10] Vehicle Travellers methodology, the Scheme was expected to result in no significant overall changes in stress for drivers on the M6. Whilst the Scheme would provide some additional capacity for traffic, this was not considered significant enough to bring peak traffic flows below the thresholds set out in the assessment methodology. However, the Scheme would provide an extra lane for traffic which was expected to reduce traffic queuing, and therefore improve safety, route certainty, and

[10] DMRB: Design Manual for Roads and Bridges, a series of 15 volumes that provide standards, advice notes, and other documents relating to the design, assessment, and operation of trunk roads, including motorways, in the United Kingdom.

reduce stress caused by frustration and fear of accidents. Merging and diverging traffic joining and exiting the junctions would be moving at slower speeds than had occurred prior to the scheme, which was expected to result in reduced driver frustration, uncertainty, and fear of accidents at junctions. Reduced delays at the junctions were expected to further reduce driver stress caused by frustration upon exiting or entering the motorway.

Consultation

5.202. No responses to consultation requests were received.

Evaluation

Traveller Care

5.203. The OYA site visit observed no change in the provision of amenities, as expected.

5.204. In terms of information and driving environment, the OYA site visit observed the route to be well signed, with junctions providing safe access and egress points to and from the M6 and Emergency Refuge Areas (ERA's) clearly marked. Detailed pictorial and textual information was provided by MS4 signs as expected.

5.205. No further evaluation regarding Traveller Care was undertaken, as no other issues were identified during the site visit.

Traveller Views

5.206. At the time of the site visit, verges were found to be generally tidy and litter free where able to be observed.

5.207. As discussed in the landscape sub-objective, above, existing vegetation has been retained wherever possible, and this vegetation continues to provide a landscape framework for the motorway corridor. However, the Landscape mitigation measures do not appear to have been fully implemented and are consequently not on track to perform the environmental Functions for which they were intended. While this aspect of the Scheme is therefore considered to be worse than expected at this OYA stage, there is no reason why the mitigation proposals would not be able to perform as expected by design year, subject to the implementation of the planting proposals during the 2017/ 2018 planting season and the ongoing management and maintenance thereof in accordance with the HEMP.

5.208. The perception of urbanisation has undoubtedly increased because of the number and density of new structures along the motorway corridor; while it is considered that signing is a part of the expected traveller experience and that the adverse effects of any increase in highway 'clutter' on Traveller Views are not significant in isolation, the cumulative effect of additional infrastructure has increased the visual presence of signage throughout the route.

5.209. Overall, it is therefore concluded that while the effects of the Scheme on Traveller Views are **worse than expected** at this OYA stage, this could be easily remedied by timely and appropriate remedial action.

Traveller Stress

5.210. It is considered that the increased capacity of the M6 is likely to provide more opportunities for the safe overtaking of slower vehicles and a greater likelihood of free-flowing traffic; consequently, the scheme is considered likely to have resulted in a reduction in the degree of driver frustration.

5.211. The provision of signed ERA's and clear, informative signage is considered to have had a beneficial effect on perceived safety and as such, the fear of accidents is likely to have been reduced.

5.212. The provision of clear, informative signage is also considered to have had a beneficial effect on route uncertainty.

5.213. Any reduction in journey times and increase in reliability because of the scheme may also have had a beneficial impact of Traveller Stress; however as noted previously it is not possible to confirm at this point in time whether journey time changes are a result of the scheme due to poor data availability.

Summary

5.214. Based on the information presented in this evaluation, it is considered that the effects of the Scheme on Journey Ambiance are likely to be generally **as expected**.

5.215. Table 5-6 and Table 5-7,, summarise the evaluation of the Scheme's impact on Traveller Factors and Journey Ambiance respectively.

Table 5-6 Evaluation Summary: Traveller Factors

Traveller Factor	AST	OYA
Care	Amenities: No change Information: Significant improvement Driving Environment: Improvement	As expected
Views	Neutral	Worse than expected, but could be remedied by full implementation of the planting proposals.
Stress	Frustration: Reduction Fear of potential accidents: Reduction Route Uncertainty: Improvement.	As expected

Table 5-7 Evaluation Summary: Journey Ambience

Sub-Objective	AST	OYA
Journey Ambience	Large Beneficial	Slightly worse than expected, but could be remedied by full implementation of the planting proposals.

Key Points – Environment

Noise and Local Air Quality

- No evaluation undertaken due to questions around post opening traffic flows.

Greenhouse Gasses

- No evaluation undertaken due to questions around post opening traffic flows.

Landscape and Townscape

- Landscape: Landscape and visual amenity effects are considered worse than expected at this OYA stage as the slight beneficial visual impacts expected from the removal of a gantry have not been realised for receptors in Great Saredon or on Malthouse Lane, Saredon Mill, and the Landscape mitigation measures do not yet appear to have been fully implemented.
- Townscape: The impacts are as expected.

Heritage & Historic Resource

- There is no reason to consider that the operational impacts of the Scheme are anything other than as expected at this stage, although mitigation measures designed to screen and reduce visual impacts on key assets do not appear to have been fully implemented.
- The Historic Environment Desk-Based Assessment referred to by SCC in their response to consultation may be available for evaluation at the FYA stage, when publication and deposition (or otherwise) with Staffordshire Historic Environment Record should be confirmed.

Biodiversity

- Habitat: Effects are considered worse than expected at this OYA stage, as the mitigation proposals do not yet appear to have been fully implemented.
- Species: Impacts on Badgers and all species considered by the EAR are considered likely to be as expected, although further evidence is required to confirm.

Water Environment and Drainage

- There is no evidence to suggest that the overall effect of the scheme on water quality and drainage is anything other than what would be expected.

Physical Activity

- As expected there have been no significant changes to NMU facilities.

Journey Quality

- Traveller Views: Effects are considered worse than expected at this OYA stage, as the mitigation (planting) proposals do not yet appear to have been fully implemented.
- Traveller Care and Driver Stress: Considered to be as expected.

6. Social Impacts Evaluation

Introduction

6.1. The WebTAG guidance at the time of scheme appraisal describes social impacts as covering the human experience of the transport system and its impact on social factors, not considered as part of economic or environmental impacts. This covers the following impacts:

- Accidents
- Physical Activity
- Security
- Severance
- Journey Quality
- Option and Non-Use Values
- Accessibility
- Personal Affordability

6.2. Accidents (collisions) and security were considered in section 3 of this report, and Physical Fitness and Journey Ambience in the environment chapter. This section covers the remaining social impacts.

Sources

6.3. The AST is the main source of the forecast social impacts of this scheme.

Physical Activity

6.4. Physical activity relates to pedestrian and cyclist journeys, and the impact of the scheme upon them.

6.5. A full evaluation is provided in the environment section, which concludes that the effects of the scheme on physical activity are likely to be neutral, as expected.

Journey Quality

6.6. Journey quality relates to traveller care (facilities and information), traveller views and traveller stress (frustration, fear of potential accidents and route uncertainty).

6.7. The AST forecast the impact of the scheme upon journey quality to be large beneficial. A full evaluation is provided in the environment section, which concludes that the effects of the scheme on journey quality are likely to be slightly worse than expected at OYA, but could be remedied by full implementation of planting proposals.

Affordability

6.8. Affordability relates to changes in transport costs. WebTAG states that the most significant impacts of the costs of travel are on young and old people, and low income household, particularly when travelling to employment or education.

6.9. The AST scores affordability as neutral, stating that:

"Cost changes are not predicted as an impact of the scheme."

6.10. It is considered that the AST forecast is valid and that further evaluation would reveal no changes in affordability connected to the scheme. Therefore, the score of neutral is upheld at the outturn.

Access to Services

6.11. WebTAG states that access to services is strongly influenced by access to a private vehicle and proximity to public transport services.

6.12. The AST states that access to services will not be altered by the scheme. The forecast score is recorded as neutral.

6.13. It is considered that the AST forecast is valid and that further evaluation would reveal no changes in access to services connected to the scheme. Therefore, the score of neutral is upheld at the outturn.

Severance

6.14. 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.

6.15. The AST forecast scores severance as neutral, asserting that the scheme is entirely within the highways boundary and thus there is no issue with severance.

6.16. It is considered that the AST forecast is valid and that further evaluation would reveal no changes in severance connected to the scheme. Therefore, the score of neutral is upheld at the outturn.

Option Values

6.17. 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 use it because they have the option of another mode should their car become unavailable.

6.18. The AST scores option values as neutral, noting that householders and service users will be unaffected by the scheme.

6.19. It is considered that the AST forecast is valid and that further evaluation would reveal no changes in option values connected to the scheme. Therefore, the score of neutral is upheld at the outturn.

Social Impacts - Key points

Physical Activity

- The impact of the scheme upon physical activity was forecast as neutral. The forecast of neutral is upheld at the outturn.

Journey Quality

- The impact of the scheme upon journey quality was forecast as large beneficial. The forecast of large beneficial is not upheld at the outturn and is reforecast to be beneficial.

Affordability

- The impact of the scheme upon affordability was forecast as neutral. The forecast of neutral is upheld at the outturn.

Access to Services

- The impact of the scheme upon access to services was forecast as neutral. The forecast of neutral is upheld at the outturn.

Severance

- The impact of the scheme upon access to services was forecast as neutral. The forecast of neutral is upheld at the outturn.

Option Values

- The impact of the scheme upon option values was forecast as neutral. The forecast of neutral is upheld at the outturn.

7. Conclusions

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

Scheme Specific Objectives

7.2. Table 7-1 presents the success of the scheme against the specified scheme objectives.

Table 7-1 Success against scheme objectives

Objective M6 J10a – J13 Highway Investment Board paper (August, 2013)	**Has the objective been achieved?**
Improve currency and quality of information provided to road users	✓
Support local development plans	**Too early to conclude**
To reduce congestion	**N/A**
Improve journey time reliability	**N/A**
To improve road safety on the strategic road network (including road workers)	✓
To minimise the environmental impact, enhancing the environment where appropriate	✓
To provide better information for drivers using the strategic road network	✓

8. Appraisal Summary Table (AST) and Evaluation Summary Table (EST)

Appraisal Summary Table (AST)

M6 Junction 10a to 13 Managed Motorway

	Impacts	Summary of Key Impacts	QUANTITATIVE MEASURE	Qualitative	Monetary £(NPV)	Distributional 7-pt scale/ vulnerable grp
Economy	Business users & transport providers.	Time Benefits: £204.3m; Private Tolls Benefits: -£37.6m; Fuel VOC Benefits: -£4.0m; Non-Fuel VOC Benefits: £15.0m; Private Sector Provider Revenue: £107.0m	Value of journey time changes (£): 204,297,637 Net journey time changes (£): 0 to 2 min: 177,859,974; 2 to 5 min: 19,201,138; >5 min: 7,236,525	-	284,724,395	-
	Reliability impact on Business users	Incident-related reliability impacts were quantified using INCA. The benefits for both Travel Time variability and incident-related Delays due to incident-related closure summed to £189.4m (Business and Commuter use combined £143.8m + £45.6m).	-	-	143,880,409	
	Regeneration	The scheme would have no impact on any Regeneration Areas	-	Neutral	-	
	Wider Impacts	No perceived impacts on welfare from the scheme due to the on-line nature	N/A	Neutral	-	
Environment	Noise	Residential properties within the settlements of Acton Trussell, Dunston, Penkridge, Calf Heath, Great Saredon, Little Saredon and Essington. 10 schools and no hospitals within 1 km. In the long term a negligible adverse effect is predicted at all the non-residential sensitive buildings and 99% of residential properties in the 600m study area.	Estimated Population Annoyed 2031 Do-Minimum =1043.835 Estimated Population Annoyed 2031 Do-Something =1093.420	Negligible adverse A total of 35 residential properties have been identified as likely to qualify under the Noise Insulation Regulations	-£2,474,47 50 people	Slight Adverse
	Local Air Quality	Two AQMAs within 200m; AQMA Number 1 at Woodbank declared for exceedances of annual mean objective for NO2, AQMA Number 2 at Bursnips has no receptors within 200m of the scheme or affected routes. Regional emissions of PM10 are predicted to increase by 0.6 tonnes/year opening year. Regional emissions of NOX are predicted to increase by 18.6 tonnes/year.	PM10; 554 properties improved, 0 properties stay the same, and 924 properties worsen. Net Total Assessment score PM10 +353.6µg/m3 NO2; 21 properties improved, 0 properties stay the same and 1457 properties worsen. Net Total Assessment score NO2 +4132.80µg/m3	Air Quality is made worse at one receptor across the scheme where concentrations are predicted to be more than the air quality limit value in both with and without scheme scenarios in the opening year. A small change in NO2 of +1.3 µg/m3 is predicted at one receptor, increasing predicted concentrations from 43.5 µg/m3 to 44.9 µg/m3 between the with and without scheme scenarios.	-£1,719,652	Slight Adverse
	Greenhouse Gases	Data for non-traded carbon extracted from DEFRA's Emissions Factor Toolkit, and interpolated as necessary. Data for traded carbon calculated assuming that the ratio between traded and non-traded carbon extracted from TUBA is accurate and constant across all years.	Change in non-traded carbon over 60y (CO2e): 507933 Change in traded carbon over 60y (CO2e): 3004	Change (SOY, 2015): 0.004Mt untraded; 0.000021Mt try Change (2013-2017): 0.013Mt untraded; 0.000078Mt traded. added. Change (2018-2022): 0.037Mt untraded; 0.000225Mt traded. Change (2023-2027): 0.043Mt untraded; 0.000257Mt traded.	-£24,302,891	
	Landscape	The area comprises a gently undulating, predominantly agricultural landscape, and includes the market town of Penkridge and urban fringe development in the south of the Scheme. The introduction of gantries and ERA along with some loss of vegetation would cause localised increased intrusion to the landscape character and visual amenity would be slight with a slight beneficial effect in the vicinity of Rodbaston Lock from increased screening from mitigation.	N/A	Slight Adverse	N/A	
	Townscape	Townscape not considered to be impacted on as part of scheme. Not considered further.	N/A	Neutral	-	
	Heritage of Historic resources	The scheme will not involve any new land-take and any intrusive works will be within areas of previously disturbed ground. The existing M6 forms part of the context of the area; therefore, key impacts are considered to be those which increase existing effects of the road.	N/A	Slight Adverse	-	
	Biodiversity	The scheme will not directly or indirectly impact on any statutory designated sites. Impacts on non-statutory site and protected species (badger, great crested newt) can be adequately mitigated.	N/A	Neutral	-	
	Water Environment	Slight increase in surface runoff due to ERAs, no change to the pollution risk to surface and groundwater. Work will be confined within the corridors of the motorway and the design and mitigation will ensure that the risk of pollution to surface and ground water remains negligible.	N/A	Neutral	-	
Social	Commuting and Other users	Time Benefits: £64.6m; Private Tolls Benefits: -£23.9m;Fuel VOC Benefits: £0.0m; Non-Fuel VOC Benefits: -£98.5m	Value of journey time changes (£): 64,628,929 Net journey time changes (£): 0 to 2 min: 53,289,178; 2 to 5 min: 8,591,251; >5 min: 2,748,500	.	-57,755,216	Moderate Adverse

	Reliability impact on Commuting and Other users	Incident-related reliability impacts were quantified using INCA. The benefits for both Travel Time variability and incident-related Delays due to incident-related closure summed to £189.4m (Business and Commuter use combined £143.8m + £45.6m).	-	-	45,516,125	
	Physical Activity	Scheme within highways boundary, no impact on non-motorised users	-	Neutral	-	
	Journey Quality	Neutral effect on travellers' views and no change in traveller care relating to amenities, Significant improvements through signage and improved driving environment. Improvement with regard to reduced traffic queuing, safety, and route certainty and reduction in stress caused by frustration and fear of accidents.	>10,000 drivers would be affected during the peak AM period	Large Beneficial	N/A	
	Accidents	Scheme would result in a reduction in the number of accidents.	Over the 60yr appraisal period there will be 2 fewer Fatal accidents, 5 more Serious accidents and 37 fewer Slight accidents, resulting in 34 fewer accidents overall.	Beneficial	1,163,774	Neutral
	Security	Not considered to be relevant to a managed motorways scheme.	-	Neutral	-	Neutral
	Access to Services	Access to services will not be altered by the scheme.	-	Neutral	-	Neutral
	Affordability	Cost changes not predicted as an impact of the scheme.	-	Neutral	-	Moderate Adverse
	Severance	Scheme is within highways boundary and thus no issue with severance.	-	Neutral	-	Neutral
	Option Values	Householders and service users not impacted on by scheme.	-	Neutral	-	
Public Accounts	Cost to Broad Transport Budget	Investment Costs of £85.959m, comprising Preparation costs of £4.567m, Supervision costs of £21.485m, Works costs of £59.563m and Lands costs of £0.345m. Operating Costs of £30.746m	-	-	116,704,983	
	indirect Tax Revenues	Data extracted from TUBA	-	-	71,155,420	

Evaluation Summary Table (EST)

Scheme Name: M6 J10a – 13 Smart Motorway		Qualitative Impacts	Quantitative Impact	Assessment
Impacts				
Economy	Business Users & Transport Providers	Average journey times have improved, however due to poor traffic data availability it is not possible at this time to conclude whether any change in journey time is a result of the scheme.	-	N/A
	Reliability Impact on Business	Reliability has remained unchanged as a result of the scheme.	-	N/A
	Regeneration	At the OYA stage it is too soon to measure any impact from the scheme upon regeneration areas furthermore, due to poor data availability although there is an observed journey time saving it is not possible at this time to determine whether this is a result of the scheme.	-	N/A
	Wider Impacts	At the OYA stage it is too soon to measure any impact from the scheme upon employment furthermore, due to poor data availability although there is an observed journey time saving it is not possible at this time to determine whether this is a result of the scheme.	-	N/A
Environmental	Noise	Not assessed at this time.	-	N/A
	Air Quality	Not assessed at this time.	-	N/A
	Greenhouse Gases	Not assessed at this time.	-	N/A
	Landscape	There is no reason to consider that the assessment of the impacts stated by the EnAR are anything other than valid.	-	Neutral
	Townscape	No changes from the AST regarding Townscape were identified during the site visit.	-	Neutral
	Heritage and Historic Resources	Likely to be as expected.	-	As expected
	Biodiversity	Habitat Slightly worse than expected, but could be remedied by full implementation of the planting proposals. Species Likely to be as expected, but confirmation required.	-	Slightly worse than expected
	Water and Environment	Likely to be as expected, but confirmation is required.	-	N/A
Social	Commuting and Other Users	Average journey times have improved, however due to poor traffic data availability it is not possible at this time to conclude whether any change in journey time is a result of the scheme.	-	N/A
	Reliability Impact on Commuting and Other Users	Reliability has generally remained unchanged as a result of the scheme, with the exception of an improvement in the very worse journey times in the AM peak..	-	N/A
	Physical Activity	There has been no reduction or increase in the degree of severance of the PRoW network because of the Scheme.	-	As expected
	Journey Quality	Slightly worse than expected, but could be remedied by full implementation of the planting proposals.	-	Beneficial
	Accidents	The number of observed collisions has reduced on the scheme section post opening. Due to the issues with traffic data, no conclusions can be drawn regarding change in collision rate.		Too early to conclude
	Security	The outturn score is balanced between the loss of hard shoulder provision, but additional installation of CCTV cameras, Emergency Refuge Areas and Smart Motorway provision.	-	Neutral
	Access to Services	Access to services has not been altered as a result of the scheme.	-	Neutral
	Affordability	Cost changes were not predicted as an impact of the scheme.	-	Neutral
	Severance	The scheme has had no impact.	-	Neutral
	Option Values	The scheme has had no impact.	-	Neutral
Public Accounts	Cost to Broad Transport	The cost of the scheme is slightly lower than forecast in cost.	6% lower than forecast	PVC = £91.3 million
	Indirect Tax Revenues	The outturn reforecast of the scheme has not been completed at this time.	-	N/A

Appendix A – Highways England Network Improvement Schemes (M6 J10a-13 local)

	Scheme	Description/Impact on Traffic	Start of Construction	Scheme Opening
1	BBMM2 (M6 Junction 8 to 10a)	Managed Motorway implemented between junction 8 to 10a.	April 2009	March 2011
2	M6 Junction 9 Traffic Signal Upgrade (Pinch Point Programme)	Implementation of MOVA traffic signals at the roundabout of M6 junction 9.	April 2013	June 2013
3	BBMM3 (M6 Junction 5 to 8)	Smart Motorway implemented between junction 5 to 9, including M5 link roads.	January 2012	April 2014
4	M6 Walsall Canal Bridge Southbound re-surfacing (Junction 9-10)	Phase 1 of this work replaced joined and re-waterproofed the deck of Walsall canal bridge between junctions 9 and 10.	April 2014	July 2014
5	Improvement scheme at M6 Junction 6 (Salford Circus Roundabout)	Widening of roundabout at Junction 6 and new traffic signals installed.	June 2014	July 2016
6	M6 Northbound Junction 7 to 10 Carriageway re-surfacing and bridge expansion	The carriageway was re-surfaced between junction 7 and 10 (northbound) to improve safety and road conditions. There were overnight closures of the M6 northbound between junction 7 and 10.	February 2015	April 2015
7	M6 8 to M5 Link Southbound re-surfacing (waterproofing)	The bridges on the link road between the southbound M6 to the M5 require re-surfacing. Traffic management was in place throughout the construction period, with single lane running. There were some overnight closures in January 2017 to complete the works.	January 2015	January 2017
8	M6 Junction 4 northbound and southbound entry slip roadworks	Roadworks planned	June 2016	
9	M6 / A38(M) Gravely Hill Interchange Waterproofing Scheme and Replacement of Lighting Columns	Roadworks planned.	May 2016	December 2016
10	M6 Bromford and Witton Viaduct Concrete Repairs (near Junction 5)	Structural maintenance work was carried out at these two locations, as well as concrete repairs to the structure over the Junction 5 southbound on-slip. This is to improve the safety of the structures. Junction 5 southbound on-slip had a full closure from January 2016. Diversion routes were in place and signposted.	October 2014	June 2016
11	M5 Junction 4a to 6 Smart Motorway	Upgrading to a smart motorway with all lanes running with four lanes for use by traffic. Overnight closures of M5 between Junctions 4a and 6 in both directions throughout construction period. 50mph speed limit enforced.	January 2016	Opened Spring 2017
12	M40 Junction 16 to M42 Junction 3a Safety Improvement	Maintenance work to improve safety and reduce queuing on the M40 northbound between Junction 16 and M42 Junction 3a. Overnight closure of this stretch of road for 5 weeks	February 2017	March 2017

	Scheme	Description/Impact on Traffic	Start of Construction	Scheme Opening
13	A449 Improvements	Resurfacing of the carriageway on the A449 from A449/A5 Gailey Roundabout to M54 Junction. The safety barriers will also be upgraded. A fully signposted diversion route will be in place using M6 Junction 11/12	January 2017	Scheduled June 2017
14	M6 northbound (Junction 7 and 8)	Structural repairs to damaged concrete and waterproofing on northbound carriageway. Work taking place in hard shoulder and lane one to minimise disruption. Overnight and weekend closures of slip roads and main carriageway. Enforced stepped speed limit from 70mph, to 50mph and 40mph through the work area, with fully signposted diversions between Junction 7 and 8.	February 2017	April 2017
15	M5 Junction 1 to 2 Oldbury Viaduct	Preparation work for major concrete work and waterproofing in advance of main scheme which started in April/May 2017. This was carried out using overnight lane closures and weekend overnight full closures of slip roads and the main carriageway.	January 2017	Scheduled Autumn 2018
16	M42 re-surfacing	Re-surfacing M42 junction 6 to 7 northbound, M42 junction 6 to 7 southbound, M6 4A to M42 southbound junction 7 and northbound junction 8 link road. Full road closures will be in place overnight with full signposted diversions with no traffic management in place during the day.	March 2017	May 2017
16	M42 Junction 3a to 7 Radar Renewal	Renewal of traffic technology between Junction 3a and 7 on the M42 northbound. Some overnight closures were used with full diversions in place.	January 2017	March 2017
17	M6 Whitgreave Lane overbridge maintenance	Essential maintenance was carried out on the bridge, resulting in full closure of the bridge overnight. Diverted through Junction 14.	February 2017	March 2017
18	M6 Lymes Road Parapets	Replacement of parts of the concrete structure underbridge which carried the M6. Traffic diverted from Junction 15 and 16.	October 2016	April 2017
19	M6 J16-19 Smart Motorway	Improving the M6 motorway between junction 16 (Crewe) and junction 19 (Knutsford) by making it a smart motorway.	December 2015	March 2019

Appendix B – HIB Paper Objectives (Full)

Number	Objectives (as per DfT HIB - August, 2013)	Considered	Notes
	Overall		
1	Support local development plans.	Y	
2	Support Highways England maintainance requirements and minimise whole life costs.	N	
3	Make best use of existing infrastructure.	N	
4	To minimise environmental impact, enhancing the environment where appropriate.	Y	
5	Promote innovation to obtain better value for money.	N	
	Transport and Safety		
6	Improve currency and quality of information provided to road users.	Y	
7	Reduce congestion.	Y	
8	Improve journey time reliability.	Y	
9	To improve road safety on the strategic road network (including road workers).	Y	
10	To provide better information to drivers using the strategic road network.	Y	

Appendix C – Interpeak MIDAS Analysis

Figure 8-1 IP flow northbound (10:00 – 16:00) M6 J10a - 13

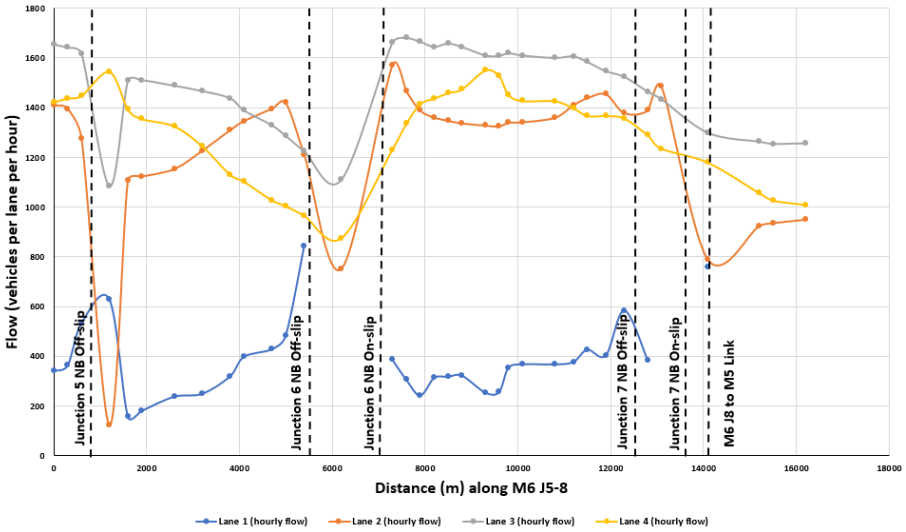


Figure 8-2 IP flow southbound (10:00 – 16:00) M6 J10a - 13

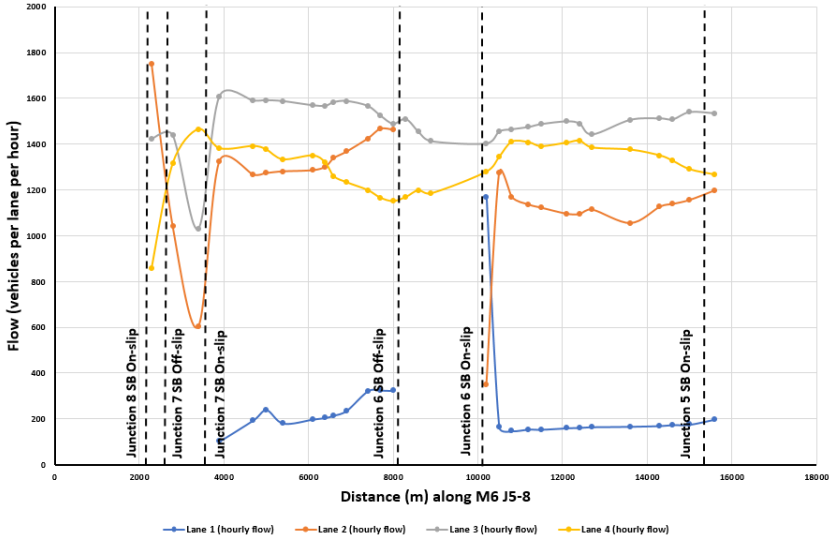


Figure 8-3 IP speed northbound (10:00 – 16:00) M6 J10a - 13

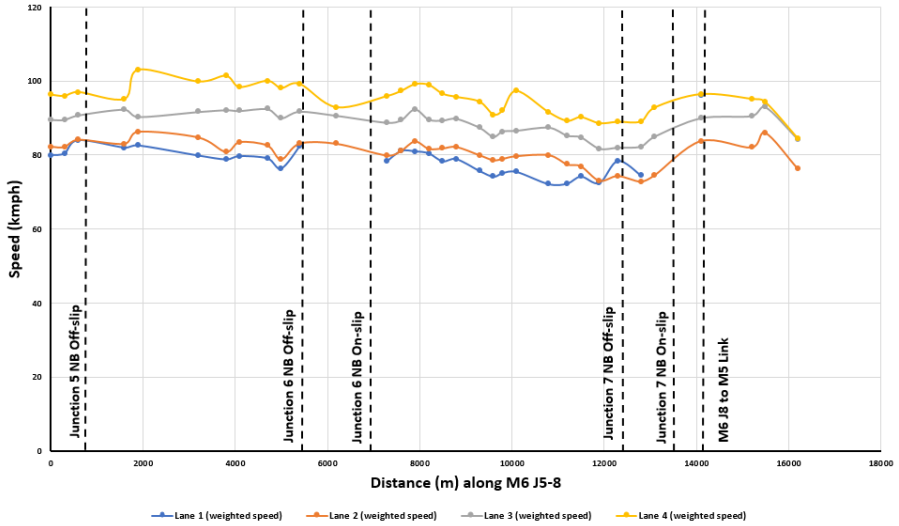
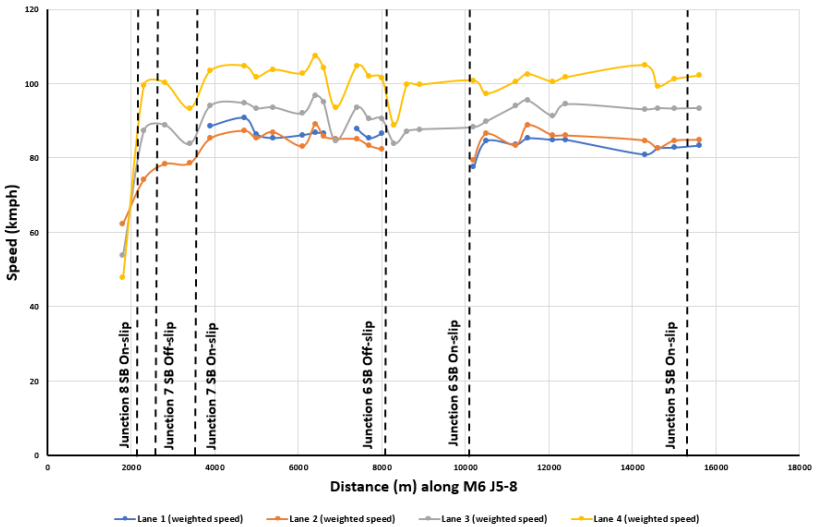


Figure 8-4 IP speed southbound (10:00 – 16:00) M6 J10a - 13



Appendix D – Environmental Background Information

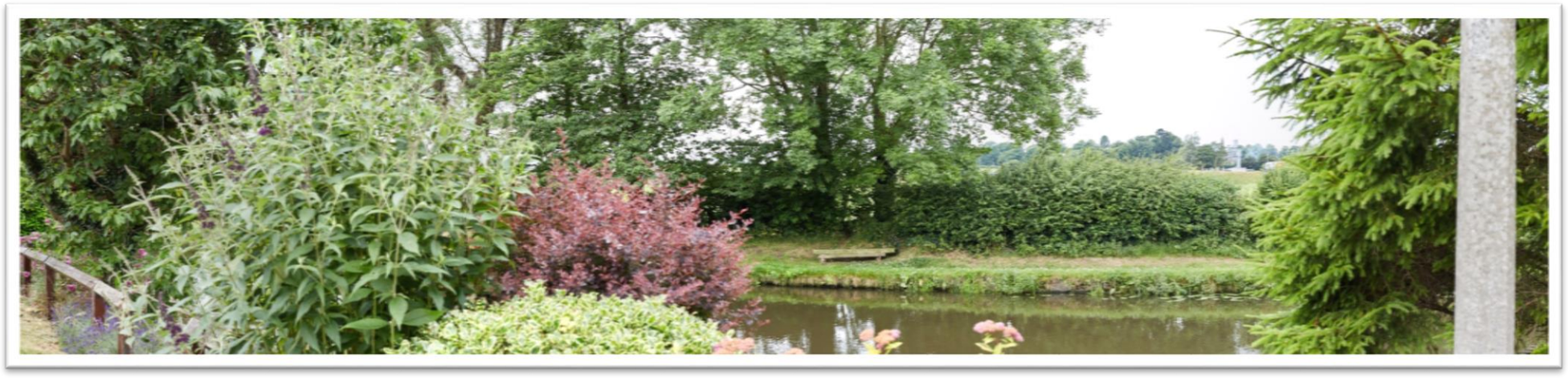
Environment Specific Requirements	OYA Response
Environment Statement (ES) or Stage 3 Scheme Assessment Report (SAR) or Environmental Assessment Report (EnAR) including Environmental Masterplan (EMP) drawings.	• EnAR Volumes 1 & 2 • Landscape Mitigation Drawings • Ecological Constraints Drawings
AST.	Provided.
Any amendments / updates, additional surveys or reports since the ES / SAR / EnAR.	None provided.
Any changes to the Scheme since the ES / SAR / EnAR e.g. to lighting and signs, retention of material on site in earthworks in the form of landscape bunds or other, or to proposed mitigation measures.	None provided.
As built drawings for landscape/ biodiversity/ environmental mitigation measures/ drainage/ fencing/ earthworks etc.	• Site Clearance Drawings.
Construction Environment Management Plan (CEMP), Landscape and Ecology Aftercare Plan (LEAP), Landscape Management Plan (LMP) or Handover Environmental Management Plan (HEMP).	• HEMP.
Health and Safety File – Environment sections (to include all environment As-Built reports).	Not provided.
Relevant Contact Names for consultation.	Sourced by POPE.
Archaeological Reports (popular and academic).	None provided.
The Road Surface Influence (RSI) value of any low noise surface installed.	Not provided.
The insulation performance properties of any noise barriers installed (The BS EN 1794-2 result provided by the noise barrier manufacturer).	Not provided.
List of properties eligible for noise insulation.	Not provided.
Employers Requirements Works Information - Environment sections.	Not provided.
Reports for any pre/ post opening survey and monitoring work e.g. for noise, biodiversity, water quality).	None provided.
Animal mortality data.	Not provided.
Pre- or Post-Opening Non-Motorised User (NMU) Audits or Vulnerable User Surveys.	None provided.

Environment Specific Requirements	OYA Response
Information may be available regarding environmental enhancements to streetscape/ townscape for bypassed settlements	Not applicable.
Scheme Newsletters/ publicity material/ Award information for the Scheme.	None provided.

Appendix E – Photographic Record of Scheme

EnAR Figure 6.17 (Photo viewpoint 1): View looking south-west from residential properties on Moathouse Close, Acton Trussell.

EnAR (Winter/ early Spring 2013)



OYA (June 2017)

As expected, visual impacts are derived from partial visibility of the gantries on embankment through the partial intervening screening vegetation along the Staffordshire and Worcestershire Canal. The overall impact from vehicular movement, given that the highway surface is not visible, is similar to the baseline.

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EnAR Figure 6.17 (Photo viewpoint 2): View looking south-west from Public Footpath No. 2 (Acton Trussell and Bednall) from Action Moat Bridge traversing the Staffordshire & Worcestershire Canal.

EnAR (Winter/ early Spring 2013)

OYA (June 2017)

As predicted, gantries are clear against a backdrop of roadside vegetation, as are vehicular movements. The carriageway surface is not visible, so the 8-lane extent of the motorway corridor has not increase the visual impact when compared with the baseline situation.

EnAR Figure 6.18 (Photo viewpoint 3): View looking north-west from the route of the Staffordshire Way Long Distance Footpath at Parkgate Bridge.

EnAR (Winter/ early Spring 2013)

OYA (June 2017)

As expected, vehicular movements are apparent where the route emerges from cutting to cross the bridge over the River Penk. The increase in carriageway width and the north-bound and south-bound ERA's are not visually apparent, and views are broadly similar to the baseline conditions. Views of the upper sections of highways infrastructure are visible above the cutting landform where gaps in tree cover facilitate glimpsed views.

EnAR Figure 6.18 (Photo viewpoint 4): View looking north from Wood Bank Lane.

EnAR (Winter/ early Spring 2013)

OYA (June 2017)

As expected, traffic movements are prominent without perception of an increase in width to an 8-lane corridor. The new gantry is a clear noticeable feature.

EnAR Figure 6.20 (Photo viewpoint 7): View looking south-west from Micklewood Lane adjacent to the dismantled railway, Otherton.

EnAR (Winter/ early Spring 2013)

OYA (June 2017)

As expected, the gantries protruding above the wooded backdrop within the middle ground form only a minor component of the view. The carriageway surfacing is not visible and although the vehicular movements are apparent, the visual impacts derived from the extension of the corridor to form an 8-lane route are similar to the baseline.

EnAR Figure 6.20 (Photo viewpoint 8): View looking north from the junction of Public Footpath No. 27 (Penkridge) with Gailey Lea Lane.

EnAR (Winter/ early Spring 2013)

OYA (June 2017)

As expected, the visual impact of the scheme is largely determined by the presence of gantries along the embankment accommodating the M6 Motorway corridor, and the removal and retention of existing gantries, along with the installation of a new gantry, has not altered the overall balance of features in the view. The increased width of the M6 corridor to accommodate 8 lanes of traffic is not visually apparent from this location due to the distance of the motorway from the viewpoint.

EnAR Figure 6.21 (Photo viewpoint 9): View looking south from the junction of Saredon and Malthouse Lane at Saredon Mill.

EnAR (Winter/ early Spring 2013)

OYA (June 2017)

As expected, the widened carriageway is not visually apparent from this location. However, for reasons unknown to POPE the concrete gantry (behind the structures to the left of the image) has not been removed and the slight beneficial impact arising from the removal of this gantry that was expected by the EnAR for this receptor has not been realised. As such, this impact is worse than expected.

EnAR Figure 6.21 (Photo viewpoint 10): View looking south-bound from the overbridge over the M6 Motorway on Hilton Lane.

EnAR (Winter/ early Spring 2013)

OYA (June 2017)

As expected, the elevated nature of the viewpoint dictates that the 8-lane extent of the M6 Motorway corridor is prominent from this location, increasing the dominance of the highway and its apparent visual impact. The upgraded gantry continues to obstruct some views towards the background, although it is set within the context of the existing M6 highway boundary, framed by roadside vegetation. However, the overall balance of features and elements comprising the existing view is unaltered.

EnAR Figure 6.22 (Photo viewpoint 11): View looking west from St. James' Church (Grade II* Listed Building) on Penkridge Road, Acton Trussell.

EnAR (Winter/ early Spring 2013)

OYA (June 2017)

The nature of vegetation cover within the shallow valley of the River Penk is likely to afford filtered (winter) views towards the existing gantries. It is considered that he combination of viewing distance and the retention of existing screening, as well as the nature of the impacts, are likely minor and as expected.

EnAR Figure 6.22 (Photo viewpoint 12): View looking north-west from Sabrina Way (long distance bridleway).

EnAR (Winter/ early Spring 2013)

OYA (June 2017)

As expected, there has been no impact from the increase in the surface area of the motorway, although vehicular movements are marginally closer and can be viewed across eight lanes rather than six. The constituent elements of the view have not changed, and the overall balance of features and elements comprising the view has not been altered.

EnAR Figure 6.23 (Photo viewpoint 13): View looking east from Public Footpath No. 6 (Dunston), accessed from the A449 Road.

EnAR (Winter/ early Spring 2013)

OYA (June 2017)

As expected, the new gantries and CCTV mast form the most visible elements of the Scheme, albeit at distance. In other respects, the Scheme does not add to visual impact at this location.

EnAR Figure 6.23 (Photo viewpoint 14): View looking north-east from Great Saredon Road at Little Saredon.

EnAR (Winter/ early Spring 2013)

OYA (June 2017)

As expected, the constituent elements of the Scheme have not changed the view to any significant extent when compared to the baseline conditions.

EnAR Figure 6.24 (Photo viewpoint 15A): View looking north bound from the overbridge over the M6/ M6 Toll Motorways, Great Saredon Road.

EnAR (Winter/ early Spring 2013)

OYA (June 2017)

As expected, highway infrastructure and vehicles dominate the northbound view at this location. The amendments to the highway width because of changes to the lanes are insignificant in this context, and the magnitude of visual impact, when compared to the baseline conditions, is minor.

EnAR Figure 6.24 (Photo viewpoint 15B): View looking south bound from the overbridge over the M6/ M6 Toll Motorways, Great Saredon Road.

EnAR (Winter/ early Spring 2013)

OYA (June 2017)

As expected, highway infrastructure and vehicles dominate the southbound view at this location. The amendments to the highway width because of changes to the lanes are insignificant in this context, and the magnitude of visual impact, when compared to the baseline conditions, is minor.

EnAR Figure 6.25 (Photo viewpoint 16): View looking north-west from Micklewood Lane, Otherton.

EnAR (Winter/ early Spring 2013)

OYA (June 2017)

As expected, the motorway remains largely screened at this location, and any visual impact derived from the increased visibility of highway infrastructure (gantries) is of negligible magnitude.

EnAR Figure 6.25 (Photo viewpoint 17): View looking north-east from Public Footpath No. 0.1055(a) from Rodbaston Lock, traversing the Staffordshire & Worcestershire Canal.

EnAR (Winter/ early Spring 2013)

OYA (June 2017)

As expected, the presence of highway infrastructure has increased, and is prominent in the views from the lock. Other elements of the Scheme have not added to the baseline visual impact, although vehicles using the former hard shoulder are marginally be closer to the viewpoint.

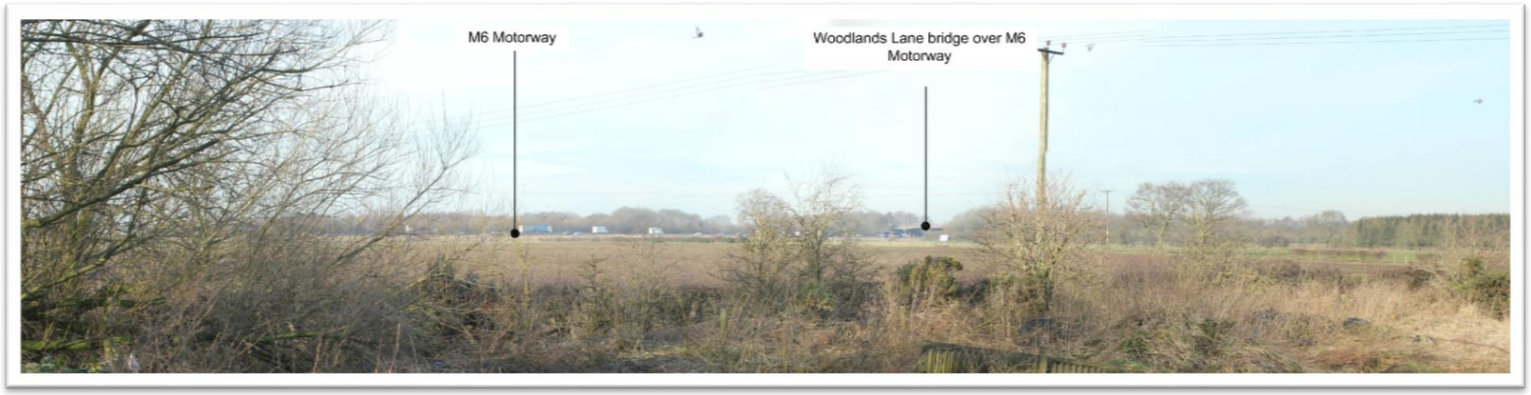
EnAR Figure 6.26 (Photo viewpoint 18A): View looking west from Saredon Lane, Great Saredon.

EnAR (Winter/ early Spring 2013)

OYA (June 2017)

For reasons unknown to POPE, the concrete gantry (G18E) was not removed and consequently, the expected, slight beneficial visual impacts resulting from its removal have not been realised; as such, these impacts are considered to be worse than expected. In all other respects however, the impact of the Scheme is as expected at this location.

EnAR Figure 6.27 (Photo viewpoint 19): View looking west from Oak Farm Lane.



EnAR (Winter/ early Spring 2013)

OYA (June 2017)

As expected, the increase in highway infrastructure resulting from the installation of two new gantries is visible against the background of woodland. Other elements of the Scheme, including the ERA, may be visible but are considered likely to form a very minor element when compared to the baseline conditions.

EnAR Figure 6.27 (Photo viewpoint 20): View looking east from Otherton Lane.

EnAR (Winter/ early Spring 2013)

OYA (June 2017)

As expected, none of the Scheme elements are visible and there has been no change in the view at this location.

EnAR Figure 6.28 (Photo viewpoint 21): View looking north-west from Cannock Road, Quarry Heath.

EnAR (Winter/ early Spring 2013)

OYA (June 2017)

As expected, there has been no perceptible change in the view or impact on visual amenity due to the screening effects of the intervening landform and vegetation.

EnAR Figure 6.28 (Photo viewpoint 22): View looking south-east from Lower Drayton.

EnAR (Winter/ early Spring 2013)

OYA (June 2017)

As expected, the retention of existing woodland adjacent to the motorway screens the new highways infrastructure. Views of traffic remain unchanged, although vehicles are slightly nearer to the receptor. Overall has been no change in visual amenity when compared to the baseline conditions.

EnAR Figure 6.29 (Photo viewpoint 23): View looking east from Old Vicarage Lane.

EnAR (Winter/ early Spring 2013)

OYA (June 2017)

As expected, the visual impact from the gantries has been mitigated (in summer) by the intervening woodland. It is considered that only a very small part of the Scheme would likely be discernible (in winter), and in effect there has been no change in the view.

Appendix F – Glossary

AADT	Average of 24 hour flows, seven days a week, for all days within the year.
ALR	All Lane Running is a type of smart motorway in which all lanes are open to traffic at all times. There is no lane which dynamically varies as a hard shoulder or normal lane.
AQMA	**A**ir **Q**uality **M**anagement **A**rea
AST	**A**ppraisal **S**ummary **T**able 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
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
CEMP	**C**onstruction **E**nvironmental **M**anagement **P**lan
CM	**C**ontrolled **M**otorway Controlled motorways have three or more lanes with variable speed limits indicated through the use of overhead gantry signing. The hard shoulder is not used as a running lane, and is only used in a genuine emergency.
DHSR/HSR	**Dynamic Hard Shoulder** is the inside line on a smart motorway when can operate in one of two modes: As the default, as a normal motorway hard shoulder i.e. only for emergency use; and Under operator control, open to all traffic. Dynamic Hard Shoulder Running is the system in a smart motorway which includes DHSR.
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.
Do Minimum	In scheme modelling, this is the scenario which comprises only the existing road network and other committed schemes.
Do Something	In scheme modelling, this is the scenario detailing the planned scheme plus improvement schemes that have already been committed
EAR	**E**conomic **A**ssessment **R**eport
EnAR	**En**vironment **A**ssessment **R**eport
EIR	**E**conomic **I**mpact **R**eport
ERA	**E**mergency **R**efuge **A**rea
EST	**E**valuation **S**ummary **T**able In POPE studies, this is a summary of the evaluations of the TAG objectives using a similar format to the forecasts in the AST.
FWI	**F**atalities & **W**eighted **I**njuries
FWI/bvkm **FWI/mvkm**	This figure is a combined measure of casualties based on the numbers of fatal, serious and slight casualties. It is weighted by severity of injuries, with fatalities having the highest weighting.
FYA	**F**ive **Y**ears **A**fter
GCN	**G**reat **C**rested **N**ewt
HALOGEN Data	HALOGEN Data is the record of the overhead gantry settings and message screens forming part of a smart motorway scheme over time.

HEMP	**H**andover **E**nvironmental **M**anagement **P**lan
HSI	Habitat Suitable Index
INCA	**I**ncident **C**ost **B**enefit **A**ssessment 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	**K**illed or **S**eriously **I**njured
LNA	**L**ocal **N**ature **A**rea
MAC	**M**anaging **A**gent **C**ontractor
MIDAS Data	**M**otorway **I**ncident **D**etection **A**utomated **S**ignalling (MIDAS) data is held by Highways England which contains lane by lane traffic flows and speeds.
MM-DHSR	See DHSR
NMU	**N**on-**m**otorised **U**ser
NPV	**Net Present Value** The difference between the Present Value Costs and Present Value Benefits.
OYA	**O**ne **Y**ear **A**fter
PIC	**P**ersonal **I**njury **C**ollision Data on these is obtained from records of road collisions collected from by police officers attending accidents.
PIC/mvkm	Ratio of PIC to the level of travel measured in million vehicle kilometres (mvkm)
Present Value	Present Value is 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	**P**resent **V**alue **B**enefits Value of a stream of Benefits accruing over the appraisal period of a scheme expressed in the value of a Present Value
PVC	**P**resent **V**alue **C**ost
RSA	**R**oad **S**afety **A**udit
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.
SEGI	Site of Ecological / Geological Importance
TUBA	**T**ransport **U**ser **B**enefit **A**ssessment
µg/m³	**Micrograms** per **Cubic Metre**
VMSL	**V**ariable **M**andatory **S**peed **L**imit
WEBTAG	Department for Transport’s website for guidance on the conduct of transport studies at http://www.webtag.org.uk/

Appendix G – List of Tables and Figures