Post Opening Project Evaluation

M1 Junction 6a to 10 Widening

Five Years After Opening Study

October 2015

Table of contents

Executive Summary

Scheme Description

The M1 Junction 6a to 10 widening scheme in Hertfordshire opened in December 2008 and brought this section of the M1 to a full standard four lane motorway with continuous hard shoulders through the junctions. This was achieved by widening the following sections from 3 to 4 lanes:

- Junctions 6a to 7 southbound;
- Junctions 8 to 9 northbound and southbound;
- Junctions 9 to 10 southbound; and
- New parallel ('Collector-Distributor') roads were also constructed between Junctions 7 and 8 to cater for local traffic travelling between Hemel Hempstead and St Albans.

It was originally envisaged that the additional capacity provided by this scheme would be used as an opportunity to trial a High Occupancy Vehicle (HOV) lane. This proposal was subsequently dropped during scheme construction. However, variable mandatory speed limits (as part of a controlled motorway) were implemented after the widening scheme opened. The scheme appraisal for the Controlled Motorway element was undertaken separately to the widening scheme. The outturn results include both the Controlled Motorway and the widening impact, as it's not possible to disaggregate the impacts of the two schemes.

Scheme Objectives

Objectives (from AST, August 2007)	**Objective Achieved?**
Reduce Congestion	✓
Improve Journey Time Reliability	✓
Reduce Accidents	✓

Key Findings

- Journey times and journey time reliability have both improved since the scheme opened.
- Traffic flows on the improved section of the M1 have increased slightly since scheme opening.
- There has been a general decrease in traffic flows on the majority of local roads in the vicinity of the scheme since opening. This indicates that increases observed on the M1 could be a result of the re-assignment from these routes, where local road users are using the M1 J6a to 10 as an alternative route.
- There has been a significant reduction in collisions on this section of the M1 since the scheme opened.

Summary of Scheme Impacts

Traffic

- Traffic flows on the improved section of the M1 have increased slightly since scheme opening.
- There has been a general decrease in traffic flows on the majority of local roads in the vicinity of the scheme since opening. This indicates that increases observed on the M1 could be a result of the re-assignment from these routes, where local road users are using the M1 J6a to 10 as an alternative route.
- Observed northbound traffic volumes are very close to predicted volumes indicating a high degree of forecasting accuracy. Observed southbound traffic volumes are higher than predicted by between 9 and 12%.
- Post opening journey times are consistently lower for both the northbound and southbound directions at both one year after (OYA) and five year after (FYA) stages.
- Observed FYA journey times are slightly higher than OYA journey times. This can be explained, somewhat, by the increase in traffic volumes during this time period.
- The forecast journey time savings were slightly higher than the observed journey time savings. The difference was largely due to the lower than forecast observed savings for Junction 9 to 10.

- Overall journey time reliability has improved indicating that the scheme has met the objective related to journey time reliability.

Safety

- The changes in collision rate are statistically significant indicating that the scheme has had a direct impact on safety.
- After allowing for the background trend in collisions, the annual average number of personal injury collisions occurring on the M1 between J6a and J10 has decreased from 188 before the scheme (March 2001 to February 2006) to 67 after scheme opening (January 2009 to December 2013).
- The number of fatal, serious and slight collisions have reduced post opening, but there has been an increase in the collision severity index post opening due to slight collisions declining faster than fatal and serious collisions.
- The impact of the scheme on collisions is not as good as expected, but the scheme is still delivering considerable safety benefits in terms of a 64% reduction in total collisions post opening.
- The scheme's impact on security is assessed as slight beneficial as predicted. This is due to CCTV (Closed Circuit Television) provision and lighting.

Environment

- Noise barriers and earth mounding have been installed as specified and are performing their noise mitigating function as expected.
- There was an increase of 13,700 tonnes of carbon. This was better than expected as an increase of 16,000 tonnes of carbon was predicted.
- Planting is generally establishing very well and is expected to reach its growth targets. Planting plots have generally achieved their target coverage within the time period stated in the 2014 Draft Handover Management Plan (HEMP), and the current levels of plant growth and establishment indicate that their visual screening and landscape integration functions are developing as expected at this stage.
- The visual effect of the scheme has been mitigated through the use of earth mounding, environmental barriers and mitigation planting. Planting has been used to good effect near environmental barriers, softening the effect of these structures.
- No further monitoring of the artificial badger sett, bird boxes, ponds or calcareous grasslands was undertaken beyond one year after opening of the scheme. It is noted at this stage that the calcareous grasslands (areas planted with hardy plants suited to limestone or chalk soil) appear to be slow to establish.
- The Nickey Line Bridge Bat Monitoring has been undertaken as a part of the scheme and in accordance with requirements within the DEFRA (Department for Environment, Food and Rural Affairs) licence. As a result of the monitoring, lighting within the tunnel has been changed to ensure that the use of the tunnel by bat species continues. The last monitoring visit was undertaken prior to the installation of the new lighting. It is not possible to comment on its impact at this point in time.

Accessibility and Integration

- This scheme has had no direct impact on public transport provision or interchange, therefore the Appraisal Summary Table (AST) assessment of neutral is considered to be valid in this instance.
- The scheme has maintained the existing crossings, facilitating movement across the M1. The severance impact is therefore neutral as expected.
- The scheme integrates well with the objectives set out in local, regional and national policies as expected.

Summary of Scheme Economic Performance

		All figures in 2002 Prices discounted to 2002	
		Forecast (Widening & Controlled Motorway)	**Outturn (Widening & Controlled Motorway)**
Present Value Costs (PVC, investment cost)		**£284.6**	**£256.1m**
Journey Time Benefit		£1,232.6m	£716.0m
Safety Benefits		£801.9m	£481.3m
Vehicle Operating Costs		£53.8m	£53.8m
Construction Delay		-£137.8m	-£137.8m
Future Maintenance Impacts		£76.6m	£76.6m
Carbon		£0.7m	£0.7m
Journey Time Reliability		£5.9m	£5.9m
Present Value Benefits (PVB)		£2,033.7m	£1,196.5m
Indirect Tax reduction impact		£17.2m	£17.2m
Indirect tax impact within costs	**PVC (incl. indirect tax as increase)**	£301.8m	£273.3m
	BCR = PVB / PVC	6.6	4.4
Indirect tax impact within benefit	**PVB (incl. indirect tax as a reduction)**	£2,016.5m	£1,179.3m
	BCR = PVB / PVC	**7.1**	**4.6**

- The outturn scheme costs are lower than forecast. This is despite the outturn figures including elements of controlled motorway which were not considered in the forecast.
- The journey time benefits are lower than expected due to lower than forecast traffic volume increases as well as a smaller than forecast journey time savings.
- The outturn safety benefits are lower than forecast as the number of observed collisions has not reduced by as much as predicted. However, the safety benefits are still considerable.
- The outturn Benefit to Cost Ratio BCR (4.6) is lower than forecast (7.1) but still represents ‘very high’ value for money.
- The scheme has contributed to the growth aspirations of the Milton Keynes South Midlands (MKSM) growth area by providing additional capacity and improved journey times on the main strategic highway through the area.

1. Introduction

Background

1.1 This report presents the Five Years After (FYA) post opening study of the **M1 Junction 6a to Junction 10** scheme (hereafter known as 'the scheme') which opened in December 2008. The evaluation has been prepared as part of Highways England's (formerly the Highways Agency, HA's) Post Opening Project Evaluation (POPE) programme. POPE is undertaken one year and five years after the opening of all HA major schemes.

1.2 The scheme involved widening the M1 from three to four lanes in Hertfordshire. The additional capacity provided by the scheme was initially earmarked as suitable to implement a HOV (High Occupancy Vehicle Lane). However, this was subsequently dropped in favour of a 'Controlled Motorway' which although now operational, was not part of the appraised scheme. The Controlled Motorway was appraised separately and had its own set of economic costs and benefits. This evaluation considers the cumulative impacts of both the widening and the Controlled Motorway because it is not possible to isolate the impacts between the two.

1.3 The purpose of the POPE FYA study is to evaluate whether the original objectives of the scheme have been achieved, and to provide a comparison of predicted and actual scheme impacts. The study presents an evaluation of the scheme's impact according to the Government's objectives for transport.

1.4 More specifically, the report sets out the following:

- A comparison of the 'before' and 'after' traffic volumes on the M1 Junction 6a to Junction 10 and other roads in the vicinity of the scheme;
- A comparison of 'before' and 'after' journey times on the scheme section;
- An outline of the changes in collision rates on the scheme following the opening of the scheme;
- A monetised comparison of the predicted and the actual (before and after) impacts of the scheme;
- An evaluation of the impact of the scheme upon the environment, more specifically its impact upon noise, air quality, greenhouse gases, landscape, biodiversity, heritage and water; and
- An assessment of the scheme's impact on the accessibility and integration objectives.

Scheme Context

1.5 The M1 motorway from London to Leeds is one of the busiest and most important roads in the country, providing a key link between London, the Midlands, and the North. The section between Junctions 6a to 10 is approximately 17km (10 miles) long stretching from the M25 to Luton. The location of the scheme and its context within the road network is shown in ***Figure 1.1***.

Scheme Objectives

1.6 The objectives of the scheme, as given in the AST dated August 2007, were:

- To reduce congestion
- To improve journey time reliability; and
- To reduce accidents.

Scheme Description

1.7 The scheme aimed to bring the M1 between Junctions 6a to 10 up to a full standard four lane motorway with continuous hard shoulders. This was achieved by widening the following sections from 3 to 4 lanes:

- Junctions 6a to 7 southbound;
- Junctions 8 to 9 northbound and southbound;
- Junctions 9 to 10 southbound; and

- New parallel 'Collector-Distributor' roads were also constructed between Junctions 7 and 8 to cater for local traffic travelling between Hemel Hempstead and St Albans.

1.8 The facilitating works to allow the above improvements to take place included the following:

- Junction 7 – Carriageway realignment of the north and southbound carriageways to the north of junction 7 and the southbound carriageway south of junction 7, including realignment of the adjacent slip roads;
- Junction 8 – Repositioning of the slip roads to the west of the junction and the alteration of the slip road arrangement to the east of the junction;
- Junction 9 – Realignment of the slip roads on all approaches and exits from the M1;
- Junction 10 – Realigning the slip roads on all approaches and exits from the M1 increasing the overall width of the junction;
- Widening or replacement of 11 underbridges; and
- Replacement of 7 overbridges.

1.9 The scheme layout in detail is shown in ***Figure 1.2***.

Requirement for the Scheme

1.10 Since its construction in the late 1950's and early 1960's the M1 has become a very heavily used strategic link between London, the Midlands, and the North. The section between Junctions 6a to 10 through Hertfordshire is one of the busiest stretches of the M1. At peak times extensive queues occurred between the M25 and Luton especially at junctions and on the steeper gradients.

1.11 Near Junction 8 (Hemel Hempstead) traffic travelling between the former M10 and A414 had to use a short section of the M1 between Junctions 7 and 8. The mixing of long distance and local traffic reduced the effective capacity of this section (due to weaving traffic) and congestion resulted.

Figure 1.1 – Scheme Location

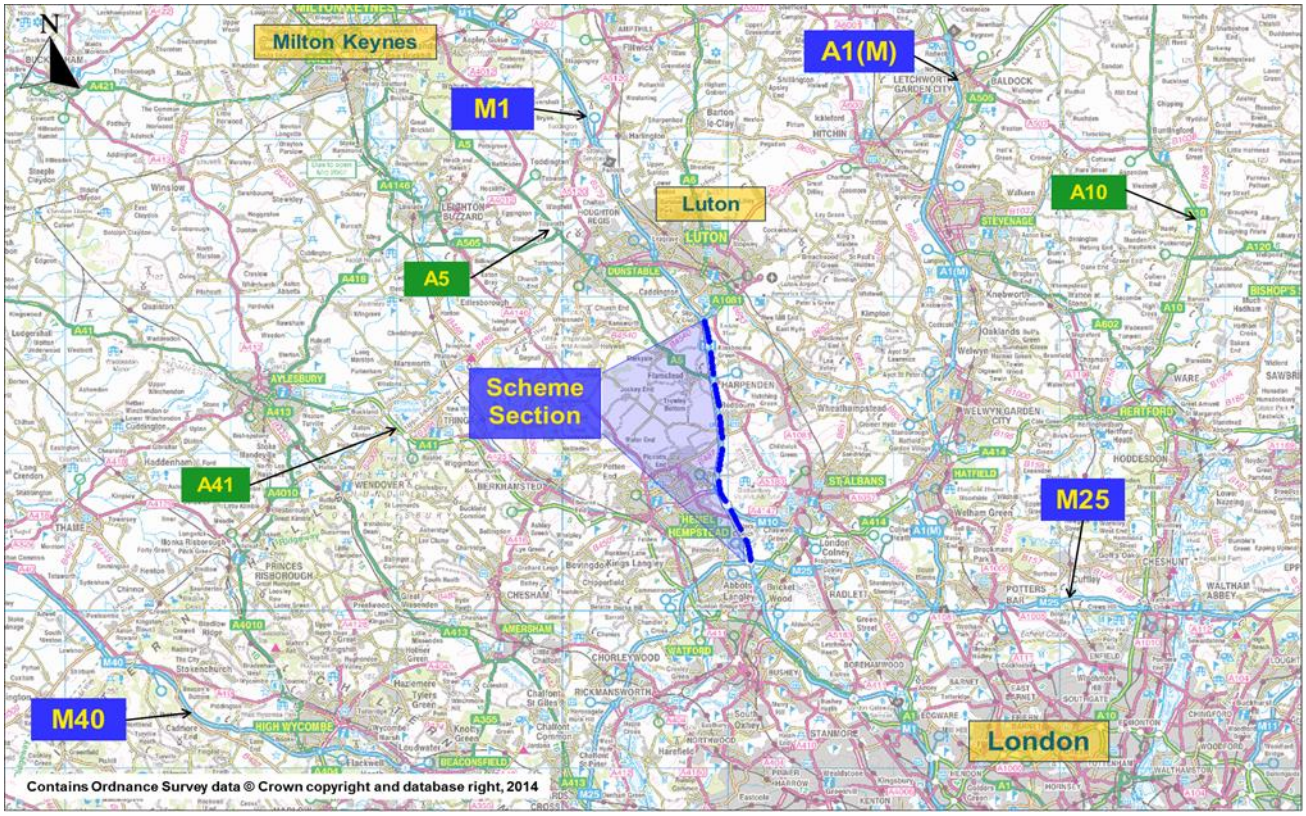
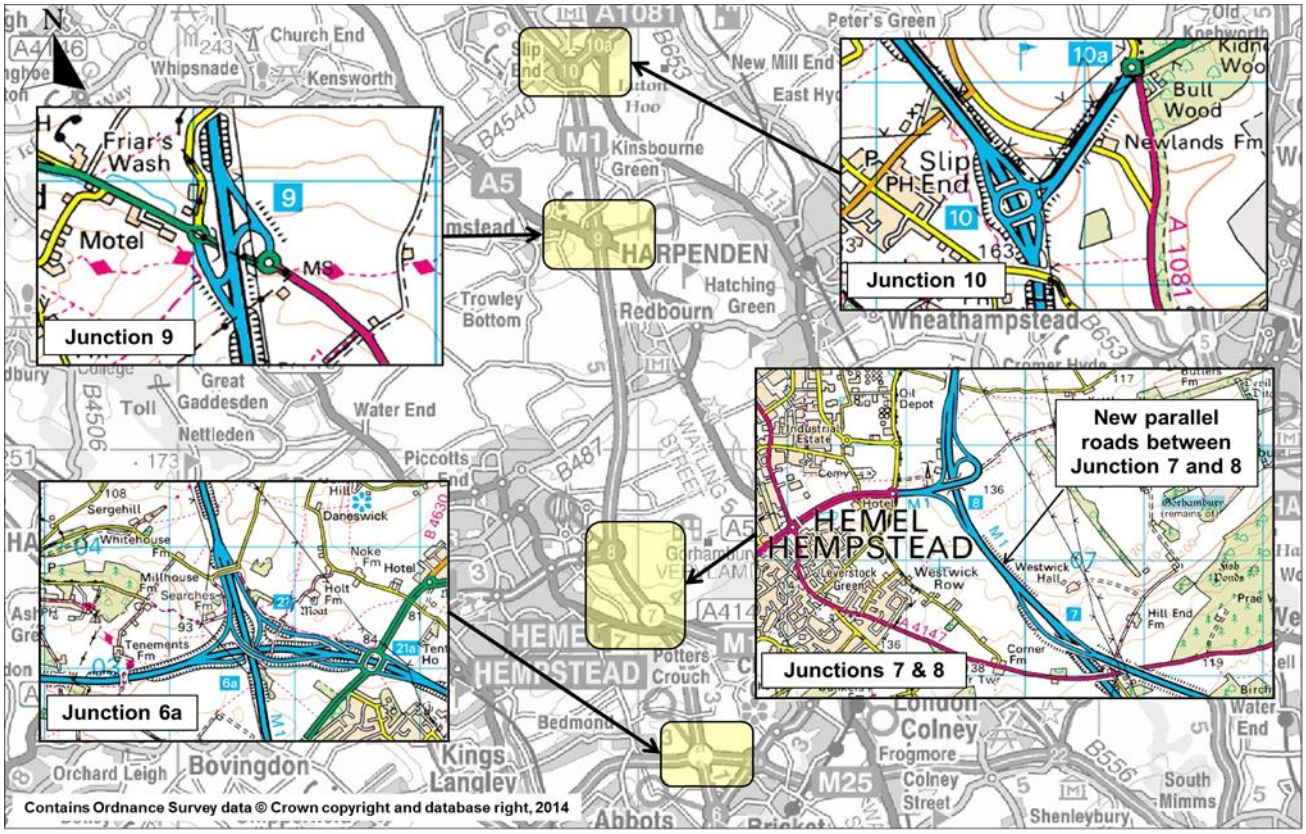


Figure 1.2 – Scheme Layout



History of the Scheme

1.12 A brief history of the principal events involved in the development of the scheme is provided in ***Table 1.1***.

Table 1.1 – Chronology of the Scheme

Date	Event
May 1989	First entered the road programme.
Aug 1992	Public consultation.
Sept 1994	Publication of Draft Orders.
Autumn 1995	Public Inquiry.
October 1996	Secretary of State's Decision following Public Inquiry.
July 2003	Entered HA's Programme of Improvements.
December 2003	Orders Confirmed.
December 2004	**Secretary of State announcement that this scheme would trial the 1st use of HOV (High Occupancy Vehicle) lanes in England.**
March 2006	**Construction starts**
March 2008	**HOV trial dropped in favour of a 'Controlled Motorway'.**
December 2008	**Scheme opened to traffic**
July 2009	**Controlled motorway introduced.**
October 2010	**One Year After report published**

Other Schemes in the vicinity

1.13 Road network changes in the locality of the scheme area can sometimes have an impact on traffic flows, journey times or collisions. Since the OYA stage a number of major schemes have been completed in the nearby area, as follows:

- M1 Junction 10 to 13 Smart Motorway was completed in December 2012;
- M25 Junction 16 to 23 Widening was completed in May 2012; and
- M25 Junction 27 to 30 Widening was completed in May 2012.

1.14 The impact of these schemes (if applicable) will be considered in the relevant sections of this report.

Post Opening Project Evaluation (POPE)

1.15 The HA 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.

1.16 When submitting a proposal for a major transport scheme, the Department for Transport (DfT) specifies that an Appraisal Summary Table (AST) is produced which records the degree to which the DfT's objectives[1] for transport have been achieved. The contents of the AST allow

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

judgements to be made about the overall value for money of the scheme. The AST for this scheme is presented in ***Table 7.1*** later in this report.

1.17 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 predictions made during the planning process. The outturn impacts of a scheme are summarised in an Evaluation Summary Table (EST) which summarises the extent to which the objectives of a scheme have been achieved. The EST for this scheme can be found in ***Table 7.2*** in this report.

1.18 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.
- Identify discrepancies between forecast and outturn impacts.
- Explain differences between forecast and outturn impacts.
- Identify key issues relating to appraisal methods that will assist the HA in ongoing improvement of appraisal approaches and tools used for Major Schemes.

Key Findings from One Year After (OYA) Study

1.19 The purpose of the FYA study is to verify and study in more detail the emerging trends and conclusions presented in the OYA study report. The main conclusions made in the M1 J6a-10 OYA report were as follows:

- The objectives of this scheme to reduce congestion, improve reliability and reduce collisions had all been met based on the evidence available at the one year after opening stage.
- There was evidence of limited traffic re-assignment onto the M1 motorway from nearby parallel roads in the local area.
- The observed journey times and safety benefits almost matched those forecast to occur.
- Observed northbound traffic volumes correlated well with the forecasts, whilst the southbound traffic flows were generally higher than forecast
- The investment cost of the scheme was less than forecast – despite the additional costs incurred implementing the controlled motorway.
- The environment mitigation measures, including extensive planting, had largely been put in place.

Report Structure

1.20 The remainder of this report is structured as follows:

- **Chapter 2** – Traffic Impact Evaluation.
- **Chapter 3** – Safety.
- **Chapter 4** – Economy.
- **Chapter 5** – Environment.
- **Chapter 6** – Accessibility and Integration.
- **Chapter 7** – Appraisal Summary Table and Evaluation Summary Table.
- **Chapter 8** – Conclusions.

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

- **Appendix A -** Tables and Figures in this Report
- **Appendix B -** Information requested for Environmental section
- **Appendix C -** Nickey Line Bat Monitoring Reports
- **Appendix D -** Summary of consultation responses
- **Appendix E -** ES Photomontage Comparison Viewpoints
- **Appendix F -** Glossary

2. Traffic Impact Evaluation

Introduction

2.1 This section examines traffic data to provide a before construction, OYA scheme opening and FYA scheme opening comparison of traffic flows and journey times on the scheme section and other roads in the vicinity. The purpose of this evaluation is to understand whether changes in traffic flows and journey times may be attributable to the scheme.

2.2 This section comprises:

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

Data Sources

2.3 This section of the report uses data from several sources to inform the "before" and "after" analysis of changes in traffic volumes and journey times on key routes that may be attributable to the scheme. For the purposes of this evaluation study, the main sources of data include:

Traffic Count Data

Permanent count data obtained from the TRADS[2] database for count locations on the HA network; count data from Hertfordshire County Council for count locations on the local network and additional local traffic data from commissioned traffic count surveys.

Journey Time Data

Journey times along the M1 J6a-J10 have been extracted from the HA's Journey Time Database (JTDB). The JTDB contains average journey times and average speeds for each junction to junction link on the HA's core network.

2.4 Road projects, in construction, can sometimes have an impact on traffic flows, journey times or collisions. During the OYA data collection stage there were three major schemes under construction in the nearby area. However, since then these schemes have been completed and there were no major schemes, in construction, which would have impacted the data during the FYA data collection stage.

Background Changes in Traffic

2.5 Historically in POPE scheme evaluations, the 'before' counts have often been factored to take account of background traffic growth so that they are directly comparable with the 'after' counts. This usually involves the use of National Road Traffic Forecasts (NRTF), with local adjustments made using local growth factors.

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

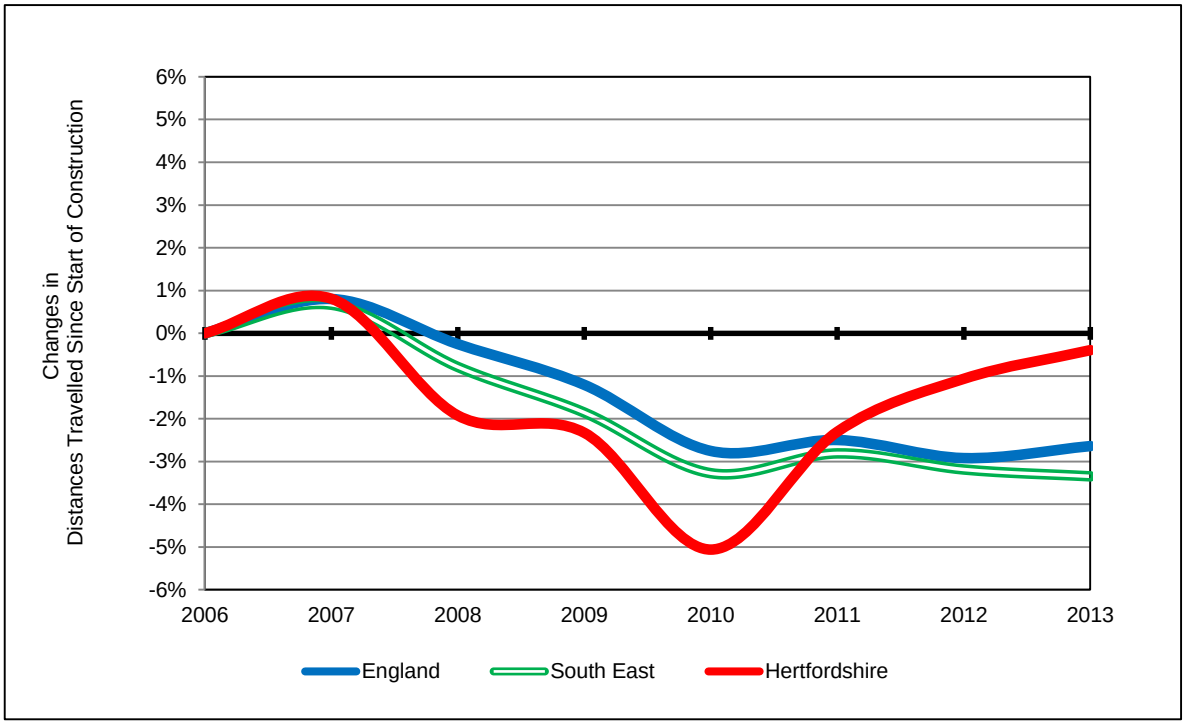
[2] TRADS is the Highways Agency website containing traffic flow data from automatic traffic counts on the HA's strategic network.

in the vicinity of the scheme, within the context of national, regional and locally observed background changes in traffic.

National Trends, Regional and Local Trends

2.7 The Department for Transport (DfT) produces observed annual statistics for all motor vehicles by local authority[3].Data between 2006 (before start of construction) and 2013 (the latest available) is shown in million vehicle kilometres (mvkm) for Hertfordshire (local), the South East (regional) and England (national) in ***Figure 2.1***.

Figure 2.1 – National, Regional and Local Traffic Trends



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

- At a national and regional level, traffic trends are broadly similar, with a slight decline in vehicle kilometres from 2006 to 2010 (3%) and then fairly constant until 2013.
- In Hertfordshire, the traffic levels reduced between 2006 and 2010. However, since 2010, traffic figures have increased close to 2006 levels.
- Overall, the vehicle kilometres travelled at national, regional and local levels have decreased between 3.3% and 0.4% from 2006 to 2013.

Conclusions on Background Growth

2.9 This section has considered the following factors which may have influenced observed traffic flows pre-scheme and post-opening:

- National, regional trends and local trends, which show an average reduction of approximately 2.1% in traffic levels between 2006 and 2013.

2.10 The years 2005, 2009 and 2014 have been selected as the respective before, OYA and FYA for the evaluation of the scheme. As there is no consistent and significant trend in background traffic at the national, regional and local level, it is not appropriate to derive a factor to apply to the before traffic counts to account for background traffic changes and hence no factoring on the 'before' counts.

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

Traffic Volume Analysis

2.11 This section presents a detailed analysis of traffic flows and journey times between pre-scheme opening and post scheme opening.

2.12 Data obtained from the TRADS database for count locations on the HA network has been used to inform the before and after analysis of changes in traffic volumes. To complete this evaluation, data from before construction (2005), OYA (2009) and FYA (2013) is compared.

2.13 Data obtained from Hertfordshire County Council and commissioned traffic count surveys have been used in the analysis of traffic volumes in the nearby local road network.

2.14 ***Figure 2.2*** shows a comparison of the long term traffic flows on the M1 between Junctions 9 and 10. This section was selected because it has the most comprehensive long term data coverage. Comprehensive data does not exist for the construction period; however, traffic would have been affected by the traffic management anyhow. ***Figure 2.3*** shows the pre-scheme and post scheme traffic flows on the motorway section, which is within the extent of the scheme.

2.15 ***Figure 2.4*** shows the pre-scheme and post-scheme traffic flows on the surrounding local network, in the vicinity of the scheme.

Figure 2.2 – Long Term Traffic Flow Trend on M1 between Junctions 9 and 10 (AWT)

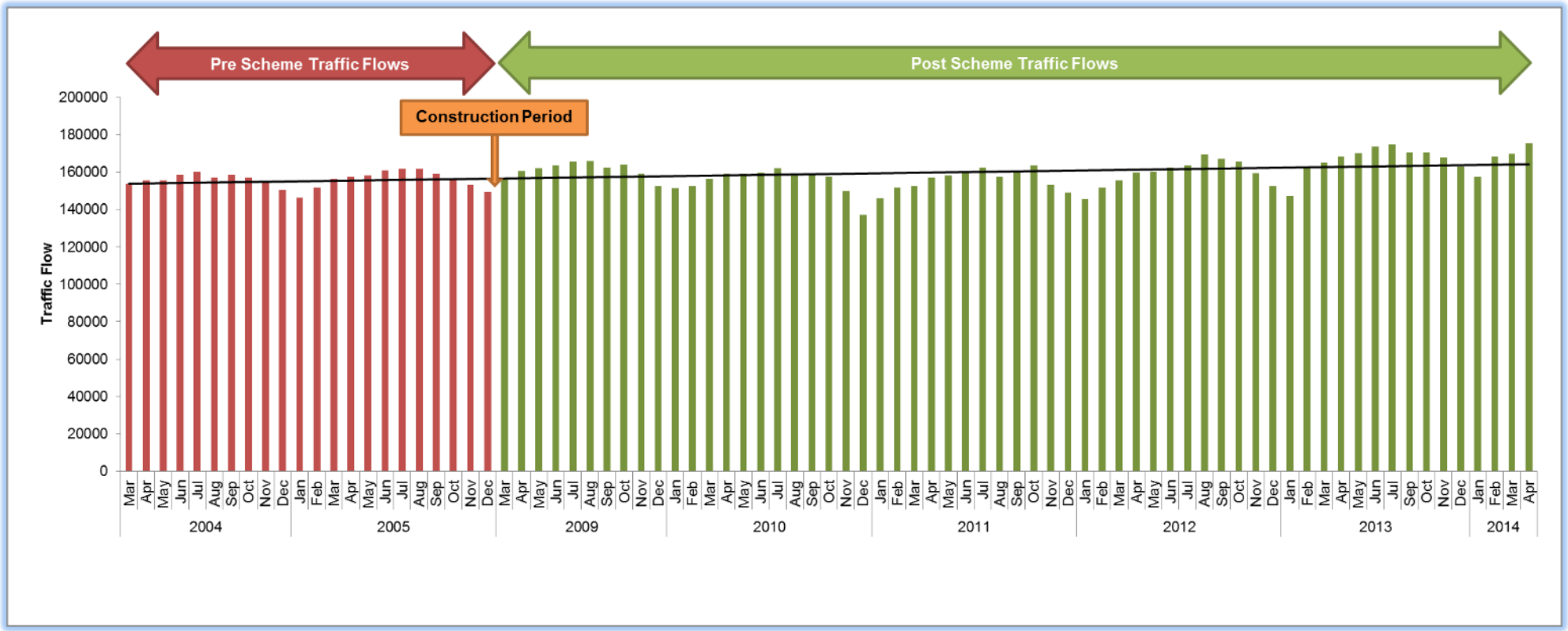


Figure 2.3 – Pre-scheme and Post Scheme Traffic Volumes on the M1 J6a to 10 (AWT)

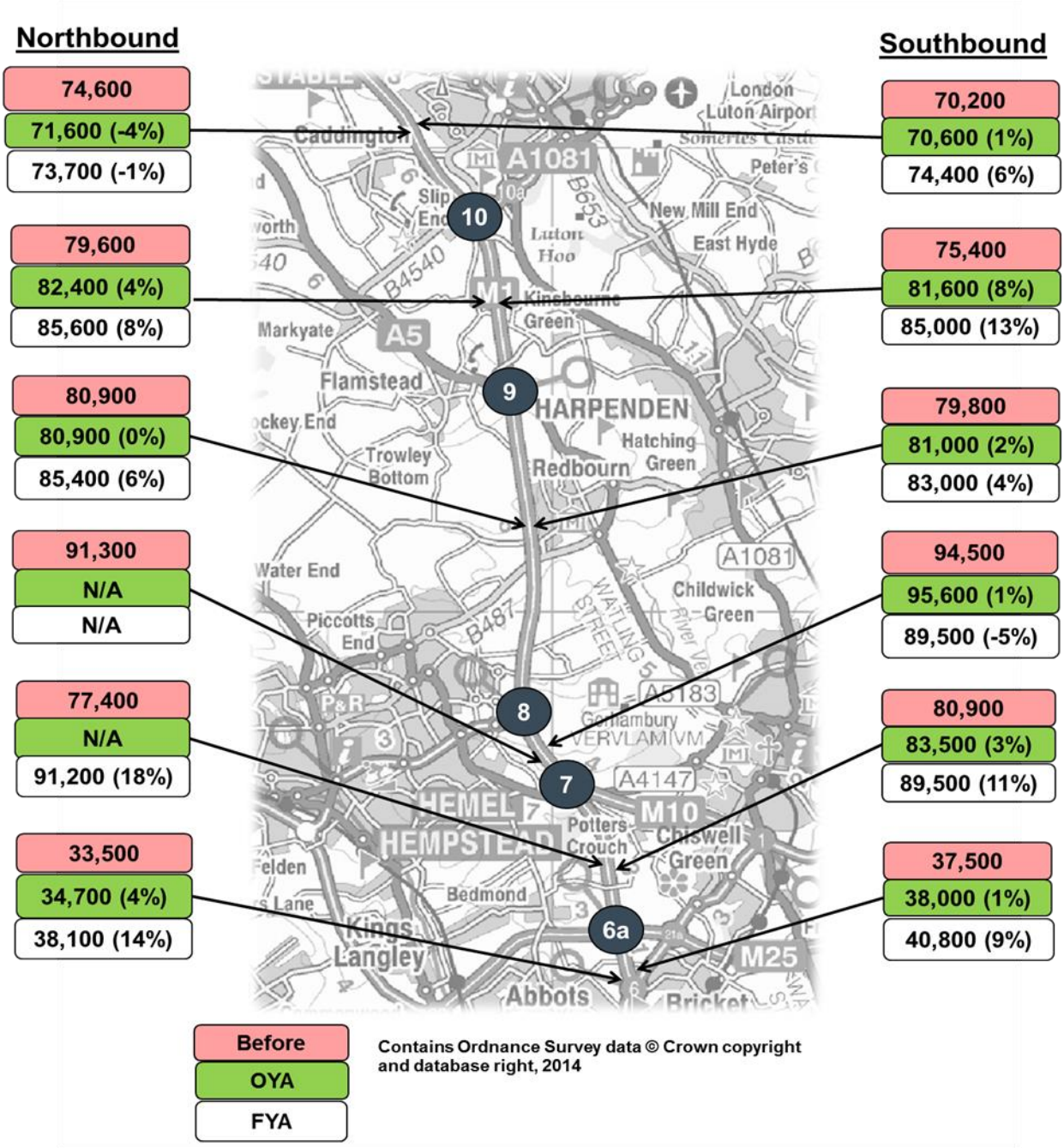
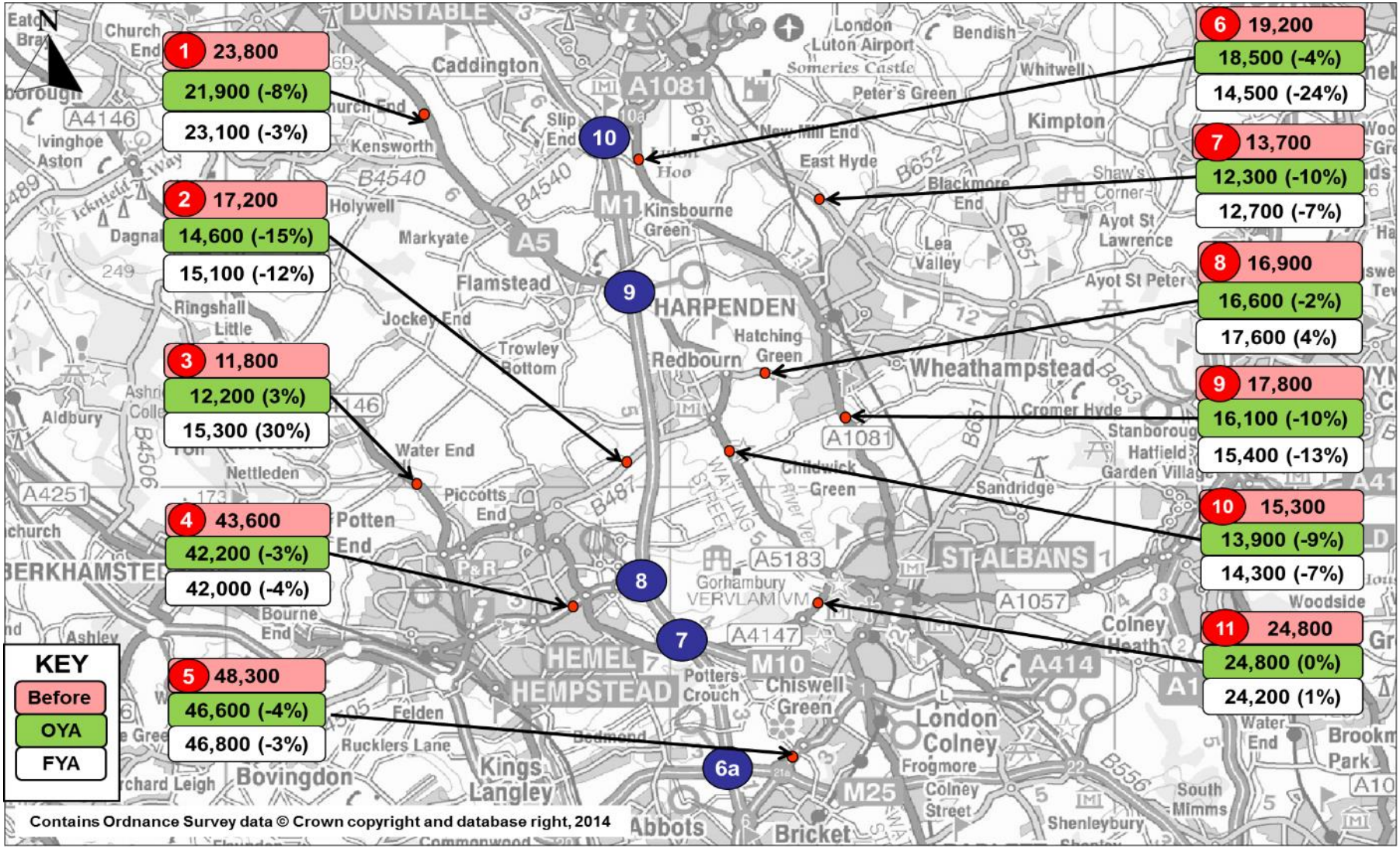


Figure 2.4 – Pre-scheme and Post Scheme Traffic Volumes on the Surrounding Network (AWT)



2.16 The key points regarding changes in Average Weekday Traffic(AWT) along the scheme section, other motorways and local roads in the study area from ***Figure 2.3*** and ***Figure 2.4*** are:

- Along the scheme section on the M1, traffic is generally higher than pre-scheme levels for both OYA and FYA scheme opening apart from Junctions 10 to 11 northbound and Junctions 7 to 8 southbound.
- There is also growth in traffic between observed OYA and FYA for the scheme section.
- There has been a general decrease in the traffic volumes on the surrounding local network apart from the A4146 Leighton Buzzard Road (Site 3), where there was a significant increase (30%) between the before and FYA stage.
- Please note that there is a significant decrease (24%) in traffic volumes on the A1081, just south of junction 10a. The data at this location was collected via a commissioned traffic count survey. However, major grade separation works were being undertaken at junction 10a and the traffic count site was within the works boundary. This is likely to have impacted on the results.
- The reduction in traffic in the surrounding local network and the increase in traffic on the M1 scheme section suggests that traffic has re-assigned to the M1 following the scheme improvement. This is particularly supported by the increase in traffic on the A5183, A1081 and A5 which are parallel routes to the M1 scheme section.

2.17 In summary, the observed traffic data from the local highway network shows that the increase in traffic on the M1 (as shown in ***Figure 2.3*** previously) is likely to be a result of re-assignment from the local road network.

Wider Network

2.18 The M1 is clearly a major strategic route which carries considerable proportions of long distance traffic. Therefore a review of the long term traffic trends on the obvious competing strategic routes has been undertaken to examine if there has been a noticeable impact on traffic flows on these routes. The most obvious routing alternatives exist on the London to Birmingham (M40) and London to Doncaster/Sheffield (A1/A1 (M)) routes.

2.19 It would be anticipated that a small proportion of traffic may re-route to the M1 following the improvement. However, a review of the traffic trends on the M40 and A1 (M) provides no clear evidence of changes in traffic flows since the M1 scheme opened and, therefore, is not presented in detail here. This is more likely to be a result of two factors:

- The level of re-assignment is likely to be very small; and
- Other highway network changes (including road works and improvements) and development changes are likely to have had a greater impact on traffic flows.

Forecast vs. Outturn Traffic Flows

2.20 This section contains the following:

- A summary of the traffic modelling approach and forecast assumptions; and
- Forecast vs. observed traffic volumes

Traffic Modelling Approach and Forecast Assumptions

2.21 Before undertaking an evaluation of the forecast traffic impacts compared to those which have actually occurred, it is firstly necessary to develop an understanding of how the scheme has been appraised and the key assumptions used. This may then assist in explaining any differences between the traffic forecasts and the observed impacts.

Study Area

2.22 The area covered by the traffic model extends from M1 Junction 14 in the north to M1 Junction 6 in the south, and from the A5 in the west to the A6 in the east. It encompasses all trunk roads and primary routes through the area, as well as other roads that carry significant volumes of traffic. The urban areas of Milton Keynes, Leighton Buzzard, Luton/Dunstable, Hemel Hempstead and St Albans are also modelled.

Modelling Approach

2.23 The traffic model which was previously developed for the M1 Junctions 10 to 13 study was updated and refined to make suitable for assessing the full J6a to 10 scheme. The model was developed using the SATURN software and is fully simulated within the M1 corridor.

2.24 The fourth lane of the widened motorway originally was due to be designated for high occupancy vehicles (HOV's) in order to encourage car sharing and thereby reduce traffic demand in M1 corridor. This proposal was subsequently dropped when the scheme was being constructed. However, as it was only planned to be a HOV lane on a trial basis, the potential impacts of the HOV lane have not been considered in the traffic modelling for this scheme.

Traffic Forecasting

2.25 The following years were modelled:

- 2008 – Opening Year; and
- 2023 – Design Year (15 years after opening).

2.26 Based on HA guidance at the time of the appraisal, the forecast flows for design assessment purposes were predicted assuming most likely (central) traffic growth for future years. No allowance was made for any uncertainty or variability in these forecasts (e.g. low or high traffic growth estimates).

2.27 It is not possible to validate the traffic growth assumptions because they were developed from sector level growth forecasts determined from forecast year cordon matrices extracted from the LSM (London to South Midlands) model.

Forecast vs. Observed Traffic Volumes

2.28 A number of traffic forecasts were prepared for this scheme and were used for different elements of the appraisal. A summary of the traffic forecasts used is provided below:

- **Traffic Forecasting, Economic and Safety Assessment**: M1 Junction 6a to 10 Widening – Design Traffic Flows Report (March 2006);
- **Noise Appraisal**: Road Traffic Noise Review (January 2006); and
- **Air Quality Appraisal**: Detailed Scheme Review (May 2004).

2.29 Each of the documents presents slightly different traffic forecasts. To maintain consistency, the actual traffic volumes are compared against those contained in the reports listed above for the relevant scheme impact (traffic, noise, air quality). Therefore different traffic forecasts are presented and compared at various stages of this report.

Evaluation of forecast traffic volumes vs. observed traffic volumes

2.30 Forecast traffic volumes for the M1 and A414 (former M10) are contained are contained in the *M1 Junctions 6a to 10 Widening – Design Traffic Flows Report* (March 2006). The appraisal documentation did not contain without scheme (do nothing) traffic forecasts therefore a comparison with the observed before opening traffic flows has not been possible. ***Table 2.1*** shows a comparison of the forecast and outturn with scheme (do something) traffic flows on links where observed data is available. The table compares forecasts for the OYA and FYA stages. As there is only one year between the forecast (2008) and observed (2009) data in the OYA stage, no factoring has been undertaken to take account of background traffic. However, in the FYA forecasts linear growth has been assumed between opening year (2008) and design year (2023) forecasts.

Table 2.1 – Comparison of Forecast and Outturn 'Do Something' OYA Traffic Flows

Site	OYA			
	Forecast (2008)	Observed (2009)	Difference	% Difference
J6a to J7 Southbound	72,200	81,000	8800	12%
J8 to J9 Northbound	80,800	77,400	-3,400	-4%
J8 to J9 Southbound	68,700	77,900	9,200	13%
J9 to J10 Northbound	78,400	78,900	500	1%
J9 to J10 Southbound	65,500	78,600	13,100	20%

Table 2.2 – Comparison of Forecast and Outturn 'Do Something' FYA Traffic Flows

Site	FYA			
	Forecast (2013)	Observed (2013)	Difference	% Difference
J6a to J7 Southbound	81,900	89,500	7,600	9%
J8 to J9 Northbound	89,900	85,400	-4,500	-5%
J8 to J9 Southbound	77,200	83,000	5,800	8%
J9 to J10 Northbound	87,100	85,600	-1,500	-2%
J9 to J10 Southbound	75,700	85,000	9,300	12%

2.31 The following points can be noted from the comparison of predicted vs. observed traffic flows presented in ***Table 2.1*** and ***Table 2.2***:

- Observed traffic volumes at FYA stage between junctions 8 to 9 northbound and junctions 9 to 10 northbound are very close to predicted (within 5%); and
- Observed southbound traffic flows, at both OYA and FYA, are considerably higher than predicted on all of the sections of the M1 where data was available to compare. The Design Traffic Flows Report does not provide any reasons why the predicted southbound flows are considerably lower than the northbound flows. A review of the Development and Validation of the Traffic Model Report shows similar traffic flows in both directions and a good level of model validation. This shows that it is highly unlikely that the differences shown in ***Table 2.2*** stem from the base year traffic model.

Journey Time Analysis

Scheme Objective: to reduce congestion

2.32 This section considers the impact on journey times following the scheme's implementation. Pre-scheme journey times along the M1 J6a to 10 scheme section are compared with post-opening journey times in both directions. The journey time analysis is split into three components:

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

2.33 The calendar periods used in this FYA study are:

- Before: 2005
- OYA: 2009
- FYA: 2013

Observed Journey Times

2.34 Before and after opening average journey times have been examined on the M1 between Junctions 6a and 10. ***Figure 2.5*** and ***Figure 2.6*** show a comparison of the northbound and southbound directions respectively. The following conclusions can be derived from this analysis:

Figure 2.5 – M1 J6a-10 Northbound Average Journey Time Profile

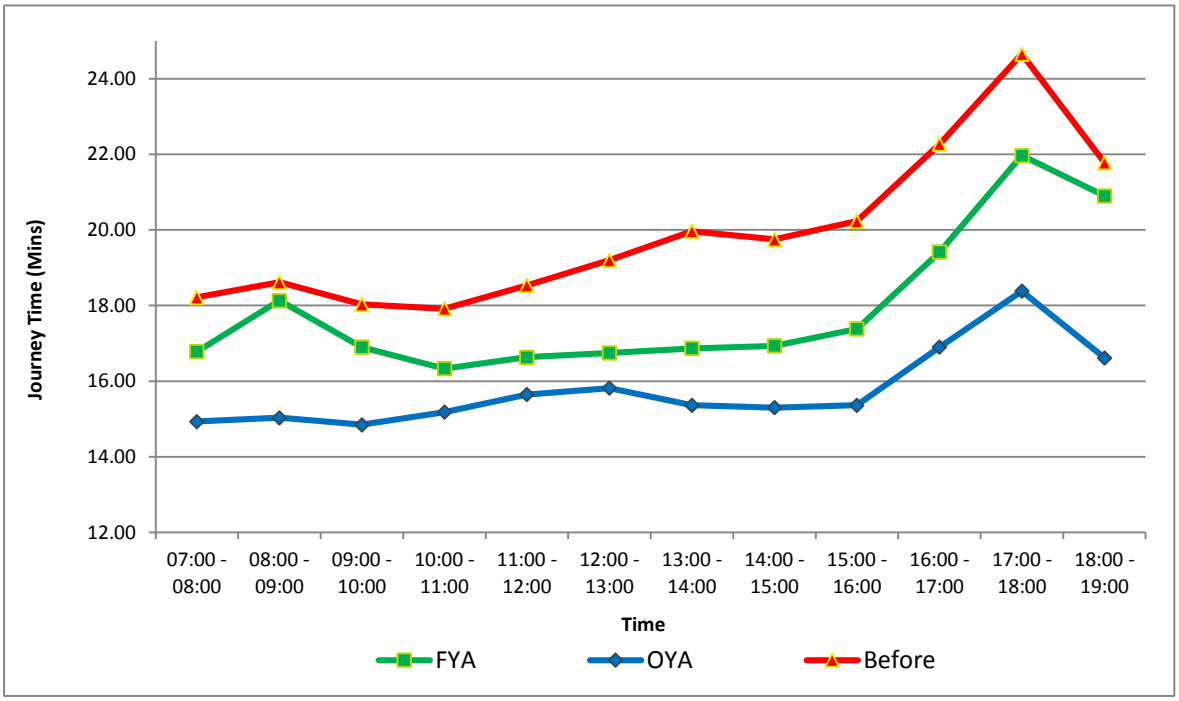
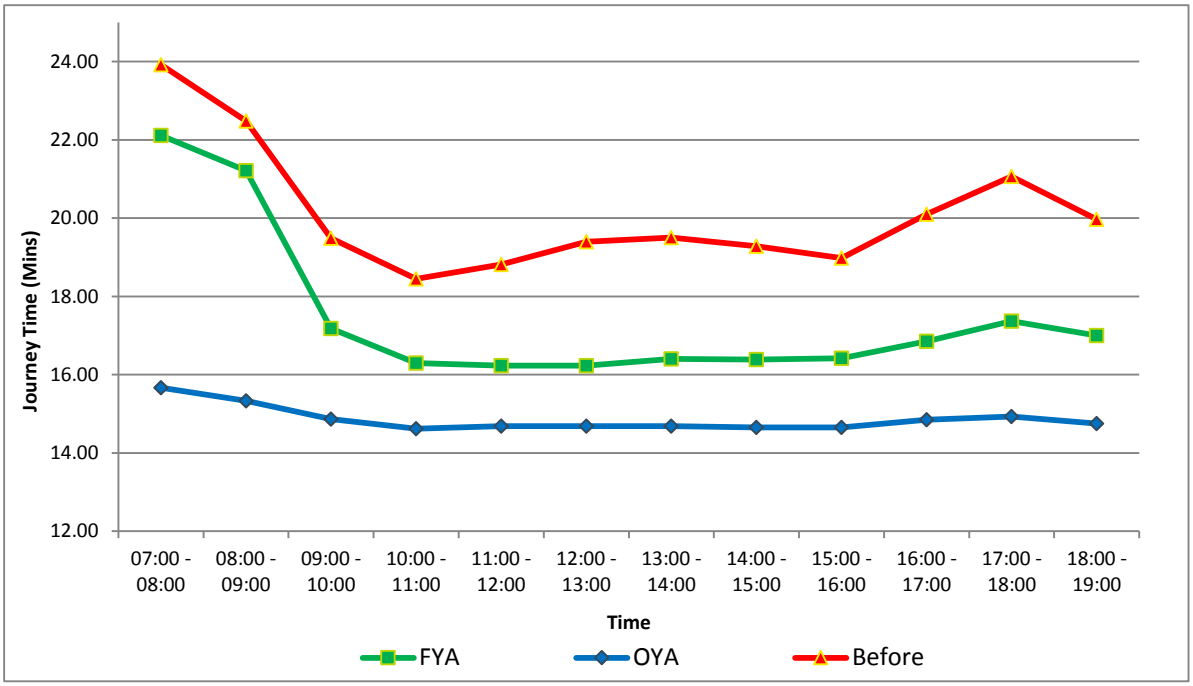


Figure 2.6 – M1 J6a to 10 Southbound Average Journey Time Profile



2.35 The results presented in ***Figure 2.5*** and ***Figure 2.6*** reveal that:

- In both directions, journey times have reduced compared to pre-scheme levels for all time periods considered, both at OYA and FYA stages.
- The results also suggest that since scheme opening, journey times have increased slightly from OYA stage to FYA stage. This is likely due to the increase in traffic volumes on the M1 scheme section as described earlier in the 'Traffic Volume Analysis' section.
- Journey times are highest in the AM peak in the southbound direction and in the PM peak in the northbound direction and this trend continues post scheme opening.
- Journey time variability (variability is the extent to which journey times vary from the expected average journey time on a particular day of the week at the time of day in question) deteriorated in both directions since the OYA stage. Northbound FYA journey time variability is marginally better that the pre-scheme journey time variability and the southbound FYA journey time variability is worse than the pre-scheme stage. Again, this can be attributed to the increased levels of traffic on the M1 scheme section.

Forecast vs. Observed Journey Time Savings

2.36 Predicted journey times have not been presented in the appraisal documentation. However, the Air Quality chapter of the '*Detailed Scheme Review'* (DSR) contains forecast speeds for each of the junction to junction sections with and without the scheme for the year 2007. In the absence of more comprehensive information, this speed data has been used to provide indicative predicted journey times. It should however, be noted that the forecast journey times are an average over the day (i.e. 24 hours). For consistency, average observed journey times over 24 hours in both directions have also been presented (see ***Table 2.3***).

Table 2.3 – Forecast vs. Observed Journey Times (mm:ss)

		Forecast 2007 (mm:ss)			Observed (mm:ss)		
M1 Section	**Distance (km)**	**Do Minimum**	**Do Something**	**Difference**	**Before (2005)**	**FYA (2013)**	**Difference**
J6a to J7	4	02:38	02:12	00:26	02:58	02:21	00:37
J7 to J8	1.1	00:54	00:36	00:18	01:00	00:45	00:15
J8 to J9	7.1	05:04	03:54	01:10	05:08	04:15	00:53
J9 to J10	3.7	03:00	02:02	00:58	02:43	02:16	00:27
Total	**15.9**	**11:36**	**08:44**		**11:49**	**09:37**	

2.37 The key points from ***Table 2.3*** are:

- The forecast journey time savings were slightly higher than the observed journey time savings. The difference was largely due to the difference between the forecast and observed for J9 to 10.
- Forecast journey times for the Do Minimum were lower than the observed pre-scheme journey times in all sections with the exception of Junction 9 to 10. The Do Something forecast journey times are lower than observed. This explains the smaller savings in observed than forecast for the scheme section.

Journey Time Reliability

Scheme Objective: to improve journey time reliability

2.38 WebTAG states that reliability is a sub-objective of the economic assessment of a scheme and refers to the impact of the scheme on improving journey time variability. It also states that assessment of reliability is a rapidly developing area. As such the following sections present the reliability impact of the scheme based on the route stress method and the changes in the standard deviation of journey times.

Forecast

2.39 The 2007 AST states:

> 'Based on preliminary INCA results, additional benefits in excess of £500m may be accrued to the scheme due to improved travel time reliability and the reduction in incidents.'

Evaluation

2.40 The INCA (Incident Cost Benefit Assessment) model for this scheme was not available to the evaluation team, and commentary relating to journey time reliability is absent from both the TFR and the EAR. The evaluation therefore focuses on the standard deviation of journey times.

2.41 Reliability is concerned with variability in journey times. Therefore a proxy for reliability can be obtained by examining the variation of journey times using the data in the JTDB. The metric used is standard deviation of journey times from the mean time for each time period in the before and after widening periods. The larger the deviation from the mean journey time, the greater the unreliability.

2.42 The metric used in the analysis is the standard deviation of mean journey times for each time period for the pre-scheme and post-opening periods. Data is presented for the twelve hour period (07:00-19:00). ***Figure 2.7*** presents the journey time reliability for the scheme section in the northbound direction, and

2.43 ***Figure 2.8*** presents journey time reliability in the southbound direction.

Figure 2.7 – M1 J6a to J10 Northbound Journey Time Reliability

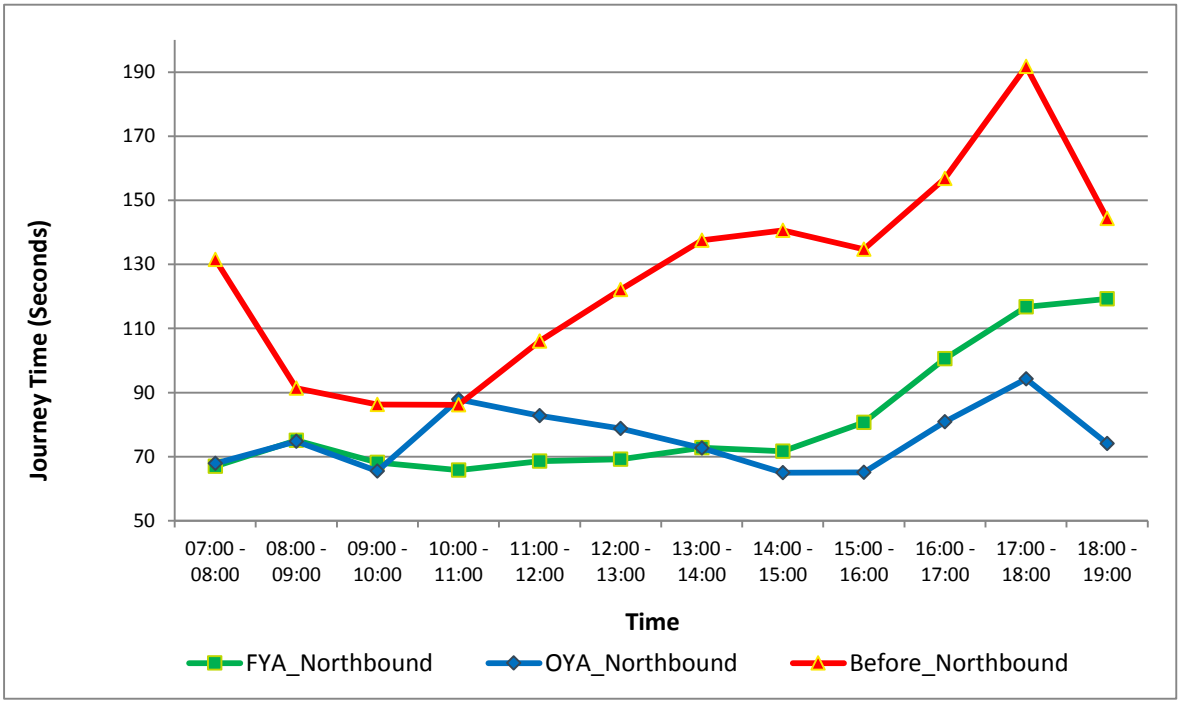
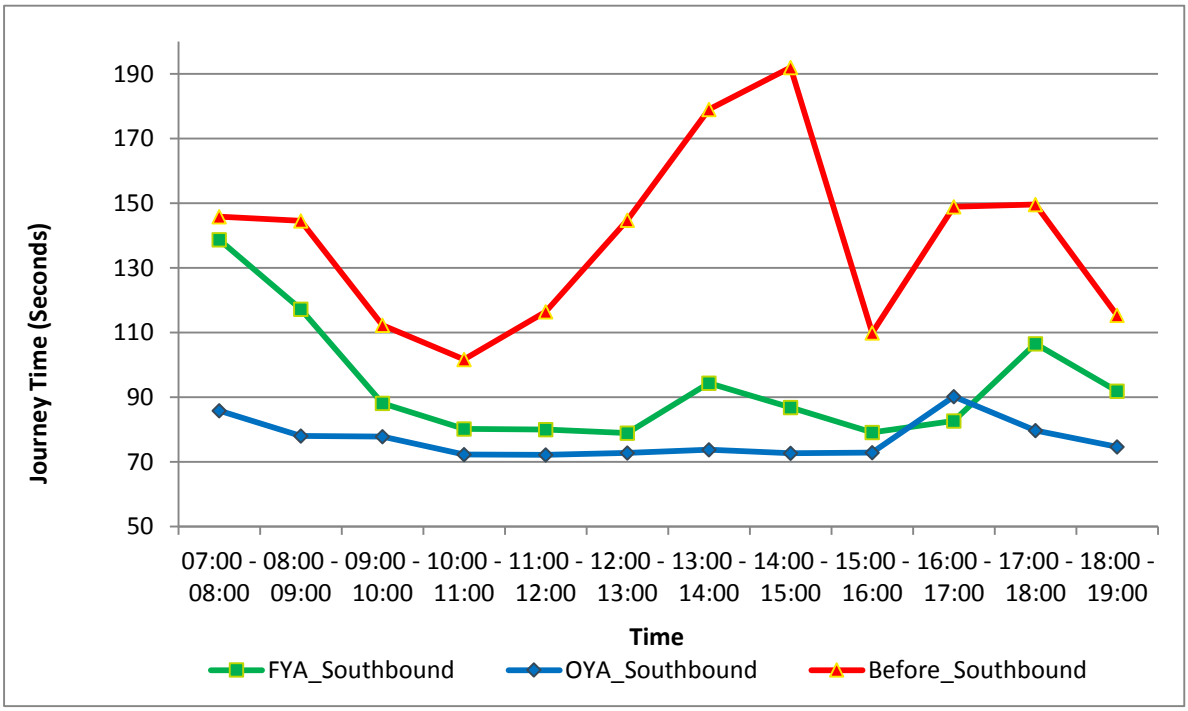


Figure 2.8 – M1 J6a to J10 Southbound Journey Time Reliability



2.44 The results presented in ***Figure 2.7*** and ***Figure 2.8*** based on the spread of average journey times reveal that:

- In the pre-scheme there were high fluctuations in the journey times in both directions and this has improved post scheme opening.
- In both directions, journey times were varying with three peaks in the AM peak, IP and PM peak. Post scheme opening, this has reduced considerably and in the IP, the curve is flat indicating that the journey time is consistent in the IP.
- In the southbound direction, since the OYA stage, journey time reliability has worsened during the AM, IP and PM peak periods.

- The results for the northbound direction show that journey time reliability in the PM peak remains an issue at FYA.
- Overall journey time reliability has improved with fewer peaks during the day indicating that the scheme has catered to the objective of improving journey time reliability in the longer term.

Key Points – Traffic Impacts

Traffic Flow Impacts

- Traffic flows on the improved section of the M1 have increased slightly since scheme opening.
- There has been a general decrease in traffic flows on the majority of local roads in the vicinity of the scheme since opening. This indicates that the increase in observed traffic on the M1 could be a result of the re-assignment from these routes.

Traffic Forecasting

- Observed northbound traffic volumes are very close to predicted indicating a high degree of forecasting accuracy.
- Observed southbound traffic volumes are higher than predicted. The reasons for these forecasting inaccuracies are unclear following a review of the appraisal documentation.

Journey Times

- Post opening journey times are consistently lower than before construction for both the northbound and southbound directions at both OYA and FYA stages.
- Post opening journey times follow the same pattern (i.e. they demonstrate the peaks in journey times at the same time)
- FYA journey times are slightly higher than OYA journey times. This can be explained, somewhat, by the increase in traffic volumes during this time period.

Journey Time Forecasting

- The forecast journey time savings were slightly higher than the observed journey time savings. The difference was largely due to the difference between the savings for J9 to 10.
- Forecast journey times for Do Minimum were lower than the observed pre-scheme journey times and the Do Something forecast journey times were lower than observed. This explains the smaller savings in observed than forecast.

Journey Time Reliability

- Overall journey time reliability has improved with fewer peaks during the day indicating that the scheme has catered to the objective of improving journey time reliability in the longer term.

3. Safety Evaluation

Introduction

3.1 This chapter examines the impact of the scheme on safety. The DfT's objectives for transport set out the principal objectives to reduce collisions and improve security. This includes reducing the loss of life, injuries and damage resulting from transport collisions and crime.

3.2 In order to assess the scheme's impact on collisions, this section of the report analyses changes in personal injury collisions (PICs) occurring in the five year period before scheme opening and after. Evaluation of the scheme's impact on personal security has also been undertaken through the use of observations made during a site visit.

Data Sources

Forecast Data

3.3 The forecast benefits for the M1 J6a – 10 widening scheme have been derived from a COBA (COst Benefit Analysis) model, which gives predicted PIC savings for the opening year and over the 60 year appraisal period. In order to ensure a like-for-like comparison between the predicted and observed collisions, the area of analysis used for this study is the same area covered by the COBA model. The study area covers the M1 Junctions 6a to 10 and the associated slip roads only. Therefore any links which have not been changed by the scheme were not considered in the appraisal.

3.4 Changes in collisions over a wider area (that covered by the London to South Midlands (LSM) model) were also considered in the appraisal manually (based on traffic flow changes) but yielded only a small saving compared to the local area. As there are likely to be many other factors influencing the collision rate on the surrounding highway network, and the relatively low predicted saving, the wider area has been excluded from this analysis.

Observed Data

3.5 Collision rate changes are evaluated for all major schemes under POPE. For the purpose of this study, the area of influence is considered to be the COBA area considered for appraisal and collision data has been obtained from the Highways Agency (at time of request) Pavement Management System (HAPMS) and the Area 8 MAC, for the area shown in ***Figure 3.1***.

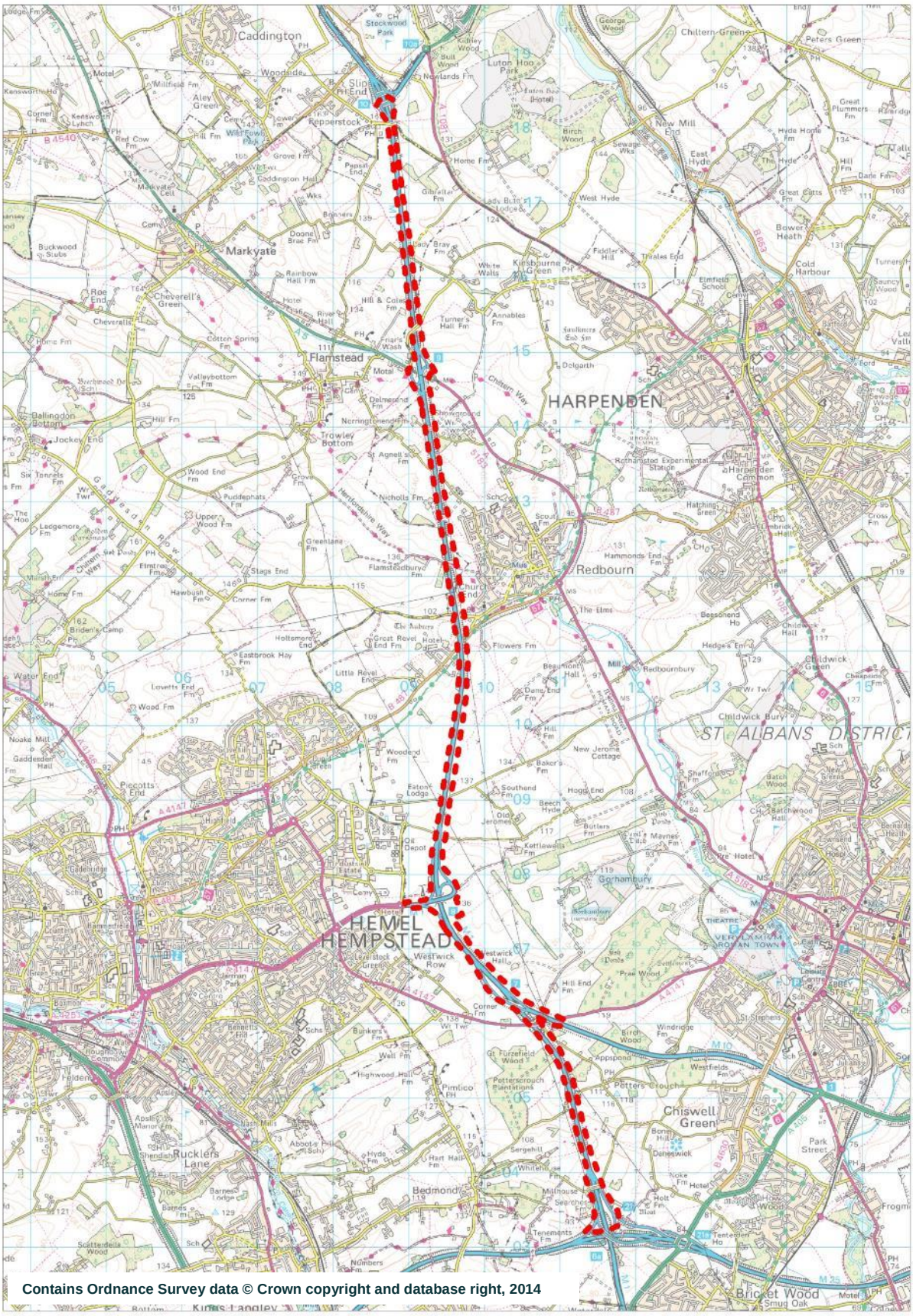
3.6 The data covers the following time periods:

- Pre-scheme: Five years before the start of scheme construction (March 2001 to February 2006).
- Construction: March 2006 to December 2008.
- Post-opening: January 2009 to December 2013.

3.7 The collision data is based on the records of PICs (i.e. collisions that may involve injuries to one or more persons) recorded in the STATS19 data collected by the police when attending collisions. Collisions that do not result in injury are not included in this dataset and are thus not considered in this evaluation.

3.8 It should also be noted that at this stage, the collision data received from the area 8 MAC is not validated. The requirement for up to date and site specific information necessitated the use of an invalidated data source. Thus the data is judged to be sufficiently robust for use in this study, but it may be subject to change. However, it is not anticipated that this would be significant in terms of the analysis of collision numbers presented in this report.

Figure 3.1 – Collision Analysis Study Area



Background Changes in Collision Reduction

3.9 It is widely recognised that for over a decade there has been a year-on-year reduction in the numbers of personal injury collisions on the roads, even against a trend of increasing traffic

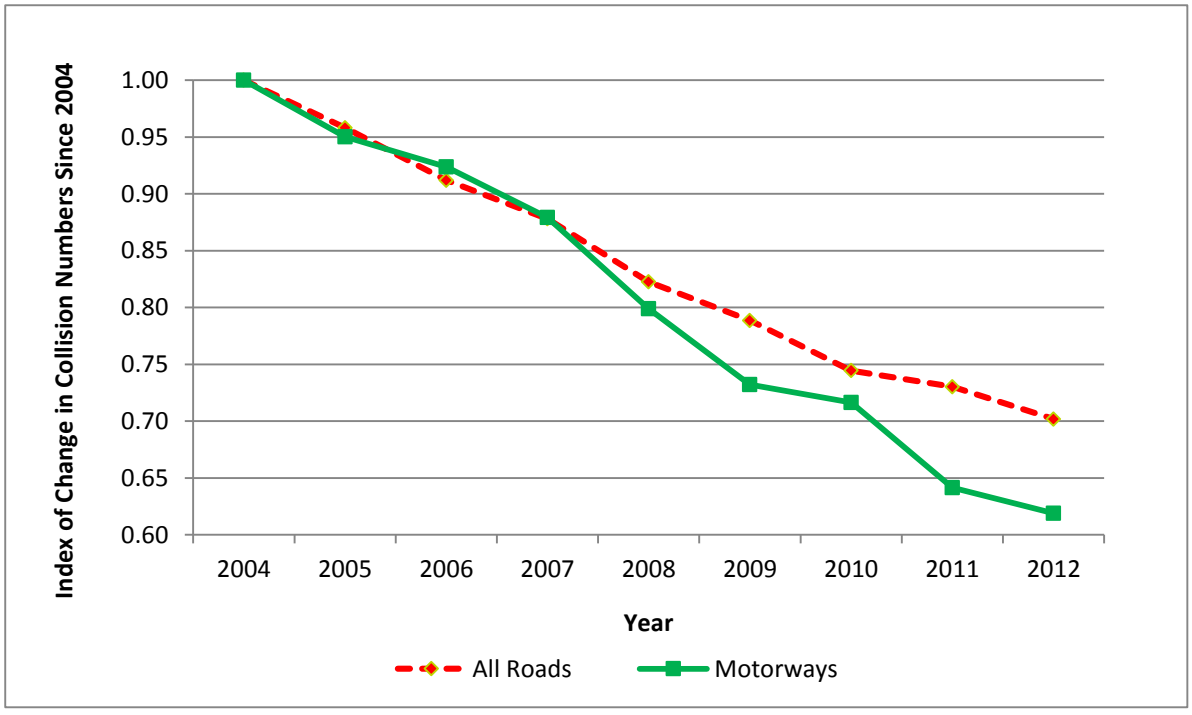
volumes during much of that period. The reasons for the reduction are considered to be multi-factorial and include improved safety measures in vehicles and reduced numbers of younger drivers. This background trend needs to be considered when considering the changes in collision numbers on the M1 J6a to J10. If the scheme had not been built, collision numbers in the area may still be influenced by wider trends and reduced.

3.10 When we compare the number of collisions in this area in the years before and after the scheme was built, and associate the net change primarily with the scheme, we need to take this background reduction into account. The best way to do this is to assume that, if the scheme had not been built, the number of collisions on the roads in the COBA area here would have dropped at the same rate as they did nationally during the same period. This gives us what is known as the counterfactual 'without scheme' scenario on a like for like basis with the observed post opening data which is the 'with scheme' scenario.

3.11 The comparison needed is between the middle year in the FYA period (2011) and the middle of the before period (2004). The approach is to use national data for the changes in the numbers of collisions in this period occurring on motorways (all the links covered by the COBA are motorway)[4]. ***Figure 3.2*** illustrates the changes in collision numbers by road type between 2004 and 2012.

3.12 The difference between the numbers of collisions in these two scenarios can then be attributed to the scheme rather than the wider national trends.

Figure 3.2 – Trends in Injury Collision Numbers[5]



Collision Numbers

3.13 This section analyses the observed trends in PICs following the implementation of the scheme. This includes investigating the changes in the number of collisions and associated casualties as well as whether there has been a reduction in the relative severity of incidents.

[4] The index of change of numbers of collisions on Motorways between 2004 and 2011 is 0.64; the index of change on all road types in the same period is 0.73.

[5] Data sourced from DfT table RAS 10002 which includes reported collisions and collision rates by road class and severity, Great Britain.

Collisions

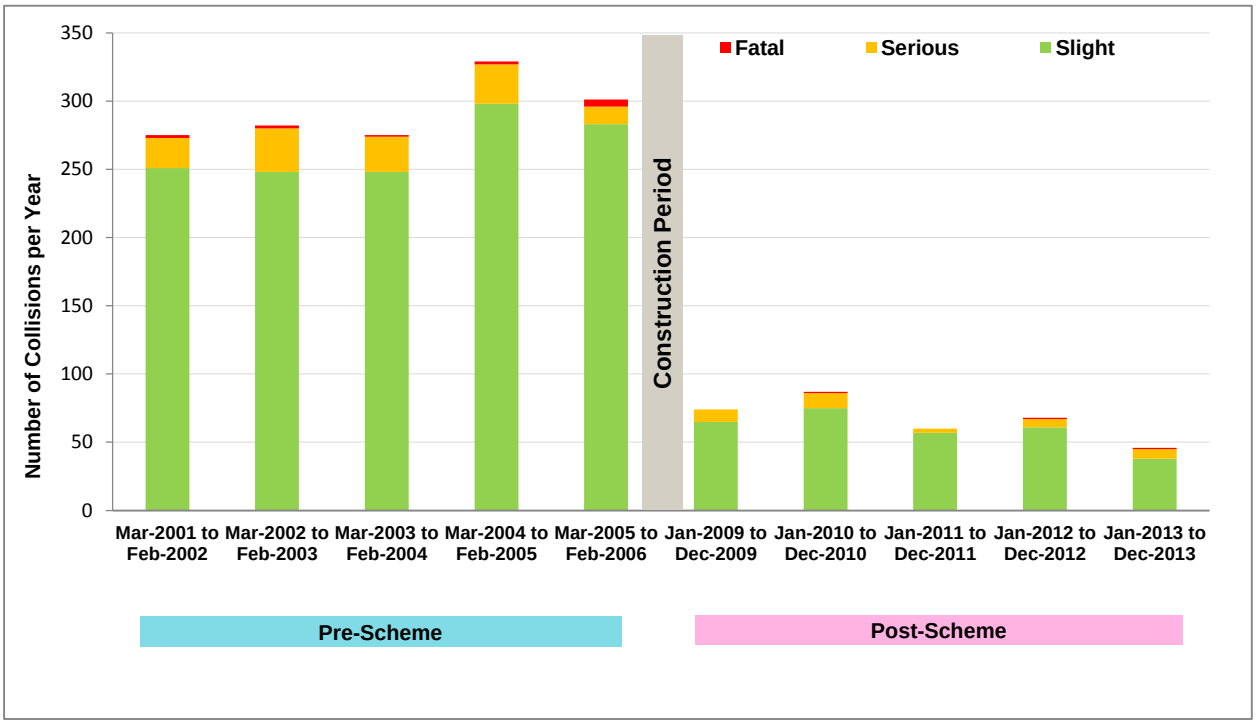
3.14 An evaluation of before and after opening collision numbers by year for the whole of the COBA M1 J6a-10 modelled area is shown in ***Table 3.1***. The results are also presented graphically in ***Figure 3.3***.

3.15 The results in ***Table 3.1*** include the 'counterfactual'. The 'counterfactual' is a figure calculated from national collision statistics which signifies the reduction in national road collisions due to a number of factors such as improved driver training and a reduction of the number of young drivers.

Table 3.1 – Number of Collisions by Severity in the M1 J6a - J10 COBA Area

Period	Time Period		Number of Collisions by Severity			Total Collisions	Average Annual Collisions			
	From	To	Fatal	Serious	Slight		Fatal	Serious	Slight	All
Pre-Scheme	Mar/2001	Feb/2002	2	22	251	275	2.4	24.4	266.0	292.9
	Mar/2002	Feb/2003	2	32	248	282				
	Mar/2003	Feb/2004	1	26	248	275				
	Mar/2004	Feb/2005	2	29	298	329				
	Mar/2005	Feb/2006	5	13	283	301				
Without Scheme Counterfactual (adjusted for background reduction)										187.9
Construction	Mar/2006	Feb/2007	0	13	136	149	0.0	13.1	136.6	149.6
	Mar/2007	Feb/2008	0	11	157	168				
	Mar/2008	Dec/2008	0	13	94	107				
Post-Scheme	Jan/2009	Dec/2009	0	9	65	74	0.6	7.2	59.2	67.0
	Jan/2010	Dec/2010	1	11	75	87				
	Jan/2011	Dec/2011	0	3	57	60				
	Jan/2012	Dec/2012	1	6	61	68				
	Jan/2013	Dec/2013	1	7	38	46				

Figure 3.3 – Number of Collisions in the M1 J6a-10 COBA Area



*

3.16 The results presented in ***Table 3.1*** and ***Figure 3.3*** show:

- The annual average number of PICs on the M1 between J6a and J10 has decreased from 292.9 in the pre-scheme to 67.0 post scheme opening. This is a significant decrease of 77%.
- The average number of fatal collisions have reduced post opening from 2.4 to 0.6 per year i.e. 3 fatal collisions have occurred during the five years post opening.
- There has been a decrease in serious collisions post scheme opening from 24.4 per year pre-scheme to 7.2 per year at post opening.
- The annual average number of slight collisions has reduced from 266.0 per year to 59.2 per year between pre-scheme and FYA.
- The pre-scheme counterfactual collision rate (accounting for the background reduction in collisions over time) is calculated as 187.9 collisions per annum. Comparing this with the post opening collision rate, there is a 64% decrease in the collisions in the study area.

Casualties

3.17 In addition to analysing the number of observed collisions, it is also useful to investigate trends in the number of casualties associated with these incidents.

3.18 ***Table 3.2*** presents total annual casualty numbers and includes the without scheme counterfactual. The casualty numbers have not been presented by severity as the data from HAPMS did not provide this level disaggregation.

3.19 It should be noted that the pre-scheme counterfactual value (accounting for background reduction in associated collisions) has been calculated for casualty numbers to be 0.73 for England from 2004 to 2011[6].

Table 3.2 – Number of Casualties in the M1 J6a-10 COBA Area

Period	Time Period		Average Annual Casualties
	From	To	
Before	Mar/2001	Feb/2002	560.7
	Mar/2002	Feb/2003	
	Mar/2003	Feb/2004	
	Mar/2004	Feb/2005	
	Mar/2005	Feb/2006	
Without Scheme Counterfactual (adjusted for background reduction)			409.31
Construction	Mar/2006	Feb/2007	254.5
	Mar/2007	Feb/2008	
	Mar/2008	Dec/2008	
Post-Opening	Jan/2009	Dec/2009	118.2
	Jan/2010	Dec/2010	
	Jan/2011	Dec/2011	
	Jan/2012	Dec/2012	
	Jan/2013	Dec/2013	

3.20 From ***Table 3.2*** it can be seen that the annual average number of casualties has reduced from 560.7 to 118.2 post scheme opening without accounting for background reduction. This is a decrease of 79%. The annual average number of casualties has reduced from 409.3 to 118.2 post scheme opening when accounting for background reduction. This is a decrease of 71%.

Collision and Casualty Severity Index

3.21 The collision severity index is the ratio of the number of collisions classed as serious or fatal compared to the total number of collisions. The casualty severity index is the ratio of the number of casualties classed as serious or fatal compared to the total number of casualties. A summary of the before and after opening collision severity indices by year is shown in ***Table 3.3***.

[6] Data sourced from DfT table RAS 30032 which includes reported casualties by region and severity, Great Britain.

3.22 It was not possible to evaluate the casualty severity index as the HAPMS data available did not provide the detail required to evaluate this. The fatality and weighted injuries (FWI) was not evaluated for this reason also.

Table 3.3 – Collision Severity Index

Period	Time Period		Severity Index	Annual Average Severity Index
	From	To		
Before	Mar/2001	Feb/2002	0.09	**0.092**
	Mar/2002	Feb/2003	0.12	
	Mar/2003	Feb/2004	0.10	
	Mar/2004	Feb/2005	0.09	
	Mar/2005	Feb/2006	0.06	
Construction	Mar/2006	Feb/2007	0.09	**0.087**
	Mar/2007	Feb/2008	0.07	
	Mar/2008	Dec/2008	0.12	
Post-Opening	Jan/2009	Dec/2009	0.12	**0.116**
	Jan/2010	Dec/2010	0.14	
	Jan/2011	Dec/2011	0.05	
	Jan/2012	Dec/2012	0.10	
	Jan/2013	Dec/2013	0.17	

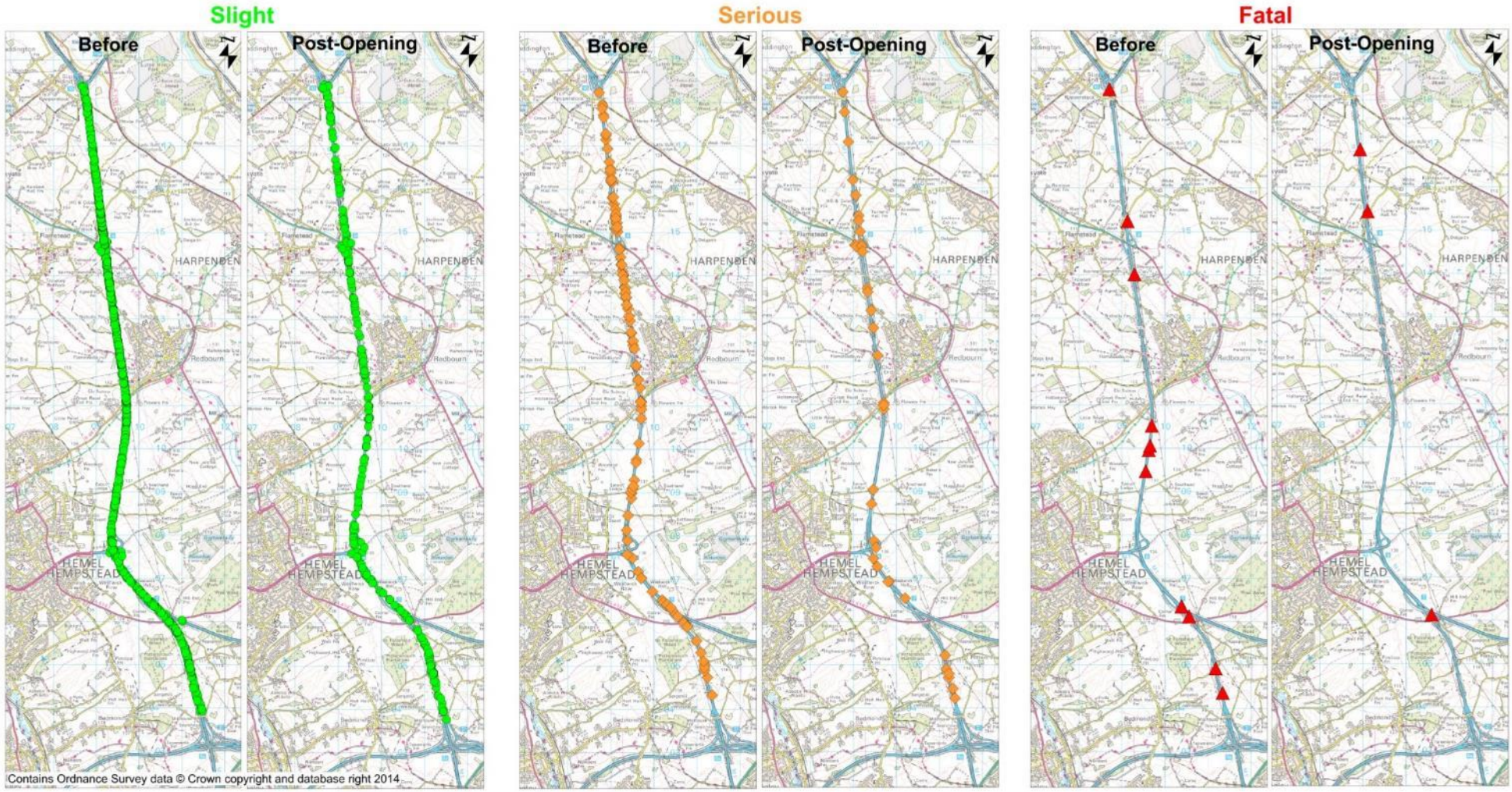
3.23 ***Table 3.3*** shows that the collision severity index has increased post scheme opening although the number of collisions have reduced as seen in the previous section. This increase is as a result of the reduction in the number of slight casualties being greater than the reduction in fatal and serious casualties combined.

Collision Locations

3.24 The location of collisions occurring within the M1 J6a-10 COBA area for the pre-scheme and post opening periods by severity is presented in ***Figure 3.4***.

3.25 From ***Figure 3.4*** it can be seen that collisions, before the scheme, were evenly distributed with slightly higher concentrations along the straight section from Redbourn to J10 on the M1. Post scheme opening, there was no observable re-distribution of collisions.

Figure 3.4 – Collision Locations – Before and Five Year Post Opening



Forecast vs. Outturn Collision Numbers

3.26 This section compares the number of observed collisions discussed earlier with those predicted to occur. The predictions have been obtained from the COBA model for this scheme and cover the whole of the modelled area. (The AST figures also match the COBA) For the observed collisions, the Do Minimum figures are based on the annual average of five years data before construction started, whilst the Do Something figures are based on the annual average of five years post opening data.

Table 3.4 – Comparison of Forecast and Outturn Collisions for the scheme

Forecast Opening Year	Do Minimum (without scheme)	327
	Do Something (with scheme)	102
	Saving	225
	% Change	**68%**
Outturn Annual Average	Before Opening	293
	Without Scheme (Counterfactual)	188
	After Opening	67
	Change*	121
	% Change*	**64%**

* Comparison of before and after completed using counterfactual scenario for before.

3.27 It can be seen from ***Table 3.4*** that the scheme appraisal forecast a decrease of 68% collisions in the opening year (225 collisions). There has been an observed average decrease in collisions of 121 per year, representing a decrease of 64%, when comparing the post-opening data to the counterfactual collisions which adjusts the pre-scheme data for background collision trends.

Collision Rates

3.28 The number of collisions along a length of road together with its AADT (Annual Average Daily Traffic) can be used to calculate a collision rate (calculated as number of collisions per million vehicle kilometres). By looking at the rates the impact on the roads of most interest can be seen whilst ignoring the impact of the change in traffic volumes. ***Table 3.5*** shows the observed pre and post opening collision rates on the M1 J6a-10 COBA area.

Table 3.5 – Observed Collision Rates on the M1 J6a-10 COBA Area

Forecast (opening year)	**Do-Something (with scheme)**	**0.098**
Observed (Pre-scheme vs. Post-opening collision rates)	Pre-scheme Observed	0.303
	Pre-scheme Counterfactual Rate[7]	0.189
	Post-Opening Observed	0.064
	Observed Saving*	**0.125 (66%)**

3.29 The results in ***Table 3.5*** shows that the observed collision rate has decreased post scheme opening when taking the background reduction into account. The net decrease observed is 0.125 PIC/mvkm when compared to pre-scheme counterfactual rate. A 1% decrease in collision rates was forecast post scheme opening. A comparison of observed and forecast collision rate for DS shows that the observed collision rate is still less than the forecast rate. It was not possible to compare against the DM because forecast DM traffic data was not available.

[7] Counterfactual without scheme is the observed rate in the before period multiplied by the national reduction in collisions rate per mvkm during the comparable period, for the middle year of the data collection periods, in this case 2004 for before the period and 2011 for the after period. The reduction factor in the collision rate for motorways was 0.64.

Statistical Significance

3.30 In order to determine whether the changes in collision numbers observed before and after the scheme opened are statistically significant, a Chi-Square test has been undertaken. This test uses the before counterfactual and post-opening number of collisions and traffic flows for the COBA area to establish whether the changes are significant or are likely to have occurred by chance.

3.31 A test has been carried out on the collision data given above, and this shows a statistically significant change. Thus the change in the average annual number of collisions may have occurred as a result of the scheme.

Security

3.32 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.

3.33 The aim of this sub-objective is to reflect both changes in security and the likely number of users affected. In terms of roads, security includes the perception of risk from personal injury, damage to or theft of vehicles, and theft of property from individuals or from vehicles.

Forecast

3.34 For the Personal Security sub-objective, the AST states:

'Not really applicable although security will be slightly enhanced by the improved flow for vehicles thus reducing the frequency of stationary traffic and the opportunity for incidents'

Score: Slight Beneficial.

Evaluation

3.35 The points listed below provide evidence that the forecast personal security impact has been slight beneficial as expected.

- Monitoring of the scheme section has improved through the increased provision of CCTV cameras mostly located on the Controlled Motorway gantries and adjacent to the hard shoulder (Figure 3.5)
- Lighting has been improved along the extent of the scheme.

Figure 3.5 – Example of CCTV Cameras and Lighting

3.36 Taking all of these points into account, the impact of the scheme on personal security can be considered slightly beneficial as expected.

Key Points - Safety

Collisions

- The annual average number of PICs occurring on the M1 between J6a and J10 has decreased from 188 (counterfactual) in the pre-scheme to 67 post scheme opening.
- Taking background reduction into account, there is a significant reduction in the annual average collisions post scheme opening.
- The number of fatal, serious and slight collisions have reduced post opening, but there has been an increase in the collision severity index post opening from 0.092 to 0.116.
- The reduction in collision rate observed is statistically significant.

Forecasts

- The observed post scheme opening collision rate is lower than the forecast collision rate.

Security

- The scheme's impact on security is assessed as slightly beneficial as predicted. This is due to improved journey time reliability, CCTV provision and lighting.

4. Economy

Introduction

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

To support sustainable economic activity and get good value for money

4.2 The four sub-objectives for economy are as follows:

- Get 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.
- Provide beneficial wider economic impacts.

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

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

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

4.5 The forecasts impacts over 60 years (30 years for the Controlled Motorway) are summarised in ***Table 4.1,*** and the approach to the evaluation taken in this section. As discussed earlier in this report, as it has not been possible to disaggregate the outturn impacts of the widening and the controlled motorway, they have been evaluated together.

Table 4.1 – Forecast Economic Impacts of Scheme

	Forecast			Evaluation	
	Widening	Controlled Motorway	Total		
	£m	£m	£m	✓/ ✗	Reasons
Journey Times	£1,235.7m	-£3.1m	£1,232.6m	✓	Represents a considerable proportion of the overall scheme benefits; and relatively straightforward to measure outturn impacts.
Safety	£773.4m	£28.5m	£801.9m	✓	Represents a considerable proportion of the overall scheme benefits; and relatively straightforward to measure outturn impacts.
Vehicle Operating Costs (VOC)	£53.8m	-	£53.8m	✗	Small proportion of overall scheme benefits; and POPE approaches to calculating outturn VOC impacts not sufficient to accurately re-estimate benefits of this low magnitude. Assumed same as forecast
Construction Delay	-£137.8m	-	-£137.8m	✗	Not within the remit of POPE; small proportion of the overall scheme impacts; almost impossible to measure outturn impacts. Assumed to be the same as forecast.
Future Maintenance Delay	£78.6m	-	£78.6m	✗	Not within the remit of POPE; small proportion of the overall scheme impacts; almost impossible to measure outturn impacts. Assumed same as forecast.
Indirect Tax revenue during operation, construction and maintenance	-£17.2m (i.e. lower tax)	-	-£17.2m	✗	Small proportion of the overall scheme impacts, some of which is due to the impact during future maintenance periods which cannot be evaluated. Assumed same as forecast.
Carbon	-	0.7	0.7	✗	Small proportion of overall impact. Assumed to be the same as forecast.
Journey Time Reliability	-	5.9	5.9	✗	Not possible to monetise outturn impacts. Assumed to be the same as forecast.

Sources

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

- Economic Appraisal Report (April 2006) covering the widening scheme.
- M1 J6a-10 Controlled Motorway Impact Assessment (September 2010).
- Outturn costs obtained from the Highways Agency (at time of request) Regional Finance Manager in August 2014.

Scheme Costs

Introduction

4.7 This section compares the forecast costs of the scheme with the outturn spend at the time of this evaluation.

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

- Investment costs before and during construction.
- Indirect tax revenues impact during construction and the 60 years post scheme opening (for the widening). Indirect tax was not appraised for the Controlled Motorway element.

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

Investment Costs

4.10 The investment cost is the cost to the HA of constructing the scheme and purchasing any land. The forecast scheme cost has been obtained from the Economic Appraisal (April 2006). This provides the undiscounted M1 J6a to J10 Widening costs. The investment costs for the Controlled Motorway element have been obtained from the Controlled Motorway Impact Assessment (September 2010) Outturn scheme costs for both the widening and controlled motorway combined have been supplied by the HA Regional Finance Manager.

4.11 A comparison between the forecast and outturn investment cost is presented in ***Table 4.2***.

Table 4.2 – Summary of Investment Costs

£m 2002 prices	Forecast Cost	Outturn Cost	Difference
Investment Cost (Widening)	268.6	249.6[8]	-10%
Investment Cost (Controlled Motorway)	7.1		

4.12 It can be seen from ***Table 4.2*** that the outturn cost is lower than forecast cost by 10%.

Impact on Indirect Tax Revenues

4.13 Indirect tax revenue is the expected change in revenue to the Government due to changes in the transport sector as a result of the scheme over the appraisal period. For the highway scheme in this study, the indirect tax impact is derived primarily from the change in fuel consumption during the construction period, future maintenance periods and operation over the 60 year period resulting in changes to the level of revenue collected from the tax on that fuel. A scheme may result in changed fuel consumption due to the following reasons:

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

4.14 It was not possible to evaluate the indirect tax impact of this scheme as the POPE methodology for this requires 'Do Nothing' traffic forecasts which were not available for this scheme. The forecast indirect tax impact is a £17.2m reduction in revenue of which £5.1m is from the normal operation over 60 years. This is small in comparison to other scheme costs.

4.15 Current guidance is for indirect tax to be assessed as part of the benefits. At the time of the appraisal, indirect tax was considered as part of the costs (in line with the guidance at the time). This evaluation will consider the impacts of both methodologies.

[8] It is not possible to disaggregate the outturn investment costs for the controlled motorway and the widening.

Present Value Costs (PVC)

4.16 The total Present Value of Cost (PVC) was made up of the following costs converted to present values using discounting:

- Investment costs.
- Indirect tax.

4.17 When this scheme was appraised, the indirect tax impact was treated as part of the costs. ***Table 4.3*** shows the forecast and outturn present value cost and the total when the indirect tax revenue impact is treated as a cost.

Table 4.3 – Summary of Forecast and Outturn Costs in Present Value

Present Value Costs (PVC) (£m, 2002 prices and values)	Forecast			Outturn
	Widening	Controlled Motorway	Total	
PVC (Investment costs only)	276.3	8.3	284.6	256.1
Indirect Tax impact as a cost	17.2	-	17.2	17.2
PVC including indirect tax impact	**293.5**	**8.3**	**301.8**	**273.3**

4.18 These values for the costs which can be compared with the benefits in the calculation of the Benefit Cost Ratio in ***Table 4.9***.

Forecast Benefits

4.19 This section compares the forecast of the economic benefits as set out in ***Table 4.2*** with evaluations of the benefits at the FYA stage.

Journey Time Benefits

Forecast Journey Time Benefits

4.20 The forecast journey time benefits for both the widening and the Controlled Motorway are shown in ***Table 4.4***. The extent of the network considered for appraisal is presented earlier in this report in ***Figure 2.2***.

Table 4.4 – Summary of TEE forecast impacts

Consumers & Business users combined	£m 2002 prices and values
Journey Time Benefits	1,232.6

4.21 Journey time benefits expected as a result of the scheme were approximately 60% of the PVB. This was expected as a result of the extra capacity provided by the scheme.

Evaluation of Journey Time Benefits

4.22 The basis of the POPE methodology (in terms of vehicle hour savings) is a comparison of changes in predicted vehicle hours (using journey times and traffic flows) and relating this to the equivalent before and after widening using observed journey times and traffic flows. As such this method is most commonly applied to schemes that have been appraised using the COBA software. However, the vehicle hour savings for the M1 Junction 6a to 10 scheme were appraised using TUBA software which is currently recommended by the DfT TUBA is matrix based (unlike COBA which is link based) so the TUBA model cannot be used as the basis on a post opening evaluation; hence the POPE methodology is not suitable for the OYA evaluation of these schemes.

4.23 As an alternative approach, the journey time benefits for these schemes have been evaluated using a Project Appraisal Report (PAR) approach, typically adopted by the HA for the appraisal

of smaller schemes[9]. This evaluation is therefore subject to a number of caveats and assumptions as listed below:

- The evaluation only includes journey time savings on the M1, and not the wider network. However, for a widening scheme with limited traffic reassignment it is anticipated that the vast majority of the benefits will occur on the M1. However, the outturn journey time benefits presented later in this section are likely to represent a slight underestimate due to the local roads being omitted.
- The PAR method provides capitalisation factors which depend only on the road type and forecast growth rate whereas modelling tools used for the appraisal consider the complexity of how traffic growth would affect future traffic behaviour in detail. For this scheme, future forecasts will be influenced by timing and severity of forecast congestion with or without the scheme.

4.24 ***Table 4.5*** compares the forecast with the outturn assessment.

Table 4.5 – Monetised Journey Time Benefits

Present Value Benefits (£m 2002 prices, discounted)	**Forecast**	**Outturn**
Journey Time Benefits	1,232.6	716.0

4.25 From ***Table 4.5*** it can be seen that the outturn journey time benefits are lower than forecast. This is because the observed traffic growth is less than forecast and journey time savings observed is less than what was predicted scenario

Evaluation of TEE Vehicle Operating Costs (VOC) Benefits

4.26 For most highway schemes including this one, the VOC and indirect tax impacts are both very closely linked to changes in fuel consumption (e.g. changes in speeds, changes in traffic flows) which has similar magnitude of impacts, but from opposite sides of the benefits balance. That is, if there is increased fuel consumption, VOC will increase due to users paying more for fuel (i.e. a dis-benefit) and thus more indirect tax will be collected by the Treasury which is considered to be a benefit according to current guidance. For this evaluation, the outturn VOC has not been evaluated as the forecast benefits are small in comparison to the overall benefits of the scheme and the POPE methodology for evaluating VOC's is not accurate enough to evaluate accurately benefits of this magnitude. Therefore VOC has been assumed to be the same as forecast.

4.27 The vehicle operating cost is shown in ***Table 4.6***.

Table 4.6 – FYA VOC Benefits

Present Value Benefits (£m 2002 prices, discounted)	**Forecast**	**Outturn**
Vehicle Operating Costs (VOC)	53.8	53.8

Collision Benefits

Forecast Benefits

4.28 The forecast collision savings for this scheme were derived using a two tier methodology described below as follows:

- **Local Area** - The DfT's COBA program has been used to estimate the number of collision and casualties by severity that would be saved by the scheme over the 60 year appraisal period (2008-2067). These savings have then been converted by the program to 2002 monetary values (discounted to 2002). The COBA model covered the M1 between

[9] PAR Guidance Project Appraisal Report Guidance Notes Version 5.0.

Junctions 6a and 10 including the slip roads (and the Collector-Distributor Roads in the do something scenario).

The results of the COBA collision analysis showed that the M1 widening scheme would reduce the number of collisions between M1 Junctions 6a and 10 by 16,600 during the 60 year appraisal period, including a reduction in fatalities of 253. This equates to collision cost savings of **£722.9m**.

- **Wider Area** - Collision cost savings outside of the immediate vicinity of the scheme were calculated based on traffic forecasts from the London to South Midlands (LSM) traffic model and resulted in further collision cost savings of **£50.5m**. The forecast collision reduction which equates to this monetary value has not been presented in the Economic Assessment Report.

4.29 Overall, the total collision savings resulting from the scheme were therefore forecast to be **£773.4m**.

4.30 The forecast collision benefits are so high because the observed collision rate on the M1 from 2001 to 2004 was used to represent the Do Minimum situation. These figures are significantly higher than the national average collision rates assumed in the do something scenario with the scheme in place. This approach is considered robust as it is in line with the guidance available at the time of the appraisal and yielded results which were very similar to the outturn evaluation.

Evaluation of Collision Benefits

4.31 The evaluation of the safety benefits is shown in ***Table 4.7*** This calculation is based on the presumption that the forecast ratio of the number of collisions saved in the opening year to the forecast 60 year benefit (shown in (c) in the table) can be used to generate a re-forecast economic benefit (e) based on the observed saving of collisions (d).

Table 4.7 – FYA Collision Benefits

		Calculation Approach	Local Area	Wider Area
COBA Forecast	Forecast number of collisions saved in opening year	(a)	225	Not Available
	Forecast benefit over 60 years	(b)	£801.9	£50.5m
	Approximate 60 year benefit per opening year collision saved	(c) = (b) / (a)	£3.56m	Not Available
Observed	Outturn number of collisions saved in opening year	(d)	121	Not considered due to reasons stated earlier in this chapter.
POPE Re-Forecast	Re-forecast 60 year collision benefit	(e) = (d) x (c)	**£430.8m**	**£50.5m**

4.32 This POPE evaluation of the re-forecast 60 year benefits indicates an outturn safety benefit of **£481.3m** based on the following assumptions:

- The collision pattern observed in the first five years is typical of the impact in the longer term; and
- The original modelled assumptions hold true.

4.33 The POPE re-forecast shows that the collision benefits are lower than predicted. However, it should be noted that the scheme is still delivering considering collision benefits compared to the pre scheme situation.

Present Value Benefits (PVB)

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

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

4.36 A comparison of all forecast and outturn benefits is presented in ***Table 4.8***.

Table 4.8 – Summary of Forecast and Outturn Present Value Benefits

Present Value Benefits (£m 2002 prices, discounted)	**Forecast (Widening & Controlled Motorway)**	**Outturn (Widening & Controlled Motorway)**
Journey Times	1,232.6	716.0
Safety	801.9	481.3
VOC	53.8	53.8
Construction Delay	-£137.8	-£137.8
Future Maintenance	76.6	76.6
Indirect Tax impact	-17.2	-17.2
Carbon	0.7	0.7
Journey Time Reliability	5.9	5.9
PVB	**2,016.5**	**1,179.3**

4.37 The outturn benefits are lower than the forecast benefits mainly due to the lower than expected journey time savings.

Benefit to Cost Ratio (BCR)

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

4.39 In ***Table 4.9***, the calculation of the BCR is presented according to the approach taken when this scheme was appraised, when the indirect tax impact was included in the cost and according to the current guidance, in which it is part of the benefits.

Table 4.9 – Forecast vs. Outturn BCR

All monetary values £m 2002 prices, discounted		**Forecast (Widening & Controlled Motorway)**	**Outturn (Widening & Controlled Motorway)**
Indirect tax impact within costs	Present Value Benefits	£2,001.7m	£1,195.5m
	Present Value Costs	£301.8m	£273.3m
	Benefit – Cost Ratio	**6.6**	**4.4**
Indirect tax impact within benefits	Present Value Benefits	£2016.5m	£1,179.3m
	Present Value Costs	£284.6m	£256.1m
	Benefit – Cost Ratio	**7.1**	**4.6**

4.40 ***Table 4.9*** shows that the outturn BCR of 4.6 is lower than the forecast BCR of 7.1, when indirect tax is considered as part of the benefits. It is lower due to the journey time and safety benefits being below forecast. The scheme still represents very high value for money.

4.41 It should be noted that the BCR ignores non-monetised impacts. In the former NATA assessment and its replacement, the Transport Business Case, the impacts on wider objectives

must be assessed but are not monetised. The evaluation of the environmental, accessibility and integration objectives is covered in the following sections.

Wider Economic Impacts

Forecast

4.42 The AST states:

'No issues relating to designated regeneration areas'.

Evaluation

4.43 Wider economic impacts were not considered as part of the appraisal, however, it's clear that the scheme has had a considerable impact on both the surrounding local and regional economy.

4.44 The M1 motorway has a key function in providing strategic connectivity between London and the Midlands and the North for consumers and businesses. This report has already shown that the scheme has increased capacity, improved journey times and reliability, and improved safety. Although the impacts cannot be quantified, it can therefore be inferred that the scheme has facilitated wider economic benefits.

4.45 The Milton Keynes South Midlands (MKSM) is one of the largest growth areas established in 2004 as part of the Government's Sustainable Communities Plan. A key facilitator in delivering increased numbers of housing and jobs in the area is a transport infrastructure that can cope with these growth plans. The M1 Junction 6a to 10 widening scheme (along with adjacent improvements to on the stretch between J10 and 13 – recently completed) will provide increased capacity to enable the growth plans to be realised whilst maintaining and improving the performance levels of the M1.

Key Points – Economy

Present Value of Benefits (PVB)

- The journey time benefits are lower than expected due to lower than forecast traffic volumes as well as a lower journey time saving than forecast.
- The outturn safety benefits are lower than forecast, but there is still a considerable saving.

Scheme Costs

- The outturn scheme costs are lower than forecast. This is despite the outturn figures including elements of controlled motorway which were not considered in the forecast.

Benefit Cost Ratio (BCR)

- The outturn BCR (4.6) is lower than forecast (7.1) due to lower journey times and safety benefits. However, the scheme still represents 'very high' value for money.

Wider Economic Impacts

- The scheme has contributed to the growth aspirations of the MKSM area by providing additional capacity and improved journey times on the main strategic highway through the area.

5. Environment

Introduction

5.1 This section documents the evaluation of the environmental sub-objectives, focusing on those aspects not fully evaluated at the OYA stage or where suggestions were made for further study.

Summary of OYA Evaluation Recommendations:

The OYA evaluation identified a number of areas where further analysis was recommended at the Five Year After (FYA) stage to confirm the longer term impacts of the scheme on the surrounding environment, these are summarised as follows:

Landscape – As built drawings indicated that the wildflower plots and areas planted with spring bulbs had been provided, although due to the time of year of the OYA POPE visit, it was not possible to evaluate how well the areas had established. It was suggested that for the FYA evaluation the site visit could be programmed to coincide with wildflower flowering. (These issues are discussed in the biodiversity section of this chapter)

The slight beneficial effect on landscape character predicted at Design Year would depend on the effective establishment of planting to reduce the influence of the M1 on the wider landscape, and this should be reviewed as part of the FYA report.

In all cases, the proposed mitigation planting, mounding and environmental barriers were in place, but it was too soon to determine the visual screening effect of the planting and this should be reviewed as part of the FYA report.

Biodiversity - It was considered too soon to fully evaluate the effectiveness of the mitigation measures, and the results of ongoing monitoring set out in the EMP should be considered as part of the FYA report.

Heritage of Historical Resources -. With regard to built heritage - the effectiveness of the scheme planting to mitigate the effects on the setting of listed buildings in the vicinity of St Mary's Church (Redbourn), Breakspears, St Andrew's Church (Woodside), Westwick Hall and Westwick Cottages, Nicholls Farm, and St Agnells Farm together with The Aubreys Scheduled Ancient monument (SAM) should be assessed in the FYA evaluation.

For archaeology it was expected that the post excavation technical report, together with details of the deposition of any finds, would be available at FYA.

Water Quality - Five of the readily accessible balancing ponds were visited for POPE: all contained well developed marginal vegetation, and their effectiveness as vegetative treatment systems should be considered at FYA.

Physical Fitness - Mitigation planting to integrate the footpaths and bridleways into the landscape had been undertaken as proposed, but it was too soon to evaluate the effectiveness of the planting measures and this should be considered as part of the FYA evaluation.

5.2 In relation to environment, the Environmental Statement Non-Technical Summary (NTS) stated that:

"…Mitigation measures form an integral part of the proposals. The main measures include extensive environmental screening, either in the form of earth mounding, screen fencing or noise barriers. This would help protect sensitive locations from the scheme effects particularly visual and/or noise intrusion. Planting both beside and away from the motorway would be used to give relief to areas exposed to the more intrusive sections of the road."

5.3 The following environmental sub-objectives were appraised in the ES and in the Appraisal Assessment Table (AST) according to NATA guidance at that time (2008):

- Noise;
- Local Air Quality;
- Greenhouse Gases;
- Heritage;
- Landscape;
- Biodiversity;
- Water Environment;
- Physical fitness; and
- Journey Ambience.

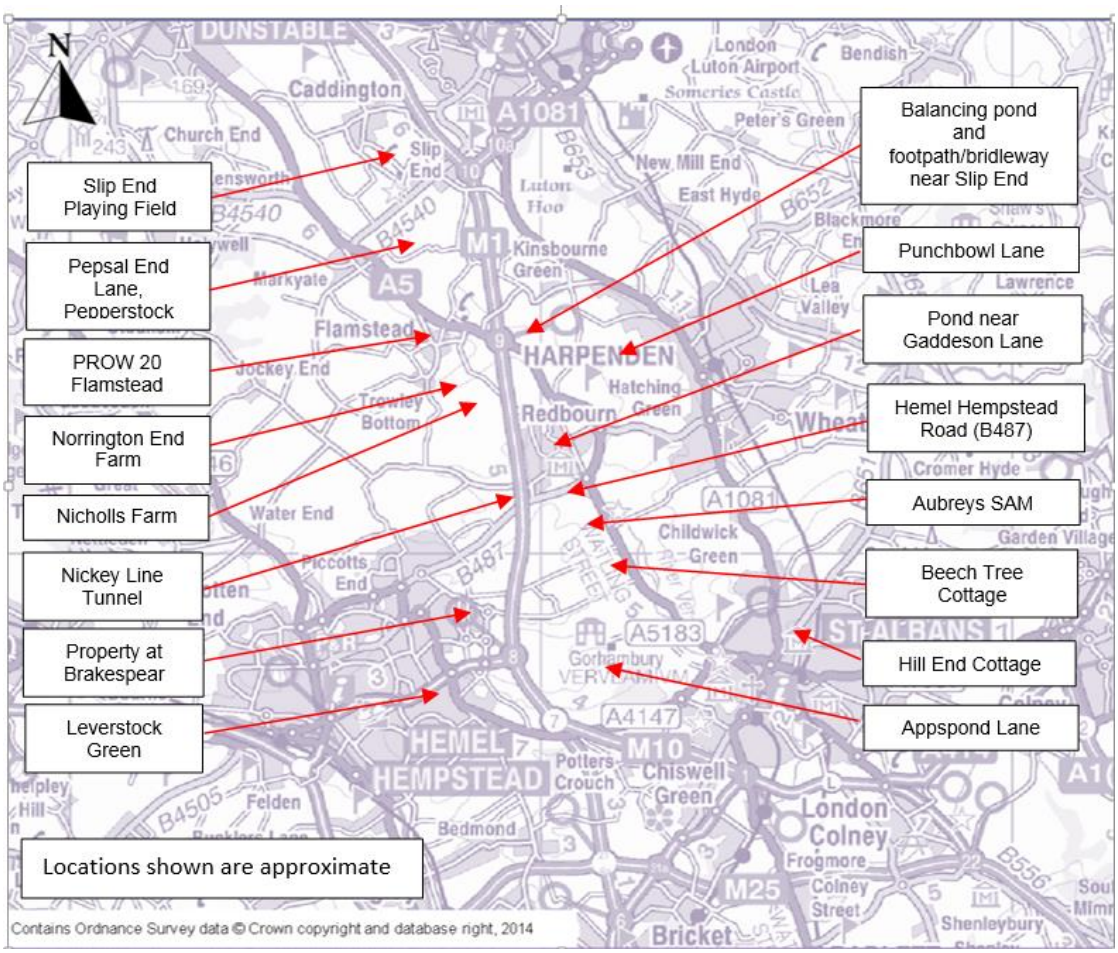
5.4 For each of these environmental sub-objectives, the evaluation in this section assesses the environmental impacts predicted in the scheme's AST and ES against those observed five years after opening.

5.5 In the context of the findings from the OYA evaluation and using new evidence collected five years after opening, this section presents:

- An evaluation of the ongoing effectiveness of the mitigation measures implemented as part of the scheme;
- An updated summary of key impacts against all of the nine environment WebTAG sub objectives, with particular focus on assessment of sub-objectives where it was too early to conclude at the OYA evaluation stage; and
- Additional analysis relevant to close out issues/ areas for further study as identified at the OYA stage for consideration at the FYA stage.

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

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



Methodology

5.7 This section focuses on those aspects not fully evaluated at OYA, or where at OYA, suggestions were made for further study and also any issues that have arisen since the OYA evaluation. The detail of the OYA study is not repeated here, and reference is made to the OYA report where required, although key points are incorporated into this FYA report where appropriate to provide contextual understanding.

5.8 No new modelling or survey work has been undertaken for this FYA environmental evaluation.

Data Collection

5.9 A full copy of the 1994 Environmental Statement has been received for the FYA evaluation, although the Non-Technical Summary has continued to be used to introduce each sub objective. The scheme was updated in 2004 including environmental information, as reported in the Design Scheme Review which has also been used in this evaluation.

5.10 The following documents have been used in the compilation of this section of the report:

- Appraisal Summary Table (AST), August 2007;
- Environment Statement Volume 1 and 2 (September 1994);
- M1 Junction 6A (M25 Interface) to Junction 10 (South of Luton) Explanation of Non-Technical Summary – September 1994;

- Detailed Scheme Review (DSR), June 2004;
- Public Inquiry Commitments, November 1996;
- Environmental Status Report, November 1995;
- Works Information, August 2004
- Ecology Design Phase 1b, November 2005;
- Landscape Management Plan (Five Year Aftercare Period Post Construction 2009 – 2013), April 2009;
- Ecological Management Plan (Five Year Aftercare Period Post Construction 2009 – 2013), March 2009;
- Ecological Monitoring Post Construction Interim Summary Results, October 2009;
- Ecological Monitoring Report 2009, June 2010;
- Road Traffic Noise Review (RTNR), January 2006;
- As Built drawings for Landscape and Ecology Design and Balancing Pond details;
- Arboricultural Report - A Preliminary Tree Condition Assessment Survey with Management Recommendations , December 2010
- Nickey Line Bridge Bat Monitoring Reports (2009-2013)
- Draft Handover Environmental Management Plan

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

Site Visit

5.12 As part of the FYA evaluation, a site visit was undertaken in June 2014. This included the taking of photographs to provide comparison views with selected ES photomontages and OYA photographs. These are shown in **Appendix E.**

Consultation

5.13 Three statutory environmental organisations (Natural England, English Heritage and the Environment Agency), St Albans District Council, Hertfordshire County Council, Central Bedfordshire Council, Luton Borough Council, Dacorum Borough Council and Flamstead, Slipend and Markyate Parish Councils were contacted as part of the FYA evaluation regarding their views on the impacts they perceive the scheme has had.

5.14 As the response to consultation has been poor for this scheme, the summary table has been relocated as **Appendix D** within this report. The Dacorum Borough Council were the single Local Authority with further comments at FYA consultation.

5.15 The Area 8 Managing Agent Contractor (MAC) has also been consulted with regard to animal mortality figures, but none have been made available for FYA period.

Traffic Forecast Evaluation

5.16 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.

5.17 The NTS (1994) stated that the M1 at the time of appraisal carried on average more than 120,000 vehicles per day with up to 20% of this traffic consisting of HGVs. The motorway was very heavily used and subject to congestion, which it was said, would be relieved by the proposed improvements.

5.18 By January 2004 a pre-scheme newsletter noted that traffic had increased to 160,000 vehicles per day with long delays at peak times.

5.19 As noted in the Traffic section of this report, a number of traffic forecasts were prepared for this scheme and were used for different elements of the appraisal.

5.20 Each of the documents presents slightly different traffic forecasts. For this environment section, (as for the OYA report) the actual traffic volumes after opening are compared against those forecast in the Road Traffic Noise Review (RTNR) (January 2006) for the noise evaluation and for air quality the Detailed Scheme Review (DSR) (May 2004).

Table 5.1 – Road Traffic Noise Review Forecast vs. Observed Traffic Flow

Site	RTNR Forecast ADT 2013	Observed ADT 2013	Difference	% Difference
Junction 6a-7 Southbound	83,900	86,000	2,100	+3%
Junction 8-9 Northbound	93,000	79,800	-13,200	-14%
Junction 9-8 Southbound	79,000	78,000	-1,000	-1%
Junction 9-10 Northbound	90,100	81,900	-8,200	-9%
Junction 10-9 Southbound	75,300	81,600	6,300	8%

Table 5.2 – Detailed Scheme Review vs. Observed Traffic Flow

Site	Forecast (2 way) DSR 2013 ADT	Observed (2 way) 2013 ADT	Difference	% Difference
Junction 8-9	184,200	157,800	-26,400	-14%
Junction 9-10	171,800	163,500	-8,300	-15%

Five Years After Assessment

5.21 Included in this section is a brief summary of statements from the AST, ES and OYA evaluations (including close out/ key issues identified for further reporting at the FYA stage) which have been included to provide the context for the FYA evaluation.

Noise

Forecast

AST

5.22 The AST stated that increases in noise levels of up to 3dB would be experienced at 10 properties and 408 properties would benefit by decreases of up to 15dB. On the basis of the assessment, no additional means of mitigation were considered necessary other than those that had already been incorporated into the scheme proposals. Overall the assessment forecast that 34 more people would benefit from the scheme.

Environmental Statement – Non-Technical Summary

5.23 The Non-Technical Summary (NTS) noted that noise reduction proposals would comprise a combination of earth mounding where sufficient land was available and / or noise fencing to provide a 3m high barrier alongside the motorway. It was estimated that noise 15 years after scheme completion would generally be no greater than existing although a few properties would have a small increase. Specific noise mitigation would be;

- Junctions 7 to 8 – earth mounding and screen fencing, including to the east of the new carriageway where fencing at Westwick Hall was expected to lower noise levels in the opening year by around 3dB compared to if no environmental barriers were used;
- The Aubreys to Junction 9 – a combination of 3m high earth mounding and noise fencing (where it was necessary to restrict land take) would be expected to reduce noise levels for properties closer to the motorway so that at 15 years after scheme completion noise would be no greater than existing levels

Updates since the ES

5.24 The DSR stated that the majority of properties within 300m of the relevant sections of the M1 would benefit from a reduction in noise levels with the improvements in place. Whilst noise levels might increase at a small number of properties, such increases would be imperceptible. The same would also be true for vibration. Overall, proposed improvements would result in a neutral to moderate beneficial impact on the surrounding countryside, such that no further mitigation measures, beyond those already proposed, were considered necessary.

5.25 The RTNR stated that the proposed scheme included the provision of environmental noise barriers and earth bunds to mitigate noise, and that the location and dimensions of these were as stated at the 1995 Public Inquiry (PI). It was expected that no houses would qualify for noise insulation compared to about 19 indicated at the 1995 PI. However, it was noted that this would need to be reviewed if there were found to be increases in forecast traffic flows or speeds up to the end of the appeals period prescribed in the Noise Insulation Regulations. The overall effect of noise from the proposed scheme, taking into account the mitigation measures, was expected to be an improvement upon the impacts shown at the 1995 PI and in the figures given in the Design Scheme Review.

OYA conclusions

5.26 Traffic data indicated that flows on the M1 were within the POPE methodology parameters of +25% or -20% of predictions, and it was likely that, based on traffic flows, the local noise climate due to traffic was **as expected**.

Consultation

5.27 No response to consultation has been received for Noise.

Evaluation

5.28 Based on observations undertaken during the site visit, mounding and acoustic barriers to a height of 3m have been constructed as stated in the RTNR.

5.29 It was noted during the site visit that the environmental barrier access gate near the Slip End playing fields (see Figure 5.2) has been vandalised and locks removed allowing access to the motorway. There were no apparent pathways towards the motorway so it is presumed that damage to the gate occurred some time ago. The open gate may decrease the barrier's acoustic

performance, although overall, in the context of the wider acoustic performance of the scheme this is not considered to be significant.

Figure 5.2 – Environmental Barrier adjacent to Slip End playing fields, including vandalised gate

5.30 ***Table 5.1*** demonstrates a decrease in traffic flows within the scheme although this reduction is not sufficient to allow for a 'better than expected' result due to the assumption made by POPE methodology that noise levels will be **as expected** if observed traffic flows are within 25% more

5.31 The Road Surface Index value of the low noise surface or the noise reduction properties of the acoustic barriers were not provided.

5.32 Based on the information presented in this evaluation, it is concluded that the effects of the scheme are **as expected** in terms of noise.

Sub-Objective	AST	OYA	FYA
Noise	Population Annoyed DS minus DM -34	Likely to be as expected	As expected Based on traffic flows alone

Local Air Quality

Forecast

AST

5.33 The AST stated that a negligible deterioration in local air quality was expected with the scheme in place. Changes in concentrations at properties within 200 metres of the scheme would be well below the significance criteria for nitrogen dioxide (NO2) and particulate matter (PM10) and were unlikely to be measurable. Changes in air quality were expected due to the increase in traffic volume and speed.

Environmental Statement – Non-Technical Summary

5.34 The NTS noted that air pollution levels were elevated along the M1 carriageway but decreased rapidly with increasing distances from the motorway. NO2 might exceed EC Directive limits at or above the M1 centreline but not beyond the motorway boundary. The decrease in congestion as a result of the scheme and improvements in vehicle technology were expected to lead to a decrease in emissions. Levels of NO2 in 15 years' time were expected to be broadly similar to existing levels despite the expected increase in traffic flows. The overall effect of the scheme would be low to moderately beneficial in the short to medium term. The long term effect would be adverse but of low to negligible significance.

Updates since the ES

5.35 The DSR stated that the proposed widening would lead to an increase in the number of properties that would fall within 200m of the road, and that there would be moderate adverse increases in annual average NO2 concentrations at a number of locations in the vicinity of the motorway. No baseline figures for HGVs or speeds were included in the DSR.

OYA conclusions

5.36 The data available indicated that traffic flows on the M1 were within +/-10% of predictions, and based on POPE methodology it was likely that the local air quality due to traffic was as expected.

Consultation

5.37 No response to consultation has been received for Local Air Quality.

Evaluation

5.38 As can be seen in table below in the Traffic Forecast Evaluation section of this chapter, the data indicates that the FYA observed traffic flow is less than that forecasted by the DSR with traffic between junctions 8 to 9 being 14% less and between junctions 9 to10 being 15% less than predicted.

5.39 Based on the information presented in this evaluation, it is concluded that the effects of the scheme are **better than expected** in terms of local air quality. This conclusion is based on the assumption made by POPE methodology that air quality will be better than expected if observed traffic flows are less than 10% of predicted flows;

Sub-Objective	AST	OYA	FYA
Air Quality	Overall PM10 score: 7 Overall NO2 score:17	Likely to be as expected	Better than expected

Greenhouse Gases

5.40 According to the DfT's WebTAG guidance, (CO2) is considered to be the most important greenhouse gas and, therefore, has been used as the key indicator for the purposes of assessing the impacts of transport options on climate change. Although the focus is on CO2 emissions, the current guidelines are to express the change in terms of the change in the equivalent tonnes of carbon released as a result of implementing a transport scheme. Therefore the original forecasts figures have been converted to tonnes carbon for the purpose of this evaluation.

Forecast Impacts - AST and ES

5.41 The greenhouse gas impact of the scheme was assessed using the guidance for regional air quality modelling from the DMRB. This models fuel consumption related carbon emission rates and requires the following basic inputs:

- Annual average daily traffic flow to include heavy good vehicles (HGVs) and light duty vehicles (LDVs);
- Percentage of HGVs on each road;
- Average speed of vehicles; and
- Assessment year.

5.42 The AST stated that there would be a 9% (16,000 tonnes) increase in CO2 due to an increase in overall length of the route and an increase in traffic with the scheme in place. This is equivalent to 4,364 tonnes of carbon.

Consultation on Greenhouse Gases

5.43 No consultation was carried out.

Evaluation of Greenhouse Gases

5.44 A summary of the evaluation compared to the forecast is shown in table below.

Sub-Objective	AST	OYA	FYA
Greenhouse Gases	Total change in CO2 emissions due to scheme in the opening year is an increase of 16,000 tonnes per year.	(14,500 tonnes of CO2)	(13,700 tonnes of CO2)

5.45 It can be seen that the increase in CO2 emissions is slightly lower than predicted. As the traffic flows and speeds are broadly in line with forecast, the difference is likely to be due to an uncertainty of which links were used in the appraisal.

Landscape

Forecast

AST

5.46 The AST stated that the M1 was already a prominent feature, cutting across the largely agricultural landscape; the improvements would initially result in a loss of existing vegetation, land take of largely agricultural land and increased visibility of the motorway and associated engineering elements. Proposed mitigation measures including mounding and planting would reduce impacts, including offering improvements when compared to the existing situation. Mitigation measures would also help to integrate the motorway, including the associated engineering structures, within the wider landscape character and improve views from adjacent visual amenity receptors including Redbourn. The overall assessment, taking into account mitigation measures, would be slight beneficial at 15 years after scheme opening.

Environment Statement – Non-Technical Summary

5.47 It was noted that the main effect of the widening proposals on landscape would result from the loss of the existing vegetation along the motorway verges, changes to the earthworks and provision of new gantries. New screening would be provided by earth mounding, environmental barriers or new planting and these measures were expected to reduce the impact of exposed sections of the works. Planting was expected to provide a screening function from about the third year after the scheme opened, improving as the landscape grew and matured.

5.48 It was also noted that there would be an adverse impact from the new gantries, although existing landform, earthworks and planting would be used to maximise visual mitigation.

Updates since the ES

5.49 The DSR included photographic views from selected receptor viewpoints at pre-construction. Where the visual effect of the scheme was considered to be slight adverse or worse, and where

possible, similar photographic views were taken during the POPE site visit to compare the baseline views with the one year after views, and these are included in **Appendix E.**

- EQ Waste Management, Appspond Lane;
- Beechtree Cottage;
- Hill End Cottage;
- Dwelling at the Breakspears;
- The Aubreys Fort SM;
- PROW 20, Flamstead;
- Church Road, Slip End;
- Playing Field at Slip End; and
- Dwellings east of Pepsal End Lane, Pepperstock.

OYA conclusions

5.50 The OYA evaluation noted that planting was generally establishing satisfactorily, with grass cut in all plots and along hedgelines, and weed-free circles clearly visible. It was noted that later planting was less well developed, but adequate maintenance had clearly been carried out, including grass cutting and establishment of weed free circles. No large areas of noxious weeds were observed, although there were occasional docks in planted areas.

5.51 The DSR included receptors where the visual effect was considered to be slight adverse or worse, but where a photographic record was not included. In these cases, a photograph was taken for the OYA report to enable a comparison to be made in the FYA report, and these are included in **Appendix E**.

- Dwellings in the vicinity of The Beeches;
- Nicholls Farm;
- Norringtonend Farm; and
- PROW 23, Flamstead.

5.52 In line with POPE methodology where the original photographs were taken from private property (Whitehouse Farm, dwelling at Sergehill, Westwick Hall, Benet Cottages and Chequers Hill, Flamstead) comparison photographs at OYA were not taken.

5.53 The OYA report noted post ES/DSR lighting changes to the underbridge at junction 9 due to changes in requirements for tunnel lighting at the time. The M1 6a-10 Widening Lighting Design, Junction 9 Friars Wash Underpass Lighting Study Report, November 2005 noted in the OYA report concluded that daytime lighting of the tunnel would be required to meet the criteria in the new requirements. This appeared to attract strong comments from consultees at OYA.

Consultation

5.54 The Dacorum Borough Council considered the landscaping on the approach from J8 into Hemel Hempstead as ‘rather poor’.

Evaluation

5.55 The OYA report stated that the slight beneficial effect on landscape character predicted at Design Year would depend on the effective establishment of planting to reduce the influence of the M1 on the wider landscape. The ES noted that little of the landscape in this section of the M1 corridor is of exceptional quality and generally, the landscape is relatively enclosed farmland interspersed with small to medium scale woodland. Increasing development and agricultural intensification has eroded the landscape fabric making it less attractive. There are no dramatic

landscape zones but subtle variations are identifiable and discussed in the ES. It is noted at FYA that planting is generally establishing very well and is expected to reach its growth targets and as such, the slight beneficial effect on landscape character is set to be achieved by design year.

5.56 The visual effect of the scheme has been mitigated through the use of earth mounding, environmental barriers and mitigation planting. Planting has been used to good effect adjacent to environmental barriers, softening the visual impact of these structures. (see ***Figure 5.3***)

Figure 5.3 – Use of planting adjacent to barriers

5.57 As a result of consultation during construction with the Redbourn Parish Council, standard trees were planted near Hempstead Road to compensate for disturbance to the Nickey Line. It is understood that vandalism and theft had been an issue in this area resulting in all trees planted by the contractor failing. The OYA report noted that offsite planting on Hempstead Road (Nickey Line/Redbourn Bypass) which was undertaken in winter 2009-2010 was found to be in poor condition, with most plants missing. During the FYA site visit, it is noted that new planting has been undertaken (presumed by the Parish Council). The planting appears ornamental and it is presumed that the site is being maintained by the Parish Council. (see ***Figure 5.4***)

Figure 5.4 – Planting Adjacent to Hemel Hempstead Road (487) – is on the left, on the right

OYA photograph **FYA photograph**

5.58 The Dacorum Borough Council noted that they felt that the landscaping was rather poor on the approach to Junction 8 from the south. The ES states that planting requirements were for a

"*Dense screen to 3m mound facing Leverstock Green. Planting along the outer face of bunding*". It was noted during the site visit that planting has been undertaken in line with the ES including the position of a bund for screening which is confirmed in the as built landscape and ecology drawings. This planting is considered to be establishing satisfactorily.

Landscape Aftercare Inspection Records

5.59 Various landscape aftercare site inspection reports were received by POPE and their evaluation of the planting progress is summarised as follows:

- Grass cutting has been undertaken as required by the contract.
- Continued removal of weeds within the plant stations was undertaken.
- Plant stations that had collapsed would be corrected with the stake secured into the ground with the plant shelter, if applicable.
- Climbers planted on soil nail slopes continued to demonstrate good levels of growth with a good reduction in weeds.
- Balancing ponds showed good levels of aquatic plant growth with an acceptable level of establishment of wildflower grass species. Evidence of Ragwort continued to be an issue within select sites.
- Retained trees at Junction 8 – it was noted that a dead tree had collapsed hanging partially over the safety barrier adjacent to the slip road in May/June 2012 – investigation into progressing the recommendations outlined in the tree survey was recommended. (It is noted by POPE that further works required to these retained trees would appear to have been undertaken – the findings and recommendations of the tree survey are discussed below).
- Due to upgrading works for the M1 Junction 10-13 HSR scheme, there is limited access for the scheme maintenance contractor around Junction 10 which has resulted in weed species increasing uncontrolled within the area.
- Removal of spiral guards and tree shelters was undertaken where corresponding tree/shrub plants were large enough to support themselves.
- The calcareous grassland was establishing satisfactorily with an emerging variety of species.
- Concern was noted in the May 2013 Landscape Aftercare Site Inspection for the establishment of the hedgerow plot 12.2 (On slip merge between the A414 from the east with the M1 at Junction 8). It was noted during the FYA site inspection that establishment appears satisfactory (June 2014 see ***Figure 5.5***).

Figure 5.5 – Hedgerow planted between the A414 from the east and the M1 junction 8 (plot 12.12)

Retained trees at Junction 8 – tree survey

5.60 The tree survey (December 2010) highlighted the need for action in this area of retained trees between the two northbound on slips at junction 8, mostly in the area south of the footpath with trees to the south almost exclusively in a very poor condition. It was noted that there were several partially and fully wind-thrown Pine and Cupressus trees within the group. Generally all trees were tall and slim due to competition with neighbouring trees as would be expected in a woodland or plantation setting.

5.61 The tree survey noted that the defects observed in Beech consisted of poor vitality, loose and missing bark exposing bare non-functioning wood and poor stem taper. Fungal decay brackets thought to be Ganoderma spp were attached to the bases of 2 trees to the southern end. Ganoderma spp are known to produce root and butt rot decay and can result in basal failure. The Elm, Larch, Pine and Cupressus trees requiring works were either standing dead, partially wind-thrown, of poor vitality or had poor stem diameter. It was considered most likely that the multiple defects, numerous dead and general poor condition of those trees in the southern area was as a result of disruption of the rooting areas. This had most probably occurred during the development of the slip roads and junction. Additional exposure due to the removal of surrounding trees had also likely contributed to the failure of several trees close to ground level

5.62 The photograph of this area, taken during the POPE site visit in June 2014 shows that there appears to have been no action undertaken based on the arboricultural survey requirements (***Figure 5.6***). Management recommendations included 'felling to ground' of identified at risk trees with some 'fell to thin' and 'monitor growth' tags applied to others. It is noted that the ES requirement for this area is dense screen planting. The as built landscape and ecology design drawings show existing vegetation retained and a small strip of shrub planting along the A4147 identified for visual screening and landscape integration. Based on this, it is important that the ES commitments are met and the retained woodland plot managed effectively.

Figure 5.6 – Junction 8 northbound on slips – retained trees subject to tree survey

Overall Landscape and Visual Evaluation

5.63 It appears that no target percentage cover requirements for planting undertaken as a part of the scheme was set. As such, assessments based on the POPE site visit are based on average expected coverage at five years.

5.64 The FYA site visit to evaluate the ongoing establishment of the planting found the road corridor generally free of noxious weeds, and planting within the scheme to be progressing well and as would be expected at the FYA stage. Grassland areas were free of significant scrub cover, and plant stock appeared to be generally healthy, establishing, and in good condition.

5.65 During the site visit, maintenance of planting plots was evident throughout and included grass cutting, herbicide application (see ***Figure 5.7***), and replacement planting where plants have presumably either failed to establish fully or have been damaged.

Figure 5.7 – Herbicide application around individual trees

5.66 The visual screening function of the planting plots is also beginning to develop throughout the scheme and subject to current plant growth being maintained, it is expected that the visual screening targets predicted in the ES will be met.

5.67 As noted in the OYA report, planting was undertaken in stages and it is apparent at FYA that growth achievements reflect this. It is presumed that during handover to the maintenance contractor, ongoing maintenance requirements will ensure younger stock achieve their growth targets in line with more mature stock reviewed at FYA. ***Figure 5.8*** demonstrates varying maturity of planting plots.

Figure 5.8 – Varying maturity of planting plots is noted throughout the site

5.68 Common Beech and Copper Beech (Fagus sylvatica sp) were planted as heavy standards as a part of the scheme. Their intention was to provide an instant impact at the approach to the junction. Growth appears limited at FYA which questions their planting as heavy standards.

Figure 5.9 – Beech and Copper Beech on the off slips to Junction 10.

5.69 The 2014 Draft Handover Management Plan (HEMP) states that plant "*shelters should be removed when plant stems thicken and become mature enough to withstand animal damage, unless causing damage to plants or having an unsightly appearance, when they can be removed and disposed of*." It was noted during the site visit that although many plant shelters remain they are apparently subject to a programme of removal.

Figure 5.10 – Plant shelters present throughout the site

5.70 Comparison views with selected ES photomontages and FYA photographs are shown in **Appendix E.**

5.71 As noted in the Landscape Management Plan, within the maintenance period replacement of dead plant stock has amounted to less than 5% of total trees and shrubs planted within the scheme. Annual inspections are being undertaken to identify affected planting plots.

5.72 Based on the good growth achieve throughout the scheme and the screening and landscape integration requirements of the scheme it is therefore concluded that the effects of the scheme on the local landscape character and visual impacts are **as expected**.

Sub-Objective	AST	OYA	FYA
Landscape & Visual	Slight Beneficial	Generally as expected	As expected

Heritage of Historic Resources

Forecast

AST

5.73 The AST stated that the scheme would only affect known archaeological sites partially - disturbing the surrounds of the Scheduled Ancient Monument (SAM), but not the designated area, and only elements of the 20th century landscape. Impacts of the scheme on buildings, Conservation Areas and Parks would be indirect (on their setting), and no greater than those posed by the existing road. Impact on buried archaeological remains would be major, but these remains (if found to be present) were not likely to be of more than regional importance. The impact overall was assessed as **slight adverse**.

Environmental Statement – Non-Technical Summary

5.74 It was noted that there were 4 known areas of archaeological interest near to the M1. The most important was The Aubreys SAM. Twelve Grade II listed buildings were noted within 200m of the motorway, none would be directly affected. Landscaping and / or earth mounding would be designed to reduce visual impact of the motorway on the conservation areas of Flamstead, Potters Crouch and Redbourn.

- Junctions 6a to 7 – to mitigate visual impact on Potters Crouch Conservation Area strong linear 'off-site' planting to both sides of Bedmond Lane to strengthen existing hedges and to the fringe of the village;
- Junction 8 to The Aubreys - The Aubreys SAM, a large banked ditch enclosure of prehistoric date to the west of the M1. Land take would be minimised alongside and use of a retaining wall would mean the monument itself would remain unaffected and intact. The motorway would come within 3m of the limit of the SAM; and
- Junctions 9 to 10 – earth mounding and fencing to screen Redbourn village. (it is noted by POPE that Redbourn Village is between junctions 8 and 9).

Updates since the ES

5.75 The DSR noted that seven sites had been identified that required trial trenching as mitigation, and the residual impact would be **neutral**. Previous geophysical survey and trial trenching at The Aubreys Scheduled Monument established that the site was of national importance, that no further evaluation was required, and that the residual impact was minor negative. It was concluded that after mitigation planting had matured, the overall residual effect on the settings of some listed buildings, such as St Mary's Church, Redbourn (Grade 1), Breakspears (Grade 2), St Andrew's Church (Grade 2), Westwick Hall, (Grade 2), Westwick Cottages, (Grade 2), Nicholls Farm, (Grade 2), and St Agnells Farm, (Grade 2), would be **neutral**.

5.76 The Archaeological Design Part 2: Mitigation Strategy (2006) (ADP2) set out the sites where archaeological excavation, a scheme wide watching brief, or a targeted watching brief were proposed, and was submitted to the consultees for approval prior to starting work on each site.

OYA Evaluation

5.77 The OYA site visit confirmed that planting proposed in the DSR to mitigate the effects on the setting of listed buildings had been undertaken in the vicinity of St Mary's Church (Redbourn), Breakspears, St Andrew's Church (Woodside), Westwick Hall and Westwick Cottages, Nicholls Farm, and St Agnells Farm. It was not considered that the setting of Luton Hoo had been affected by the scheme; the historic park and garden was at some distance from the M1 separated by existing vegetation and an A road.

5.78 The OYA site visit also confirmed that the impact on the Redbourn and Potters Crouch Conservation Areas (as set out in the Landscape section of the DSR) was **as expected**, and that there would be no direct impact on the Redbourn Conservation Area, and that the improved screening planting had been carried out to improve the setting of the Potters Crouch Conservation Area. Screening and planting mitigation measures had been carried out as expected to reduce the impact on the setting of The Aubreys SAM (**medium adverse** at Year 15, as set out in the Landscape section of the DSR).

Consultation

5.79 No response to consultation has been received for Heritage of Historic Resources.

Evaluation

5.80 The visual impact on the listed buildings relatively close to the M1 is noted as low to medium adverse in the ES. This increased visual impact is based on the amount of existing vegetation that would be removed as a part of the construction phase and the highway boundary being moved out from its pre-scheme location. It is noted in the ES that the visual impact of the scheme will reduce as vegetation planted as a part of the scheme matures. It is noted in the landscape section of this chapter that vegetation planted as a part of the scheme is progressing well and is expected to reach its screening targets by the design year. This will ensure that the predicted visual impacts on most listed buildings within the scheme remains as predicted.

5.81 No further evaluation has been undertaken, as no changes regarding Heritage have been identified during the FYA site visit. A comparison view of the effect of the scheme on The Aubreys SAM is included in **Appendix E** and this illustrates that the planting on the embankment visible to the SAM should attain its growth projections by the design year, and as such will achieve an 'as expected' rating.

5.82 POPE methodology assumes that by the FYA evaluation, all archaeological reports should have been published and deposited with the archaeological finds in the agreed archive for future reference. No confirmation of this has been received at the time of submission

5.83 It is therefore concluded that the effects of the scheme on the heritage resource are generally as expected.

Sub-Objective	AST	OYA	FYA
Heritage of Historic Resources	Slight Adverse	As expected	As expected

Biodiversity

Forecast

AST

5.84 The AST stated that the impacts of the widening scheme were judged on the basis that many of the habitats adjacent to the motorway had already been bisected and degraded in quality and that further damage would be limited. The majority of the impacts were assessed as being **slight adverse** on this basis. Impacts on protected species were envisaged to be **negligible**. Proposed mitigation such as replacement of bat roosts, re-planting of native species-rich hedges, creation of species-rich grassland and the creation of wildlife ponds near Junction 8

would go some way to addressing the impacts of the scheme. The overall impact was assessed as **slight adverse**.

Environment Statement – Non-Technical Summary

5.85 The NTS noted that there were no designated sites directly affected by the scheme. Some 22 sites of varying nature conservation interest were identified where proposals were likely to have some impacts, in most cases of negligible importance and any losses would be adequately restored over the medium term (5 – 7 years) by planting to set ecological policies. The loss of verge vegetation would not be important ecologically as most of it was not of significant nature conservation value. Replacement hedgerows would reflect local species in order to extend habitats for the benefit of wildlife.

5.86 Specific biodiversity impacts and mitigation were noted as;

- Junction 7 to 8 – alteration of the existing balancing ponds would be required but the mature oak and ash trees would be retained where possible, natural regeneration of the existing scrub vegetation would be encouraged and replacement planting where appropriate. Remodelling of Junction 8 would make the redundant slip road loop area available for either dense woodland or large scale grassland habitat creation;
- Junction 8 to the Aubreys – the widening of the motorway would give the opportunity to extend habitats for locally native flowering species. Where appropriate thin sowings of native grasses would be used to allow natural colonisation from local seed sources, elsewhere species-rich seed mixes would be used;
- The Aubreys to Junction 9 – Retaining walls would be used to reduce the land take in the vicinity of the ancient woodland site Bury Wood. The wood would not be directly affected but some trees and scrub on the highway verge would be removed which provided woodland edge protection. Earthworks might cause changes in groundwater patterns. New planting would be re-established;

Updates since the ES

5.87 The DSR noted that the main direct impacts of the scheme would be the realignment of the M1, which would bring the road closer to several areas of high ecological habitats and protected species, loss and severance of habitats, particularly linear habitats, mature trees and woodland areas. Further survey work was recommended for bats, badgers, great crested newts and reptiles, and as mitigation measures could not therefore be formulated at that stage, no overall effect was stated. The additional survey work was undertaken and suggested mitigation measures were set out in 'Ecology Design Phase (EDP) 1b', January 2006.

5.88 The EDP stated that approximately 25 mature trees would be lost, one badger sett could be disturbed as the motorway would be closer to the sett, there would be a total loss of 2080m of hedgerows, one pond would be lost, a total of 10,996m² of land would be lost from County Wildlife Sites and loss of hedges and bridges used as foraging areas and flight paths could impact on bats. Ten ponds were surveyed for great crested newts. No great crested newts were found in water bodies within 500m of the site, except in one pond, from which it was considered that the newts were very unlikely to roam as far as the motorway verge, and that no great crested newt mitigation was necessary. No reptiles were found at any of the survey sites, possibly because the populations were isolated when the original motorway was built.

OYA conclusions

5.89 The OYA report noted that most of the ecological mitigation measures had been implemented in line with proposals. These included:

- construction of 2 ecological ponds;
- installation of bat boxes;
- installation of bird boxes as an ecological enhancement
- planting of standard trees in known bat foraging areas;
- installation of replacement bat roost features in new bridges;
- no lighting introduced in replacement underbridges that were originally unlit;
- construction of vegetated balancing ponds;
- planting of native trees, shrubs and hedges to replace those lost;
- sowing of wildflower seed mixes; and
- Installation of permanent badger fencing.
- creation of an artificial badger sett as an ecological enhancement

5.90 The Ecological Management Plan, March 2009, (EMP), detailed the five year monitoring requirements for bats, badgers, birds, ecological ponds, calcareous grassland and bluebells. It is noted at FYA that monitoring has only been made available for bats.

5.91 The OYA report noted that post construction monitoring of ecological ponds was carried out. It was noted that the pond at Punchbowl Lane did not initially contain water or aquatic vegetation although in subsequent surveys it contained some water but no aquatic vegetation, although some terrestrial vegetation was present. In the final submission, it was noted that the junction 8 pond and the Punchbowl Lane ponds contained water, but no aquatic vegetation.

5.92 The calcareous grasslands was an ecological enhancement measure and was to be monitored as the creation of specific calcareous grassland was an HA Biodiversity Action Plan (BAP) priority habitat for its value for butterflies. Post construction ecological monitoring assessed at the OYA stage noted that the seeding had been generally successful, with a lot of fine grasses.

5.93 The introduction of bluebells was noted in the OYA report as an ecological enhancement measure. Post construction ecological monitoring estimated that 20% of the planting had been successful, with the planted area mostly encroached by nettle. Despite there being a note that further monitoring should be undertaken in 2011, no monitoring reports were made available to POPE at FYA.

5.94 The OYA biodiversity evaluation section noted the presence and monitoring of bat boxes including access for bats through the Nickey Line tunnel. Common Pipistrelle bats were identified flying through the tunnel. No myosotis or long-eared bats had been recorded using the tunnel at the time of the OYA evaluation.

5.95 The OYA report noted that the lighting within the Nickey Line underpass (a County Wildlife Site) may have been deterring bats from using the tunnel. It suggested that day time lighting should be motion sensitive and night time lighting reduced or the lamps hooded to direct the light onto the ground. It was noted at FYA that lighting which had been vandalised after scheme opening has been replaced by Highways England (formerly the Highways Agency) in 2013.

Consultation

5.96 No response to consultation has been received for Biodiversity

Evaluation

5.97 No further monitoring of the artificial Badger sett and bird boxes, was undertaken beyond one year after opening of the scheme as required.

5.98 The 2009 Ecological Monitoring report states that "As a condition of Natural England development licences 20052701 and 20062701, there is a five-year post-construction requirement for the artificial sett near Westwick Farm.

5.99 Additionally, in 2.4 of the 2009 Ecological Monitoring Report it states that "The Ecological Management Plan recommends that ongoing annual monitoring of the nest boxes continues until 2013 as this is the best way to determine the success of these nest boxes as a form of mitigation for the loss of habitat. It also recommends that nest boxes should be cleared out annually either after the breeding season, or prior to the nest breeding season to ensure that new nest material is used, avoiding the spread of diseases and parasites."

5.100 It is noted at FYA that the calcareous grasslands appear to be slow to establish in some areas but most plots are establishing in line with growth expectations.

Figure 5.11 – Calcareous grassland showing mixed establishment rates

5.101 Bluebells were not visible at the time of the site visit, although it is expected that the establishment of 20% of planted bluebells at OYA would remain accurate at FYA.

Nickey Line Bridge Bat Monitoring Reports

5.102 The Nickey Line Bridge Bat Monitoring Reports state that there was a record of the results of monitoring that had been implemented as a result of the M1 J6A-10 Widening Scheme, specifically with respect to bat mitigation carried out at the Nickey Line Bridge. The reports state that the monitoring for bats had been based on the commitments stated in the European protected species licence in respect of bats for the Nickey Line Bridge (Defra licence WLF 023256 granted for the period 22 June 2006 to 21 June 2007, for brown long-eared bats.)

5.103 Recommendations from the reports included:

- Artificial bat boxes – four 1FF boxes that had been installed on the underpass itself and noted as missing in 2012 had not been replaced in 2013. This was still a requirement, and it was therefore recommended that these boxes should be replaced and installed on nearby trees as they would be safer there. The positioning of the boxes should ensure that they receive a sufficient amount of direct sunlight and therefore warmth.
- The directional design of the lighting does limit light on the upper part of the underpass. In 2009, it was recommended that the night-time lighting was changed to either remove or switch off three lights in every four (i.e. have one light on then three lights off) instead of every other one. The level of vandalism that followed did indirectly decrease the lighting intensity within the underpass, which is now in total darkness. No evidence of bats roosting

in the underpass has been indicated by the monitoring surveys. However, bats have been recorded moving through the underpass.

- Bats are legally protected species, and Highways Agency (at time of construction) Biodiversity Action Plan priority species. The underpass is used by pedestrians, so it is understood that Highways England must seek a balance between human health and safety and the underpass' use as a commuting route for bats.

Figure 5.12 – Avenues of trees leading to Nickey Line underpass. Bat boxes installed within trees

5.104 At FYA it is noted that lighting changes have occurred. These are discussed in more detail in **Appendix C**. It is noted that that there appears to be no further monitoring reports post installation of the amended lighting scheme which would confirm whether the mitigation has been successful in encouraging bats to continue using the tunnel.

5.105 ***Figure 5.13*** below shows the original installed lighting design and the 2014 view of the tunnel, with new lighting along the top sides of the structure. A camera flash was used for the FYA view to allow the lighting to be seen within the tunnel – the lighting installed has resulted in a darker space for use by non-motorised users (NMUs) however, during the day the light from either end of the tunnel does allow for reasonably safe access.

Figure 5.13 – Nickey Line Underpass showing original lighting and new lighting installed in late 2013 along tracks on the upper part of the tunnel light.

5.106 During the FYA site visit, the presence of bat boxes was confirmed as shown in ***Figure 5.14***. As noted in the 2009 monitoring report, these boxes were installed to provide replacement roost crevices.

Figure 5.14 – Bat boxes installed south west of the M1 along the Nickey Line

5.107 At FYA, reference to the pond at Punchbowl Lane was noted in the landscape aftercare inspection reports where it noted that reeds were colonising the pond which contained a good level of water. The aftercare site inspection undertaken in June 2012 noted a pair of Golden Finches and a colony of Broad Bodied Chaser dragonflies on/near the pond. At FYA it is noted that the pond appears to be functioning as originally intended although monitoring reports were not made available to POPE to confirm whether any species colonisation other than vegetative had occurred. The pond near Junction 9 was not accessible during the site visit and has therefore not been reported on further due to the lack of monitoring reports.

Figure 5.15 – Ecological pond (Punchbowl Lane)

5.108 As discussed in the landscape section, planting within the scheme is progressing well with plant stock generally healthy, established and in good condition, with planting plots achieving good coverage. Consequently, it is considered that habitat establishment and maintenance is developing in line with the ecological mitigation proposals. Confirmation of species success is not available due to monitoring appearing to not have been undertaken beyond OYA, with the exception for bats. However it is concluded that the overall effects of the scheme on biodiversity are **as expected**.

Sub-Objective	AST	OYA	FYA
Biodiversity	Slight Adverse	Likely to be as expected	As expected

Water Quality and Drainage

Forecast

AST

5.109 The AST stated that the use of current good practices in accordance with Environment Agency guidelines during the construction phase and the implementation of Vegetative Treatment Systems during the operational phase should significantly reduce any potential impact to controlled waters. The scheme would include improvements to: pollution control, storm water attenuation, discharge to groundwater and would reduce the risk of accidental spillage. The installation of a new highway drainage system to treat water from the road would improve the management of both water quality and quantity. The impacts were assessed to be **slight beneficial** overall.

Environmental Statement – Non-Technical Summary

5.110 It was noted that the majority of existing surface water from the motorway drained via soakaways into the ground except between Lybury Lane and Coles Lane where the outfall was to the River Ver at Junction 9. The new highway drainage system would outfall to watercourses where possible rather than use soakaways to reduce the risk of pollutants entering the ground water, and particularly in the groundwater protection area around Junction 9. Between Punchbowl Lane and Junction 10, surface water run-off would be collected and stored in balancing ponds before out-falling to the River Ver. Pollution control measures would be incorporated into the scheme.

Updates since the ES

5.111 The DSR stated that sufficient pollution control measures had been built into the project design to ensure that discharges of surface run off would not have a detrimental effect on the receiving water, resulting in a **neutral** impact on water quality. The implementation of surface water attenuation measures as part of the drainage strategy would ensure that local flooding was kept to a minimum. The DSR also stated that the scheme could have a potential **minor beneficial** effect on the aquatic environment of the River Ver as a result of the improved flow during periods of low flow, through an increase in the volume of surface water runoff discharged to the river.

OYA Evaluation

5.112 The OYA assessment stated that the As Built Drainage drawings were not made available and that these should be requested at FYA. The DSR did not state how many balancing ponds were already present or how many new ponds were proposed, but the Phase 2 Environmental Masterplan showed 9 proposed balancing ponds. The As Built Landscape and Ecology Design drawings showed that 8 of these were constructed, and that two ecology ponds were also constructed as ecological enhancement.

5.113 The OYA assessment stated that five of the readily accessible balancing ponds were visited and that all contained well developed marginal vegetation, and their effectiveness as vegetative treatment systems should be re-considered at FYA.

Consultation

5.114 No response to consultation has been received for Water Quality and Drainage.

Evaluation

5.115 The As Built balancing pond detail drawings were received at FYA and were used for the evaluation of drainage facilities within the scheme.

Figure 5.16 – Balancing pond near Slip End

5.116 Balancing ponds visited during the site visit appear to be operating as expected, and the vegetative treatment systems (common reed, yellow flag iris, bur reed and bulrushes) appear to have generally established well where planted except for the Slip End pond. The surrounds of these balancing ponds were also inspected, and appeared to be maintained and performing as expected. No information was received at FYA to indicate whether any incidents had occurred that may have affected the drainage system.

Figure 5.17 – Balancing ponds near Gaddeson Lane

5.117 No further information regarding the drainage system or water quality monitoring has been made available for this report but based on the FYA site visit and the comments received at consultation, it is concluded that the overall the effect of the scheme on water quality and drainage is likely to remain beneficial, **as expected**.

Sub-Objective	AST	OYA	FYA
Water Quality and Drainage	Slight Beneficial	As expected	As expected

Physical Fitness

Forecast

AST

5.118 The AST stated that crossing facilities and Public Rights of Way (PROW) would be maintained and improved/replaced when disrupted. Other improvements would also be incorporated as part of the scheme. Journey distances by non-motorised users would increase by approximately 800m equating to an additional journey time for pedestrians of 10 minutes across the scheme. The scheme was unlikely to reduce the number of walking/cycling trips made once the scheme has been implemented. Any increase in physical activity was unlikely to be significant enough to contribute to the overall health strategy. The impacts were assessed to be **neutral**.

Environmental Statement – Non-Technical Summary

5.119 The NTS stated that the scheme impacts on pedestrians would be negligible with a small benefit in the long term gained due to all existing routes being retained and at a number of locations a greater separation achieved between the footpath and motorway.

Updates since the ES

5.120 The DSR stated that where a route had already been severed by the motorway, it would be further shortened by the amount of the proposed widening. Where a route had already been diverted to run adjacent to the motorway boundary, it would be diverted to run adjacent to the new boundary. Where a route crossed the motorway by means of an existing structure, the route would be maintained via modified replacement structures. In all, 22 footpaths would be affected by the proposals, with neutral impacts on 20 of these.

5.121 The impacts on the footpath 7 (St Michael Parish), and footpath 9 (Redbourne) was considered to be **minor negative**, due to a slight increase in journey time in each case. The impacts on all bridleways, designated cycleways and other designated routes were considered to be **neutral**. No overall impact was stated.

OYA Evaluation

5.122 The OYA assessment confirmed that no post opening Non-motorised User (NMU) survey had been undertaken and no new NMU/VU surveys had been carried out specifically for POPE which would provide any quantifiable measures of use of the PROWs. At the time of the OYA site visit no pedestrians, cyclists or horse riders were observed using footpaths, cycleways or bridleways.

5.123 Mitigation planting to integrate the footpaths and bridleways into the landscape had been undertaken as proposed, but it was too soon to evaluate the effectiveness of the planting measures and this should be considered as part of the FYA evaluation.

5.124 The OYA report confirmed that based on the site visit and desk study, PROWs had been retained and diverted as proposed and the impacts on footpaths, bridleways and cycle facilities were in line with expectations, although the recommendations for lighting of tunnels had changed since the NTS and DSR.

Consultation

5.125 No response to consultation has been received for Physical Fitness

Evaluation

5.126 No NMU post opening audit report, which would provide information relating to NMU usage appears to have been undertaken for this scheme and POPE has not undertaken any specific NMU surveys.

5.127 During the FYA site visit, pedestrian and cycle use of the Nickey Line between Redbourn and Hemel Hempstead was noted. The lighting within the Nickey Line tunnel under the M1 was replaced towards the end of 2013 (as discussed in the Biodiversity section) and allows for use during the day.

Figure 5.18 – Nickey Line crosses Hemel Hempstead road to the west of the M1

5.128 A public footpath near Slip End, suitable for walkers and equestrians is noted to be well constructed but not maintained. Trees and shrubs are planted along its route for screening, but if these plants are not maintained, they will encroach onto the footpath and restrict use.

Figure 5.19 – Footpath near Slip End

5.129 No further evaluation has been undertaken as no changes regarding Physical Fitness have been identified during the FYA site visit.

5.130 Based on the information presented in this evaluation, it is concluded that the effects of the scheme on physical fitness are likely to remain **as expected**.

Sub-Objective	AST	OYA	FYA
Physical Fitness	Neutral	As expected	As expected

Journey Ambience

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

Forecast

AST

5.132 The AST stated that driver's frustration and fear of potential collisions was likely to reduce. Improved route signs and road information should reduce the driver's uncertainty, whilst the improvements in the view from the road were likely to improve (despite some new restrictions to views). The impacts were assessed to be **beneficial** overall.

Environmental Statement – Non-Technical Summary

5.133 The NTS noted that the proposed scheme would have a **highly beneficial** effect in the short and medium term for users of the motorway and adjacent routes. The provision of improved road capacity would assist in the reduction of congestion and benefit drivers by reducing delay, inconvenience and journey times, and by improving safety and alleviating traffic flows on unsuitable routes adjacent to the motorway.

Updates since the ES

5.134 The DSR stated that the provision of new lanes on the southbound and northbound carriageways would result in fewer cars per lane, easing congestion, reducing queues and enabling drivers to drive at a more consistent speed. In addition, the road surfacing would be improved from 80% to 100% bituminous surfacing, which was likely to have a positive impact on driver stress. By the introduction of further lanes it was considered likely that there would be more space between vehicles and less need to change lanes, reducing the fear of potential collisions. The scheme would also give an opportunity to provide new lighting, signage, screening and other planting, reducing driver stress. The mounding, environmental screens and landscaping would considerably restrict views from the road, but would create a more varied highway landscape than before. Overall, the effects were considered to be **moderate positive**.

OYA Evaluation

5.135 The OYA report noted that much of the motorway was in cutting which prevented views out, and mounding, planting and noise barriers had been designed to screen the road from sensitive visual receptors. It noted that some long, open views of the surrounding landscape were retained, although these views were likely to be reduced or filtered as mitigation planting matured. However, views within the motorway corridor were varied by the mosaic of different planting schemes and areas of wildflower grassland.

5.136 The report further noted that the scheme had reduced congestion which would have benefitted driver stress. Although traffic levels had increased slightly, the provision of new lanes meant fewer cars per lane, greater space between vehicles, less need to change lanes, reduction in queues and more consistent speeds which alleviated driver frustration. Improved signage and lighting had been installed which would have reduced driver uncertainty and stress.

Consultation

5.137 No response to consultation has been received for Journey Ambience

Evaluation

5.138 It is noted in the traffic evaluation section of this report that southbound traffic flows are considerably higher than predicted although it is noted that the predicted southbound flows are considerably lower than the northbound flows and are unlikely to have stemmed from the base year traffic model.

5.139 Pre-scheme journey times saw large fluctuations in both directions which have improved post scheme opening. It is noted that, since OYA, southbound journey time reliability has worsened during the peak periods while northbound journey time reliability remains an issue between OYA and FYA. Overall journey time reliability has improved with fewer peaks during the day indicating that the scheme has catered to the objective of improving journey time reliability in the longer term.

5.140 The annual average number of Personal Injury Collisions (PICs) occurring on the M1 between J6a and J10 has decreased from 187.9 (counterfactual) in the pre-scheme to 67 post scheme opening. Taking background reduction into account, there is a significant reduction in the annual average collisions post scheme opening. The observed collision rate is lower than the forecasted DS collision rate.

5.141 No further evaluation has been undertaken as no changes regarding Journey Ambience have been identified during the FYA site visit.

5.142 Based on the information presented in this evaluation, it is concluded that the effects of the scheme on physical fitness are likely to remain **as expected**.

Sub-Objective	AST	OYA	FYA
Journey Ambience	Beneficial	As expected	As expected

Key Points - Environment

Noise

- The observed traffic flow within the scheme is slightly less than predicted although not sufficient to influence a final evaluation of 'as expected'. Noise barriers and earth mounding have been installed as required by the ES and are presumed to be performing their noise mitigating function **as expected**.

Air Quality

- The observed traffic flow for the scheme is less than predicted and is sufficient to influence the final POPE score which is '**better than expected'**.

Greenhouse Gases

- There was an increase of 13,700 tonnes of carbon (17%). This was slightly **better than expected**.

Landscape

- Planting is generally establishing very well and is expected to reach its growth targets. Planting plots have generally achieved their target coverage within the time period stated in the HEMP, and the current levels of plant growth and establishment indicate that their visual screening and landscape integration functions are developing as expected at FYA.
- Retained trees at junction 8 appear to not have received the arboricultural care required. It is expected that without this care, these woodland plots will deteriorate further over time until deemed a hazard and removed. Based on the requirements of the ES, failed trees should be replaced to meet the requirements of '*dense screen planting*'.
- The visual effect of the scheme has been mitigated through the use of earth mounding, environmental barriers and mitigation planting. Planting has been used to good effect adjacent to environmental barriers, softening the effect of these structures.
- The overall assessment is **as expected.**

Biodiversity

- No further monitoring of the artificial Badger sett and bird boxes was undertaken beyond one year after opening of the scheme. It is noted at FYA that the calcareous grasslands appear to be slow to establish.
- The Nickey Line Bridge Bat Monitoring has been undertaken as a part of the scheme and in accordance with requirements within the DEFRA license. As a result of the monitoring, lighting within the tunnel has been changed to ensure that the use of the tunnel by bat species continues. The last monitoring visit was undertaken prior to the installation of the new lighting so that the effect cannot be reported on within this report.
- Overall, habitat establishment and maintenance is developing in line with the ecological mitigation proposals as stated in the ES.
- The overall assessment is **as expected.**

Cultural Heritage

- Although confirmation has been received that that copies of the archaeological report have been submitted to the Cumbria HER (Historic Environment Record), the project archive does not appear to have been deposited with the Penrith Museum as stated in the archaeological report.
- The effects of the scheme on built heritage are **as expected**.

Water

- No information has been made available to POPE which would indicate that the scheme drainage measures are performing other than as intended. Based on the FYA site visit, the Landscape As-Built drawings, and consultation comments received, it is likely that the overall effect of the scheme on water quality and drainage is **as expected**.

Physical Fitness

- POPE is not aware whether there have been any NMU audits or Vulnerable User Studies undertaken for this scheme, but footpaths viewed during the FYA site visit generally appeared to be capable of performing as expected, although the lack of active maintenance for the public footpath near lip End is a cause for concern for future use.
- The overall assessment is **as expected.**

Journey Ambience

- Traveller views remain as discussed in the OYA report.
- Traveller stress has improved with the observed collision rate lower than forecast and , reduced journey time fluctuations
- The overall assessment is **as expected.**

6. Accessibility and Integration

Introduction

6.1 The Accessibility objective consists of three sub-objectives:

- Option values;
- Severance; and
- Access to the Transport System.

6.2 The Integration Objective consists of the following sub-objectives:

- Interchange with other transport modes; and
- Land Use and Other Government Policies.

6.3 This section will examine each of these sub-objectives in relation to the M1 Junction 6a to 10 scheme.

Accessibility

Option Values

6.4 Option values, as defined in WebTAG, largely relate to measures which will substantially change the availability of transport services within the study area.

Forecast

6.5 The AST stated that there would be no change to option values as a result of the scheme.

Evaluation

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

Severance

6.7 This sub-objective is concerned with those using non-motorised modes, in particular pedestrians.

Forecast

6.8 For the severance sub-objective the AST states:

'Due to the overall increase in length of NMU facilities throughout the carriageway widening scheme, there may be a very slight increase in severance on pedestrians using such facilities. However, increased severance between community facilities and a reduction in the amenity level of routes between facilities has been considered unlikely during the operational phase.' Score: Neutral.

Evaluation

6.9 The M1 Junctions 6a to 10 Widening – Non Motorised User Context Report outlined a number of measures that have been implemented to mitigate the severance issues resulting from the scheme. These are summarised below as follows:

- Implementation of a cycle path along the A414 (former M10) from the National Cycle Route 6 (NCR6) at Watford Road to Buncefield Roundabout (East of Hemel Hempstead adjacent to M1 Junction 8).

- It was known at OYA stage that the cycle path along the A414 is yet to be implemented. However, the segregated cycle path which runs parallel to the Collector – Distributor Roads is complete.
- Existing bridges and subways crossing the M1 at seventeen locations have been extended or replaced in their existing location or adjacent to their existing location.
- A successful example of this has been the provision made National Cycle Network 57 to cross the M1. This route consists of a dismantled railway (the 'Nickey Line) between Junctions 7 and 8 and the new tunnel (shown in ***Figure 6.1***) Includes high levels of lighting throughout to increase perception of security.

Figure 6.1 – M1 Underpass serving National Cycle Network 57

- Although there have been some diversions of footpaths and bridleways, none have been severed completely as a result of the scheme.

It is noted that when the M1 was originally constructed in the 1950's, a number of footpaths and roads were severed, restricting movements across the M1. The widening of the M1 does not create any further severance so the impact is **neutral** as expected.

Access to the Transport System

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

Forecast

6.11 For the Access to the Transport System sub-objective, the AST states:

'No direct proposals (not applicable to road schemes.)' Score: Neutral.

Evaluation

6.12 This scheme has had no direct impact on public transport provision, therefore the AST assessment of **neutral** impact is considered to be valid in this instance.

Integration

Transport Interchange

6.13 This objective relates to the extent to which the scheme contributes towards improving transport interchange for passengers and freight.

Forecast

6.14 The AST states:

'The opportunity to use public transport will exist at current levels' Score: **Neutral**.

Evaluation

6.15 The scheme has not had an impact on the provision of transport interchange facilities therefore a neutral impact has been observed as expected.

Land Use and Other Government Policies

Forecast

6.16 For both Land Use and Other Government Policies, the AST predicted a neutral impact.

Evaluation

6.17 This section undertakes a review of the relevant local, regional and national policy documents applicable to this scheme in order to determine if the main objectives outlined in these policies closely align to the achievements of the M1 scheme. In summary, the scheme integrates well with the objectives set out in local, regional and national policies as expected.

Table 6-1 – Scheme Alignment with National, Regional and Local Policy

Policy/Document	Relevant Policy Objective/Reference	Relevant Scheme Impacts	Alignment
Hertfordshire Local Transport Plan **(2011-2031)**	The overall aim of the Local Transport Plan is summarised in Hertfordshire's transport vision statement: "To provide a safe, efficient and resilient transport system that serves the needs of business and residents across Hertfordshire and minimises its impact on the environment." Key challenges identified in the Local Transport Plan relevant to the scheme are: • To keep the county moving through efficient management of the road network to improve journey time, reliability and resilience and manage congestion to minimise its impact on the economy; • To support economic growth and new housing development through delivery of transport improvements and where necessary enhancement of the network capacity; • To improve accessibility for all and particularly for non-car users and the disadvantaged; • To maintain and enhance the natural, built and historic environment managing the streetscape and improving integration and connections of streets and neighbourhoods and minimising the adverse impacts of transport on the natural environment, heritage and landscape; • To reduce the impact of transport noise especially in those areas where monitoring shows there to be specific problems for residents; • To improve road safety in the county reducing the risk of death and injury due to collisions; and • To reduce greenhouse gas emissions from transport in the county to meet government targets through the reduction in consumption of fossil fuels.	• The scheme has provided increased capacity to cater for growth in traffic and potential economic benefits. • The scheme has not increased carbon emissions to the extent as forecast. • The scheme has catered to congestion relief and improved journey time and reliability. • There has been a reduction in collisions. • The scheme's impact on noise levels is as expected. • The scheme's impact on landscape and townscape were as expected.	✓

Policy/Document	Relevant Policy Objective/Reference	Relevant Scheme Impacts	Alignment
The Future of Transport: a Network for 2030	The Strategy builds on the progress that had already been made since the implementation of the 10 year plan for transport. This plan extended out to 2014-2015 but strategy also looks even further ahead, at the challenges we face over next 20-30 years. The Strategy is built around three themes: • Sustained investment; • Improvements in transport management; and • Planning ahead. The main goal is to provide a road network that provides a more reliable and free-flowing system for motorists, other road users and businesses, where travellers can make informed choices about how and when they travel, and so minimise the adverse impact of road traffic on the environment and other people.	• The scheme is part of a series of improvement measures along the M1, and as such provides an improved road network to cater for the increased traffic along the corridor. • The improved scheme section has resulted in less traffic in alternate routes with the possibility of further developments at these alternate routes.	✓
Action for Roads - A network for the 21st century (July 2013)	• Support the UK economy and drive growth into the future through provision of a well-connected road infrastructure with sufficient capacity; • Push for greater safety, and avoid letting the improvements of recent years breed complacency; and • Ensure transport plays its part in meeting carbon budgets and other environmental targets.	• By improving the strategic road network in the area, the scheme enhances the integrated transport network at both a local and regional level, supporting economic growth objectives. • Observed growth in carbon emissions is lower than forecast as a result of the scheme.	✓

Key Points – Accessibility and Integration

- It is considered that the AST forecast for option values is valid and that no more detailed evaluation would reveal any changes connected to the scheme.
- This scheme has had no direct impact on public transport provision, therefore the AST assessment of neutral impact is considered to be valid in this instance.
- The scheme has maintained the existing crossing facilities facilitating movement across the M1. The severance impact is therefore neutral as expected.
- The scheme has not had an impact on the provision of public transport interchange as expected.
- The scheme integrates well with the objectives set out in local, regional and national policies as expected.

7. Appraisal and Evaluation Summary Tables

Appraisal Summary Table (August 2007)

7.1 The Appraisal Summary Table (AST) is a brief summary of the main economic, safety, environmental and social impacts of a highway scheme***.*** ***Figure 7.1*** presents the AST for the M1 Junction 6a to 10 widening scheme prepared at the time of the appraisal.

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

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

Evaluation Summary Table

7.3 The Evaluation Summary Table (EST) was devised for the POPE process, to record a summary of the outturn impacts for the objectives, compared to the predictions in the AST.

7.4 Drawing on results presented in this report, ***Figure 7.2*** Table 7.2 Evaluation Summary

7.5 presents the EST for the M1 Junction 6a to 10 Widening. An assessment for each of the objectives at the FYA stage is given. Where possible, the format of the EST mirrors the appearance and process of the AST to enable direct comparison between the two.

Figure7.1 Table 7.1 – Appraisal Summary Table (AST)

Scheme Name: M1 J6a to 10 Widening		**Description:** Widening existing M1 between Junction 6a and 10 to D4M in both directions. Addition of D2 distributer roads between junctions 7 and 8.	**Problems:** Severe congestion and delay and high collision occurrence.	**PVC to Public Accounts:** £290m
Ob	**Sub-Objective**	**Qualitative Impacts**	**Quantitative Impacts**	**Assessment**
Environment	**Noise**	The assessment has found that increases in noise levels of up to 3dB would be experienced at 10 properties. The assessment has also found that 408 properties would gain decreases of up to 15dB On the basis of the assessment, no additional means of mitigation are considered necessary other than those that have already been incorporated into the scheme proposals.	Estimated Population Annoyed Do Minimum: 191 Estimated Population Annoyed Do Something: 157	**Population Annoyed DS minus DM -34**
	Local Air Quality	A negligible deterioration in local air quality is expected with the scheme in place. Changes in concentrations at properties within 200 metres of the scheme are well below the significance criteria for NO2 & PM10 (2 & 1 micrograms per cubic metre respectively, as an annual mean) & are unlikely to be measurable. Changes in air quality are expected due to the increase in traffic volume & speed.	Number of Properties with an improvement: 1 Number of Properties with no change: 0 Number of Properties with a deterioration: 20	**Overall PM10 score: 7** **Overall NO2 score:17**
	Greenhouse Gases	Emissions of CO2 are estimated to increase with the scheme in place by around 9% in the opening year (2008). Increases are due to the increase in the overall length of the route from J 6 to 10 with the scheme in place. The number of vehicles on this part of the road network is expected to increase with the scheme in place.	Compared to the existing case (2001) there is an increase of 17% (27,500 tonnes) of CO2 with the scheme in 2008. There is an increase of 9% (16,000) tonnes in 2008 with the scheme compared to the do-minimum situation.	**Total change in CO2 emissions due to scheme in the opening year is an increase of 16,000 tonnes per year.**
	Landscape	The M1 is currently a prominent feature, cutting across the largely agricultural landscape; the improvements will initially result in a loss of existing vegetation, land take of largely agricultural l& & increased visibility of the motorway & associated engineering elements. Proposed mitigation measures including mounding & planting will reduce impacts, including offering improvements when compared to the existing situation. Mitigation measures will also help to integrate the motorway, including the associated engineering structures, with the wider landscape character & improve views from adjacent visual amenity receptors including Redbourn.	N/A	**Slight Beneficial**
	Townscape	N/A	N/A	**Neutral**
	Heritage of Historic Resources	The scheme will only affect known archaeological sites partially - disturbing the surrounds of the SAM, but not the designated area, & only elements of the 20th century landscape. Impacts of the scheme on buildings, Conservation Areas & Parks will be indirect (on their setting), & no greater than those posed by the current road. Impact on buried archaeological remains will be major, but these remains (if found to be present) are not likely to be of more than regional importance.	N/A	**Slight Adverse**
	Biodiversity	The impacts of the widening scheme have been judged on the basis that many of the habitats adjacent to the motorway have already been bisected & degraded in quality & that further damage will be limited. The majority of the impacts have been assessed as being slight adverse on this basis. Impacts on protected species are envisaged to be negligible. Proposed mitigation such as replacement of bat roosts, re-planting of native species rich hedges, creation of species-rich grassland& & the creation of wildlife ponds near J 8 should go some way to addressing the impacts of the scheme.	N/A	**Slight Adverse**
	Water	The use of current good practices in accordance with Environment Agency guidelines during the construction phase & the implementation of Vegetative Treatment Systems during the operational phase should significantly reduce any potential impact to controlled waters. The scheme will include improvements to: pollution control, storm water attenuation, discharge to groundwater & will reduce the risk of accidental spillage.	N/A	**Slight Beneficial**
	Physical Fitness	Crossing facilities & Public Rights of Way will be maintained & improved/replaced when disrupted. Other improvements have also been incorporated as part of the scheme. Overall the proposals suggest that journey distances by non-motorised users will increase by approximately 800m equating to an additional journey time for pedestrians of 10 minutes across the scheme. The scheme is unlikely to reduce the number of walking/cycling trips made once the scheme has been implemented. Any increase in physical activity is unlikely to be significant enough to contribute to the overall health strategy.	N/A	**Neutral**
	Journey Ambience	Driver's frustration & fear of potential collisions is likely to reduce. Improved route signs & road information should reduce the driver's uncertainty, whilst the improvements in the view from the road are likely to improve (despite some new restrictions to views). Overall journey ambience will benefit from moderate positive impacts.	N/A	**Beneficial**
Safety	**Collisions**	Collision rates based on observed data are relatively high, whereas default rates have been assumed for the scheme. Hence the high level of collision cost savings.	Over 60 years: / Central Growth PIA's: 16,600 Slight: 26,889 Serious: 1,520 Fatal: 253	**PVB: £773.4m**
	Personal Security	Not really applicable although security will be slightly enhanced by the improved flow for vehicles thus reducing the frequency of stationary traffic & the opportunity for incidents.		**Slight Beneficial**
Economy	**Public Accounts**	Investment cost of scheme is £276.3m. Additional cost of indirect taxation is £17.2m, maintenance cost saving is £3.4m. Overall cost is £290m.	Central Government PVC: £290m Local Government PVC: £0m	**PVC: £290m**
	Business Users	Business User travel time benefits of £803.3m, no VOC benefits.	Business Users PVB: £803.3m	**PVB: £803.3m**
	Consumer Users	Consumer travel time benefits £373.9m, VOC benefits of £53.8m.	Consumer Users PVB: £427.7m	**PVB: £427.7m**
	Reliability	Based on preliminary INCA results additional benefits in excess of £500 million may be accrued to the scheme due to improved travel time reliability & the reduction in incidents.		**High Beneficial**
	Wider Economic Impacts	No issues relating to designated regeneration areas.	N/A	**No**
Access	**Option Values**	Not directly affected by the scheme (not applicable to road schemes).	N/A	**PVB: £0m**
	Severance	Due to the overall increase in length in NMU facilities throughout the carriageway widening scheme, there may be a very slight increase in severance on pedestrians using such facilities however increased severance between community facilities & a reduction in the amenity level of routes between facilities has been considered unlikely during the operational phase.		**Neutral**
	Access to Transport System	No direct proposals (not applicable to road schemes).	N/A	**Neutral**
Integration	**Trans Interchange**	The opportunity to use public transport will exist at current levels.		**Neutral**
	Land-use Policy	Proposal complies with elements of local, regional & national policy namely those which specifically support the M1 widening scheme to improve capacity of the strategic road network, reduce congestion & improve local accessibility. Conflicts with a range of environmental & sustainability policies at all three policy spheres to a certain degree. However, the identified impacts on biodiversity, flora & fauna, on known archaeological remains & landscape will be mitigated where possible, through the incorporation of detailed mitigation measures into the scheme design & as such, accord with local planning policy objectives. Through detailed ecological & landscape proposals, the scheme will be sympathetically integrated into the surrounding landscape.		**Neutral**
	Other Gov't Policies	With mitigation measures in place during the construction & operational phase, the widening scheme would broadly assist in meeting the policy objectives of the main Government Departments & the main Government Advisory bodies: Environment Agency, English Heritage, Countryside Agency & English Nature. However, the scheme will conflict with the overarching environmental objectives in conserving & enhancing biodiversity, landscape & the historic environment & those seeking a reduction in the dependence on road transport.		**Neutral**

Figure 7.2 Table 7.2 Evaluation Summary

Objective	Sub-Objective	Qualitative Impacts	Quantitative Impacts	Assessment
Environment	**Noise**	A decrease in traffic flows within the scheme is noted although this reduction is not sufficient to allow for a 'better than expected' result.	N/A	**As expected.**
	Local Air Quality	Traffic data indicates that the FYA observed traffic flow is less than that forecasted with traffic between junctions 8 to 9 being 14% less and between junctions 9 to10 being 15% less than predicted. And therefore it is concluded that the effects of the scheme are better than expected in terms of local air quality.	N/A	**As expected.**
	Greenhouse Gases	Increased emissions due to increased speeds and traffic volumes.	**Increase of 17% (13,700 tonnes)**	**Better than Expected**
	Landscape	It appears that no target percentage cover requirements for planting undertaken as a part of the scheme were set. As such, assessments based on the POPE site visit are based on average expected coverage at five years. Ongoing establishment of planting found the road corridor generally free of noxious weeds and planting within the scheme to be progressing well and as would be expected at the FYA stage. Grassland areas were free of significant scrub cover, and plant stock appeared to be generally healthy, establishing, and in good condition.	N/A	**Slight Beneficial** **As expected**
	Townscape	N/A	N/A	**Neutral**
	Heritage of Historic Resources	The visual impact on the listed buildings relatively close to the M1 increased as a result the amount of existing vegetation that was removed as a part of the scheme and the highway boundary being moved out from its pre-scheme location. It is noted in the ES that the visual impact of the scheme will reduce as vegetation planted as a part of the scheme matures. It is noted in the landscape section of that vegetation planted as a part of the scheme is progressing well and is expected to reach its screening targets by the design year. This will ensure that the predicted visual impacts on most listed buildings within the scheme remains as predicted. The Aubreys SAM was exposed to the scheme due to vegetation removal on an embankment visible to the SAM although woodland screen planting should reach its screening height by design year which will serve to mitigate this effect.	N/A	**Slight Adverse** **As expected**
	Biodiversity	Planting within the scheme is progressing well with plant stock generally healthy, established and in good condition, with planting plots achieving good coverage. Consequently, it is considered that habitat establishment and maintenance is developing in line with the ecological mitigation proposals. Confirmation of species success is not available due to monitoring appearing to not have been undertaken beyond OYA, with the exception for bats. Changes to the lighting within the Nickey Line tunnel used by bats has been undertaken, although there is no confirmation at FYA whether this has proved successful in encouraging bat use.	N/A	**Slight Adverse** **As expected**
	Water	Balancing ponds visited during the site visit appear to be operating as expected, and the vegetative treatment systems appear to have generally established well where planted except for the Slip End pond. The surrounds of these balancing ponds were also inspected, and appeared to be maintained and performing as expected. No information was received at FYA to indicate whether any incidents had occurred that may have affected the drainage system	N/A	**Slight Beneficial** **As expected**
	Physical Fitness	Use of the Nickey line route under the M1 was noted during the site visit and included walkers and cyclists. No NMU audits appear to have been undertaken post opening	N/A	**Neutral** **As expected**
	Journey Ambience	Some long views out preserved, but much of the motorway is in cutting. Noise barriers, mounding and planting all reduce views out. Congestion and therefore driver stress likely to have been reduced by the provision of new lanes which would have an effect on journey time reliability. Improved signage and lighting installed to reduce driver stress.	N/A	**Beneficial** **As expected**
Safety	**Collisions**	Re-forecast collision savings almost exactly the same as forecast.	Collision Benefits of £439m	**Beneficial** **Lower than Expected**
	Personal Security	The impact on personal security is slight beneficial as expected due to improved journey time reliability and increased CCTV provision.	N/A	**Slight Beneficial** **As expected**
Economy	**Transport Economic Efficiency**	Journey time impacts similar to those forecast	Outturn journey time savings in excess of £1.2billion.	**As expected**
	Reliability	Analysis of the standard deviation of journey times shows that journey time reliability has improved since scheme opening.	N/A	**As expected**
	Wider Economic Impacts	The scheme has contributed to the growth aspirations of the MKSM area by providing additional capacity and improved journey times on the main strategic highway through the area.	N/A	**Not Appraised (Evaluated as beneficial)**
Accessibility	**Option Values**	The scheme has not changed the availability of transport services in the vicinity of the scheme.	N/A	**Neutral** **As expected**
	Severance	The scheme has not severed any footpaths or bridleways, crossing provision has been maintained, and extension of the existing cycle network along the A414 (former M10) was constructed.	N/A	**Neutral** **As expected**
	Access to the Transport System	No direct change in public transport provision as a result of the scheme.	N/A	**Neutral** **As expected**
Integration	**Transport Interchange**	The scheme has not had an impact on the provision of transport interchange facilities.	N/A	**Neutral** **As expected**
	Land-use Policy	The scheme integrates well with the objectives set out in local, regional and national policies.	N/A	**Neutral** **As expected**
	Other Gov't Policies			

8. Conclusions

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

Scheme Specific Objectives

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

Table 8.1 – Success against Scheme Objectives

Objective (Source)	Has the scheme objective been achieved?	
Reduce congestion	Increased capacity, reduced journey times, and improved reliability indicate that congestion has been reduced as a result of the scheme.	✓
Improve journey time reliability	An analysis of the standard deviation of before and after opening journey times shows that journey time reliability has improved as a result of the scheme.	✓
Reduce accidents	Based on the limited amount of post opening data available, the evidence suggests that the scheme has been very successful in reducing collisions.	✓

Appendices

Appendix A. Tables and Figures in this Report

Tables

Figures

Appendix B. Information requested for Environmental section

Table B.1 – Information requested to evaluate the environmental sub-objective.

Environment Specific Requirements	OYA Response	FYA Response
Environmental Statement	Not available in full although the NTS for the 1994 was available	Received at FYA.
Appraisal Summary Table	Provided by HA version	Received at OYA.
Any amendments, updates or addendums to the ES or any relevant further studies or reports. Any significant changes to the scheme since the ES.	Detailed Scheme Report (DSR), ecology, heritage and noise update reports provided	Received at OYA
'As Built' drawings for landscape, ecological mitigation measures, drainage, fencing, earthworks etc.	Landscape and Ecology As Built drawings provided Drainage As Built drawings not provided	No further drawings received at FYA.
Landscape and Ecology Management Plans	LEAP provided	No further update received at FYA
Construction Environment Management Plan	CEMP provided	Received at OYA
Relevant contact names, of people with knowledge of the scheme: the statutory consultees (Environment Agency, English Heritage and Natural England); the local authorities; the designer or environmental coordinators for the scheme and for the MAC; and, any other relevant specialist consultees that were contacted.	Provided by HA	None provided at FYA
Archaeological reports (popular and academic)	Draft unpublished Post Excavation Archaeology Report provided, the technical archaeology report should be available at FYA	No further update provided at FYA
Results of any post opening survey or monitoring work e.g. ecology surveys, water quality surveys pre- and post- construction	Ecology surveys received	Bat monitoring reports received at FYA.
Animal mortality data, pre and post scheme construction	Provided by MAC	None provided

Appendix C. Nickey Line Bat Monitoring Reports

Nickey Line Bridge Bat Monitoring Reports (some text used from reports)

- The Nickey Line Bridge Bat Monitoring Reports state that there was a record of the results of monitoring that had been implemented as a result of the M1 J6A-10 Widening Scheme, specifically with respect to bat mitigation carried out at the Nickey Line Bridge. The reports state that the monitoring for bats had been based on the commitments stated in the European protected species licence in respect of bats for the Nickey Line Bridge (Defra licence WLF 023256 granted for the period 22 June 2006 to 21 June 2007, for brown long-eared bats and common pipistrelles (a three-week extension was subsequently obtained, to 13 July 2007, due to a slight delay in the construction programme).

- Historically, bats were recorded flying through the underpass in 2008 before the lamps within the tunnel were switched on. Bats were not recorded using the underpass as a flight corridor during bat surveys carried out in 2009 and 2010. During the 2009 bat surveys, it was noted that the lights in the underpass were constantly switched on, day and night, with the only difference being that at night, every other light was switched off, as per agreed design, in order to reduce light levels at night. In May 2010, although most lamps were still working, 25 out of a total of 70 lights had been vandalised. In September 2010, 46 lights out of the 70 lights present had been vandalised.

- Up to five common pipistrelle bats were recorded flying through the underpass during the bat surveys in June and September 2011. The underpass was quite dark on these occasions as the majority of the lamps had been vandalised, with shattered glass found on the ground. In June 2011, none of the lighting columns within the underpass were working, and in September 2011, only two lighting columns were switched on.

- The 2012 and 2013 survey results (Common Pipistrelles and Myotis bats recorded flying through the underpass from north to south and south to north and others flying into the underpass and then straight out again) indicated that bat activity had increased substantially, the most likely reason for this being the lack of any lighting when compared to the results from previous years. With regards to lighting levels within the underpass, when considering all survey results to date, these indicate that bats were recorded when a low number of lighting columns were being switched on (five pipistrelles flew through the underpass in September 2011 when two lamps were switched on, which represents approximately 3% of the lighting total). However, the results also indicated that bats were not recorded using the underpass with a lighting regime of 35% or more of the lamps being switched on. Foraging activity was observed on both sides of the underpass. Day time inspections of the artificial bat boxes showed no sign of usage by bats.

- Recommendations from the report included:

    - Artificial bat boxes – four 1FF boxes that had been installed on the underpass itself and noted as missing in 2012 had not been replaced in 2013. This was still a requirement, and it was therefore recommended that these boxes should be replaced and installed on nearby trees as they would be safer there. The positioning of the boxes should ensure that they receive a sufficient amount of direct sunlight and therefore warmth.
    - The directional design of the lighting does limit light on the upper part of the underpass. In 2009, it was recommended that the night-time lighting was changed to either remove or switch off every three lights (i.e. have one light on then three lights off) instead of every other one. The level of vandalism that followed did indirectly decrease the lighting intensity

within the underpass, which is now in total darkness. No evidence of bats roosting in the underpass has been indicated by the monitoring surveys. However, bats have been recorded moving through the underpass.

- Bats are legally protected species, and Highways Agency (at time of construction) Biodiversity Action Plan priority species. The underpass is used by pedestrians, so it is understood that Highways England must seek a balance between human health and safety and the underpass' use as a commuting route for bats.

Figure C.1 – Avenues of trees leading to Nickey Line underpass. Bat boxes installed within trees

- In summer 2013, the Highways Agency (at time of request) requested a quotation from Lighting Services for the provision of illumination to allow safe passage through the tunnel again for walkers, cyclists and horse riders. They requested that the design should take into account the usage of the underpass by bats.

- A site visit subsequently took place on the 5th July 2013 between the Highways Agency (as known as at time of meeting), St. Albans City & District Council, Redbourn Parish Council, and with the lighting engineer (Lighting Services), lighting installer, and an experienced ecologist.

- The new design involves the use of luminaires attached to the roof of the underpass, as opposed to the scheme lighting columns originally installed on either side of the underpass. The luminaires are lit by LED and would not emit Ultra Violet light. Each has a flat glass cover/shade and is angled downwards at 45° to prevent light spill. The initial average illuminance of 6.8 lux was reduced to 3.5 lux in line with current recommendations. Spacing between each luminaire is 10m on alternate sides of the roof (i.e. 20m between luminaires each side).

- There appeared to be no requirement for post installation monitoring to determine the effect of the newly installed lighting

- Figure C.2 shows the original installed lighting design and the 2014 view of the tunnel, with new lighting along the top sides of the structure. A camera flash was used for the FYA view to allow the lighting to be seen within the tunnel – the lighting installed has resulted in a darker space for use by non-motorised users (NMUs) however, during the day the light from either end of the tunnel does allow for reasonably safe access.

Figure C.2 – Nickey Line Underpass showing original lighting and new lighting installed in late 2013 along tracks on the upper part of the tunnel light.

- During the FYA site visit, the presence of bat boxes was confirmed as shown in FigureC.3. . As noted in the 2009 monitoring report, these boxes were installed to provide replacement roost crevices.

Figure C.3 – Bat boxes installed south west of the M1 along the Nickey Line

Appendix D. Summary of consultation responses

Table C.3 – Summary of Environmental Consultation Responses

Organisation	Field of Interest	OYA Comments	FYA Comments
Natural England	Biodiversity & Landscape	No comments	No response received at FYA
English Heritage	Heritage	As expected	No response received at FYA
Environment Agency	Water	Surface water drainage systems and balancing ponds carried out to high standard.	No response received at FYA
St Albans District Council	Water/air quality / noise	No response	No response received at FYA
	Heritage	Some concerns	No response received at FYA
Hertfordshire County Council	Public Rights of Way	No response	No response received at FYA
	Heritage	Several concerns	No response received at FYA
	Biodiversity	No response	No response received at FYA
Central Bedfordshire Council	Landscape	No comments	No response received at FYA
	Public Rights of Way	Some concerns	No response received at FYA
	Heritage	No comments	No response received at FYA
	Biodiversity	No comments	No response received at FYA
Luton Borough Council	Landscape	Implemented as expected	No response received at FYA
	Biodiversity	Implemented as expected	No response received at FYA
	Water /air quality /noise	No comments	No response received at FYA
Three Rivers District Council	Landscape	No response	No further contact made
	Water/air quality / noise	No comments	No further contact made
Dacorum District Council	Landscape/noise/water / air quality	Loss of green landscape noted, general comments.	Considered the landscaping on the approach from J8 into Hemel Hempstead was rather poor. Noted that from the local authority's perspective the improvements had been good for movement in the local area.
Flamstead Parish Council	General	Excessive lighting at Junction 9 tunnel. Size of signage at J9 too large for rural location.	No response received at FYA
Redbourn Parish Council	General	No response	No further contact made
St Stephen Parish Council	General	No response	No further contact made
Caddington Parish Council	General	No response	No further contact made
Hyde Parish Council	General	No response	No further contact made
Slip End Parish Council	General	Insufficient acoustic fencing at Pepperstock Bridge. Increase in noise following removal of mature trees. Drainage structure on Church Road has industrial appearance. View from M1 impaired by long stretches of acoustic barriers. Lighting under Church Road bridge poor compared to lighting at J9. Concerns that any increase in traffic will affect air quality.	No response received at FYA
Markyate Parish Council	General	Major impact on landscape character, more planting needed. Lighting at Junction 9 tunnel over-engineered. Concern at further marginalisation of River Ver due to widened structure. Water bodies at J9 and 10 not camouflaged. PROWs retained as expected. No increases in noise or pollution noticed.	No response received at FYA
Harpenden Wildlife Trust	General	No comments on environmental topics	No further contact made
	Biodiversity	No comments	No further contact made

Appendix E. ES Photomontage Comparison Viewpoints

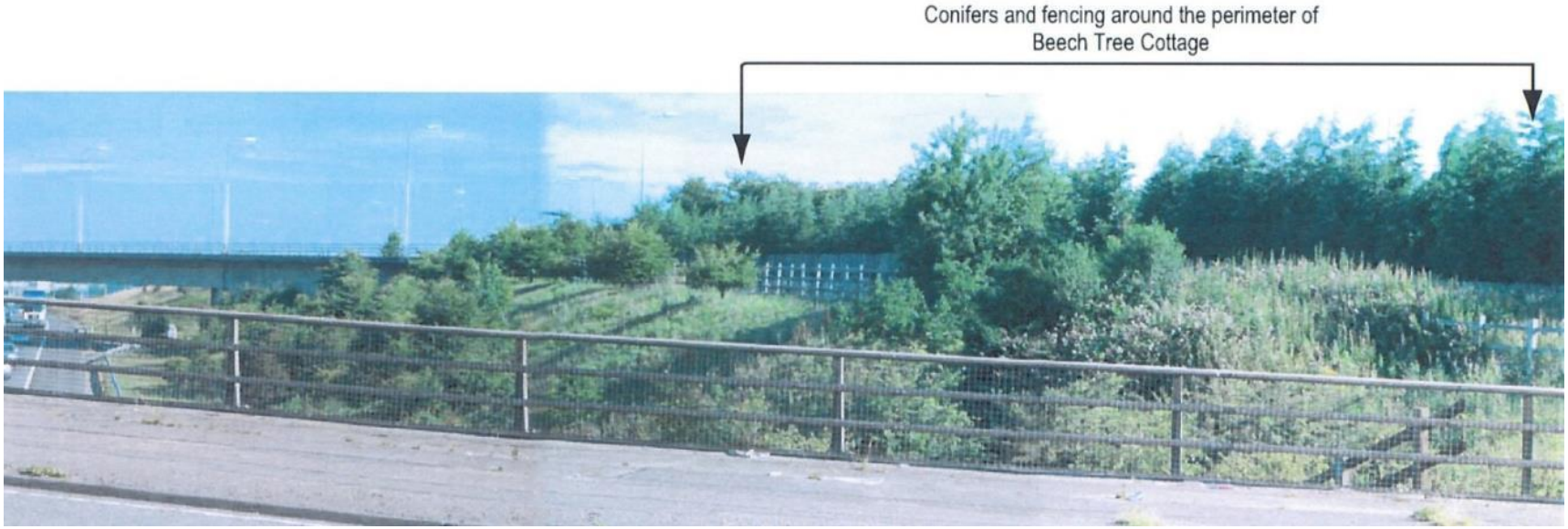
Waste Management, Appspond Lane:

DSR baseline: design year effect, slight adverse

1 year after: noise barrier reduces view of traffic, gantry clearly visible.

FYA: Vegetation has grown significantly since planting and is set to provide screening of the environmental barrier, but doubtful that it will effectively screen the gantry due to maintenance requirements along the local road.

Beechtree Cottage

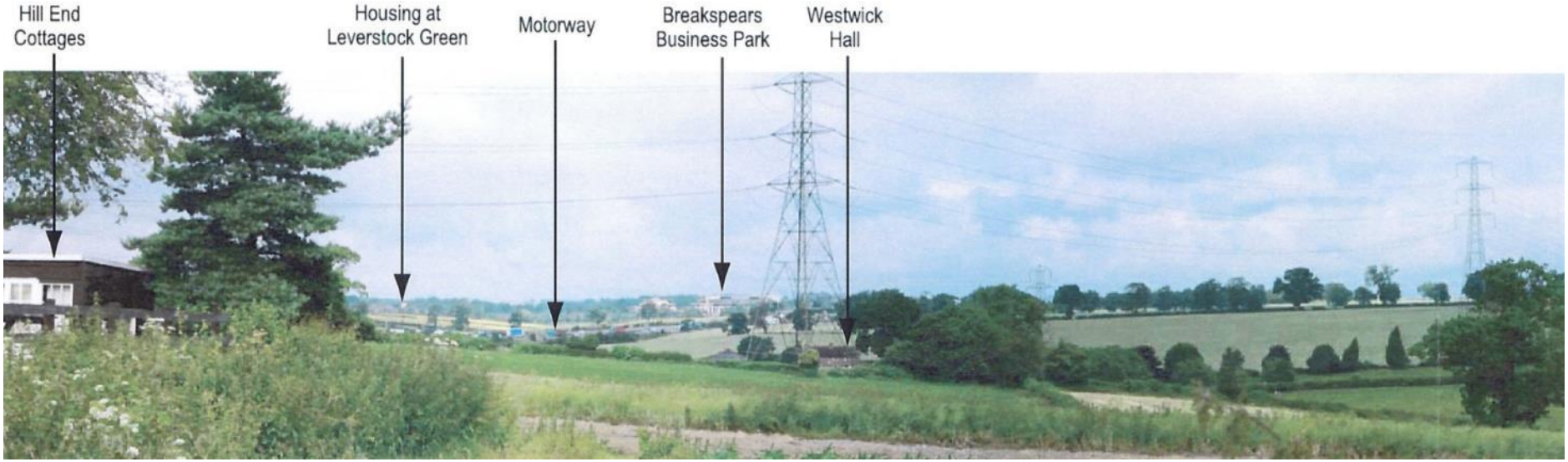


DSR baseline: design year effect, possibly moderate adverse

1 year after: carriageway closer to property, but screening vegetation retained.

FYA: Screening vegetation in the form of the conifer hedge is still in place and existing vegetation has grown substantially since the DSR photomontage was produced. It is expected that there has been an improvement on the moderate adverse scoring predicted during the baseline assessment

Hill End Cottage



DSR baseline: design year effect, slight adverse

1 year after: some screening vegetation lost, but view relatively unchanged.

FYA: As noted at OYA, the view remains largely unchanged from the DSR baseline although the slight increased visibility of the motorway is apparent and will remain so until scheme vegetation has matured.

Dwelling at the Breakspears

DSR baseline: design year effect, large adverse

1 year after: considerable screening vegetation lost, noise barrier/screen installed.

FYA: As noted in the DSR baseline, the effect of the inclusion the A414 from the A1(M) and the A414 from Hemel Hempstead onto the M1 at junction 8 has resulted in a large adverse effect on the dwelling at Breakspears. Screen mitigation in the form of an environmental barrier is in place adjacent to the dwelling.

The Aubreys Fort SAM

DSR baseline: design year effect, moderate adverse

1 year after: some screening vegetation lost. (Photograph taken from slightly different location).

FYA: Loss of vegetation along the embankment of the M1 is apparent, although planting has been undertaken and is expected to provide similar screening by the design year

PROW 20, Flamstead

DSR baseline: design year effect, slight adverse

1 year after: distant view, relatively unchanged.

FYA: The PROW through the allotments at Flamstead – the distant view remains relatively unchanged

Church Road, Slip End

DSR baseline: design year effect, slight adverse

1 year after: considerable screening vegetation lost, noise barrier in place.

FYA - close up view of progress of planting adjacent to the environmental barrier

FYA: Gantry and lighting remain visible at FYA. Planting is progressing well.

Playing Field at Slip End

DSR baseline: design year effect, slight adverse

1 year after: some screening vegetation lost.

FYA: Limited planting has been undertaken between the tennis courts and environmental barrier. However, planting has been undertaken between the M1 and the environmental barrier which will assist with screening of the gantry in time (see figure on previous page). It is noted that the gantry was not a part of the works for the M1 Junction 6a to 10, but was a part of the M1 junction 10-13 improvement completed in December 2012.

Dwellings east of Pepsal End Lane, Pepperstock

DSR baseline: design year effect, slight adverse

1 year after: considerable mature screening vegetation lost, noise barriers installed.

FYA: Environmental barrier remains unscreened at FYA due to the need to steepen the slope to 1:1 and strengthening it with soil nails[10]. Ivy, clematis and honeysuckle were planted on the strengthened slope and have succeeded in establishing a cover on the slope. Planting has been undertaken south of the location for integration with adjacent woodland plot. It is noted that some screen planting has been undertaken on the other side of the barrier which will assist with screening for properties east of Peppersal End Lane.

[10] Soil nailing provides a cost effective and efficient solution to slope stability and earth retention problems.

Dwellings in the vicinity of The Beeches

DSR baseline: the property occupies an elevated position close to the motorway. A deciduous hedge provides some screening in summer. No baseline photograph in DSR. Design year effect, slight adverse

1 year after: Noise barriers installed, proposed planting in place. (Photograph taken from end of The Beeches driveway, facing north east).

FYA: View is similar to the one taken at OYA, although this demonstrates progress of planting which is expected to screen the barrier by Design Year.

Norringtonend Farm

DSR baseline: in summer the motorway is screened from view by the cutting and associated woody vegetation. Includes Grade II listed building, but faces away from motorway.
No baseline photograph in DSR.
Design year effect: moderate adverse.

1 year after: Proposed planting in place, gantry clearly visible.

FYA: planting has grown substantially since the OYA review, although the gantry is still visible.

PROW 23, Flamstead

DSR baseline: clear views of the motorway where the footpath crosses open fields.
No baseline photograph in DSR.
Design year effect, substantial adverse.

1 year after: Clear views of motorway from footpath.

FYA: The motorway remains clearly in view at FYA. Progress of planting on embankment has progressed and is expected to provide some screening of the motorway at design year. An enlargement of the planting is also shown.

OYA vs FYA Comparison Views

OYA: Calcareous grassland near Watery Lane overbridge

FYA: Some progress of calcareous grassland is noted at FYA, although there are still substantial areas that have not achieved acceptable cover

OYA: Well vegetated balancing pond close to Hempstead Road

FYA: Well-maintained planting near Norringtonend Farm overbridge (OYA)

FYA: no updated drainage information was received at FYA. It is noted that the pond close to Hempstead road is mostly covered by reeds and bulrushes.

FYA: Planting at FYA has progressed well. (Similar location)

Appendix F. Glossary

Terms	Definition
AADT	**Annual Average Daily Traffic**. Average of 24 hour flows, seven days a week, for all days within a year.
Accessibility	Accessibility can be defined as 'ease of reaching'. The accessibility objective is concerned with increasing the ability with which people in different locations, and with differing availability of transport, can reach different types of facility.
ADT	**Average Daily Traffic**. Average daily flows across a given period.
AST	**Appraisal Summary Table**. This records the impacts of the scheme according to the Government's five key objects for transport, as defined in DfT guidance contained on its Transport Analysis Guidance web pages, WebTAG.
AAWT	**Annual Average Weekday Traffic**. As AADT but for five days (Monday to Friday) only.
AWT	**Average Weekday Traffic**. As ADT but for five days (Monday to Friday) only.
BAP	**Biodiversity Action Plan**
BCR	**Benefit Cost Ratio**. This is the ratio of benefits to costs when both are expressed in terms of present value i.e. PVB divided by PVC.
COBA	**Cost Benefit Analysis**. A computer program which compares the costs of providing road schemes with the benefits derived by road users (in terms of time, vehicle operating costs and collisions), and expresses the results in terms of a monetary valuation. The COBA model uses the fixed trip matrix unless it is being used in Collision-only mode.
DEFRA	**Department for Environment, Food and Rural Affairs**
DfT	**Department for Transport**
Discount Rate	The percentage rate applied to cash flows to enable comparisons to be made between payments made at different times. The rate quantifies the extent to which a sum of money is worth more to the Government today than the same amount in a year's time.
Discounting	Discounting is a technique used to compare costs and benefits that occur in different time periods and is the process of adjusting future cash flows to their present values to reflect the time value of money, e.g. £1 worth of benefits now is worth more than £1 in the future. A standard base year needs to be used which is 2002 for the appraisal used in this report.
DM	**Do Minimum**. In scheme modelling, this is the scenario which comprises the existing road network plus improvement schemes that have already been committed.
DMRB	**Design Manual for Roads and Bridges**
DS	**Do Something**. In scheme modelling, this is the scenario detailing the planned scheme plus improvement schemes that have already been committed.
DSR	**Detailed Scheme Review**
EA	**Environment Agency**
EDP	**Ecology Design Phase**
EMP	**Ecological Management Plan**
ES	**Environmental Statement**
EST	**Evaluation Summary Table**. In POPE studies, this is a summary of the evaluations of the TAG objectives using a similar format to the forecasts in the AST.
FYA	**Five Year After**
FWI	**Fatalities Weighted Index**
HA	**Highways Agency**. An Executive Agency of the DfT, responsible for operating, maintaining and improving the strategic road network in England. As of April 1st
HAPMS	**The Highways Agency Pavement Management System.** A central database consisting of collision data.
HGV	**Heavy Goods Vehicle**

Terms	Definition
KSI	**Killed or Seriously Injured**. KSI is the proportion of casualties who are killed or seriously injured and is used as a measure of collision severity.
MAC	**Managing Area Contractor** Organisation normally contracted in 5-year terms for undertaking the management of the road network within a HA area.
MVKM	**Million Vehicle Kilometres**
NATA	**New Approach to Appraisal**. The basis of the standard DfT appraisal approach when this scheme was appraised.
NMU	**Non-Motorised User**. A generic term covering pedestrians, cyclists and equestrians.
NRTF	**National Road Traffic Forecasts**. This document defines the latest forecasts produced by the Department of the Environment, Transport and the Regions of the growth in the volume of motor traffic. At the time this scheme was appraised, the most recent one was NRTF97, i.e. dating from 1997.
OYA	**One Year After**
PIC	**Personal Injury Collisions**
POPE	**Post Opening Project Evaluation**. The before and after monitoring of all major highway schemes in England.
Present Value	**Present Value**. The value today of an amount of money in the future. In cost benefit analysis, values in differing years are converted to a standard base year by the process of discounting giving a present value.
PROW	**Public Rights of Way**
PVB	**Present Value Benefits**. Value of a stream of benefits accruing over the appraisal period of a scheme expressed in the value of a present value.
PVC	**Present Value Costs**. As for PVB but for a stream of costs associated with a project
RSI	**Road Surface Influence**
RTNR	**Road Traffic Noise Review**
STATS19	A database of injury collision statistics recorded by police officers attending collisions.
TEE	**Transport Economic Efficiency**
TEMPRO	**Trip End Model Program**. This program provides access to the DfT's national Trip End Model projections of growth in travel demand, and the underlying car ownership and planning data projections.
TRADS	**Traffic Flow Data System**. Database holding information on traffic flows at sites on the strategic network.
UK	**United Kingdom**
WebTAG	DfT's website for guidance on the conduct of transport studies at http://www.webtag.org.uk/