

Post Opening Project Evaluation

M25 Junctions 27-30 Widening (Section 4)



One Year After Study

December 2014

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Executive Summary

Scheme Description

The M25 Junctions 27 to 30 (section 4) widening scheme is a Highway's Agency major project which was completed in May 2012. The scheme section runs between the M25 at Junction 27 near Epping to Junction 30 near Aveley. The scheme widened this section of the motorway from three to four lanes in both directions along the length of the route.

Prior to the scheme, this section of the M25 operated as a three lane motorway in each direction with full width hard shoulders. This section suffered from increasing congestion levels and unpredictability of journey times. The scheme is part of an overall strategy for the M25 comprising a series of widening schemes and smart (managed) motorway schemes.

In addition to widening, gantries were erected along the M25 between junctions 27 and 30. This part of the M25 has operated as a controlled motorway (mandatory variable speed limits to reduce stop-start congestion during busy periods) since March 2014.

Scheme Objectives

Objectives	Objective Achieved?
Deliver trunk road improvements	✓
Improve journey time reliability	✓
Improve safety	Too early to conclude
Reduce congestion	✓

Key Findings

- Comparing pre and post opening data shows that traffic flows on the M25 between junctions 27 and 29 have increased by 1% whereas the section between junctions 29 and 30 has seen a 1% reduction.
- Observed traffic flows are consistently lower than the forecast traffic flow changes. This is due to an over estimation of background traffic growth in the appraisal. The general pattern of traffic flow changes is consistent between forecast and observed.
- Average journey times along the scheme section have reduced compared to pre-scheme, though the reduction in journey times has not been as high as was forecast in the appraisal.
- Some improvement in journey time reliability has been observed since the scheme opened.
- There has been a 14% (13.8 collisions per year) reduction in the annual average number of collisions observed in the collision data, although this is not statistically significant.
- Economic benefits are lower than forecast due to the observed journey time benefits being lower than forecast.

Summary of Scheme Impacts

Traffic

- Since the scheme opened, the average weekday traffic volumes on the M25 have increased by 1% between junctions 27 and 29, and a reduction of 1% has been observed between junctions 29 and 30.
- Average weekday peak hour traffic flows were predicted to increase in the range of 4% to 7% along the scheme section. This can be compared to observed changes in peak hour traffic flows of between -1% and 4%.

- The scheme's impact on traffic patterns was reasonably consistent with the forecast. Having said that, traffic flows are generally slightly lower than forecast.
- Since scheme opening, average journey time reductions in the AM (morning) and interpeak periods have been in the range of 1% to 2%. The reduction in journey times is greater in the PM (evening) peak with reductions of between 4% and 13%.
- The scheme appraisal forecasted an average journey time saving of one minute whereas the observed savings are between 13 and 33 seconds.
- Following the scheme's introduction the standard deviation of journey times along the scheme has reduced - particularly in the busiest hours. This provides an indication that journey time reliability has improved as a result of the scheme.

Safety

- The annual average number of collisions along the scheme's section and the wider study area has seen a 14% and 5% reduction respectively (after accounting for the background reduction in collisions which has occurred in the UK over recent years).
- The appraisal for the scheme forecast an increase in collisions with a net expected increase in the opening year of 27.2 collisions. The observed collision data has shown an annual average net saving of 13.8 collisions since the scheme opened.
- The severity of collisions has increased slightly since the scheme opening for the M25 scheme section, but remains consistent across the wider study area. This is an early indication only at this One Year After stage since this is based on a small sample size and a clearer picture will be available at the Five Years After stage.
- The small amount of data available post opening shows a positive benefit for safety in the study area. However, statistical analysis of the change in collision rates shows that at present the improvements in safety are not statistically significant- indicating that the forecast may be inaccurate, although a longer period of data is required before drawing firm conclusions on accuracy.

Environment

- The noise and local air quality impacts of the scheme are generally as expected, whilst greenhouse gas increases are better than expected due to lower than forecast traffic flows.
- Landscape impacts are worse than expected due to the majority of planting not being as established as would have reasonably been expected at this stage.
- All aspects of the heritage mitigation measures have been addressed.
- Biodiversity impacts are as expected, although unless the maintenance regime undergoes required adjustments in the near future, it is unlikely that habitats will develop in the long term as intended.
- Water quality and drainage impacts are as expected.

Accessibility and Integration

- As expected, the scheme has not had an impact on the provision of public transport interchange.
- This scheme integrates well with regional and national transport policies and most local policies.

Summary of Scheme Economic Performance

All monetary figures in 2002 Prices and values	Forecast	Outturn Re-forecast
Journey Time Benefits	£638.9m	£204.5m
Vehicle Operating Costs	£-19.1m	£-2.4m
TEE impacts during construction	£6.7m	
TEE impacts during maintenance	£56.2m	
Safety Benefits	£-80.1m	-
Journey Time Reliability	£88.9m	£77.6m
Noise	£-0.1m	
Carbon	£-4.8m	£-0.7m
Total Present Value Benefits (PVB)	£686.7m	£341.8m
Investment costs (Construction)	£377.7m	£272.4m
Future Maintenance costs	£-23.9m	
Indirect Tax Revenue	£-40.5m	£-5.1m
Total Present Value Costs (PVC)	£313.3m	£243.3m
Benefit Cost Ratio (BCR) Indirect Tax as Cost	2.2	1.4
Benefit Cost Ratio (BCR) Indirect Tax as Benefit	2.1	1.4

- The outturn reforecast journey time benefits are 32% of that forecast owing to lower than expected traffic flows and journey time savings.
- The scheme was not expected to reduce the number of collisions over the 60 year appraisal period. Whilst the observed collision data shows a slight reduction in collisions, statistical tests show that the change observed at this stage is not significant. As such the monetary safety benefits are reforecast to be £0m.
- The outturn investment cost is 28% lower than forecast.
- The outturn Benefit to Cost Ratio (BCR) is lower than forecast, despite the cost being lower than forecast, owing to the much lower than expected benefits.
- The scheme is likely to facilitate wider economic benefits through increased capacity, improved journey times and reliability, although it is too early to quantify at this stage.

1. Introduction

Background

- 1.1 This report represents the One Year After (OYA) post opening study of the **M25 Junctions 27 to 30 Widening** scheme (hereafter known as ‘the scheme’) which opened in May 2012. The evaluation has been prepared as part of the Highways Agency’s (HA’s) Post Opening Project Evaluation (POPE) programme. POPE is undertaken one year and five years after the opening of all major schemes.
- 1.2 The purpose of the POPE OYA 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 five transport objectives; economy, safety, environment, accessibility and integration.
- 1.3 More specifically, the report sets out the following:
 - A comparison of the ‘before’ and ‘after’ traffic volumes on the M25 J27-30 and other roads in the vicinity of the scheme.
 - A comparison of ‘before’ and ‘after’ journey times on the M25 J27-30.
 - An outline of the changes in collision rates on the M25 J27-30 following the opening of the scheme.
 - A monetised comparison of the predicted and actual impacts of the scheme.
 - Evaluation of the impact of the scheme upon the environment, more specifically its impact upon noise, air quality, landscape, biodiversity, heritage and water.
 - An assessment of the scheme’s impact on the accessibility and integration objectives.

Scheme Context

- 1.4 The M25 is a strategic orbital road in South East England surrounding London and plays a pivotal role in the Highways Agency’s network. It is a vital route for freight, commuter and tourist traffic. The M25 is of local, regional, national and international importance, forming part of the E30 route on the European E-road network. By linking with the M2 and M20, it also provides a gateway to and from the continent via the Eurotunnel and Dover. Junctions 27-30 is a 16.8 mile stretch of the M25 in Essex which for part of its length forms a boundary with the Greater London Authority. Geographical context of the scheme is shown in **Figure 1-1**.
- 1.5 As one of Europe’s busiest motorways, vehicle demand on the M25 is high, placing pressure on the network and leading to congestion and unpredictable journey times especially during peak hours.
- 1.6 In April 2004, the preferred routes for the widening works were announced for the M25. These schemes were informed by the London Orbital Multi Modal Study (ORBIT), published in 2002. The works were divided into five sections for construction purposes:
 - Section 1 – from Junctions 16 (M40) to 23 (A1(M)).
 - Section 2 – from Junctions 5 (M26) to 7 (M23).
 - Section 3 – from Junctions 1b (A282) to 3 (M20).
 - Section 4 – from Junctions 27 (M11) to 30 (A13).
 - Section 5 – from Junctions 23 (A1(M)) to 27 (M11).
- 1.7 In addition to the scheme evaluated here (Section 4), the widening works for Section 1 and Section 3 were completed as planned (in 2012 and 2008 respectively). In more recent years, however, proposals to widen the physical extents of motorways have been curtailed, with Smart (managed) Motorway schemes becoming the preferred option for increasing route capacity. Smart Motorway programmes allow for hard shoulder running and traffic management systems to effectively manage vehicle flow. The widening schemes for Section 2 and Section 5 were therefore suspended and have been replaced by Smart Motorway schemes.

Figure 1-1 – Geographical Context of the M25 Junctions 27-30 Widening Scheme



1.8 The M25 crosses a number of roads as it passes between Junctions 27 and 30 as follows:

- Junctions 27 to 28: M11 and A113.
- Junctions 28 to 29: A12 and A1023.
- Junctions 29 to 30: A127, B187, B1421 and A13.

1.9 The London Orbital Multi Model Study (ORBIT), published in 2002, was tasked with addressing the problems of the M25 motorway and the orbital transport corridor around London. The study concluded that if current trends were to continue, traffic levels would increase and all users, including those essential to the economy, would suffer increasing congestion and unreliable journey times. The ORBIT report recommended that most of the dual three lane sections of the M25 should generally be widened to dual four lanes and the work on junctions 27 to 30 was part of this project. The level of pre-scheme traffic flows led to unreliable journey times and lengthy delays, causing driver stress.

Scheme Objectives

1.10 The primary objectives, as established within the Environmental Statement(November 2007) of the scheme, were:

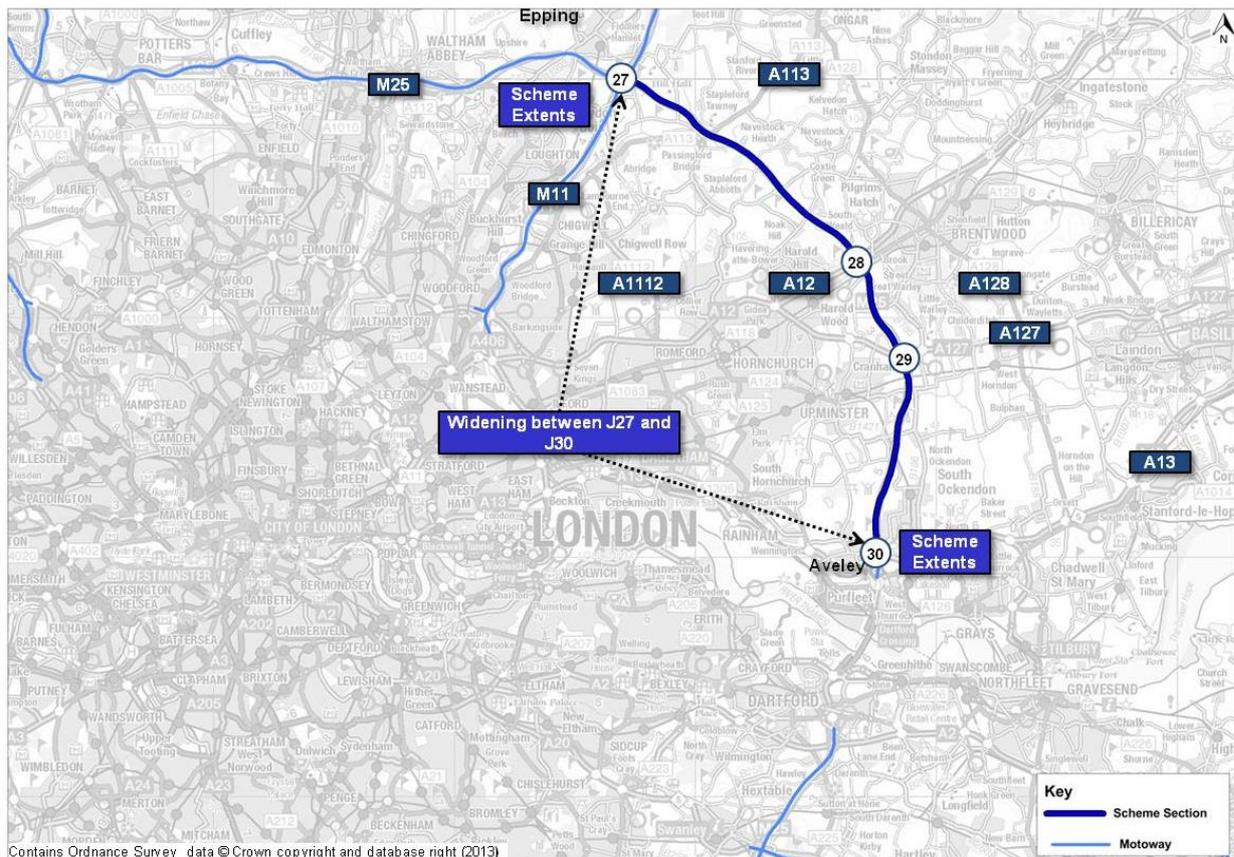
- To deliver the trunk road improvements accepted by the Secretary of State following the recommendations of the Orbit Multi-Modal Study;
- To improve journey time reliability;
- To improve safety on the M25; and
- To ensure no worsening of the Appraisal Summary Table (AST) sub-criteria assessment results and improve on them where possible.

Scheme Description

1.11 The scheme section runs between M25 Junction 27 near Epping to Junction 30 near Aveley. The M25 J27-30 prior to scheme completion operated as a motorway with three lanes in each direction, with full width hard shoulders.

- 1.12 The scheme involved widening the carriageway from three to four lanes in both directions along the length of the route. The scheme also comprised:
- Discontinuous hard shoulder at all bridges;
 - Replaced central reserve;
 - Provided new verge-side lighting where appropriate;
 - Provided new gantries and variable message signs;
 - Improved drainage, including new balancing ponds; and
 - Provided environmental mitigation measures.
- 1.13 Construction began in July 2009 and the scheme opened in May 2012. Key features of the scheme are shown in **Figure 1-2**.

Figure 1-2 – Key Features of the M25 Junctions 27-30 Widening Scheme



History of the Scheme

- 1.14 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 M25 Junctions 27-30 Widening Scheme

Date	Event
April 2004	Preferred Route Announcement Date
September 2004	Public Consultation
March 2007	Invitation to Tender
November 2007	Draft Order/ Environmental Statement
June 2008	Secretary of State Declaration
May 2009	Date of Contract Award
July 2009	Construction starts
May 2012	Scheme open to traffic

Local Highway Network Changes

- 1.15 Local road network changes in the locality of the scheme area can sometimes have an impact on traffic flows, journey times or collisions. A number of schemes are either in construction or have been completed recently on M25. Those in the vicinity of, and of most relevance to, the widening between junctions 27 and 30 are listed in **Table 1-2** and shown in **Figure 1-1**. In addition to this, other schemes on the feeder roads to this scheme are also listed.
- 1.16 The M25 J27-J30 is amongst a number of schemes in the area, forming an overall long-term strategy to manage the existing motorway network more effectively.

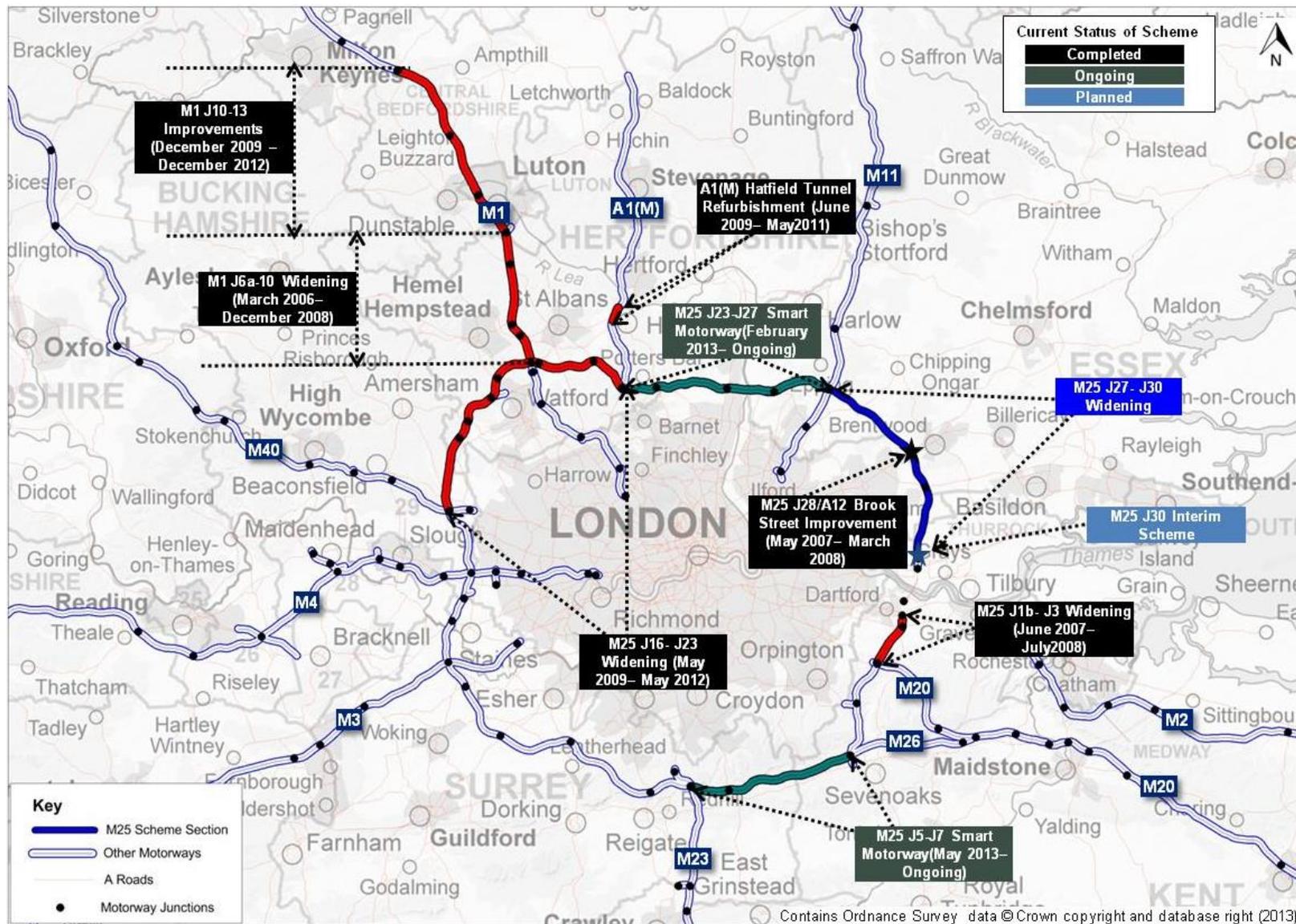
Table 1-2– Other schemes in the vicinity of the M25 Junction 27-30 Widening Scheme

Scheme Name	Current Status	Start Date	Opening Date/ Latest Forecast Opening Date
M25 J16-23 Widening (Section 1)	Completed	May 2009	May 2012
M25 J28/A12 Brook Street Improvement	Completed	May 2007	March 2008
A1(M) Hatfield Tunnel Refurbishment	Completed	June 2009	May 2011
M25 J1b-3 Widening	Completed	June 2007	July 2008
M1 J10-13 Improvements	Completed	December 2009	December 2012
M1 J6a-10 Widening	Completed	March 2006	December 2008
M25 J30 – Interim scheme	Completed	April 2013	October 2013
M25 J23-25 (Section 5a) – Smart Motorway	Completed	February 2013	April 2014
M25 J25-27 (Section 5b) – Smart Motorway	Under Construction	July 2013	End of 2014
M25 J5-7 (Section 2)- Smart Motorway	Completed	May 2013	April 2014

Changes since Scheme Appraisal

- 1.17 The scheme appraisal (in 2007) made assumptions about which schemes would be implemented over the modelled appraisal period. The network used in the appraisal comprised the M25 and any committed schemes or schemes on the verge of approval that were likely to have an impact on the M25 sections to be widened. This excluded widening of Section 1 and Section 5 but included the proposed widening schemes elsewhere on the M25.
- 1.18 Section 5 (M25 J23-27) was completed in April 2014. The SM-ALR for J23-25 became operational in April 2014 and J25-27 is due to open in late 2014. The impact of these works has been considered when drawing conclusions about the impact of the scheme on strategic traffic. The timeline of the Section 5 construction has been considered in the evaluation presented here in order to develop conclusions that consider the impact of Section 4 alone.
- 1.19 Widening from three to four lanes in both directions for Section 1 (M25 J16-23) started in May 2009 and the scheme opened to traffic in May 2012. The controlled motorway element became operational in March 2014.
- 1.20 Gantries were erected along the M25 between junctions 27 and 30 as part of the scheme and the scheme cost included this element. The scheme section has the capacity to operate as a controlled motorway, but any use of the gantries has only been advisory for the first year of opening. The speeds/messages were manually inputted as the system did not currently respond automatically to changes in flow. The HA project manager for the scheme confirmed that the controlled motorway was made operational in March 2014.

Figure 1-1 –Other schemes in the vicinity of the M25 Junction 27-30 Widening Scheme



Post Opening Project Evaluation (POPE)

- 1.21 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.
- 1.22 When submitting a proposal for a major transport scheme, the Department for Transport (DfT) specifies that an Appraisal Summary Table (AST) is produced which records the degree to which the DfT's objectives for transport have been achieved. The contents of the AST allow judgements to be made about the overall value for money of the scheme. The AST for this scheme is presented in **Table 7-1** on page 99.
- 1.23 POPE studies are carried out for all Major Schemes to evaluate the strengths and weaknesses in the techniques used for appraising schemes. This is vital 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** on page 100.
- 1.24 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 to:
- 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 reasons for differences between forecast and outturn impacts; and
 - Identify key issues relating to appraisal methods that will assist the HA in ongoing improvement of appraisal approaches and tools used for major schemes.

Report Structure

- 1.25 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.
- 1.26 There are also a number of appendices listed below as follows:
- **Appendix A** – Tables and Figures in this Report.
 - **Appendix B** – M25 Journey Time Sections.
 - **Appendix C** – Information requested for Environmental section.
 - **Appendix D** – Photographic Record of Scheme.
 - **Appendix E** – Glossary.

2. Traffic Impact Evaluation

Introduction

- 2.1 This section examines traffic data from a number of sources to provide a before and after opening comparison of traffic flows and journey times on the M25 between junctions 27 and 30. The purpose of this evaluation is to understand whether changes in traffic flows and journey times may be attributable to the scheme.
- 2.2 This section comprises:
- A summary of the sources used to compile data for this evaluation.
 - A description of national, regional and local background traffic trends to provide context against which observed changes in actual traffic can be considered.
 - A detailed comparison of before and one year after traffic flows at key locations in the study area likely to be affected by the scheme to determine the scheme's impact on traffic.
 - An evaluation of key differences between forecast and outturn impacts of the scheme in terms of traffic flows and journey times to identify whether changes were as expected or otherwise. Consideration is then given for any differences to identify whether alternative approaches in the scheme appraisal would have lead to a more accurate forecast.

Data Sources

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

Traffic Count Data

- 2.4 For the purposes of this evaluation study, the main sources of count data include:
- Permanent count data obtained from the TRADs¹ database for count locations on the HA network.
 - Pre-scheme 24-hr classified automatic traffic count (ATC) surveys conducted in July 2009, commissioned specifically for the purpose of this study.
 - Post-opening 24-hr classified ATC data conducted in November 2013, commissioned specifically for the purpose of this study.

Journey Time Data

- 2.5 Journey times along the M25 between junctions 27 and 30 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 Highways Agency's core network.

Background Changes in Traffic

- 2.6 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 National Transport Model (NTM) Local Growth Factors.
- 2.7 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

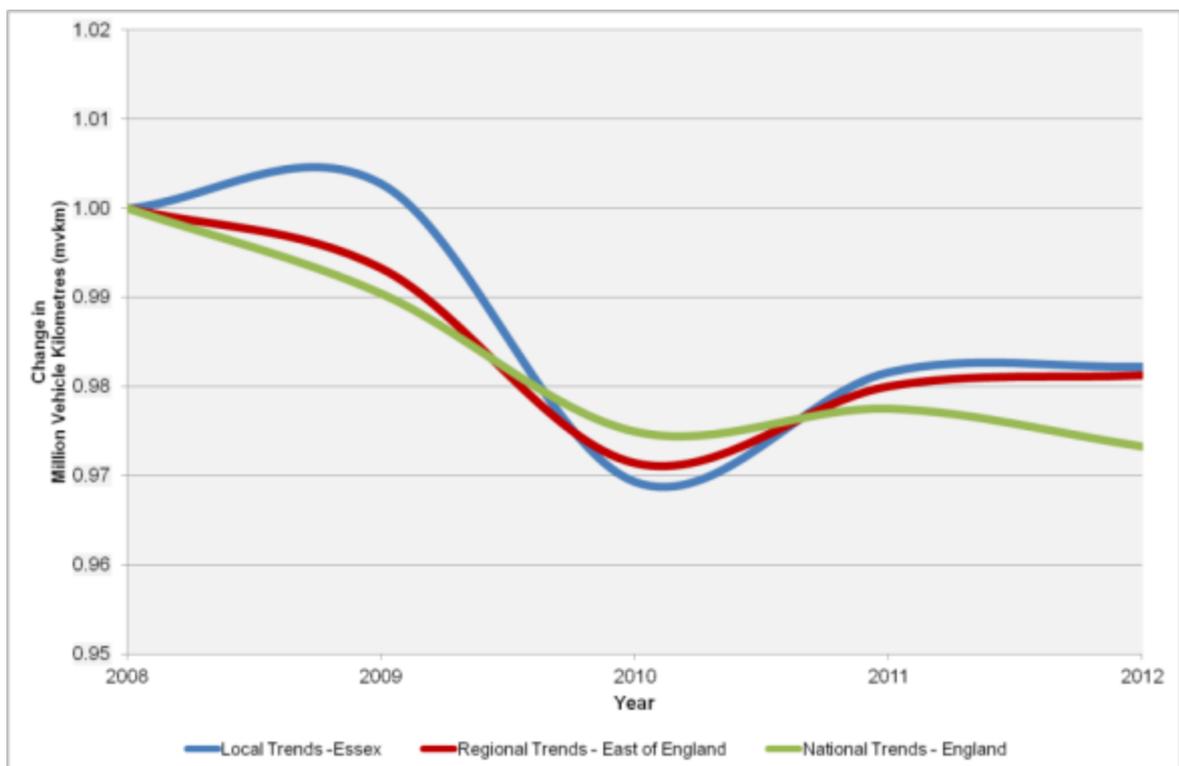
¹ TRADs is the Highways Agency website containing traffic flow data from automatic traffic counts on the HA's strategic network.

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

National Trends, Regional and Local Trends

2.8 The Department for Transport (DfT) produces annual statistics for all observed traffic by local authority². At present, this data is available up to 2012. The proportional change in million vehicle kilometres (mvkm) between 2008 (before start of construction) and 2012 (the latest available) is shown in for Essex, the East of England and England in **Figure 2-1**.

Figure 2-1 – National, Regional and Local Traffic Trends



2.9 The following points can be made from **Figure 2-1** :

- At a national and regional level, traffic trends are broadly similar, with a slight decline in vehicle kilometres from 2008 to 2010 and then a marginal increase in 2011. Traffic levels saw minimal change between 2011 and 2012.
- Traffic trends in Essex have shown a similar trend to those seen nationally and regionally, with the vehicle kilometres travelled falling significantly from 2009 to 2010 and then increasing by 1.3% between 2010 and 2012.

Conclusions on Background Growth

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

- National and regional trends show a reduction of approximately 2% in traffic levels between 2008 and 2012.
- Local trends across Essex show a similar pattern in background changes compared to national and regional level and there is a reduction of 1.8% in the vehicle kilometres travelled between 2008 and 2012.

² Motor vehicle traffic (vehicle kilometres) by region in Great Britain, annual from 1993 to 2012. Table TRA8904 (Department for Transport).

- 2.11 Given the marginal change in traffic levels across the region it has been decided not to factor the traffic counts used in this evaluation. Rather, any changes in observed traffic flows will be considered against this background trend in regional and national traffic.

Traffic Volume Analysis

- 2.12 The changes between pre-scheme and post-opening traffic flows on all key roads in the vicinity of the M25 scheme section are now considered in the context of the wider traffic trends, in order to assess the scheme's impact on traffic patterns.
- 2.13 This section of the report uses data from a variety of sources to inform the before and after analysis of changes in traffic volumes and journey times for the scheme. To complete this evaluation, data from before construction (November 2008) and after scheme opening (November 2012) is compared.
- 2.14 Construction for Section 5 (junctions 23 to 27, Smart Motorway), adjacent to the scheme considered here, started in February 2013 and is ongoing at the time of this evaluation. As such, the post-opening impacts for this evaluation have been taken from November 2012, a neutral month prior to the start of construction for Section 5. This has been done to ensure that the evaluation is not affected by the ongoing construction on the adjacent section.

Traffic Count Locations

- 2.15 The locations of the traffic count data sources used in this evaluation is shown in **Figure 2-2** for scheme section and wider area alongside and the details of each traffic count site is shown in **Table 2-1**.

Table 2-1 – Traffic Count Locations and Data Source

Section	Source	Map Reference	Site Name and Description
M25-Scheme Section	TRADS	1	M25 between J27 and J28
		2	M25 between J28 and J29
		3	M25 between J29 and J30
Other Motorways in the scheme vicinity	TRADS	4	M25 between J26 and J27
		5	M11 between J5 and J6
		6	M11 between J6 and J7
Wider Area-Local Roads	Surveys Commissioned for this study	A	Mount Road, Theydon Mount
		B	Mount Road / Epping Lane
		C	A113 Arnolds Farm
		D	A113 Mitchells Farm
		E	A128 / Coxtie Green Road
		F	A12 / Maylands Way
		G	M25 / Warley Road
		H	B186 Tooks Farm
		I	A128 Ingrave
		J	A127 / Warley Street
		K	A127 / Folkes Lane
		L	Aveley Road
		M	B1421 / Stubbers Lane
		N	B186 North Ockenden
		O	Dunnings Lane
		P	A128 Brentwood Rd
		Q	B1335 (E of M25) near South Ockendon
		R	B1335 (W of M25) Aveley
	U	A1036 between A126 and Jn 31	
TRADS	V	A12 Brentwood	

Observed Flows

- 2.16 A comparison of pre-scheme and post-opening 24-hour Average Weekday Traffic (AWT) flows along the scheme is presented in **Figure 2-3**. The change in traffic flows across the wider area is shown in **Figure 2-4**. The percentage change in flow at OYA compared to the before stage is indicated by colour code.

Figure 2-3 – Comparison of Pre-scheme and Post-opening AWT along the scheme section

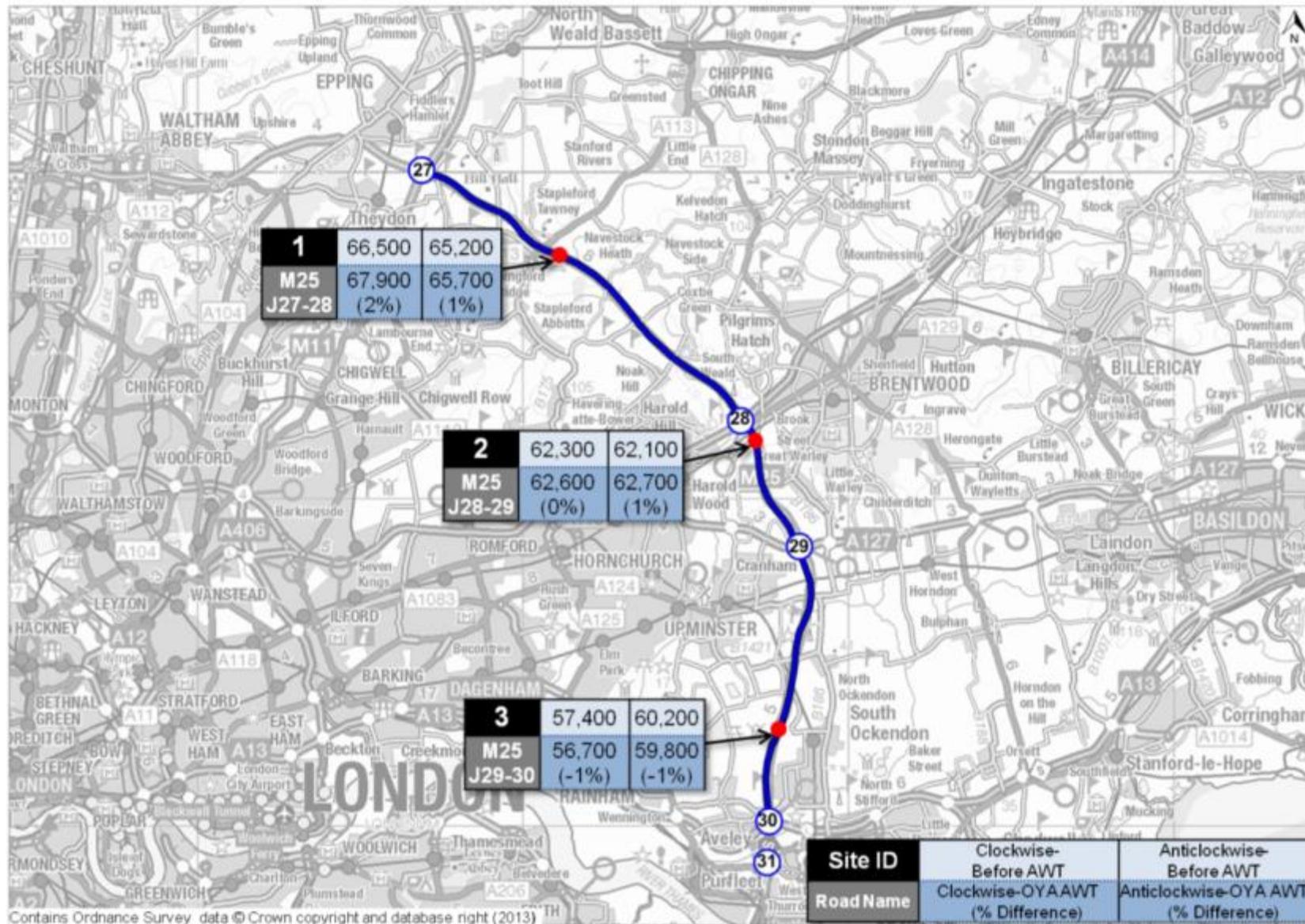
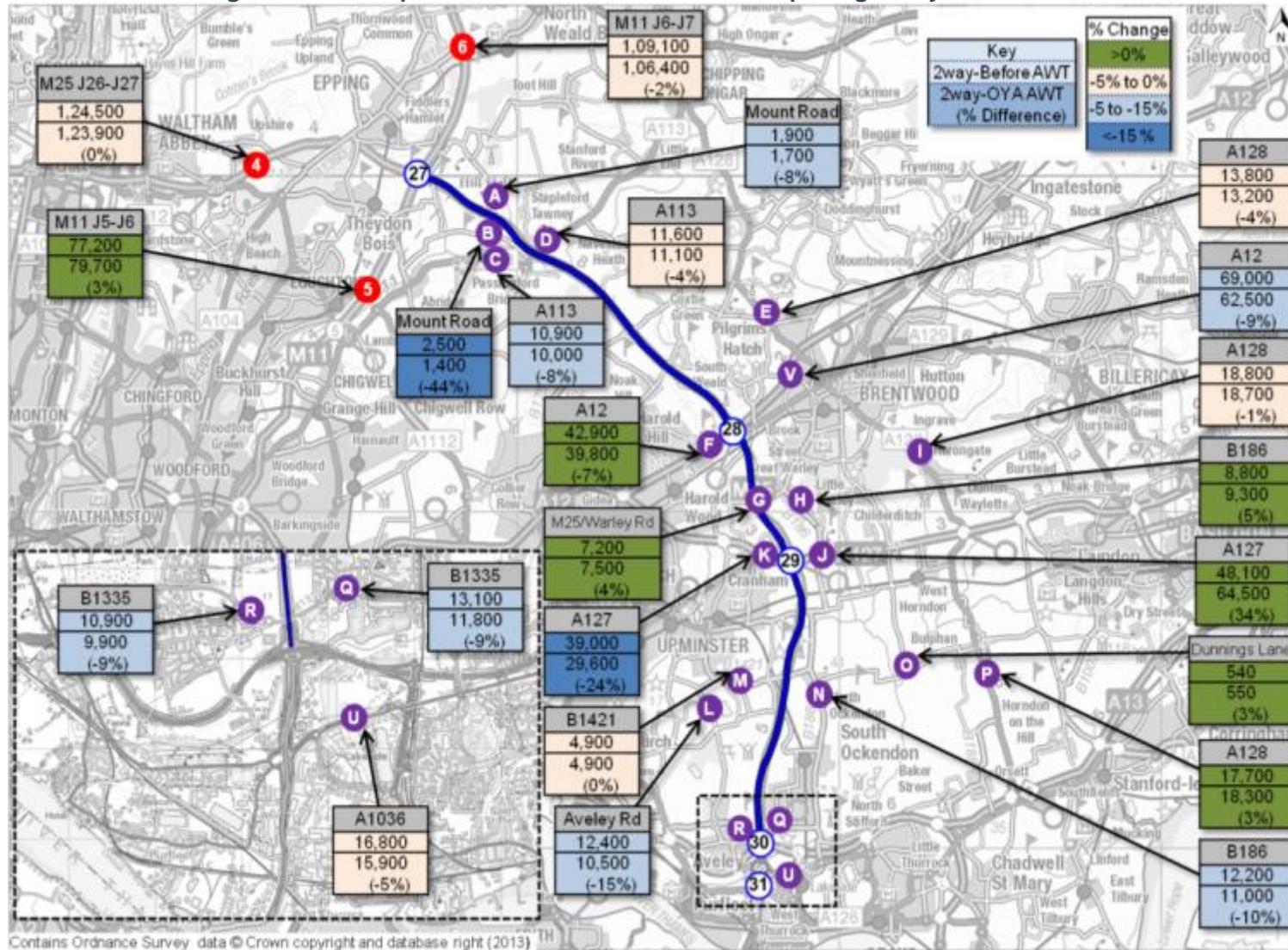


Figure 2-4 – Comparison of Pre-scheme and Post-opening 2-way AWT in the wider area



- 2.17 The following observations regarding changes in Average Weekday Traffic (AWT) along the scheme section, other motorways and local roads in the study area can be made from **Figure 2-3** and **Figure 2-4**:

Scheme Section

- At One Year After opening, traffic volumes have increased at the start of the section (M25 J27-28).
- In the middle of the scheme section, there is a marginal increase in traffic at OYA in both directions. Traffic has grown by 1% compared to pre-scheme levels.
- At the end of the scheme section, i.e. between J29 to J30, there has been a slight decrease in traffic compared to pre-scheme levels.

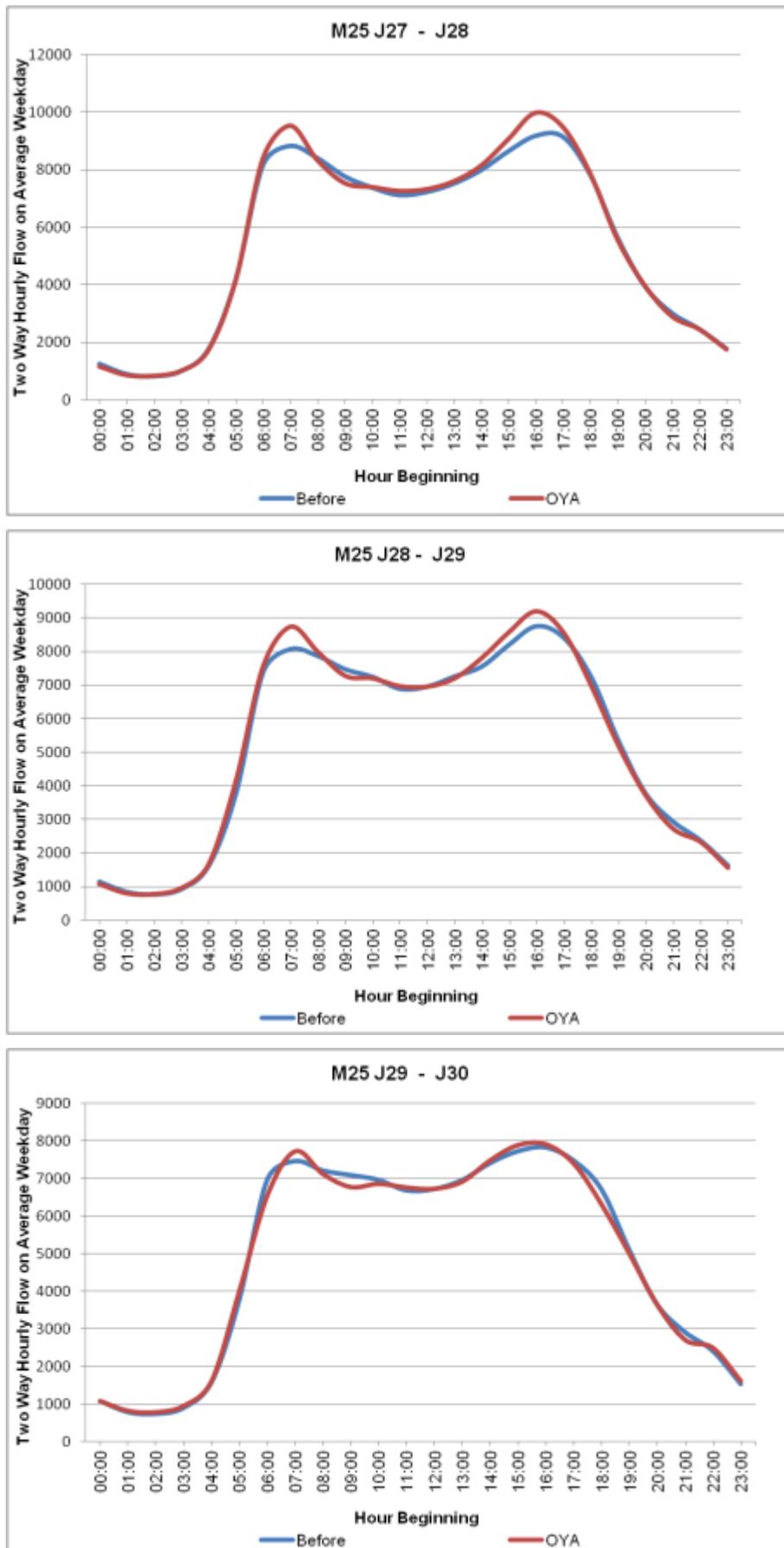
Wider Area

- The M25 to the west of the scheme, between J26 and J27, has seen a marginal decrease in traffic levels.
 - The M11 between J5 and J6 (South of M25 J27) has seen an increase in traffic compared to pre-scheme levels whereas the M11 between J6 and J7 (North of M25 J27) has seen a decrease in traffic flow.
 - Other local roads on either side of M25 between J27 and J28 have recorded lower traffic levels post scheme opening compared to before scheme construction.
 - Local roads on either side of M25 between J28 and J29 have recorded an increase in traffic levels between 3-5%. The only exception being A128 near Ingrave where there was a reduction of 1%.
 - To the west of the M25, between J29 and J30, there has been a decrease in traffic on local roads. To the east of the M25 at J29, there has been an increase in traffic on local roads. Traffic on local roads near the M25 at J30 has seen a decline in traffic since the scheme opening.
- 2.18 In general, there was marginal growth in traffic at the western end of the scheme and a decrease in traffic flows towards the eastern end of the scheme. This should also be considered against the background traffic trends discussed previously, which indicated that at a national and regional level there has been a reduction of 2% in vehicle kilometres travelled between 2008 and 2011 and for Essex this reduction is 1.8%. The traffic reduction in East of England and Essex were higher than reduction seen on M25 scheme section, so the possible reason could be that an increase in traffic caused by the scheme section has been masked by a larger decrease in background traffic volumes. This can be explained by the fact that the reduction at a regional level is 2% whereas the reduction towards the end of the scheme section is 0-1%.
- 2.19 There is no clear pattern or trend at local roads between locations or road type. For example, on the A128 (parallel route to the east of the M25) at the beginning of scheme section has recorded lower traffic levels compared to pre scheme levels whereas towards the end of the scheme section, there is a 3% increase at OYA. Also, the B186 has shown different trends in traffic volumes at different sections of the scheme.
- 2.20 The lack of any strong identifiable trends suggests that other local and national factors may be affecting these traffic volumes more than the M25 scheme section widening itself.

Hourly Distribution of Flows on the M25

- 2.21 The hourly distribution of flows across the day can be useful to determine the nature of peak flows on a particular link, and whether for instance peak spreading or contracting is occurring.
- 2.22 The following figures present the hourly profile of traffic throughout an average weekday, before and one year after opening for the three section of the scheme.

Figure 2-5 – Hourly Flow Profile on various sections of M25 between J27 and J30



2.23 The following conclusions can be drawn:

- Peak spreading was prominent in the before period, especially for the section between J29 and J30 where there was hardly any difference between peak period and inter peak period. The traffic growth between pre-scheme and post opening is negligible between J29 and J30 with slight decrease during some time periods and this is reflected in the daily traffic as discussed in previous **Section 2.17 (pg.22)**.
- At the OYA stage, there is a more distinct AM and PM peak for each section, indicating the scheme's increased capacity during periods of high demand. Any increase in traffic flow along the scheme has been concentrated on the peak periods.
- There is little change in traffic during inter peak and off peak time periods between pre-scheme and post opening for all three scheme sections.
- At OYA, the M25 between J27 and J28 has attracted more traffic in the AM and PM peak whereas in before scenario this section would have been congested making this route less favourable for some traffic. From the daily traffic trend discussed in **section 2.17 (pg.22)** and the hourly profile, it can be concluded that the scheme has attracted more traffic in the morning and evening peak periods when the pre scheme congestion levels were high enough for some traffic to choose alternate routes. Since congestion is less of an issue in the inter peak and off peak periods, traffic levels have remained the same. This increase in traffic along the scheme can be considered against a slight reduction in background traffic, demonstrating the increased attractiveness of the M25 corridor as a result of the additional capacity provided by the scheme.

Forecast vs. Outturn Traffic Flows

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

Traffic Modelling Approach and Forecast Assumptions

2.25 The M25 North of Thames Assignment Model (NoTAM) was developed from the Highways Agency's NAOMI strategic traffic model v5.5 and used in the appraisal for Sections 1, 4 and 5 of the M25. SATURN (version 10.3) modelling suite was been used to develop the M25 NoTAM model.

2.26 The modelled base year was 2004 and the networks and demand matrices were developed for Section 1 using the following forecast years:

- 2012 – Proposed Opening Year.
- 2015 – Intermediate Year/Proposed Opening Year for Section 5.
- 2027 – Design Year (15 years after opening).

2.27 This evaluation will focus on the 2012 forecasts to provide a direct comparison against the observed traffic flows in 2012.

2.28 Modelled time periods were as follows:

- Morning peak hour (AM) from 08:00 to 09:00.
- Inter peak hour (IP), average hour between 10:00 and 16:00.
- Evening peak hour (PM) from 17:00 to 18:00.

Network Coverage

2.29 The base network consisted of a simulation area, buffer area and a skeletal network covering a large part of Great Britain. The area covered by the SATURN simulation network included the entire area within the M25 and an area roughly bounded by Luton, Reading, Guildford, Crawley,

Maidstone, Chelmsford and Stansted. Inside the simulation area, all motorways, A and B roads, as well as important unclassified roads, were included in the modelled network. Junctions were represented at several levels, with important junctions being fully simulated.

Forecast Traffic Growth Rates

- 2.30 Planning forecasts were taken from TEMPRO version 5.3 to provide traffic growth for cars. Goods vehicle growth factors were derived from NRTF (NRTF 1997). The forecast flows for appraisal purposes were forecast assuming the most likely traffic growth (central) to future years. There were no low or high traffic growth forecasts.

Forecasts vs. Observed Traffic Flows

- 2.31 Forecast traffic flows and speeds are provided in the 'North of Thames Assignment Model-Section 4 Forecasting Report (October 2007)'. The Traffic Forecasting Report provides the forecast traffic flows and speeds on the M25 mainline for Section 4 in each modelled period, i.e. Morning Peak Hour, Inter Peak Hour and Evening Peak Hour.
- 2.32 **Table 2-2**, **Table 2-6** and **Table 2-4** presents the modelled Do-Minimum flows vs. Do-Something flows for the 2012 opening year. These are then compared against the observed flows (pre-scheme 2008 and post-opening 2012) in the study area for each time period respectively. Observed flows are unadjusted due to the fact that background traffic growth shows minimal change in overall traffic volumes between 2008 and 2012.
- 2.33 The forecasting report predicted traffic growth of 9-13% in the Do-Minimum and 15-18% in the Do-Something between the years 2004 and 2012. A level of growth in the region of 5-6% might therefore have been expected between 2008 and 2012 without the scheme in place, with an additional 5% of growth with the scheme as a result of traffic reassignment.

Table 2-2 – Forecast vs. Observed Traffic Flows-AM peak Hour, Two Way AWT

Section	Forecast			Observed		
	DM	DS	% Diff	2008	2012	% Diff
J27 – J28	9,600	10,000	4%	8,400	8,300	-1%
J28 – J29	9,900	10,300	4%	7,900	8,000	1%
J29 – J30	9,400	9,800	4%	7,200	7,100	-1%

Table 2-3 – Forecast vs. Observed Traffic Flows – Interpeak, Two Way AWT

Section	Forecast			Observed		
	DM	DS	% Diff	2008	2012	% Diff
J27 – J28	9,800	10,200	4%	7,600	7,700	1%
J28 – J29	9,800	10,200	4%	7,400	7,400	0%
J29 – J30	10,100	10,600	5%	7,100	7,000	0%

Table 2-4 – Forecast vs. Observed Traffic Flows- PM peak Hour, Two Way AWT

Section	Forecast			Observed		
	DM	DS	% Diff	2008	2012	% Diff
J27 – J28	10,500	11,200	6%	9,100	9,500	4%
J28 – J29	10,700	11,500	7%	8,400	8,600	2%
J29 – J30	10,400	11,100	7%	7,500	7,400	-1%

- 2.34 It can be seen from and **Table 2-2**, **Table 2-3** and **Table 2-4** that:

- The forecasts assumed a consistent growth in background traffic between the base year and opening year, whereas the observed trend shows little change in traffic between 2008 and 2012 across the region. This suggests that the forecasts overestimated the traffic using the corridor in the opening year.

- The scheme appraisal forecast that in the AM peak, traffic would increase by 4% for all three sections compared to Do-Minimum. This can be compared to an observed increase of between +/-1% for the different sections in the morning peak hour.
- In the inter peak, traffic was expected to increase by 4-5% with a greater increase forecast at the end of the section. The observed trend is 0-1% growth with the largest increase seen at the start of the scheme rather than the end.
- The greatest increase in forecast traffic flows was for the evening peak this is consistent with observed traffic flow changes at OYA. The scale of the increase was lower in the observed traffic than the forecast. The forecast increase in the evening peak was up to 7%, where as the observed flows increased by a maximum of 4%. The largest difference between forecast and observed is towards the end of the scheme (between junctions 29 and 30).
- In summary, the observed traffic along the scheme is consistently lower than forecast. This difference is explained by the lower than expected background traffic growth. This is likely to be due to the economic downturn and associated reduction in traffic volumes which commenced in 2008. The general change in traffic patterns is consistent between the forecasts and observed impacts.
- The forecasts for the Do Something scenario did not consider the impact of widening between M25 J16 and J23 (section 1) and this widened section opened at the same time as M25 J27-J30. The opening of Section 1 may have had some influence on the observed traffic along the scheme section. However, due to the neighbouring section of the M25 (J23 – J27) operating at three lane standard for the duration of the evaluation period, it is not considered that the Section 1 scheme would have had a significant impact on traffic flows along Section 4 at this stage.

Journey Time Analysis

Scheme Objective: to reduce congestion

- 2.35 This section considers the impact on journey times following the scheme's implementation. Pre-scheme journey times along the M25 route are compared to post-opening journey times for both directions. The journey time analysis is split into three components:
- Analysis of pre and post-scheme journey time differences along the scheme.
 - A comparison of forecast and outturn journey times along the scheme.
 - A comparison of journey time reliability pre-scheme and post-opening.
- 2.36 The journey time periods assessed align with the modelled journey times in the Economic Appraisal Report, and are as follows:
- Weekdays AM peak (07:00 to 10:00).
 - Weekdays inter-peak period (10:00 to 16:00).
 - Weekdays PM peak (16:00 to 19:00).
- 2.37 The calendar periods used in this OYA study are given below:
- Pre-scheme: October 2008.
 - Post-Opening: October 2012.

Observed Journey Times

- 2.38 Observed journey times have been taken from the HA's Journey Time Database (JTDB). The links used in the analysis can be found in Appendix C. This section will analyse the journey time results along the M25 J27-J30 scheme section. **Table 2-5** gives the direction wise pre-scheme and post-opening journey time along the scheme and the observed savings in journey time.

Table 2-5 – Average Journey times and savings on the M25 J27-J30 (mm:ss)

	Time Period	Before	OYA	Savings	% Change
M25 J27-J30 CW	AM	0:14:46	0:14:26	00:20	2%
	IP	0:15:07	0:14:54	00:13	1%
	PM	0:20:07	0:17:34	02:33	13%
M25 J27-J30 AC	AM	0:16:18	0:16:27	-00:09	-1%
	IP	0:14:43	0:14:37	00:06	1%
	PM	0:15:36	0:15:03	00:33	4%

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

- Average journey times for each peak period in the post-opening period are consistently lower than the pre-scheme journey times along the scheme with the only exception being anti-clockwise morning peak journey times. The slight increase in journey times in this case is negligible and is not considered to be an indication that the scheme has had a negative impact on traffic conditions.
- Time savings are more dominant in the clockwise direction, with the highest savings observed in the evening peak.
- The pattern of savings observed is same for both clockwise and anti-clockwise directions with higher journey time savings achieved in the evening peak compared to the morning peak. This journey time saving can be considered against an increase in traffic along the scheme as shown in **Table 2-4**.
- In the inter peak period, savings are negligible in both directions (between 6-13 seconds) and traffic has not increased considerably as can be seen from **Table 2-3**. This is consistent with the pre-scheme conditions generally being better in the interpeak than the peak periods.
- Journey times have decreased despite an increase in traffic along the scheme in the peak hours. This indicates that the extra capacity created by the scheme has catered for the observed increased traffic. This suggests that the scheme has met its objective to reduce congestion.

Forecast vs. Observed Journey Time Savings

2.40 Forecast traffic speeds are provided in the ‘North of Thames Assignment Model-Section 4 Forecasting Report (July 2007)’. This provides forecast information for the M25 mainline for the Do-Minimum and Do-Something scenario for the opening year of 2012. Section 4 speeds in the Do-Minimum (2012) were forecast to deteriorate by up to 5% compared with the 2004 base year. The proposed widening was predicted to bring about an improvement in journey times on most sections in the opening year of 2012 compared with the Do Minimum.

2.41 The forecast journey times, alongside observed journey times are presented in **Table 2-6**. Observed journey times for the before/without scheme scenario are taken from October 2008. For the after/with scheme scenario, observed journey times are taken from October 2012.

Table 2-6 – Forecast vs. Observed Journey Times (mm:ss)

Section	Time Period	Forecast				Observed			
		DM	DS	Diff	% Diff	Before	After	Diff	% Diff
M25 J27-30 CW	AM	17:19	15:42	-01:37	-9%	14:46	14:26	-00:20	-2%
	IP	16:06	14:30	-01:36	-10%	15:07	14:54	-00:13	-1%
	PM	15:54	14:16	-01:38	-10%	20:07	17:34	-02:33	-13%
M25 J27-30 AC	AM	15:47	14:54	-00:53	-6%	16:18	16:27	00:09	1%
	IP	15:42	14:42	-01:00	-6%	14:43	14:37	-00:06	-1%
	PM	15:39	14:25	-01:15	-8%	15:36	15:03	-00:33	-4%

2.42 **Table 2-6** shows that:

- Observed journey time savings are lower than the forecast savings except for clockwise in the evening peak hour.
- The scheme appraisal forecasted an average journey time savings of one minute whereas the observed savings are approximately 13 to 33 seconds.
- The success of the scheme in improving journey times must, however, consider that the forecasts assumed that traffic volumes would increase by approximately 4% to 7% during peak periods when in fact outturn flows have not increased to the same level as expected. Therefore the forecast deterioration in journey times in the DM was greater than would be expected in the observed data due to this lack of background traffic growth.
- A greater improvement in journey times was forecast in the clockwise direction compared to anti-clockwise. This is consistent with the observed impact of the scheme.
- These results provide evidence to conclude that the scheme has achieved its objective of reducing congestion along this section of the M25.

Journey Time Reliability

Scheme Objective: to improve reliability

2.43 One of the scheme’s key objectives was to improve journey time reliability along the M25 between junctions 27 and 30. Reliability is concerned with variability in journey times within the same time periods on different days. Therefore, a proxy for reliability can be determined by examining the variation of journey times using the data extracted from the JTDB, as used in the previous section.

2.44 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. Although being based on the mean journey time means that this metric will hide some of this impact on reliability, it will still show any large changes in reliability. Data is presented for a twelve hour period (07:00-19:00). **Figure 2-6** presents the journey time reliability for the scheme section in the clockwise direction, and **Figure 2-7** presents journey time reliability in the anti-clockwise direction.

Figure 2-6– Journey Time Reliability on M25 between J27 and J30-Clockwise

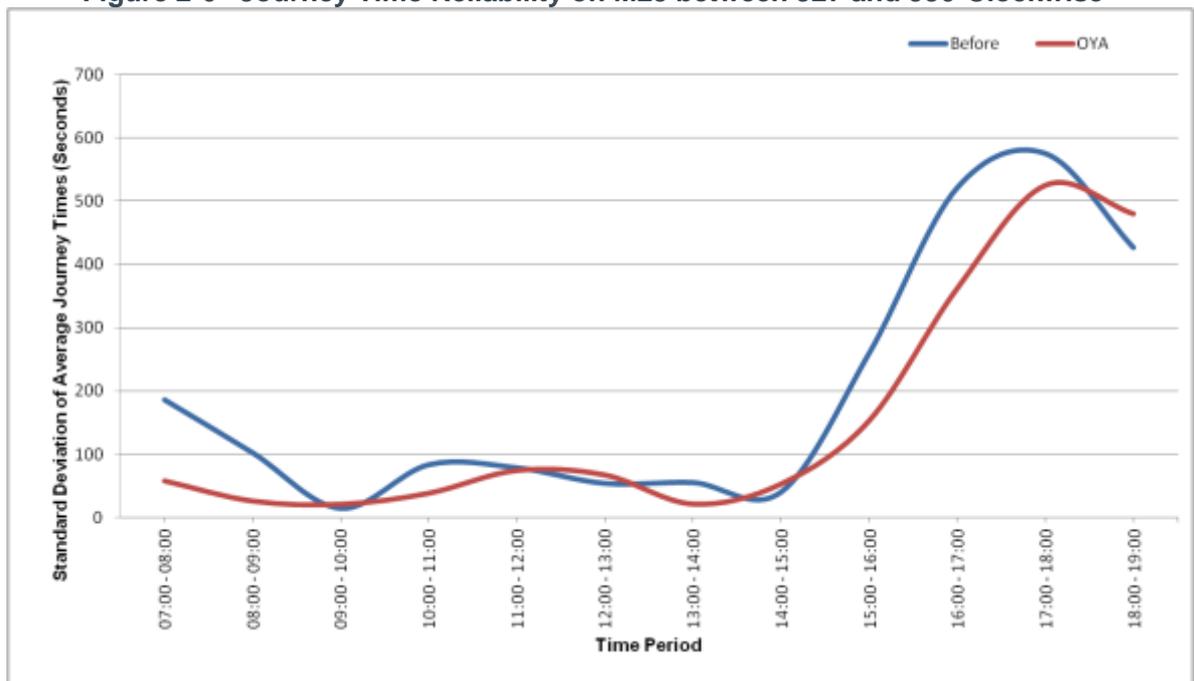
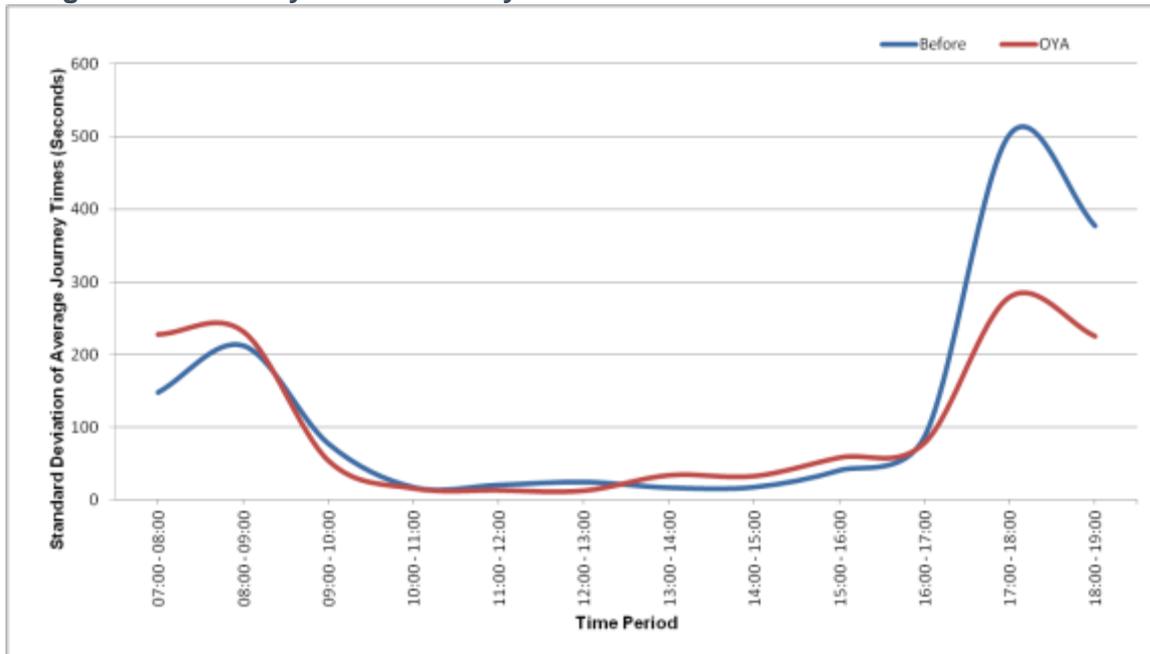


Figure 2-7– Journey Time Reliability on M25 between J27 and J30-Anti-Clockwise



2.45 It can be seen from **Figure 2-6** and **Figure 2-7**, based on spread of standard deviation of average journey times, that:

- Before the scheme, there were pronounced differences in the standard deviation (i.e. the variability) in the journey times between the different peaks. This reflects the congestion and delays in the PM peak where the standard deviation was high compared to other peaks. After the scheme opening the standard deviation of journey times is lower in the busier periods indicating that journey times have become more reliable.
- In the PM peak, more congestion was observed pre-scheme and this is evident from the observed journey times (see **Table 2-6**) and post scheme opening there is significant savings in journey times along with less variability in journey times leading to reduced congestion.
- Journey times have a greater variability in the anti-clockwise direction, this is consistent with the fact that journey times tend to be higher in this direction. Following the scheme's introduction the standard deviation of journey times along the scheme has reduced particularly in the busier hours. This provides an indication that journey time reliability has improved as a result of the scheme.

2.46 The appraisal of the reliability impacts for this scheme involved the use of INCA (Incident Cost Benefit Analysis) which attributes a monetary value to the journey time reliability impacts. This is considered further in Section 4 on page 44.

Consideration of other schemes

2.47 As discussed in Section 1 page 11, the scheme is part of a series of schemes in the area and more specifically along the M25, forming an overall long-term strategy to manage the existing motorway network more effectively.

2.48 At the time of writing this OYA report, the construction of the smart motorway along M25 between J23 and J27 (Section 5a) is complete and J25-J27 (Section 5b), immediately east of the scheme is ongoing and the expected opening period is the end of 2014. Smart motorways help relieve congestion by using technology to vary speed limits. They also allow the hard shoulder to be used as a running lane to create additional capacity. This indicates that the section of the motorway immediately west of the scheme section is currently highly congested and therefore likely to suppress the traffic growth towards this end of the Section 4 scheme.

- 2.49 Gantries were erected along the scheme section as part of the scheme and currently the speed limits are only advisory. The speeds/messages are manually inputted as the system for flow change recognition is not yet operational. The HA project manager for the scheme has confirmed that the controlled motorway along the scheme (M25 J27-30) was operational by March 2014. Controlled motorway enables proactive management of the motorway network by displaying Variable Mandatory Speed Limits above each lane of the main carriageway that takes in to account prevailing traffic conditions with the aim of ensuring smooth flow of traffic.
- 2.50 On completion of the Smart Motorway scheme at J23 to J27 and implementation of the controlled motorway on M25 from J27 to J30, i.e. along the scheme section, it is likely that the traffic would increase further in the future years and subsequent changes in journey times and average speed can be expected. Hence this OYA report only presents a snapshot of the changes at one year after scheme opening and the long term impacts of the scheme could be greater than currently observed at OYA given the nature and quantum of improvements taking place in the vicinity of the scheme. It should be noted that the appraisal did not include the controlled motorway element and simply modelled the motorway widening as considered in this evaluation.

Key Points – Traffic Impacts

Traffic Flow Impacts

- Traffic volumes have increased at the start of the scheme section where as at the end of the scheme there has been a slight reduction in traffic compared to pre-scheme.
- There is no identifiable trend in the traffic pattern on local roads, with some roads showing an increase in traffic whilst others show a decrease.
- Background trends in traffic in the region show a decrease in traffic levels of 2% between 2008 and 2012. The moderate change in traffic along the scheme should be considered against this background trend in traffic reduction.
- Hourly flow profile comparisons show that the scheme has attracted more traffic in the peak periods and that flow in the interpeak and off peak has remained consistent with pre-scheme levels.

Traffic Forecasts

- Observed traffic flows are consistently lower than forecast traffic flows. The forecasts included forecast growth of around 15% to 18% in traffic between the base year (2004) and opening year (2012), whereas the observed trend shows little growth in traffic between 2008 and 2012 across the region. This demonstrates that the forecasts overestimated the traffic using the corridor in the opening year.
- The general change in traffic patterns is consistent between the forecasts and observed impacts, suggesting that whilst the background trend in traffic was overestimated in the appraisal, the impact of the scheme on traffic patterns was well represented in the forecasts.

Journey Times

- Average journey times for each peak period since the scheme opened are lower than the pre-scheme journey times along the length of the scheme.
- The observed pattern of journey time savings is the same for both the clockwise and anti-clockwise directions with significant journey time savings achieved in the evening peak hour compared to the morning peak hour.

Journey Time Forecasts

- Observed journey time savings are lower than the forecast reduction in journey times. Though it can be noted that the trend of journey time savings is consistent in the forecast and observed scheme impacts.
- The scheme appraisal forecasted an average journey time saving of one minute whereas the observed savings are between 13 and 33 seconds.

Journey Time Reliability

- Following the scheme's introduction the standard deviation of journey times along the scheme has reduced particularly in the busier hours. This provides an indication that journey time reliability has improved as a result of the scheme.

3. Safety Evaluation

Scheme Objective: to improve safety

Introduction

- 3.1 This section of the report examines how successful the scheme has been in addressing the objective of improving safety. The focus of this objective is to reduce the loss of life, injuries and damage to property resulting from transport collisions and crime. This is assessed by analysing the changes in Personal Injury Collisions³ (PICs) occurring in the five years before the start of construction compared to the available post-opening data.
- 3.2 The Economic Assessment Report (EAR) stated that: ‘*The scheme will have a forecast accident disbenefit over the 60- year evaluation period*’. This section of report assesses how far the scheme has achieved this expectation, based on observed data.
- 3.3 In order to assess the impact of the scheme on collisions, this section of the report analyses change in personal injury collisions (PICs) occurring in the five year pre construction period, and the 15 month post-opening period. Evaluation of the scheme’s impact on personal security has been undertaken through the use of observations made during a site visit.

Data Sources

Forecast data

- 3.4 Forecasts of the impact of the scheme on safety have been obtained from the COBA (Cost Benefit Analysis) model (Version 11R7) and the Appraisal Summary Table (AST).
- 3.5 The forecast impact on safety is expressed in terms of numbers of personal injury collisions saved along with the associated numbers of casualties and the economic benefit of any forecast PIC saving. This section of the study concerns collision numbers; the economic impact of changes in collisions is evaluated in **Section 4**.
- 3.6 The COBA network consisted of the M25 main carriageways, slips and junctions, as well as all-purpose roads along the M25 corridor. The extent of the network in the appraisal was determined after a comparison between the Do-Minimum and Do-Something 2015 forecast flows within the SATURN network. Links close to the widening scheme forecasting a change in Annual Average Daily Traffic flow of $\pm 5\%$ were included in the COBA network. This is illustrated in **Figure 3-1**.

³ Collisions previously referred to as accidents, naming convention has been changed in line with HA’s terminology.

Table 3-1 – Forecast Safety Impact (60 years)

Section of COBA Network	Scenario	Number of Collisions	Casualties		
			Fatal	Serious	Slight
M25 main carriageways	DM	8,303	121	724	13,409
	DS	10,238	150	893	16,535
	Change	1,935▲	29▲	169▲	3,126▲
Local Roads, M25 junctions and slip roads	DM	16,595	295	2175	23,004
	DS	16,659	296	2180	23,103
	Change	64▲	1▲	5▲	99▲
M25 and local roads (combined)	DM	24,898	416	2899	36,413
	DS	26,897	446	3073	39,638
	Change	1,999▲	30▲	174▲	3,225▲

- 3.12 The results presented in **Table 3-1** show that an increase in collisions and casualties was forecast to occur with the M25 Section 4 widened to four lanes, rather than retaining the three lane layout. The increase is equivalent to one additional injury collision every eleven days, with one additional fatality every two years. The majority of this increase was forecast to occur on the M25 main carriageways. The change on the local roads, due to traffic increase resulting from the widening of the M25, was forecast to be approximately one additional collision per year.

Evaluation Approach

- 3.13 The evaluation is divided into two parts :
- **Key links:** M25 mainline between J27 and J31 including slip roads and junctions.
 - **COBA area:** M25 mainline between J27 and J31 including slip roads and junctions and other local roads as represented in **Figure 3-1**.
- 3.14 The original appraisal was based on observed data for the period January 2000 to December 2004 inclusive. This OYA report compares the five years prior to the start of construction, with the maximum post opening data available at the time (15 months) for key links and COBA network. We also briefly examine the collisions during the construction period. The periods considered are as follows:
- Pre-construction (July 2004 – June 2009).
 - During construction (July 2009 – May 2012).
 - Post opening (June 2012 – August 2013).

Collision Numbers

- 3.15 This section analyses the observed changes in PICs following the implementation of the scheme. One of the stated objectives of this scheme was to improve safety along the route. This section includes an investigation into the changes in the number of collisions and associated casualties as well as whether there has been any change in the relative severity. This section first considers the impact on the scheme key links, and then further detail is provided regarding the impacts on the whole modelled (COBA) area.

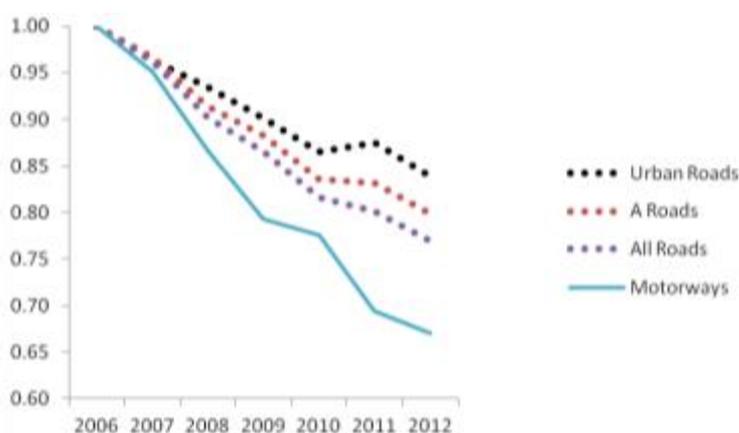
Background Changes in Collision Reduction

- 3.16 It is widely recognised that, for over a decade, there has been a year-on-year reduction in the number of personal injury collisions on the roads, even against a trend of increasing traffic volumes during much of that period. The reasons for the reduction are considered to be wide ranging and include improved safety measures in vehicles and reduced numbers of younger drivers. This background trend must be considered against the changes in collision numbers in the scheme area in the before and after periods. If the scheme had not been built, collision numbers in the area are still likely to have been influenced by wider trends, i.e. a reduction in collisions might have been expected even if the scheme hadn't been built.
- 3.17 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 study area here would have dropped at the same rate as they did nationally during the same time period⁴. This gives us what is known as a counterfactual scenario. We can now compare this data for the counterfactual 'without scheme' scenario on a like-for-like basis with the observed post opening data which is the 'with scheme' scenario.

- 3.18 The difference between the numbers of collisions in these two scenarios can then be attributed to the scheme rather than the wider national trends. This result will inform the calculation of monetised safety benefits achieved by the scheme as discussed in the economy chapter of this report.
- 3.19 The comparison of the counterfactual scenario compares the national collision data in the One Year After period (2012) and for a representative year in the pre-construction period (taken as the middle year, 2006). The change in the number of collisions over this period for motorways is calculated from the national collision data⁵. **Figure 3-2** illustrates the change in collision numbers by road type between 2006 and 2012.

Figure 3-2– Trends in Injury Collision Numbers



- 3.20 The reduction in national collision numbers presented above is used in the development of the counterfactual scenario for the post-construction collision data, i.e. how many collisions would have occurred during the post-construction period had the observed improvement in national safety trends already occurred.

Collision Numbers– Scheme Key Links

- 3.21 The key links for this scheme comprise the M25 between junctions 27 to 31, including the junctions and slip roads. This is consistent with the mainline M25 considered in the COBA evaluation. An evaluation of the before and after collision numbers by year for the key links is shown in **Table 3-2** and **Figure 3-3**. This enables a direct comparison with forecast collision savings derived from COBA for the same key links. The severity of a collision is defined by the most serious injury incurred.
- 3.22 The table also includes the counterfactual without scheme which is comparable to the with scheme data. It should be noted that where periods of less than one year are displayed, the number of collisions for the period has been extrapolated to provide an equivalent number of collisions per year; the number of collisions added as a result of the extrapolation is shown as a dotted bar.

⁴ National trend data is sourced from DfT table RAS10002

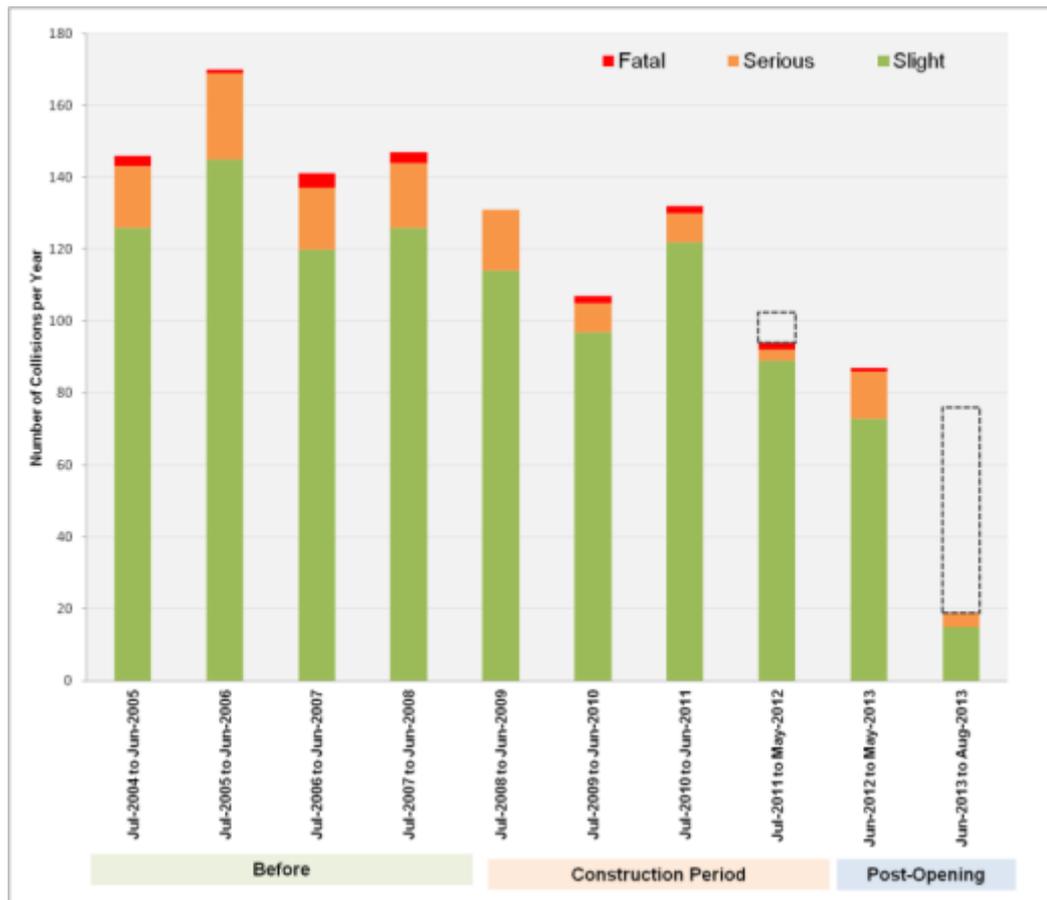
⁵ Data sourced from DfT table RAS10002 which includes reported accidents and accident rates by road class and severity, Great Britain.

Table 3-2 – Number of Collisions by Severity in the Key Links

Period	Time Period		Collision Severity			Total	Annual Average
	From	To	Fatal	Serious	Slight		
Pre Scheme	Jul-2004	Jun-2005	3	17	126	146	147.1
	Jul-2005	Jun-2006	1	24	145	170	
	Jul-2006	Jun-2007	4	17	120	141	
	Jul-2007	Jun-2008	3	18	126	147	
	Jul-2008	Jun-2009	0	17	114	131	
Construction	Jul-2009	Jun-2010	2	8	97	107	114.2
	Jul-2010	Jun-2011	2	8	122	132	
	Jul-2011	May-2012	2	3	89	94	
Pre scheme Counterfactual (adjusted for background reduction)⁶							98.6
Post Opening	Jun-2012	May-2013	1	13	73	87	84.8
	Jun-2013	Aug-2013	0	4	15	19	

⁶ Background factor for reduction in collision numbers for Motorways 2006-2012 was 0.67

Figure 3-3 – Number of Collisions on Year by Year Basis for Key Links



3.23 The post opening data in **Figure 3-3** has been presented to allow identification of the fifteen months of observed data and the extrapolation to an annual average.

3.24 It can be seen from **Figure 3-3** and **Table 3-2** that:

- The average number of collisions has reduced along the M25 scheme section between pre-scheme and post opening from 147.1 collisions per year to 84.8 collisions per year. This represents a decrease of 42% at OYA compared to the pre-scheme scenario.
- The annual average collisions in the ‘counterfactual scenario is 98.6 collisions per year. Compared to the post opening period collision values this represents an annual collision saving of 13.8 collisions a year, suggesting that the scheme has had a beneficial impact on the number of collisions along the scheme section (M25 section between J27 and J31 including slip roads and junctions).
- **Figure 3-3** illustrates that the number of collisions after scheme opening is consistently lower than the pre-scheme collisions.

Collisions - COBA Area

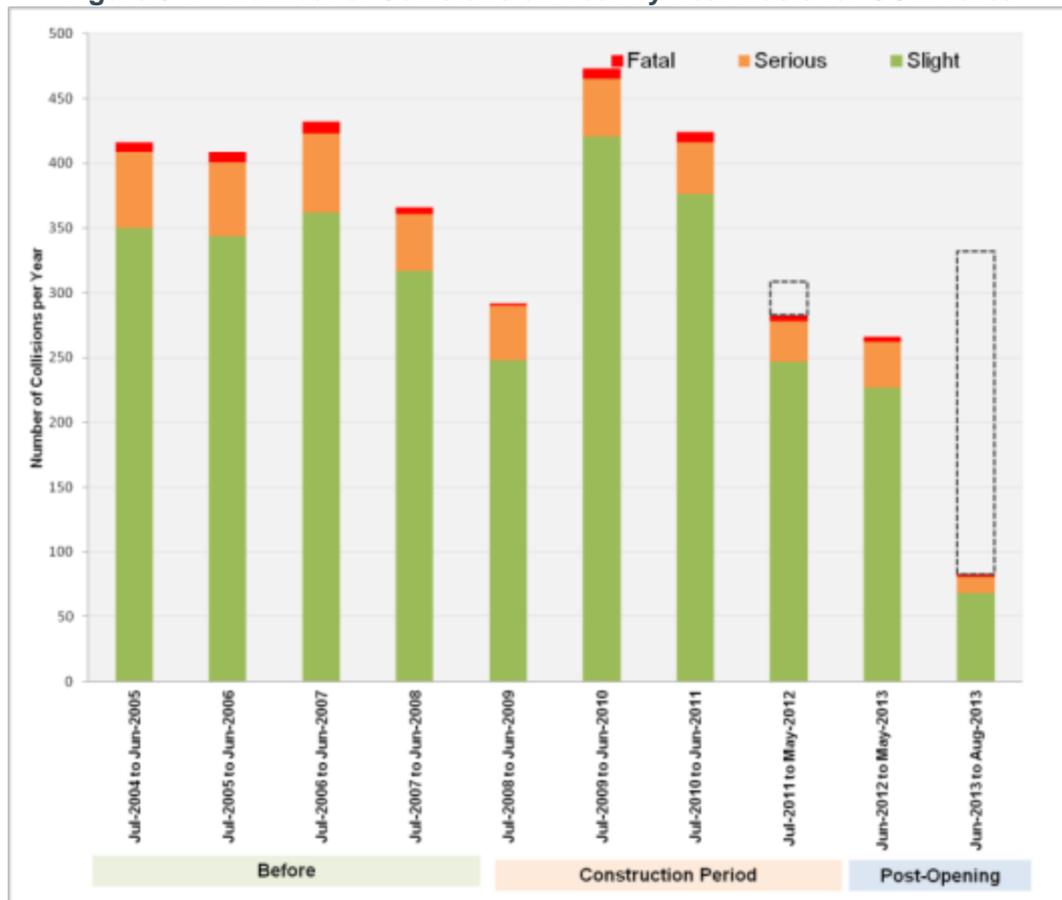
3.25 The COBA area includes the mainline M25 between J27 and 31 including slip roads and junctions and local roads in the scheme vicinity as considered for the COBA appraisal. The extent of the COBA area considered is shown in **Figure 3.1**. An evaluation of the before and after collision numbers by year for the COBA area is shown in **Table 3-3** and **Figure 3-4**.

Table 3-3 – Number of Collisions by Severity in the COBA Area

Period	Time Period		Collision Severity			Total	Annual Average
	From	To	Fatal	Serious	Slight		
Pre Scheme	Jul-2004	Jun-2005	7	59	350	416	383.2
	Jul-2005	Jun-2006	8	57	344	409	
	Jul-2006	Jun-2007	9	61	362	432	

Construction	Jul-2007	Jun-2008	5	44	317	366	404.6
	Jul-2008	Jun-2009	2	42	248	292	
	Jul-2009	Jun-2010	8	44	421	473	
	Jul-2010	Jun-2011	8	40	376	424	
	Jul-2011	May-2012	5	31	247	283	
Pre scheme Counterfactual (adjusted for background reduction)⁷							294.9
Post Opening	Jun-2012	May-2013	4	35	227	266	279.2
	Jun-2013	Aug-2013	2	13	68	83	

Figure 3-4 – Number of Collisions on Year by Year Basis for COBA area



3.26 It can be seen from **Table 3-3** and **Figure 3-4** that:

- The average number of collisions has reduced in the COBA area between pre-scheme and post opening from 383.2 collisions per year to 279.2 collisions per year. This represents a decrease of 27% at OYA compared to the pre-scheme scenario.
- After accounting for the background trend in collision reduction, we find that in the counterfactual before scenario there were 294.9 collisions per year compared to 279.2 after scheme opening. This represents a decrease of 5%.
- The number of collisions in the wider area is consistently lower than the pre-scheme scenario.
- There was an increase in collisions during the construction period compared to pre-scheme whereas from **Figure 3-3** it is clear that along the scheme section collisions did

⁷ Background factor in collision numbers for All roads 2006-2012 was 0.77

not increase during construction period. Hence this increase is observed on the local roads where traffic would have diverted during the scheme construction period.

Collision Severity Index – Key Links and COBA Area

3.27 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 average collision severity index for the key links and COBA area is shown in **Table 3-4**.

Table 3-4 – Average Collision Severity Index

Period	Time Period		Key Links		COBA Area	
	From	To	Collision Severity Index	Annual Average	Collision Severity Index	Annual Average
Pre Scheme	Jul-2004	Jun-2005	14%	14%	16%	15%
	Jul-2005	Jun-2006	15%		16%	
	Jul-2006	Jun-2007	15%		13%	
	Jul-2007	Jun-2008	14%		15%	
	Jul-2008	Jun-2009	13%			
Construction	Jul-2009	Jun-2010	9%	8%	11%	12%
	Jul-2010	Jun-2011	8%		11%	
	Jul-2011	May-2012	5%		13%	
Post Opening	Jun-2012	May-2013	16%	17%	15%	15%
	Jun-2013	Aug-2013	21%		18%	

3.28 It can be seen from **Table 3-4** that the collision severity index has increased marginally at the OYA stage for the key links. This can be attributed to the fact that the total number of slight collisions has reduced significantly compared to pre-scheme and whilst the number of fatal and serious collisions has also reduced they have not reduced to the same extent. Given the amount of available post-opening collision data, it is too early to draw conclusions on collision severity and a clearer picture will be available at the Five Years After POPE reporting stage. For the COBA area, the severity index has remained the same during pre-scheme and post-opening.

Forecast vs. Outturn Collision Numbers

3.29 This section compares the observed change in collision numbers against the forecast change from the scheme appraisal. The forecasts have been taken from the COBA model outputs from the scheme appraisal and cover the scheme key links (including junctions and slip roads). The forecasts presented here use 'Method 1' from the forecast approach, consistent with what was reported in the Appraisal Summary Table. For the outturn collisions the observed annual average collisions before and after the scheme opened are used for the same area.

Table 3-5 – Comparison of Forecast and Observed Collisions for the Scheme Key Links

Annual Average Collisions		Central Growth
Forecast Opening Year	Do Minimum (without scheme)	126.5
	Do Something (with scheme)	153.7
	Change	27.2
	% Change	22%
Observed Annual Average	Observed Before Opening	147.1
	Without Scheme (counterfactual)	98.6
	Observed After Opening	84.8
	Change*	-13.8
	% Change*	-14%

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

- 3.30 It can be seen from **Table 3-5** that the scheme appraisal forecasted an increase in collisions post scheme opening. The scheme was expected to result in an increase in annual collisions by 22%. However post scheme opening, the observed savings in collisions is about 13.8 collisions per annum, representing a saving of 14%, even after accounting for the background trend in collision reduction.
- 3.31 The majority of the increase in collisions was forecast to occur on the M25 main carriageways. The lower than expected increase in traffic flows explains why the scheme has not resulted in the forecast increase in collisions along the M25.

Collision Rates – Key Links

- 3.32 The number of collisions along a length of road, used together with the Annual Average Daily Traffic (AADT) for the same section, can be used to calculate collision rates, known as Personal Injury Collisions per million vehicle kilometres (PIC/mvkm). This allows comparisons to be made which take into account traffic growth.
- 3.33 In this section, collision rates during the pre and post scheme data for the key links are compared with the forecasts (from COBA) for the same area. **Table 3-6** shows the forecast collision rates for the key links compared to that observed collision rates.

Table 3-6 – Forecast vs. Observed Collision Rates (PIC/mvkm) for the Key Links

Forecast (2012 Opening Year)	Do-Minimum (without scheme)	0.09
	Do-Something (with scheme)	0.10
	Forecast Saving	-0.01 (-16%)
Observed (Pre-scheme vs. Post-opening collision rates)	Observed before opening	0.12
	Without Scheme (counterfactual) ⁸	0.08
	Observed after opening	0.07
	Observed Saving*	0.01 (14%)

*Observed saving is calculated using counterfactual before scenario.

- 3.34 **Table 3-6** shows that the scheme appraisal forecast an increase in collision rate as a result of the scheme. As detailed in the AST, this is because when the scheme was appraised, the existing M25 had a better safety record than the national average rate, which was used to assess the widened motorway.

⁸ Counterfactual is the observed rate in the before period multiplied by the national reduction in collisions rate per mvkm during the comparable period. The reduction factor in the collision rate for motorways was 0.66.

- 3.35 This trend is not reflected in the observed collision impact with a reduction to the collision rate of 14% after considering the background trend in collision reduction. The observed counterfactual collision rate is in line with the forecast.

Statistical Significance of Outturn Collision Impacts

- 3.36 In order to determine whether the changes in collision numbers observed before and after the scheme opened are statistically significant, Chi-Square tests have been undertaken. This test uses the before (counterfactual) and after numbers of collisions and traffic flows to establish whether the changes are significant or likely to have occurred by chance.
- 3.37 The result found that after accounting for the background trend in collision reduction, the change in collisions as a result of the scheme is not statistically significant over either the scheme key links or the wider study area.
- 3.38 The results are based on five years of data for before scheme opening and 15 months of data post opening. A clearer picture will be available at the Five Years After study for this scheme when a larger sample will be available for post opening comparison.

Fatalities & Weighted Injuries

- 3.39 The collision rate discussed previously and shown in **Table 3-2** does not take into account the severity of collisions. To analyse this we now present the Fatalities and Weighted Injuries metric which is a combined measure of casualties based on the numbers of fatal, serious and slight casualties. The FWI for the five years before and the available after period are shown in **Table 3-7**. To take into account the change in traffic on the M25 and for comparison with other schemes, we also present the FWI rate per billion vehicle kilometres (bvkm). It should be noted that these figures do not account for changes in the background reduction in casualties.

Table 3-7 – FWI on the Key Links

Period	FWI/collision	FWI/year	FWI/bvkm
Before	0.047	6.90	5.6
After	0.044	3.77	3.1

- 3.40 **Table 3.7** shows that the FWI/bvkm has decreased post opening indicating that the seriousness of collisions has reduced.

Security

- 3.41 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).
- 3.42 The primary indicators for roads include surveillance, landscaping, lighting and visibility, emergency call facilities and pedestrian and cycling facilities.

Forecast

- 3.43 The scheme appraisal stated that a 'slight beneficial' impact was expected for Security. The AST noted that a Slight beneficial impact on security due to improved surveillance / signage/landscaping as a result of the scheme.

Evaluation

- 3.44 This outturn evaluation supports the AST assessment of neutral as the scheme did not affect the provision of security facilities. The outturn traffic flows are lower than forecast, had changes

been made to the security provision the number of users affected would have been a consideration.

Key Points - Safety

Collisions

- There has been a 14% decrease in the average number of collisions along the M25 scheme section post scheme opening after accounting for the background trend in collision reduction; this represents an annual average saving of 13.8 collisions per year.
- Across the wider study area there has been a 5% reduction in annual average collisions, representing a saving of 15.7 collisions per year.
- Collision severity has increase marginally along the length of the scheme but remains unchanged across the wider study area.
- The Fatal and Weighted Injuries metric (FWI/bvkm) has decreased post opening indicating that the relative impact of collisions has reduced, when related to the change in traffic volumes.
- Collision rates along the scheme key links have reduced slightly suggesting that the scheme has had a beneficial impact for safety along the key links. However, at this stage the improvement in collision rates is not statistically significant.

Forecast vs. Outturn Collision Savings

- The scheme appraisal forecasted an increase in collisions in the Do Something scenario compared to a reduction of 13.8 collisions per annum in the outturn data.
- The scheme appraisal forecast an increase in collision rate as a result of the scheme, compared to an observed reduction of 14% between pre and post opening.

Security

- The scheme's impact on security was as forecast in the scheme appraisal, which is a neutral impact due to no change in the provision of security measures along the length of the scheme.

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 five 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.
- Improve reliability.
- Provide beneficial wider economic impacts.

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

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

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

Sources

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

- M25 DBFO – Section 4 Widening – Economic Appraisal Report (October 2007).
- Outturn costs obtained from the Highways Agency Regional Finance Manager.
- The forecast scheme costs have been taken from the pre-construction ministerial approved budget (MP Director's Instruction 06/07, Annex 1, Version 1.2 final-a, issued May 2007).

Forecast Benefits

- 4.6 A summary of the predicted scheme impacts from the Economic Assessment Report is shown in **Table 4-1**. This shows that over the 60 year appraisal period, the scheme was predicted to generate in excess of £686 million in benefits, with the vast majority arising from reduced journey times. **Table 4-1** also provides a summary of the benefits which will be considered in this post opening evaluation, and those which have been excluded (i.e. assumed same as forecast).

- 4.7 A green tick in **Table 4-1** indicates that this element of the benefits will be considered as part of this evaluation. A red cross indicates that the forecast impact from the appraisal will be used in place of a full evaluation at this stage.

Table 4-1 – Economic Impact of Scheme

Benefit Stream	Predicted Benefits		Evaluation	
	£m	%	Evaluate?	Reasons
Journey Times	638.9	93%	✓	Represents a considerable proportion of the overall scheme benefits Relatively straightforward to measure outturn impacts in opening year.
Vehicle Operating Costs	-19.1	-3%	✓	Based on the ratio of fuel consumption forecast and observed
TEE impacts during construction	6.7	1%	✗	Not within the remit of POPE Small proportion of the overall scheme impacts.
TEE impacts during maintenance	56.2	8%	✗	Small proportion of the overall scheme impacts.
Safety	-80.1	-12%	✓	Safety impact was found to be a positive benefit, but was statistically not significant so is not included at this stage as it cannot be directly linked to the scheme.
Journey time reliability	88.9	13%	✓	Journey time reliability benefits were calculated using INCA in the appraisal. For the OYA evaluation the INCA has been rerun with the observed flows to calculate the opening year impacts
Noise	-0.1	0%	✗	Small proportion of the overall scheme impacts.
Carbon	-4.8	-1%	✓	See Section 5, Greenhouse Gases for full detail of the evaluation.
Total	686.7	100%		

Journey Time Benefits

Forecast Journey Time Benefits

- 4.8 Journey time benefits for this scheme were forecast using the Department for Transport’s (DfT) TUBA (Transport Users Benefit Analysis) (version 1.7a) program. The forecast journey time benefits over the whole 60-year appraisal period have been taken from the Economic Appraisal Report. These are shown in **Table 4-2**.

Table 4-2 – Summary of TEE forecast impacts

Consumers & Business users combined	£m 2002 prices and values
Journey Time	638.9

- 4.9 Journey time benefits expected as a result of the scheme were 93% of the total PVB. The scheme was expected to reduce travel time for highway users by enabling them to travel at higher speeds on the dual 4-lane carriageway. The additional capacity would accommodate the increase in demand whilst also providing congestion relief and improved journey times.

Evaluation of Journey Time Benefits

- 4.10 The TUBA model used in the appraisal was based on the benefits across a wide area. For this outturn evaluation the benefits have only been considered along the scheme section. It is not possible to use TUBA outputs to create a comparable forecast for just the scheme section as TUBA is matrix-based and its output does not provide any breakdown of the impacts on a link-wise basis.

- 4.11 The POPE methodology for evaluating the economic value of benefits from vehicle hour savings is based upon comparing the observed vehicle hour savings, combined with the assumption that the observed vehicle hour saving at the OYA stage can be taken as indicative of that over the whole 60 year period. Based on this assumption, comparing the forecast vehicle hour saving along the scheme section with the observed vehicle hour saving enables the calculation of the 60 year outturn monetised benefit.
- 4.12 Savings were considered for the weekday peak periods and interpeak. This was done using a 'saving per vehicle' approach for existing traffic. Additional traffic in the corridor, which is the traffic attracted by the improved M25 scheme, was attributed with half the benefits using the economic principle of rule-of-half in line with WebTAG guidance. The outturn vehicle hour savings were then compared to the forecast vehicle hour savings calculated in the same manner.
- 4.13 The opening year savings forecast and observed are shown in **Table 4-3**.

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

Scheme Section	Forecast	Observed	% difference
M25 between J27 and J30	681,411	220,471	-67%

- 4.14 From **Table 4-3** it can be seen that the forecast vehicle hour savings on the scheme section is much higher than the outturn vehicle hour savings. The two contributing factors to this are (i) outturn changes in traffic flow are much lower than forecast and (ii) outturn journey times savings are also much lower than forecast.
- 4.15 The 67% difference between the forecast and outturn vehicle hour savings is applied to the forecast journey time benefits in line with the POPE methodology. **Table 4-4** compares the forecast with the outturn assessment.

Table 4-4 – Monetised Journey Time Benefits

Present Value Benefits (£m 2002 prices, discounted)	Forecast	Observed
Journey Time Benefits	638.9	204.5

- 4.16 The results presented in **Table 4-4** shows that the outturn journey time benefits at the OYA stage are lower than forecast. This difference can be attributed to the fact that observed traffic on the scheme section is lower than forecast and the journey time savings are not as high as expected. It should also be noted that the scheme forms part of an overall strategy along the M25. When all the schemes are complete it is likely that there will be additional benefits that cannot be attributed to any one scheme.
- 4.17 As discussed in section 2.50 page 31, the scheme appraisal did not take into account the impacts of widening on M25 between J16 and J23 and the Smart Motorway between J23 and J27. Controlled motorway is programmed to operate along the scheme and M25 J16-23 in May 2014. These changes mean that the potential benefits from the scheme in the long term could be higher than what was forecast at the appraisal.

Vehicle Operating Costs (VOC)

Forecast Benefits

- 4.18 As with journey time benefits for this scheme, the change in vehicle operating costs was forecast using the Department for Transport's (DfT) TUBA (Transport Users Benefit Analysis) (version 1.7a) program. The forecast vehicle operating costs over the whole 60-year appraisal period have been taken from the Economic Appraisal Report. The total disbenefit forecast was 3% of the total PVB.

Evaluation of Vehicle Operating Costs

- 4.19 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). That is, if there is increased fuel consumption, VOC will increase due to users paying more for fuel (i.e. a disbenefit) 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 ratio used for the reforecast indirect tax calculation (section 4.46) has been applied to the monetary value for VOC.
- 4.20 The forecast and the outturn vehicle operating cost comparison is shown in **Table 4-5**.

Table 4-5 – Monetised Vehicle Operating Costs

Present Value Benefits (£m 2002 prices, discounted)	Forecast	Observed
Vehicle Operating Costs	-19.1	-2.4

- 4.21 This evaluation shows that the outturn disbenefit is lower than forecast due to the lower than expected increase in traffic and less change in speeds.

Safety Benefits

Forecast Benefits

- 4.22 For the purpose of assessing the economic impacts of road schemes changes in safety are monetised, as measured by changes in collision numbers and severity. Forecast benefits were appraised in line with the COBA Manual (DMRB Volume 13, Section 1) and produced by the computer program, COBA (version 11R7).
- 4.23 The safety impact of the scheme was appraised over the COBA area shown in **Figure 3-1** which included the M25 scheme section and local roads in the scheme vicinity.
- 4.24 The EAR predicted an collision disbenefit over the 60 year evaluation period. The forecast was based on a central growth scenario and was -£80.1m over 60 years for the study area.

Evaluation of Safety Benefits

- 4.25 The analysis performed at this OYA stage showed that there is no statistical evidence that the scheme has had an impact on safety within the study area, even though the number of collisions has reduced in the post opening period. As such the monetised safety impact is reforecast to be £0m. It should be noted that this analysis is based on a limited sample size and will be revisited at the FYA study when a more robust sample size will be available.

Journey Time Reliability

Forecast Benefits

- 4.26 The scheme appraisal estimated the reliability benefits for the scheme. The monetised reliability benefit was included in the Analysis of Monetised Costs and Benefits table (AMCB). The reliability sub-objective includes the impact of the scheme on incidents and day-to-day journey time variability.
- 4.27 The appraisal used INCA (INcident Cost Benefit Assessment) version 3.0 for estimating the benefits of reduced delay and travel time variability (TTV) caused by unforeseen incidents that reduce capacity, such as collisions, breakdowns, debris on the carriageway and major disruptions such as fire, load shedding or spillage.
- 4.28 The benefits presented in this section are in 2002 prices, discounted to 2002 in line with the methodology set out in the Present Value of Benefits section below.

Table 4-6 – Monetised Journey Time Reliability Benefits Forecast

Journey Time Reliability Benefits	£m 2002 prices and values
Journey Time Savings During Incidents	-7.3
Travel Time Variability Benefits	96.2
Total	88.9

4.29 The results presented in **Table 4-6** shows that benefits were predicted from reductions in journey time variability and a disbenefit during incidents was expected. The latter is likely to be a result of the increase in forecast traffic flows along the scheme.

Evaluation

4.30 **Section 2** of this report considered the change in the standard deviation of journey times resulting from the scheme and the scheme has improved journey time reliability during the day.

4.31 A full re-run of INCA would require data and analysis that is beyond the scope of the OYA evaluation. In line with the traditional POPE methodology, the opening year benefits have been re-calculated and then translated into a 60 year re-forecast. The opening year benefits were calculated by updating the appraisal INCA files with the observed changes in traffic data. INCA includes default values for incident rates, average lanes blocked, maximum diversion proportion, etc and these default values were assumed to be unchanged as part of this OYA evaluation. The outturn monetised journey time reliability benefits are presented in **Table 4-7**.

Table 4-7 – Monetised Journey Time Reliability Benefits Outturn

Journey Time Reliability Benefits	£m 2002 prices and values
Journey Time Savings During Incidents	-13.5
Travel Time Variability Benefits	91.1
Total	77.6

Present Value Benefits (PVB)

4.32 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.

4.33 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.

4.34 A comparison of all forecast and outturn benefits is presented in **Table 4-8**.

Table 4-8 – Summary of Forecast and Observed Present Value Benefits

Present Value Benefits (£m 2002 prices, discounted)	Forecast	Outturn
Journey Times	638.9	204.5
Vehicle Operating Costs	-19.1	-2.4
TEE impacts during construction	6.7	
TEE impacts during maintenance	56.2	
Safety	-80.1	0
Journey time reliability	88.9	77.6
Noise	-0.1	
Carbon*	-4.8	-0.7
PVB	686.7	341.8

*See Section 5, Greenhouse Gases

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

Scheme Costs

Introduction

- 4.36 This section compares the forecast costs of the scheme as of the start of the construction period with the actual spend at the time of this evaluation.
- 4.37 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 components:
- Investment costs: before and during construction.
 - Indirect Tax Revenues: during the 60 years after opening.
- 4.38 Investment costs are considered in terms of a common price base of 2002 for comparison with forecast. For comparison with the benefits, overall costs are expressed in terms of present value, termed Present Value Cost (PVC).

Investment Costs

- 4.39 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 latest ministerial approved budget. This provides the undiscounted scheme costs (including forecast spend, scheme risks, optimum bias and land provisions) in 2006 costs for the second quarter. This has been converted to 2002 prices for comparison with outturn costs. Historic costs (pre 2007-8) are included in the calculation of forecast investment cost. Outturn scheme costs have been supplied by the HA Regional Finance Manager. The scheme costs included the cost of gantries erected as part of the scheme to display mandatory speed limits when required.
- 4.40 A comparison between the forecast and outturn investment cost is presented in **Table 4-9**.

Table 4-9 – Summary of Investment Costs

Forecast Cost (May 2007)		Outturn Cost (as of December 2013)		% Difference
Ministerially approved budget(May 2007), 2006 Q2 prices	£470.6m	As spent costs in 2004-2014 years and prices	£393.7m	-
Costs in £m 2002 prices, undiscounted	£419.7m	Costs in £m 2002 prices, undiscounted	£300.2m	-28%

4.41 It can be seen from **Table 4-9** that the outturn cost is lower than forecast cost by 28%.

Maintenance Costs

4.42 The total maintenance cost over 60 years was estimated to be -£23.9m in 2002 prices and values. This represents a reduction in forecast maintenance costs. This cost saving occurs primarily because of the renewal to the motorway during widening reducing the need for future maintenance. The user impact during maintenance has already been included in the PVB.

4.43 For this evaluation, these costs are still almost entirely in the future and no evaluation has been done of maintenance costs to date. It will therefore be assumed that the outturn maintenance costs are the same as forecast. It can be noted that the maintenance cost is only a small proportion (7%) of the total construction cost.

Indirect Tax Revenues

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

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

4.45 Forecast changes to indirect tax revenues were taken from the TUBA model and the value represents the change over the whole study area. The scheme was expected to increase tax revenue over the 60 year appraisal period in comparison with the Do Minimum (i.e. no scheme) scenario.

4.46 To assess the outturn impact, the change in fuel use along the scheme section has been calculated from observed changes to traffic flows and speeds. A corresponding calculation was performed using the forecast changes to traffic flows and speeds for the same section. The difference between the forecast and observed changes in fuel use is then applied to the monetised impact on indirect tax revenues to determine an outturn impact.

Table 4-10 – Indirect Tax Revenues as a cost

£m 2002 prices and values	Forecast	Outturn
Change to Indirect Tax Revenues	-40.5	-5.1

4.47 This evaluation shows that the outturn assessment of indirect tax revenue as a costs is lower than forecast. This is due to the fact that the forecasts assumed higher background traffic growth and hence higher changes to indirect tax, whereas in the outturn the background traffic growth is negligible compared to pre-scheme. This assessment is based on the scheme section where both pre-scheme and post opening traffic counts are available.

Present Value Costs (PVC)

- 4.48 A cost benefit analysis of a major scheme requires all the costs to be considered for the whole of the appraisal period and they need to be expressed on a like-for-like basis with the benefits. This basis is termed Present Value. Present Value is the value today (or at a set consistent date) of an amount of money in the future. In cost-benefit analysis, values in differing years are converted to a standard base year by the process of discounting giving a present value.
- 4.49 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.
- 4.50 The total Present Value of Cost (PVC) is made up of the following costs converted to present value:
- Investment costs – construction.
 - Investment costs – maintenance.
 - Changes to indirect tax revenues.
- 4.51 **Table 4-11** shows details of the PVC.

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

Present Value Costs (£m, 2002 prices and values)	Forecast	Outturn
Investment costs (Construction)	377.7	272.4
Maintenance costs	-23.9	
Indirect Tax Revenue	-40.5	-5.1
Total	313.3	243.3

- 4.52 It can be seen from **Table 4-11** that the outturn scheme present value costs are 22% lower than forecast costs. These values for the costs are used in the calculation of the Benefit Cost Ratio in **Table 4-12**.

Benefit to Cost Ratio (BCR)

- 4.53 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.
- 4.54 Schemes with a BCR greater than one have greater benefits than costs; hence they have a positive Net Present Value (NPV). The higher the BCR, the greater the benefits relative to the costs.
- 4.55 At the time of scheme appraisal, Treasury guidance was to include indirect tax as a cost. However, the most recent guidance on indirect tax impacts is to include these as a benefit, rather than a change in cost. This means that when a scheme leads to increase in fuel consumption and hence an increase in tax revenue, the PVB is increased rather than the PVC being decreased. **Table 4-12** below presents the BCR for both calculation approaches.

Table 4-12 – Predicted vs. Reforecast BCR

All costs in £m 2002 prices and values	Indirect Tax as Cost		Indirect Tax as Benefit	
	Forecast	Outturn	Forecast	Outturn
PVB	686.7	341.8	727.1	346.9
PVC	313.3	243.3	353.7	248.4
NPV	373.4	98.7	373.4	98.5
BCR	2.2	1.4	2.1	1.4

- 4.56 **Table 4-12** shows that the outturn BCR is lower than forecast largely due to the benefits being significantly lower than forecast, and as shown previously in **Table 4-8**, this is mainly due to lower than forecast journey time benefits.
- 4.57 It should be noted that the BCR ignores non-monetised impacts. In 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

- 4.58 The AST (**Table 7-1**) for this scheme stated that ‘*The assessment of the transport spin-off benefits suggests the widening of the M25 in Section 4 would not have a significant impact on job creation. The calculated value of -74 is insignificant within the context of the current job climate in the Thames Gateway Region*’. The forecast impact of the scheme was ‘Neutral’.
- 4.59 The EAR for this scheme states that an EIR (Economic Impact Report) had been prepared as since the southern end of the scheme lies within the Thames Gateway regeneration area. With Thames Gateway being by far the largest such regeneration area in South East England and considering the impracticality to assess in accordance with the WebTAG guidance, the effect on the whole of the regeneration area was not assessed. The study concentrated on areas like Belhus that were within a few kilometres of the scheme. The resulting analysis concluded that the scheme was unlikely to have a direct beneficial effect on the employment prospects in the study area and could possibly result in generated new jobs being filled by people living in other areas, including elsewhere in the Thames Gateway.

Evaluation

- 4.60 A large proportion of the wider benefits come from the agglomeration and imperfect condition components (whereby changes to the transport system allow improved access to higher productivity areas for employment). These components are largely driven by the travel time and accessibility benefits of the scheme. Previous sections have shown that the scheme has led to increased capacity, improved journey times and reliability. This is likely to facilitate the wider economic benefits.
- 4.61 In the absence of a full evaluation into the possible wider impacts of the M25 junction 27 to 30 scheme, this evaluation is in agreement with the appraisal’s assessment of ‘neutral’.

Key Points - Economy

Present Value Benefits (PVB)

- The monetised journey time benefits are lower than forecast due to lower than expected increases in traffic and lower journey time savings. The outturn journey time benefits are 32% of the forecast of benefits.
- The appraisal predicted a collision disbenefit over the 60 year appraisal period. This disbenefit reduced the total benefits by 12%. The analysis performed at this OYA stage showed that there is no statistical evidence that the scheme has had an impact on safety within the COBA study area even though the number of collisions have reduced post opening. As such the monetised safety impact is reforecast to be zero.
- The disbenefit from carbon emissions is lower than forecast owing to the outturn traffic flows being lower than forecast.
- The outturn PVB is 47% of forecast. This is largely as a result of the journey time benefits being lower than forecast.

Scheme Costs

- The outturn investment cost was 28% lower than forecast.
- The outturn impact on indirect tax is lower than forecast due to lower traffic growth than was expected during appraisal.
- The outturn PVC of £243.3m is higher than the forecast PVC of £313.3m. This is due to the indirect tax revenues (a negative cost) being lower than forecast.

Benefit Cost Ratio (BCR)

- Taking the indirect tax impact as part of the costs, the scheme achieves a BCR of 1.4 compared against a forecast value of 2.2. This is almost identical when indirect tax is treated part of the benefits.
- The outturn BCR is lower than forecast due to a lower than forecast PVB..

Wider Economic Impacts

- The scheme is likely to facilitate wider economic benefits through increased capacity, improved journey times and reliability. However, in the absence of a full evaluation into the possible wider impacts of the M25 junction 27 to 30 scheme, this evaluation is in agreement with the appraisal's assessment of 'neutral'.

5. Environment

Introduction

- 5.1 For each of the environmental sub-objectives, the evaluation in this chapter assesses the environmental impacts predicted in the scheme's AST and Environmental Statement (ES) against those observed one year after opening.
- 5.2 The ES notes that the objectives for the scheme are:
- to deliver the trunk road improvements accepted by the Secretary of State following the recommendations of the Orbit Multi-Modal Study⁹
 - to improve journey time reliability and safety on the M25
 - to ensure no worsening of the Appraisal Summary Table (AST) sub-criteria assessment results and improve on them where possible.
- 5.3 In the context of the AST and ES predictions and using evidence collected one year after opening, this chapter presents:
- A record of any significant changes to the scheme that have taken place since the ES.
 - An evaluation of the effectiveness of the mitigation measures implemented as part of the scheme.
 - A summary of key impacts against all of the ten environmental WebTAG sub-objectives.

Data Collection

- 5.4 The following documents/ data concerned with Section 4 as a whole have been used in the compilation of this environmental chapter of the OYA report:
- Appraisal Summary Table (October 2007).
 - M25 Joint Venture Section 4 Appraisal Summary Table Report¹⁰ (August 2007).
 - M25 Widening Section 4 (Junctions 27 to 30) Environmental Statement, including Volume 1 and sub-objective Technical Reports and Figures (November 2007).
 - Partial, i.e. incomplete, 'As Built' Section 4 Environmental Masterplan drawings (October 2010).
 - Sections 4A and 4B Landscape & Ecology Monitoring Plan, 1st Annual Report (February 2012).
 - Section 4 Environmental Statement Comparison Report¹¹ (June 2012).
 - Sections 4A and 4B Landscape & Ecology Monitoring Plan, 6-Monthly Establishment and Maintenance Report (July 2012).
 - Junction 27-30 Annual Landscape & Ecology Monitoring Report (December 2012).
 - Archaeological Discoveries on the M25 Junctions 27 to 30 (Highways Agency, 2013).
 - DRAFT M25 Widening Section 4 Junctions 27-30 Handover Environmental Management plan (HEMP).
 - Highways Agency newsletters and web based scheme information.
- 5.5 A list of the background information specifically requested and received to help with the compilation of this report is included in **Appendix C**. This appendix also includes a list of additional documents obtained and used for each of the sub sections.

⁹ London Orbital Multi-Modal Study – The aim of the ORBIT MMS was to develop a long term multi-modal strategy for the sustainable management of the M25 orbital motorway and more generally for the transport corridor around London

¹⁰ Report containing both the AST and supporting assessment worksheets

¹¹ Comparison of the ES Environmental Scheme Plans to the As-built design, noting design changes originating either from design development or from addressing on-site constraints found during construction.

Alternative Design Proposals and Design Development Changes

- 5.6 During design development, alternative design proposals were assessed for approval. Several alternative proposals relating to Earthworks and Land Take, Structural Amendments and Retained Vegetation and Proposed Planting were made due to changes throughout the design process, originating either from design development or from addressing on-site constraints found during construction. Some of these alternative design proposals utilised private land outside the highway boundary. The purchase of the land was subject to General Permitted Development Orders.
- 5.7 Alternative Design Proposals which were built (and detailed further in the relevant sub-objective section) included;
- Minor changes to lane/ hard shoulder alignments.
 - Changes to retaining wall solutions.
 - Positions and gradients of embankments and cuttings.
 - Changes to lane surfacing.
 - Two additional environmental bunds (Passingford and Upminster Bunds)

Updated Environment AST report

- 5.8 An updated AST report (ASTR) was undertaken during the Construction stage to confirm that no worsening to the AST score had resulted from changes undertaken. POPE usually compares against the AST which is completed prior to the start of construction. The ASTR relates more closely to what was actually built, however as it was not produced until during construction, it has been decided to present both here. Conclusions reached in this AST have been included within each Environmental topic.

Site Visit

- 5.9 As part of the OYA evaluation, two site visits were undertaken; one in mid-August, and one in early-October 2013. These visits included the taking of photographs to provide comparison with material produced for the ES (**Appendix D**).

Consultation

- 5.10 Statutory environmental organisations, stakeholders, Borough and District councils and relevant organisations that were consulted prior to the final publication of the ES were contacted as part of the OYA evaluation regarding their views on the impacts they perceive the scheme has had on the environment as shown in **Table 5-1**, below. A number of consultees contacted did not provide feedback. A table of those contacted is included in **Appendix C**, Table D2.

Table 5-1 – Summary of Environmental Consultation Responses

Organisation	Field of Interest	Comments at FYA
Natural England	Biodiversity & Landscape	Considers the impacts and mitigation to have been broadly as expected.
English Heritage	Heritage	Did not respond to the invitation to provide feedback.
Environment Agency	Water	<ul style="list-style-type: none"> • Satisfied that the development would not have an adverse impact on local watercourses, floodplains or the groundwater/ aquifer. • Found the Joint Venture environment team to be very competent, maintaining strong environmental controls to minimise environmental risks from the works. • Noted that in some cases, such as the pollution control measures, the measures are an improvement on the previous controls. • Stated that scheme design and assessment ensured that receiving watercourses could accommodate any increase in pollutant load without adversely affecting the status/quality of watercourses.
Epping Forest District Council	General	Declined the invitation to provide feedback.

Animal Mortality

- 5.11 The Managing Agent has also been consulted with regard to animal mortality figures which have been made available for the M25 route corridor between Junction 27 and Junction 30 for the approximate 4 year period from September 2009 to Jan 2014 inclusive. These figures are discussed in the biodiversity chapter.

Awards

- 5.12 The M25 widening project involved the widening of the motorway from 3 to 4 lanes with a hard shoulder in both directions of the M25 between junctions 16-23 and 27-30, and the widening and refurbishment of the 1.1 km long Hatfield Tunnel.
- 5.13 The Environmental section of the Project Newsletter for Junctions 27-30 (January 2012) noted that the M25 widening project was awarded a Bronze Green Apple Award in 2011 in recognition of the environmental protection activities that had taken place to that date.
- 5.14 The Green Apple Awards are organised by the Green Organisation, an independent, not-for-profit environmental group dedicated to recognising, rewarding and promoting environmental best practice around the world, and awards are presented annually in recognition of companies, councils and communities carrying out projects that enhance the environment.

Traffic Forecast Evaluation

- 5.15 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.
- 5.16 The ES outlined the need for the scheme and included data on the Annual Average Daily Totals (AADT) for traffic flows. In order to provide a context for the following review and evaluation of environmental topics, the key findings in terms of 2-way AADT for traffic flows between Junction 27 and Junction 30 for the opening year (2012) as predicted by the ES are summarised as follows:
- The difference between the Do-Minimum and Do-Something scenarios was less than 6%.
 - The difference between the Do-Something High and Low Growth scenarios was less than 1%.

Noise

Forecast

AST

- 5.21 The AST stated that 213 properties had been considered and that 7 of these would experience an increase of 1-3 dB(A)*, 160 would experience a decrease of 1-3 dB(A), 6 would experience a decrease of 3-5 dB(A), and that 40 would have no change in noise levels in the year 2027 due to Low Noise Surfacing (LNS). Overall, the AST assessed that eight more people would be annoyed by noise as a result of the scheme.

Updated AST

- 5.22 The M25 DBFO-JV Section 4 Appraisal Summary Table Report (ASTR) noted that a new entry for the AST had been prepared for the scheme. This was based on the detail design and included additional noise modelling and noted that the new assessments could not be directly compared with those in the previous AST as several differences were noted** in the previous AST that did not fit with the assumptions and the ES data used.
- 5.23 The overall impact of the scheme with regard to operational road traffic noise and vibration was deemed to be **Slight Beneficial/ Neutral** by the ASTR, mainly as a result of the reduction in noise levels due to the LNS being laid as part of the scheme. However in locations along the motorway where the LNS already existed opposite 7 No. properties, the operational scheme was deemed to have a **slight adverse** impact, although no mitigation was recommended to address this.
- 5.24 The ASTR also stated that the LNS for the scheme on the clockwise carriageway had not changed from the time of the ES, but noted that surfacing on the anti-clockwise carriageway extended by approximately 2km over that which was originally modelled; the ASTR confirmed that this had been accounted for in the revised modelling.
- 5.25 Alternative design proposal reports were submitted and approved for two new environmental bunds which have the potential to affect the local noise climate at Passingford, clockwise, and at Upminster, anti-clockwise). The ASTR noted that these bunds were not considered by the ES.

Environment Statement

- 5.26 The ES stated that sensitive locations were not expected to be affected by the Scheme, the Traffic Noise and Vibration Technical Report (TR) stating that 213 properties distributed between 85 receptors had been considered for assessment.
- 5.27 No mitigation measures were considered, as only one property was identified that would potentially qualify under the provisions of the Noise Insulation Regulations (1975), and only one property was predicted to be affected by vibration.
- 5.28 The Technical Report concluded that the overall impact of the scheme with regard to road traffic noise and vibration impacts would be **Slight Beneficial** as a result of the LNS. However, 7 properties located where the LNS was already in place were expected to experience a **Slight Adverse** impact as a result of predicted minor increases in traffic flows due to the scheme.

Consultation

- 5.29 No responses to consultation requests were received.

* A-weighted noise level. Although the unit of measurement used for sound pressure levels and noise levels are usually quoted in decibels (dB), the human ear is less sensitive at low and high frequencies. The A-weighting is therefore applied to measured sound pressure levels so that these levels correspond more closely to the subjective response, and is expressed in dB(A).

** The number of properties was inconsistent, and noise banding was based on exceedence levels (L_{A10}) rather than the equivalent continuous noise level (L_{Aeq}) using the TAG correction factor of -2.5dB.

Evaluation

- 5.30 The ASTR concluded that the distribution of noise changes had been altered as a result of the design changes, but that there had been no significant changes to the AST conclusions as a result of the design changes; changes to the AST scores were considered to be as a result of providing a more detailed model with more accurate locations.
- 5.31 The design changes from the ES have been reviewed by a combination of desk studies and site visits, and there is no reason to suppose that the ASTR assessment of the design changes should not be considered by POPE to be a valid reflection of the situation on site.
- 5.32 Regarding environmental bunds, it should be noted that they are not necessarily effective as noise barriers unless they have been specifically designed for that purpose; the ASTR confirmed that the bunds at Passingford and Upminster were not identified in the ES and had not been designed with noise mitigation in mind and as such, were unlikely to have any significant effect on the noise climate of the scheme at these locations.
- 5.33 The site visits confirmed that both clockwise and anti-clockwise anti-noise barriers at Nags Head Lane have been replaced as proposed by the ES Illustrative Masterplan (see **Figure 5-2** below), the clockwise barrier with one of greater height (right hand side of **Figure 5-2**); an additional noise barrier to those reported in the ES has also been installed between J30-29 anti-clockwise (see **Figure 5-3** also below), and this is expected to improve the noise climate at this location.

Figure 5-2 – Noise barriers that have been replaced at Nags Head Lane



Figure 5-3 – the additional noise barrier not reported in the ES



- 5.34 An assumption is made by POPE methodology that noise levels will be as expected if observed traffic flows are within 25% more or 20% less than predicted; as can be seen by the comparison of both the predicted and observed AADT flows in **Table 5-2** above, the data indicates that the observed 2-way AADT Traffic Flows are between 3% and 15% lower than forecast at all locations and as such, these figures are within the tolerances prescribed by POPE.
- 5.35 Based on the information presented in this evaluation, it is therefore concluded that the effects of the scheme are as expected in terms of noise.

Table 5-3 – Evaluation Summary: Noise

Origin of Assessment	Summary of Effects on Noise	Assessment
AST	213 properties have been considered. 7 properties would have an increase of 1-3 dB(A), 160 properties would have a decrease of 1-3dB(A), 6 properties would have decrease of 3-5dB(A) & 40 properties would have no change in noise levels in the year 2027 due to low noise surfacing.	Total people annoyed: DM = 443, DS = 451, Scheme annoys 8 more people
EST	Observed 2-way AADT Traffic Flows are between 3% and 15% lower than forecast at all locations.	As expected

Local Air Quality

Forecast

AST

- 5.36 The AST stated that the scheme would have a **low adverse** impact overall, due to relatively low increases in traffic flows/ speeds and the low number of properties within 50m of the scheme. All Air Quality objectives were expected to be achieved both with and without the scheme in the opening year (2012), and in subsequent years. The majority of properties affected by the scheme were stated to be on the Brentwood bypass, where the increase in pollutant concentration would be marginal at an average of 0.01ug/m³ for Nitrogen dioxide (NO₂)^{***}. Air Quality objectives were also predicted to be met in all 9 Air Quality Management Areas in 2012.
- 5.37 Overall, the AST assessed that in terms of changes in NO₂ concentrations, 1,118 properties would experience a degree of deterioration and in terms of changes in Particulate Matter (PM₁₀) concentrations, 170 properties would experience improvement, 134 would experience deterioration, and 841 would experience no change as a result of the scheme.

Updated AST

- 5.38 The ASTR confirmed that during the development of the scheme from the indicative design included in the ES, there had been no change to the predicted parameters modelled for the opening year of 2012 for the Do-Minimum and Do-Something scenarios. A number of changes to road width and embankment design had been made but no changes to road width were identified that would affect residential properties particularly sensitive to air quality (i.e. those located within 50m of the existing motorway carriageway).
- 5.39 The ASTR reported that the final design changes would be insignificant in the context of air quality responsiveness and the available assessment techniques. No design changes resulted in a road alignment change of over 5 metres, the change criteria reported in HA207/ 07 Clause 3.12 which triggers the requirement for warranting air quality calculations.
- 5.40 Overall, the ASTR concluded that there was no evidence that changes to the final design would have any impact on traffic activity.

Environmental Statement

- 5.41 The ES noted that an assessment of the potential construction dust impacts had been undertaken and a medium risk score had been assigned to the Scheme. Appropriate mitigation measures had also been proposed, the implementation of which were expected to minimise the effects of the Scheme in terms of construction dust.
- 5.42 The ES also assessed the Scheme at local, general and regional levels:
- Localised Air Quality Assessment: This assessment predicted that within the baseline year (2004), the NO₂ annual mean air quality objective would be exceeded at 13 residential properties and the PM₁₀ daily mean air quality objective would be exceeded at 11 properties. By the opening year (2012) however, pollutant concentrations were predicted to decrease to within the relevant air quality objectives (EU limit value) either with or without the Scheme in operation. Concentrations of all other pollutants were considered to be well within their respective objectives in the baseline year, and were predicted to decline further by the opening year. The opening year was predicted to be the worst case for localised air quality;

*** The concentration of an air pollutant is given in micrograms (one-millionth of a gram) per cubic metre of air: µg/m³

- General Air Quality Assessment: An overall deterioration in air quality with respect to NO₂ and PM₁₀ was predicted as a result of the Scheme. This deterioration was stated as being due to an increase in traffic emissions resulting from the predicted increase in traffic speeds and volumes along the M25; and
- Regional Air Quality Assessment: This assessment predicted that there would be an overall increase in all emissions during the opening year, but noted that there were no standards against which to evaluate these effects. The assessment also showed that the total emission of pollutants would increase by up to 10% with the operation of the Scheme when compared with the Do-Minimum scenario.

Consultation

5.43 No responses to consultation requests were received.

Evaluation

5.44 The ASTR concluded that the AST remains a valid reflection of the final design; no information has been received by POPE to suggest that the ASTR assessments of the design changes are anything other than valid.

5.45 An assumption is made by POPE methodology that local air quality will be as expected if observed traffic flows are within 10% more or 10% less than predicted; as can be seen by the comparison of both the predicted and observed AADT flows in **Table 5-2** above, the data indicates that the observed 2-way AADT Traffic Flows are:

- 3% lower than forecast between Junctions 27-28.
- 12% and 15% lower than forecast between Junctions 28-29 and Junctions 29-30 respectively.

5.46 Where the tolerances assumed by POPE are exceeded; in terms of the shortfall between the absolute number of vehicles and the predicted figures, traffic flows between Junctions 28-29 and Junctions 29-30 are less than predicted by 15,500 and 19,900 AADT respectively and being greater than 1,000 AADT, the percentage differences at these locations are considered to be significant.

5.47 Based on the information presented in this evaluation, it is therefore concluded that the effects of the scheme in terms of local air quality are as expected between Junctions 27-28, and better than expected between Junctions 28-30.

Table 5-4 – Evaluation Summary: Local Air Quality

Origin of Assessment	Summary of Effects on Air Quality	Assessment
AST	Scheme has overall low adverse impact due to relatively low increases in traffic flows & speeds & low number of properties within 50m of Scheme. All AQ Strategy objectives expected to be achieved with & without the Scheme in opening year (2012) & subsequent years. The majority of properties affected by the Scheme are on the Brentwood bypass, where increase in pollutant concentration is marginal (<0.01ug/m ³ average for NO ₂). AQ objectives are met in all 9 AQMAs in 2012.	PM ₁₀ = 4.93 NO ₂ = 19.82
EST	Observed 2-way AADT Traffic Flows are 3% lower than forecast between Junctions 27-28. Observed 2-way AADT Traffic Flows are 12% and 15% lower than forecast between Junctions 28-29 and Junctions 29-30 respectively. The absolute number of vehicles is less than predicted by 15,500 and 19,900 AADT at each respective location and as the shortfall in both these figures is greater than 1,000 AADT, the percentage differences are considered to be significant.	As expected between Junctions 27-28 Better than expected between Junctions 28-30

Greenhouse Gases

- 5.48 The assessment of the impacts of transport schemes on emissions of greenhouse gases is one of the environment sub-objectives. WebTAG notes that carbon dioxide (CO₂) is considered the most important greenhouse gas which is therefore used as the key indicator for the purposes of assessing the impacts of transport options on climate change. Changes in CO₂ levels are expressed in terms of equivalent tonnes of carbon released as a result of the scheme.

Forecast

- 5.49 The AST stated that ‘the Scheme results in net increase in carbon emissions over the 60 year appraisal period, compared to the Do-Minimum scenario due to more vehicles’. The increase was forecast to be less than 0.03%. Net Carbon emissions over the 60 year appraisal period were estimated to be 142,894 tonnes and in the opening year this was forecast to be 1,783 tonnes.
- 5.50 The methodology used in the ES for regional air quality assessment is DMRB via its Screening Method spreadsheet, for calculating the impact of the scheme on emissions of pollutants of importance to transboundary and global impacts. The assessment calculates the total emission of carbon monoxide, nitrogen oxides, total hydrocarbons, particulate matter and carbon dioxide (as Carbon) from all roads within the regional study area.
- 5.51 The inputs required in the assessment are traffic data as annual average flows, speeds, fleet mix and the road length for each road in the study area. Emissions were calculated for the Do-Minimum and Do-Something scenarios for the Opening year (2012) and Design year (2027) compared to base year (2004).

Evaluation

- 5.52 For this study it is not possible to analyse carbon emissions for such a large geographical area. Rather, an analysis of emissions from vehicles using the M25 scheme section has been undertaken. In order to undertake this analysis, current Design Manual for Roads and Bridges (DMRB) guidance has been used to re-forecast carbon emissions for the DM and DS scenarios, using data contained in the Traffic Forecasting Report. Observed carbon emissions were calculated using the same methodology for the DM and DS scenarios, using flow and speed data collected for this study. As the same geographic area has been modelled for the forecast and observed scenarios, a clear comparison can be made between the data outputs. Reforecast and outturn carbon emissions are provided in **Table 5-5**.

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

	Reforecast	Observed
Do Minimum /Counterfactual(based on before)	159,104	123,917
Do-Something/ Post opening	171,607	125,646
Net Difference	12,503 (8%)	1,728 (1%)

- 5.53 It can be seen from **Table 5-5** that the outturn carbon emissions along the scheme section is less than the forecast emissions. The difference between forecast and outturn net emissions as a result of the scheme is 10,775. The observed proportionate increase in emission as a result of the scheme is 1% whereas the forecast value is 8%. This difference is primarily due to the fact that the forecasts assumed higher traffic growth along the scheme section, whereas in the observed the traffic growth is marginal at the beginning of the scheme section while the section between J29 and J30 has seen a reduction in traffic since scheme opening compared to pre scheme. The observed increased in speed is smaller compared to the predicted impact on speed.
- 5.54 Therefore it can be concluded that whilst the scheme has led to an increase in carbon emissions from vehicles travelling on the M25 scheme section, this net increase is not as high as expected.

Table 5-6 –Summary of Greenhouse Gases Evaluation

Sub-Objective	AST Score	OYA Evaluation
Greenhouse Gases	Carbon Emissions change (tonnes) 60 year = 142,894, Opening yr = 1,783 Net Present Value of Emissions (60 yrs) = - £4.944m	Better than expected

Landscape and Townscape

Landscape

Forecast

AST

- 5.55 The AST stated that for the scheme, landscape values ranged from ordinary-good (J27-28) to poor-good (J28-29), and poor-ordinary (J29-30). Loss of screening and increased surfacing, earthworks, gantries and structures were all stated to have a negative impact on the landscape and although the number of lighting columns would increase, there would be better light spillage control. Overall, the AST assessed the impact of the scheme as **Slight Adverse**.

Updated AST

- 5.56 The Environmental Statement Comparison Report (ESCR) prepared with the ASTR compared the ES Environmental Scheme Plans (ESPs) to the As-built design, noting that design changes originated either from design development or from addressing on-site constraints found during construction. The majority of design changes to the landscape proposals were considered to have either a **neutral** or **beneficial** impact, whilst 2 changes were considered to be **adverse**.
- 5.57 The As-built Responses to the ES commitments have been reviewed by a combination of desk studies and site visits, and the ESCR’s assessment of the design changes are considered by POPE to be a valid reflection of the situation on site.
- 5.58 The ESCR concluded that due to the large areas that have been constructed using strip widening in land outside the original HA boundary and the additional planting provided in many locations where detail design has threatened the achievement of ES commitments, opportunities for planting have generally been increased above the ES commitment.

Table 5-7 – ESCR Landscape and Visual Impact Assessment Summary

Landscape and Visual Impact Assessment	Design Changes
No Change, No Material Change, or Neutral Assessment	25
Beneficial change	15
Adverse change	6

Environmental Statement

- 5.59 The ES predicted that the landscape impacts would essentially be confined to the existing motorway corridor, and would generally result from the loss of vegetation within the highway boundary and the introduction of new elements that would include verge mounted lighting and gantries, associated feeder pillars, retaining walls and associated pedestrian guard fencing. It was noted that the baseline landscape evaluation paid particular regard to the establishing Thames Chase Community Forest, extending throughout the southern part of the study area.

Landscape Impacts

- 5.60 The ES considered the following potential landscape impacts:

- Permanent loss of some landscape elements/features.
- Permanent loss of some vegetation.
- Increase in road infrastructure including signage, gantries and lighting and retaining features.
- The creation of new landscape elements and new planting.

5.61 The potential impacts on the Primary Landscape Character Areas were predicted to range from **Moderate / Slight Adverse** in areas of Good landscape, to **Slight Adverse** in Ordinary landscape and **Slight Adverse / Neutral** in areas of Poor landscape.

5.62 The ES also predicted that overall landscape impacts would generally tend to reduce to **Slight Adverse / Neutral** with the maturing of the proposed Scheme planting.

Visual Effects

5.63 The ES noted that the M25 broadly crosses undulating ground in a wide sweeping curve across several ridges and valleys which open up wide arcs of views to and from the motorway where it follows higher ground or cuts through ridgelines, further noting that screening had not been achieved (in 2007) where the road crosses valleys on embankment. The ES also noted that although the settlement pattern is quite dispersed and relatively few properties lay in close proximity to the motorway, an extensive rights of way network and some golf courses/ open spaces were in close proximity to the motorway.

5.64 The ES stated that main causes of intrusion upon existing views and impingement upon visual amenity would arise from the loss of existing screen vegetation and the introduction of verge mounted lighting, additional signage, gantries, retaining walls and associated fencing.

5.65 The visual effects were predicted by the ES to adversely affect the visual amenity of a number of receptors, with most local roads, Public Rights of Way, leisure facilities and properties with views of the existing motorway being subject to a change in degree of visual impact likely to range from **Moderate Adverse** to **No Change** at opening. Overall, the visual effects were expected to reduce generally, but remain **Slight Adverse** by Year 15 due to the loss of existing screening vegetation and the introduction of verge mounted lighting, additional signage/ gantries, and retaining walls with associated fencing.

Night Time Effects

5.66 The ES considered that the new lighting would represent an improvement over the existing situation because of the better control of light spillage, although considered that this benefit would be offset by the increased height of the lighting columns and the double row effect resulting from verge mounting. On balance, the night effect of the lighting was considered to be **No Change**.

5.67 With regard to illuminated road signs, it was considered that the effects would be **Slight Adverse / Neutral** on opening and with regard to gantries, it was considered that these would give rise to a **Slight Adverse** effect.

5.68 Overall, the ES considered that the night time effects of the Scheme would be **Slight Adverse** on opening, and considered it unlikely that these effects would reduce by Year 15.

Consultation

5.69 Natural England considers the landscape impacts and mitigation to have been broadly as expected.

Evaluation

5.70 The design changes have been reviewed by a combination of desk studies and site visits, and it is considered by POPE that there is no reason to consider the ESCR assessment of the As-built Responses to be anything other than a valid reflection of the situation on site.

5.71 Where landscape and visual impacts of the proposals were identified in the ES, a number of mitigation measures were proposed with the aim of reducing the significance of adverse impacts; adding visual interest and local distinctiveness; minimising visual intrusion; integrating

the proposals into the landscape setting; promoting and protecting habitats; and developing a distinctive, yet cohesive landscape design for the scheme.

- 5.72 Specific landscape mitigation measures outlined by the ES included:
- New and replacement planting within the motorway boundary.
 - Reinforcement and enhancement planting to retained woodland, grassland areas, and environmental barriers.
 - Meeting the primary objective of establishing and maintaining vegetative cover over earthwork and soft structural solutions, and behind hard structural solutions.
 - Keeping vegetation loss to a minimum where possible, including vegetation making a significant positive contribution to landscape quality/ screening and with significant value in terms of biodiversity.
 - Planting and seeding with species appropriate to the local character and to enhance biodiversity value.
 - Implementing management regimes which would ensure effective establishment and maintenance of landscape mitigation measures and existing and new habitats.
- 5.73 Comparison views with ES photomontages are shown in **Appendix D**.

Landscape and Visual Assessment of Gantry Amendments

- 5.74 The gantry proposals in the ES were reviewed in detail during the detailed design phase of the contract and changes which would result in improvements in driver information, buildability, value for money and ease of maintenance were proposed.
- 5.75 As a result of this review, the numbers of gantry and MS3 structures were reduced, although the scheme incorporates a greater number of gantries that span across both carriageways. These revised proposals were reviewed further during the detailed design phase by a Landscape Architect to establish whether there would be any significant changes to the environmental impact of the gantry proposals as set out in the ES. Adjustments were made to the position of gantries where adverse effects were identified and intervisibility and spacing requirements permitted.
- 5.76 The review resulted in recommendations to keep new locations as far into cuttings as possible, and as far away from the more exposed embankment areas as possible. Regarding embankments however, it was accepted that no matter how exposed, gantries would have to be sited somewhere within longer lengths of embankments. Therefore, rather than declare any 'no-go' areas as part of the initial assessment, it was decided to prepare a schedule of recommended locations and a series of principles to be adopted. These locations, and principles behind them, such as locating gantries adjacent to areas of off-site woodland, were applied to the overall gantry optimisation process.
- 5.77 The overall assessment of the review was **slight adverse**, and included mitigation implemented as detailed in the landscape design. The landscape and visual assessments of the 20 gantry changes considered to have led to adverse effects. Having been reviewed by a combination of desk studies and site visits, the assessments are considered by POPE to be a valid reflection of the situation on site.

Table 5-8 – Gantry Assessment Summary

Landscape and Visual Impact Assessment	No. of Gantries
No Change, No Material Change, or Neutral Assessment	20
Beneficial change	11
Adverse change	20

Implementation of Planting Proposals

- 5.78 The ES mitigation proposals in relation to new grassland were stipulated and involved the creation of new and diverse species rich grasslands and development of scrub to provide reptile and other species habitats. These requirements were stated in the ESCR as having been met throughout the scheme by the creation of thousands of square metres of species rich grasslands and tussock forming grasslands, in addition to scrub planting and scrub development/ management proposals.
- 5.79 The creation of grassland/ scrubland referred to by the ESCR was confirmed during the OYA site visits, which also observed that as a result of design changes, some of the additional land-take now supports planting intended to re-establish physical connections between disparate blocks of woodland which, in conjunction with the extent of the new planting associated with strip-widening, is considered likely to have a beneficial effect on the broader landscape. Elsewhere, the tree and shrub planting/ grassland plots comprising the landscape mitigation measures generally appear to have been implemented in line with the ESPs as expected.

Landscape Management and Maintenance

- 5.80 The 2012 annual Landscape and Environmental Management Plan (LEMP) reported that no evidence of management of grassland swards or injurious weeds was noted other than near structures where contractors had been strimming for access/ visibility purposes; this was considered as having resulted in levels of injurious/ other weed cover that was preventing the species rich and tussocky swards from developing, and inhibiting the establishment of the herbs in these mixes. The 2012 LEMP also reported that in some cases, the swards were so well developed that cutting would be required to reduce the cover of grasses to allow herbs to flower.
- 5.81 Percentage tree and shrub cover was reported by the 2012 LEMP to generally range between 5-10%. Some plots were noted as achieving 15% cover, although these were recorded as being mainly hedgerows with tree species. It was further noted that "*little, if any, maintenance has been undertaken*" and that throughout the vast majority of plots, excessive weed competition was a problem; the overriding actions required to remedy this situation were stated as being the replacement of dead and defective plants, and maintenance work to control weed growth.
- 5.82 The 2012 LEMP also noted that the previous LEMP had recommended that Standard trees be double-tubed to discourage the local deer population from stripping the bark, noting that in 2012, this had not been carried out and the trees in question were badly damaged. Deer damage was also noted to be occurring throughout other areas of the scheme, and was considered likely to prejudice the achievement of targets.
- 5.83 Generally the scheme was considered by the 2012 LEMP "*to be in a poor state*", the maintenance levels specifically stated as not meeting those as specified in the Series 3000 Appendices (Landscape & Ecology). As it was considered evident that the establishment targets were unlikely to be met, the 2012 LEMP noted that an action plan describing the remedial works which would be carried out to try to address the situation was to be produced by the commencement of the 2013 growing season; it is unknown by POPE whether this action plan has been produced and as such, these remedial works have not been assessed at this time.

Establishment and Condition of Grasslands at OYA (Aug/ Oct 2013)

- 5.84 The 2012 LEMP confirmed the species mixes of the implemented grassland areas, referring to the Series 3000 Appendices (Landscape & Ecology) documentation which specified the seed mixes to be used in areas of new grasslands, wildflower grassland, proposed reptile and amphibian habitat and proposed planting plots. The establishment target percentages of cover of the new grasslands at Year 5 were stated by the 2012 LEMP as being greater than or equal to 95% cover, with less than 10% weed cover and less than 5% scrub cover.
- 5.85 In terms of establishment and condition at the time of the OYA site visit, all grassland plots had generally attained 100% cover, although injurious/ other weeds comprising between c.35-80% of the total cover was observed in most plots. Grassland herbs were broadly present where

expected, but generally appeared to be poorly represented and scattered through the plots at a low frequency.

- 5.86 Going by the definition of the measurement of weed cover as stated by the LEMP, the plots can certainly be assumed to be falling short of attaining their target percentages by Year 5 and illustrate the typical conditions of the grassland plots at the time of the OYA site visit.

Establishment and Condition of Trees, Shrubs, and Hedgerows at OYA (August - October 2013)

- 5.87 As far as could be ascertained at OYA, plant species appear to be broadly as specified and set out as per the Planting Schedules; plant shelters generally remain in place throughout planted areas, and sheet mulch is evident along hedgerows as specified in the Series 3000 Appendices (Landscape & Ecology). No evidence of the double-tubing of standard trees as recommended and noted by the LEMP's was observed during the OYA site visits.
- 5.88 The measurement of cover is stated by the 2012 LEMP to be a combination of the density of planting and the number of woody species healthy at any one time. If all plants are healthy and planted to the correct density, then the plot will assumed to be on course to attain the target percentage cover at Year 5. Although the percentage cover will be low in the early years of establishment, this measure will increase as trees and shrubs establish.
- 5.89 In terms of establishment and condition at the time of the OYA site visits, although the plants appeared to be planted at the expected densities throughout the representative sample of plots accessed during the site visits, excessive weed growth was observed and is considered likely responsible for the observed plant stock failures and stunted nature of the surviving plant stock.
- 5.90 Going by the definition of the measurement of cover as stated by the LEMP, the plots can certainly be assumed to be falling short of attaining their target percentages by Year 5, and confirmed as such at the time of the OYA site visit.

Overall Evaluation of Planting

- 5.91 The OYA site visits to evaluate the ongoing establishment of the planting found that in terms of weeds, the situation on-site was not dissimilar to that as reported by the LEMP in 2012, specifically that:
- The soft estate is now becoming a health and safety hazard due to the extent and height of weed growth which is covering such things as flattened signs and scaffold tubes etc, and is considered to present an unacceptable risk in relation to accessing selected planting plots.
 - Where planting plots are able to be accessed safely, the density of weeds at the time of the OYA site visits continues to make the identification of planted stock almost impossible.
 - The abundance of weeds and subsequent competition for resources in almost all plots has meant that the majority of the planted plots have likely not established and progressed as well as would have been reasonably expected at OYA.
- 5.92 Although many plots were unable to be assessed properly during the site visits, the following photographs are generally illustrative of the excessive weed growth observed within the representative sample of planting plots that were able to be accessed during the site visits.

Figure 5-4 – Significant Percentages of Weed Cover within Grassland Areas



Figure 5-5 – Tree and Shrub Planting Suffering the Effects of Resource Competition as a result of excessive weed growth



Figure 5-6 – Hedgerow Planting Suffering the Effects of Resource Competition as a result of excessive weed growth



Figure 5-7 – Plant Stock Failure(left)



Figure 5-8 – Lack of Weed Control Resulting in Abundant Seed Set of Weeds (left and right)



- 5.93 The maintenance regime was specifically stated by the 2012 LEMP as not meeting that as specified in the Series 3000 Appendices (Landscape & Ecology) and the situation appears not to have materially changed at the time of the OYA site visits in 2013.
- 5.94 Overall, little evidence of any recent vegetation management (other than the strimming of grassland swards for access/ visibility purposes near and around structures as illustrated by Figure 5-9 and Figure 5-10 below) was observed during the site visits, and similar conclusions

to those made by the 2012 LEMP are consequently drawn; “if maintenance is not corrected in the near future, there will be little chance of planting plots achieving their targets”.

Figure 5-9 – Vegetation Management Around Structures for Visibility Purposes



Figure 5-10 – Vegetation Management Around Structures for Access Purposes



Draft Handover Environmental Management Plan (HEMP)

- 5.95 The 2012 LEMP stated that before the end of the five-year Establishment Period, a Handover Environmental Management Plan (HEMP) was to be prepared. Although in draft status at the time of the OYA evaluation, the HEMP states that the detailed Landscape Design seeks to:
- Provide appropriate and effective screening and integration for the widened motorway;
 - To use native species and create habitats of potential value for wildlife wherever possible.
 - Generally provide a robust and attractive roadside environment.
- 5.96 The draft HEMP further states that the landscape and ecological proposals set out in the ES represent commitments by the Highways Agency (HA), and recognises the need for these commitments to be carried forward into the future, noting the general need to provide screen planting in the locations shown in the ES and the general commitment to provide for the future management of the landscape and ecological areas.
- 5.97 In light of the draft HEMP’s acknowledgement of the commitments made by the HA regarding the objectives of the detailed landscape design and the subsequent maintenance thereof, it is suggested that the establishment and maintenance of the landscape proposals should be considered further at FYA when the final version of the HEMP is available.

Visual Effects at Night

- 5.98 Although a full night time evaluation of the effects of the scheme has not been undertaken for this study, there is no information available to POPE that would suggest that the effects of the illuminated plate signs and the control of light spillage/ increased height of the lighting columns/ double row effect from resulting from verge mounted lighting is likely to be significantly different than as expected.
- 5.99 With regard to gantries, it is considered that adverse night time effects of the scheme are likely to have increased as a result of the gantry optimisation process, given the overall negative impact of gantry relocation and the increase in gantry size from single to super-span reported by the M25 DBFO-JV LVIA (day time) assessment of the scheme.

Landscape Summary

- 5.100 The design changes from the ES have been reviewed by a combination of desk studies and site visits, and the ASTR and ESCR assessments of the design changes are considered by POPE to be valid reflections of the situation on site.
- 5.101 Overall, the changes brought about by the final design, including clearance, geotechnical solutions, changes to proposed planting, gantry positions (including types and sizes), and off-site features, are evident along the length of the scheme. Some areas, for example where vegetation clearance has been reduced, will experience slightly beneficial effects, others slightly

- worse effects. Similar adverse and beneficial effects are considered to occur locally in relation to gantry re-positioning and re-design of the gantry structures.
- 5.102 Extended slope re-grades, ponds and bunds in the final design have led to net additional off-site land-take, with new land-take within existing open farmland or areas of scrub and young woodland. The new off-site plots are generally large compared with the on-site motorway verge plots and the reinstatement measures therein are considered to make a significant contribution to the landscape and environmental objectives of the scheme as a whole.
- 5.103 In places, some of the additional land-take supports planting that will assist in filtering and reducing views of the motorway and associated vehicular movement, and re-establishing physical connections between disparate blocks of woodland in the longer term. The extent of the new planting associated with strip-widening is considered to ultimately have benefits in relation to the motorway corridor as it sits within the broader landscape.
- 5.104 However, these beneficial effects of design changes are tempered by the adverse impacts of the gantry optimisation process; although gantries were optimised as far as possible in relation to landscape and visual impacts, the associated, optimised gantry mitigation planting has not offset the overall negative impact of the gantry relocations and the increase in gantry size from single-span to super-span.
- 5.105 Consequently, it is considered that the design changes have not materially changed the landscape or visual impact of the scheme as predicted by the ES, and the overall AST score would not be altered from **Slight Adverse** as a result of the design changes alone.
- 5.106 Other than the design changes noted above, landscape mitigation measures in the form planting proposals appear to have been broadly implemented as expected, and insofar as the primary landscape objective is stated in the ES as establishing and maintaining vegetative cover over earthworks, soft structural solutions, and behind hard structural solutions, it could be considered that the effects of the scheme on the landscape are **as expected**.
- 5.107 However, in terms of the objective of implementing management regimes which would ensure effective establishment and maintenance of landscape mitigation measures and existing and new habitats, the coverage, establishment, and condition of the plant stock at the time of the OYA site visits indicates that the environmental functions of the mitigation measures are not developing well and that unless the maintenance regime is corrected in the near future, it is unlikely that the planting plots will achieve their targets and consequently, their intended environmental functions by Design Year.
- 5.108 The landscape effects of the scheme are therefore considered to be **worse than expected** at OYA.

Table 5-9 – Evaluation Summary: Landscape

Origin of Assessment	Summary of Effects on Landscape Evaluation	Assessment
AST	The M25 landscape value ranges from ordinary-good (J27-28), poor-good (J28-29), poor-ordinary (J29-30). Loss of screening & increased surfacing, earthworks, gantries & structures all negatively impact on landscape. The no. of lighting columns would increase but with better spillage control.	Slight Adverse
EST	<p>The beneficial effects of design changes are tempered by the adverse impacts of the gantry optimisation process; although gantries were optimised as far as possible in relation to landscape and visual impacts, the mitigation planting has not offset the overall negative impact of the gantry relocations and the increase in gantry size from single-span to super-span.</p> <p>It is therefore considered that the design changes have not materially changed the landscape or visual impact of the scheme as predicted by the ES, and the overall AST score would not be altered from Slight Adverse as a result of the design changes alone.</p> <p>Other than the design changes noted above, landscape mitigation measures in the form planting proposals appear to have been broadly implemented as expected.</p> <p>In terms of implementing management regimes to ensure effective establishment and maintenance of the landscape mitigation measures, the coverage, establishment, and condition of the plant stock at the time of the site visits indicates that the environmental functions of the planting plots are not developing well and that unless the maintenance regime is corrected in the near future, it is unlikely that the planting plots will achieve their targets by Design Year.</p>	Worse than expected

Townscape

Forecast

AST

- 5.109 The AST stated that no Townscape features would be affected as settlements were well separated from the road, and that the impact of the scheme would be **Neutral** overall.

Updated AST

- 5.110 Although a number of changes originating either from design development or from addressing on-site constraints found on-site during construction have been made to the scheme design since the ES, no Townscape issues were identified in the scheme ADRs available to POPE.

Environmental Statement

- 5.111 Townscape assessment was scoped out of the ES by the AST and as such, no assessment was undertaken by the ES.

Consultation

- 5.112 No consultation responses were received relating to this topic.

Evaluation

- 5.113 No changes from the AST regarding Townscape were identified during the site visits, and settlements remain generally well separated from the road by embankments and vegetation; it is therefore considered unlikely that any townscape feature would have been affected by the widening scheme.
- 5.114 No further evaluation has been undertaken, as an assessment of Townscape was scoped out of the AST, there were no Townscape issues identified in the scheme ADRs, and no changes from the AST regarding Townscape were identified during the site visits.
- 5.115 It is therefore concluded that the effects of the scheme on Townscape are likely to remain neutral, **as expected**.

Table 5-10 – Evaluation Summary: Townscape

Origin of Assessment	Summary of Effects on Townscape	Assessment
AST	No Townscape features would be affected as settlements are well separated from the road.	Neutral
EST	No Townscape issues were identified in the alternative design reports, and no changes from the AST regarding Townscape were identified during the site visits.	As expected

Heritage

Forecast

AST

- 5.116 The AST stated that **slight adverse** impacts to 15 known archaeological sites and areas of general archaeological potential were expected, along with **slight adverse** impacts to 98 listed buildings. **Neutral** impacts were predicted for 2 Scheduled Ancient Monuments, 4 Registered Parks and Gardens, 8 Conservation Areas and 4 Historic Woodlands. Overall, the AST assessed the impact of the scheme as **Slight Adverse**.

Updated AST

- 5.117 The ASTR noted that a number of variations did occur from the conclusions of the ES in relation to the final design:
- The ES stated that the Registered Park at Belhus would be affected by a slight temporary adverse impact to its setting during the construction phase. However, works within the highway boundary extended into the non-statutory designated area, creating a permanent/ direct impact. The significance level of this was considered to be slight as the land-take was not significant and the original park had already been significantly degraded from its bisection during the original M25 works. Although the scheme involved further piecemeal land-take, the extent of land-take was minimised.
 - The ES identified the potential for nationally important Palaeolithic horizons to survive within the terrace gravels around Thurrock. This resulted in a potentially slight adverse effect of buried archaeology being recognised for works within the Belhus Cut. The ES also listed Palaeolithic potential in the Ockendon Embankment. For both areas, a Preliminary Assessment by a Palaeolithic/ Pleistocene Specialist was recommended; however, subsequent to the ES, emerging information suggested that the Palaeolithic resource was wider than anticipated and an assessment of the potential for the recovery of such remains was commissioned. This ties in with the ES statement that “the archaeological resource was not fully identified during the course of the ES (because no

on-site investigation was undertaken)", and so reflects a commitment to the identification of that resource.

- A geo-archaeological desk-based assessment was produced by an archaeological consultant, which acted as a preliminary archaeological assessment/ early evaluation works. The report identified a mitigation strategy, comprising a watching brief in various cuttings along with boreholes at the top of Ockendon and Belhus cuttings if deemed appropriate.

Environmental Statement

- 5.118 The ES predicted that the proposed Scheme would have **Slight Adverse** visual effects upon 7 Grade II Listed Buildings, one of which (Stony Hills Farmhouse) would be a temporary effect limited to the construction phase. It was also considered possible that by Year 15, improved planting/ screening on the Ockendon embankment could result in:
- 1 **Moderate Beneficial** impact to the setting of St Mary Magdalene's Church (Grade I) at North Ockendon.
 - 3 **Slight Beneficial** impacts on the settings of the farmhouse at Warley Franks (Grade II), North Ockendon Rectory (Grade II), and the North Ockendon Conservation Area.
- 5.119 Effects on the archaeological resource were expected to be limited to the foot of embankments, the top of cuttings, and where the M25 was at grade. A potential **Slight Adverse** effect was predicted within the Corbett's Tey/ Lynch Hill terrace formations in the face of the Belhus Cut, the ES stating that this area had the potential to contain Palaeolithic horizons of high importance. Further Palaeolithic horizons were noted by the ES as potentially surviving beneath the Ockendon Embankment, and four **Slight Adverse** effects and five uncertain, but potentially **Slight Adverse**, effects on the archaeological resource were also identified.
- 5.120 The ES also noted that the scheme corridor crossed a largely rural landscape with the potential to contain further unrecognised archaeological sites of all periods, and that there was therefore a potential risk of **slight adverse** effects occurring to hitherto unrecognised sites. This risk was considered likely to be most pronounced where the M25 crossed valleys such as the Roding and on the Thames Terraces.
- 5.121 The location of construction compounds, haulage roads, spoil storage areas etc was unknown at the time the ES was written. These areas were noted in the ES as likely being located outside the existing M25 boundary and therefore in areas where archaeological remains could have survived relatively undisturbed. A full assessment of the archaeological potential of these areas was recommended as soon as they were identified and based on the findings of this assessment, it was further recommended that an appropriate archaeological evaluation and mitigation strategy be developed. The ES also recommended that construction compounds etc should be located so as to avoid Archaeological Priority Areas (APA) designated by Essex County Council and the London Borough of Havering.
- 5.122 The ES stated that any archaeological work required would need to be agreed well in advance of construction, and that the implementation of a suitable archaeological response should result in permanent **Slight Adverse** effects to the buried resource being reduced to an acceptable level (**Negligible** effect).
- 5.123 The ES finally noted that it was suggested by the Essex County Archaeologist that any proposed archaeological mitigation could also be used to assess the past impacts of an existing major road on the buried archaeological resource, the findings of which could then be used to inform future cultural heritage assessments of similar schemes.

Consultation

- 5.124 No responses to consultation requests were received.

Evaluation

- 5.125 In terms of the potential 4 beneficial impacts on the listed buildings and the Conservation Area provided by the improved planting/ screening on the Ockendon embankment, these benefits

- were predicted to be realised by Year 15 and as such, it is considered too early for any meaningful evaluation to be made. However as noted by the Landscape sub-objective, above, the condition of the plant stock at the time of the OYA site visits indicates that unless the maintenance regime is corrected in the near future, there will be little to no chance of the planting plots achieving their targets by design year. This aspect should be reconsidered at FYA.
- 5.126 For all other statutory and non-statutory designated features however, based on desk studies and site visits there is no reason to believe that the impacts of the scheme are anything other than Slightly Adverse, **as expected**.
- 5.127 In addition to known designated features, the ES identified a background potential for the disturbance of buried archaeological remains. Unlike the known receptors within the scheme, due to the unknown nature (i.e. extent, form, and significance) of the buried resource, the level of impact could not be established during the ES and was designated as “uncertain” for such remains.
- 5.128 In relation to works outside the highway boundary in areas where archaeological remains could have survived relatively undisturbed (for construction compounds, haul roads etc), the ES recommended a full assessment of the archaeological potential of these areas be undertaken based on the findings, an appropriate archaeological evaluation and mitigation strategy developed.
- 5.129 The ASTR confirmed that in line with the recommendations of the ES:
- Where works were proposed outside of the highway boundary, programmes of advance archaeological investigation works were developed during the production of the Archaeological Designs. The purpose of these works was stated as being to understand whether archaeological remains were surviving if so, to assess the sensitivity and potential of the impacts of the scheme on such receptors; this strategy enabled appropriate mitigation measures to be developed when required.
 - In relation to works within the highway boundary, it was considered that overall there had been significant previous impact. The need for works within the highway boundary were further targeted by a full comparison of the geological profile, plans of the existing M25 cross-sections and detailed indicative design cross-sections (at 10m intervals) along the proposed route. This was considered to enable areas of no archaeological potential to be scoped out at source.
- 5.130 Works within areas designated as having the potential for the recovery of Pleistocene deposits were subject to an archaeological watching brief by a Palaeolithic specialist.
- 5.131 Given the unknown nature of the buried resource, the ASTR concluded that any impacts on identified archaeological remains could be reduced to a **Slight Adverse** or less, depending on the implementation of suitable mitigation measures, which is in line with the AST.
- 5.132 The draft HEMP confirmed that an archaeological design for the works had been completed and adhered to, and that each of these designs detailed the archaeological mitigation required as part of the widening, describing the methods by which the works would take place. The HEMP also noted that a post-excavation report would be provided detailing finds across the site when available, although no date was specified and POPE has not had access to this report.
- 5.133 The archaeological consultant has been contacted regarding the final publication and deposition of reports and finds relating to the Scheme, and has confirmed that the reports are under review at the time of the OYA evaluation and that all are due be published/ submitted to journals, and deposited with all finds with the various County Council’s Heritage Environmental Records for future reference; it is suggested that this should be confirmed at the FYA stage.
- 5.134 It can be confirmed by POPE that a popular archaeological report, Archaeological Discoveries on the M25 Junctions 27 to 30, has been published by the HA (2013). In summary, although Palaeolithic flint flakes (pre-modern humans, 350,000 to 3000,000 BC) were discovered at Belhus cut, the remainder of the finds dated from the last 10,000 years after the end of the most recent ice age. The dates and locations of the significant finds were:
- Late Bronze Age, Iron Age, and Roman artefacts at Passingford Bridge.

- Late Iron Age artefacts at Codham Hall Bund.
- A Roman settlement at Hobbs Hole.
- Early Saxon activity around Junction 29.
- Middle-late Saxon and Medieval remains at Upminster Bund.

- 5.135 No further evaluation has been undertaken as there were no outstanding issues highlighted by the design reports or raised during the site visits.
- 5.136 Other than the final publication and deposition of reports and finds relating to the Scheme, all other aspects of the proposed mitigation phases appear to have been addressed and it is therefore considered that the effects of the scheme on the heritage resource are likely to be as expected at this OYA stage.

Table 5-11 – Evaluation Summary: Heritage

Origin of Assessment	Summary of Effects on Heritage	Assessment
AST	Slight adverse impacts to 15 known archaeological sites & areas of general archaeological potential. Slight adverse impacts to 98 listed buildings. Neutral impacts to 2 Scheduled Ancient Monuments, 4 Registered Parks and Gardens, 8 Conservation Areas and 4 Historic Woodlands.	Slight Adverse
EST	There is no evidence to suggest that the impact of the scheme on any statutory or non-statutory designated feature is anything other than as expected. Where works were proposed outside of the highway boundary, programmes of advance archaeological investigation works were developed during the production of the Archaeological The need for works within the highway boundary were targeted by a full comparison of the geological profile, plans of the existing M25 cross-sections and detailed indicative design cross-sections (at 10m intervals) along the proposed route. A popular archaeological report, Archaeological Discoveries on the M25 Junctions 27 to 30, has been published by the HA (2013). All aspects of the proposed mitigation phases appear to have been addressed.	As expected

Biodiversity

Forecast

AST

- 5.137 The AST stated that the scheme would result in **slight beneficial** impacts for the River Roding, other amphibians, otters, water voles and common aquatic invertebrates as a result of improved motorway drainage. **Slight adverse** impacts on bats and birds resulting from an increase in habitat edge effects & changes in noise/light pollution were also expected. Overall, the impact of the scheme on biodiversity was assessed by the AST as **Slight Adverse**.

Updated AST

- 5.138 The ASTR noted that a local loss of water vole habitat and subsequent water vole population translocation was predicted. In the ES it was noted that the water voles would be released upstream in the event that captures were necessary but in a change from the ES, the water voles were released into the River Colne as part of a re-introduction scheme to the benefit of this species in Essex rather than being released in the same catchment. This was noted in the ASTR as being endorsed by NE, and that a licence was issued for this mitigation.
- 5.139 The ASTR confirmed that mitigation design had changed through the construction phase for each sub-section to allow for impacts on the additional land areas, for instance Great Crested

Newt (GCN) licences being amended to incorporate changes in the widening, attenuation tanks or balancing pond design. Additional surveys were confirmed to have been carried out to inform mitigation requirements in certain locations, with reptile surveys being carried out in widening locations to determine both the need and the form of reptile mitigation.

- 5.140 The ASTR also considered that the additional clearance required within the HA boundary when compared to that assessed in the ES was not significant in terms of the effects on habitats, and consequently the assessment and changes in lighting were also not considered to be significant.
- 5.141 The final design was noted as differing from the indicative design in that 4 non-statutory designated Local Wildlife Sites (LWS's) would be directly affected, with temporary habitat losses in these sites and a consequent slight adverse impact was predicted. Following the construction phase, the ASTR reported that these habitats were reinstated according to the landscape design and reported to benefit biodiversity as part of the highway estate – therefore, the overall significance of these impacts was not considered by the ASTR to change the impacts predicted by the ES.
- 5.142 The ASTR also noted that:
- There were generally no conflicts with the mitigation proposed in the ES; Great Crested Newt (GCN), badger and water vole licences were obtained for the works, ensuring that the overall conservation status of these species remained unaffected by the works.
 - Reptile and bat mitigation had been carried out throughout the scheme following the methods defined in the Advanced Environmental Designs for each sub-section.

Environmental Statement

- 5.143 The ES predicted that the proposed Scheme would have both **beneficial** and **adverse** effects on the numerous habitats and species that occurred within the Study Area.
- 5.144 Although the ES stated that no European or national statutorily protected sites were to be affected by the Scheme, the ES considered that the most direct impacts to habitats would occur during the construction phase when vegetation would be removed from the motorway verges to facilitate the widening. However, the majority of these habitats were considered to have a low biodiversity value, having been created relatively recently and being continually exposed to the effects of the motorway.
- 5.145 Overall, effects were considered to be temporary **Slight Adverse** for most habitats during the construction phase.
- 5.146 Habitat impacts at opening were not expected to differ greatly from the construction phase impacts, as the new landscaping would be too immature to have developed sufficiently.
- 5.147 The operational (Year 15) mitigation proposals outlined in the ES focused on verge habitat reinstatement, biodiversity enhancement of existing habitats and strengthening of buffer zones that were expected to screen adjacent sites such as ancient woodlands. Also:
- The proposed drainage system was predicted to result in an improvement in the quality of water that would be discharged into watercourses and in maintaining water flows.
 - Air quality in adjacent habitats, including non-statutorily designated sites, was not expected to change significantly, as the increase in traffic emissions over time would be offset by less traffic congestion and improved vehicle technology. Buffer zones in key areas were also expected to be strengthened and according to the air quality assessment, all air pollutant concentrations were expected to remain within their respective objectives or EU limit values.
- 5.148 Overall, the impact of the operation of the Scheme on habitats, including designated sites, was considered by the ES to be **Neutral** at Year 15.

Species Impacts

- 5.149 Habitat removal during construction was also stated by the ES as resulting in disturbance to several protected species such as birds, reptiles, badgers, bats and possibly amphibians;

measures such as seasonal timing of activities, species translocation/ exclusion and the provision of new habitats were expected to greatly reduce this disturbance.

- 5.150 Although species were expected to experience less impacts at opening than during the construction phase, the potential for some species of bats and birds to be affected by the upgraded motorway lighting was noted by the ES. Species were not expected to be benefiting from the long-term mitigation measures by this point, and the impact on species at opening was therefore considered to **Slight Adverse**.
- 5.151 The operation of the widened motorway was not considered by the ES to significantly alter the existing effects of the motorway on species within the study area, as these species were considered to already be accustomed to traffic related noise, light and vibration. The ES noted that edge effects to woodlands and other important wildlife sites were expected to reduce as verge buffer zones developed, and further noted that the proposed upgrade to the road lighting would potentially have some long-term effects on some species of bats and birds occurring near the motorway.
- 5.152 By Year 15, the ES predicted that the new landscaping would be mature enough to have reduced the impact of the initial habitat loss for species occurring in the verges. Although a net loss of habitat would remain, the new habitats were predicted to be more botanically and structurally diverse, and would likely offer species better foraging, commuting and nesting opportunities than the pre-construction phase. Specific measures such as the inclusion of hibernacula and mammal ledges were also considered to further improve the Study Area for species.
- 5.153 The ES also noted that the DBFO Contractor would be encouraged to work with the Thames Chase Community Forest and/ or the Green Arc Initiative to further mitigate the loss of the motorway verge habitats.
- 5.154 Overall, the species impact of Scheme during Year 15 of the operational phase was considered by the ES to be **neutral**.

Consultation

- 5.155 Natural England considers the impacts on Biodiversity and the ecological mitigation to have been broadly as expected.

Evaluation

- 5.156 No information has been received by POPE to suggest that the ASTR assessments of the design changes are anything other than a valid reflection of the situation on site.
- 5.157 POPE has been unable to confirm whether the DBFO Contractor has worked with the Thames Chase Community Forest and/ or the Green Arc Initiative to further mitigate the loss of the motorway verge habitats, as no responses to consultation with these organisations have been received.
- 5.158 However, the ESCR confirmed that the Advanced Environmental Design reports and their drawings/ addendums had defined the approach to ecological mitigation adopted during the construction phase, and that mitigation had involved obtaining protected species licences from NE where appropriate. It was also stated that where unlicensed mitigation had been carried out, it was to accepted standards with the mitigation approach discussed with NE.
- 5.159 The ESCR also confirmed that ecological surveys of new land that was in addition to that shown on the ESPs was undertaken to accepted standards and mitigation was devised and implemented following the approach to mitigation throughout the rest of the soft estate; although not available to POPE, the ESCR did state that ecological certificates had been produced following the successful completion of mitigation.
- 5.160 **Table 5-12** below, shows the specific ecological requirements of the contract for the scheme and the commentary on the as-built response from the site team responsible for the implementation of the ecological design.

Table 5-12 – Ecological Requirements

Contract Requirements	As-built Response
20 Bat boxes in Section 4, in areas where natural roosting opportunities are rare.	32 bat boxes provided
The DBFO Co. shall install 200 bird boxes Section 4 and maintain and replace them as appropriate.	200 bird boxes installed
The DBFO Co. shall create 50 new reptile log pile hibernacula in Section 4.	Hibernacula and log piles installed as per the advanced environmental design, which meets this requirement.

Bats and Birds

- 5.161 A number of trees and structures within the scheme were considered by the ES to provide potentially suitable roosting, commuting and foraging habitat for bats. Where construction works were considered to have a potential impact on structures or trees, the draft HEMP confirmed that the trees had been inspected by a licensed bat worker (using endoscopes or through dawn and dusk surveys), and that tree inspections had confirmed that no bats were present in any trees scheduled for felling.
- 5.162 The draft HEMP also stated that precautionary measures recommended by ES to reduce the construction impact on bat foraging and commuting corridors were implemented during construction, specifically the control of lighting, replacement of removed vegetation, and maintenance of bat commuting corridors.
- 5.163 Bat and bird boxes were also noted by the draft HEMP to have been installed throughout the scheme, the draft HEMP stating that in each area equal numbers of each nest box (small and large open holes, small, medium and large open fronted) had been installed between 1.5-4m from ground level as near as practicably possible to the locations detailed in the Ecological Design drawings; however, it was noted that site access areas and areas of additional clearance had led to some variation in location.
- 5.164 The OYA site visit confirmed the installation of bat/ bird boxes, and confirmed them to be broadly located as specified by the ESPs; see **Figure 5-11** below.

Figure 5-11 –Provision of Ecological Mitigation Measures in the Form of Bat/ Bird Boxes



Reptiles

- 5.165 The ES reported that reptiles had been recorded in a total of 58 sites within the motorway verges between Junctions 27 and 30, most sites being considered to be of medium or low priority.
- 5.166 The ES stated that a clearance exercise would be implemented to remove reptiles from all sites where works would be carried out, further noting that although any such clearance would not require a licence, the methodology would be agreed with NE.
- 5.167 Reptile exclusion fencing was noted by the ES as to remain standing for the duration of the construction period; in line with this, no reptile exclusion fencing was noted during the OYA site visits.

- 5.168 The draft HEMP reported that construction impacts upon GCN within Sub-sections 4A, 4B, and 4C had resulted in the direct loss of terrestrial habitats. Although some of these habitats were reported as being within 50m of GCN ponds:
- No GCN ponds were reported as being lost or damaged.
 - Due to the impacts on terrestrial habitats and potential harm to GCNs, a European Protected Species Licence (EPSL) under the Habitat Regulations 1994 (as amended) was required.
- 5.169 The ASTR concluded that due to the presence of reptiles throughout the scheme and GCN's in several places along the scheme, any issues regarding additional clearance had been addressed through the NE GCN licences and revised mitigation to take the presence of additional reptiles into account. It was considered that this ensured that the significance of the impact of the Scheme on GCN's had not changed, and no evidence has been made available to POPE to suggest that this is anything but the case.
- 5.170 The draft HEMP also stated that newt and reptile hibernacula had been constructed throughout the scheme and comprising a combination of buried hibernacula and log piles, as far as practicable these had been installed at the locations shown by the Ecological Design drawings.
- 5.171 Although no buried hibernacula were confirmed during the OYA site visit, surface hibernacula and log piles were observed to be broadly located as specified by the ESPs; examples are illustrated in **Figure 5-12** and **Figure 5-13** below.

Figure 5-12 – Ecological Mitigation Measures in the Form of Log Piles



Figure 5-13 – Surface Hibernacula



Water Voles

- 5.172 Based on the level of water vole activity recorded and confirmed prior to construction, areas where works to drainage features were carried out close to water vole habitat, the habitat was made unsuitable for water voles through habitat manipulation (localised removal of vegetation).
- 5.173 In terms of water vole mitigation, the draft HEMP confirmed that in areas where widening works directly impacted on water vole burrows, water voles were removed from the footprint of the works through trapping and subsequent translocation to a pre-prepared receptor site. This work was completed in accordance with the terms of the NE Licence and agreed with Essex Wildlife Trust, who co-ordinated the release of the water voles into the River Colne.
- 5.174 The ASTR considered that although water vole mitigation was recorded as including translocation from habitat in the highway estate under NE licence, as the animals were not released locally (as stated in the ES), the impact on water voles was considered to change from **slight beneficial** to **neutral**; however, the overall conservation status of this species in Essex was considered to have been maintained by the release of the captured animals in the River Colne, thereby ensuring no change to the significance of the impact of the Scheme on water voles.

- 5.175 POPE is unaware of any further information regarding water voles and as such, there is no reason to suggest that the impact of the scheme on this species is anything other than as expected.

Badgers

- 5.176 The ES reported that badger evidence had been recorded in several areas within a 150m corridor between Junctions 27 and 28, the evidence including setts, latrines, trails, and foraging signs.
- 5.177 It was noted in the ASTR that there were generally no conflicts with the mitigation proposed in the ES, and that badger licences were obtained for the works to ensure that the overall conservation status of the species remained unaffected by the works.
- 5.178 The draft HEMP reported that no active badger setts had been impacted by the construction works.
- 5.179 POPE is unaware of any other information regarding badgers, and as such there is no reason to suggest that the impact of the scheme on this species is anything other than as expected.

Plants

- 5.180 The ES noted that the Phase I habitat survey did not highlight any areas of high botanical interest within the HA boundary or adjacent to the verges within a 150m zone beyond the highway boundary over the length of the scheme, although it was noted that despite no historical records of protected plant species within the verges, Bluebell (*Hyacinthoides non-scripta*) had been recorded in several ancient woodlands outside of the HA boundary but within 150m of the M25; this species has UK protection under Schedule 8 of the Wildlife and Countryside Act 1981.
- 5.181 The LEMP 1st Annual Monitoring Report, the LEMP 6-Monthly Establishment and Maintenance Report, and the 2012 LEMP, all contained a survey methodology table (referenced 3.1 in each) that noted an area of replanted Bluebells; all three tables noted that annual inspections at the end of April/ early May would be undertaken throughout the 5-year establishment period to ascertain the success of the transplanting/ establishment of the species, although no mention of location or results of any monitoring were made in any of the LEMPs.
- 5.182 It is considered likely that any soil/ species translocation or replacement planting may have been undertaken as a result of strip widening, possibly adjacent to an area of ancient woodland, but in the absence of any further information regarding specific location(s) or monitoring results, this remains unconfirmed by POPE at this OYA stage.

Habitat Implementation

- 5.183 The ASTR concluded that overall, the final design required the loss of a greater area of low value verge habitat than identified in the indicative design due to the replacement of some retaining wall solutions with re-graded slopes, and the construction of balancing ponds and attenuation tanks. It was noted that although these solutions had also resulted in temporary loss of habitat in LWS's, the additional site clearance had not changed the overall significance of the scheme's impact on biodiversity.
- 5.184 Taken as a whole, the ASTR considered that the landscape proposals had changed to reflect the additional purchase areas and had allowed more planting of trees, species rich hedgerows, and grassland creation than had been indicated by the indicative design.
- 5.185 Linear features such as hedgerows were considered to provide corridors for wildlife movement throughout the scheme and in areas where widening had extended into farmland, were considered to have replaced species-poor arable land with habitats of greater wildlife value. The creation of balancing ponds was also considered to have provided valuable, additional habitat in previously farmed land.
- 5.186 As noted in the landscape section, above, the OYA site visits found that the planting proposals appear to have been implemented broadly as expected, but changes brought about by the final design, including clearance, geotechnical solutions, changes to proposed planting and off-site features are evident along the length of the scheme; extended slope re-grades, ponds and

bunds have led to net additional off-site land-take within existing open farmland or areas of scrub and young woodland.

- 5.187 The site visits observed that the new off-site planting plots are generally large when compared with the on-site motorway verge plots, and it is considered that the reinstatement measures therein have the potential make a significant contribution to the foraging, commuting and nesting opportunities of the scheme as a whole when successfully established. In places, some of the additional land-take supports planting that will assist in re-establishing physical connections between disparate blocks of woodland.
- 5.188 As also confirmed by the OYA site visits, balancing ponds throughout the scheme have the potential to provide a varied wetland habitat for a range of wildlife; the land surrounding each pond has been engineered to provide a range of habitats where possible, thus providing the opportunity to maximise wildlife potential subject to ongoing management and maintenance.

Habitat Management and Maintenance

- 5.189 The ES predicted that by Year 15, the new landscape planting would be mature enough to have reduced the impact of the initial habitat loss for species that occur in the verges. Although a net loss of habitat would remain, the new habitats would be more botanically and structurally diverse, and would offer species better foraging, commuting and nesting opportunities than at the time of assessment.
- 5.190 As discussed in the landscape section, above, although the planting proposals appear to have been broadly implemented as expected, the coverage, establishment, and condition of the planted areas at the time of the OYA site visits indicate that the environmental functions of the plots are not developing as well as expected; it is therefore considered that unless the maintenance regime is corrected in the near future, it is unlikely that the habitat (and species) diversification referred to by the ES will be realised.

Animal Mortality

- 5.191 Animal mortality figures have been received for the period between 2009 and 2014 (inclusive), and these are shown in **Table 5-13** below; no locations of animal mortalities were provided, and the records date from the start of the construction period.
- 5.192 Consequently, no comparisons can made between the baseline, pre-construction, effects of the scheme and the operational effects of the scheme, but the data does suggest that there were no significant changes in the effects of the scheme on the mortality rates of the recorded species from the start of construction through to, and including, the first year of operation.

Table 5-13 – Animal Mortality Data, 2009-2014

Animal	From Sept	2010	2011	2012	2013	To Jan
	2009					2014
Deer		8	7	7	7	
Fox		1		2		
Swan		1				
Badger				1		

Summary

- 5.193 The design changes from the ES have been reviewed by a combination of desk studies and site visits, and the ASTR and ESCR assessments of the design changes are considered by POPE to be valid reflections of the situation on site.
- 5.194 Despite the evident changes along the length of the scheme, advance ecological mitigation works regarding species and in terms of habitat manipulation/ reinstatement/ enhancement measures appear to have been implemented throughout the scheme broadly as expected. Overall, the extent of the new planting associated with strip-widening is considered to have potential benefits in relation to wildlife corridors and habitat connectivity in the long term.

- 5.195 Consequently, it is considered that the design changes have the potential to have a better than expected impact on biodiversity, and thus there is the possibility that the overall AST score could be amended from Slight Adverse to Neutral in the future as a result of these design changes alone.
- 5.196 However, any potential (or actual) better than expected effects are detracted from by the poor coverage, establishment, and condition of habitats observed during the OYA site visits – as previously noted, unless the maintenance regime is not corrected in the near future it is considered unlikely that either existing or new habitats will successfully establish and ecologically enhance or diversify the M25 corridor in the long term as intended.
- 5.197 It is therefore considered that subject to appropriate (and ongoing) habitat management and maintenance, although the implemented scheme has the potential to have better than expected long term impacts on habitat and species diversification, the impact of the scheme on biodiversity at OYA is likely to be Slight Adverse, **as expected**.
- 5.198 In light of the draft status of the HEMP at the time of the OYA evaluation and the acknowledgement therein of the commitments made by the HA regarding the objectives of the detailed landscape design and the subsequent maintenance thereof, it is therefore suggested that habitat establishment and maintenance could be considered further at the FYA stage when the final version of the HEMP is likely to be available.
- 5.199 It is further suggested that in the absence of any information regarding specific sites of Bluebell translocation or monitoring thereof available to POPE, that consideration be given to further investigation of the effect(s) of the scheme on this legally protected species.

Table 5-14 – Evaluation Summary: Biodiversity

Origin of Assessment	Summary of Effects on Biodiversity	Assessment
AST	Scheme would result in slight beneficial impacts for River Roding, other amphibians, otters, water voles & common aquatic invertebrates as a result of improved motorway drainage. Slight adverse impacts to bats & birds from increase in habitat edge effects & changes in noise/light pollution.	Slight Adverse
EST	<p>Despite the changes evident along the length of the scheme, advance ecological mitigation works regarding species and in terms of habitat manipulation/ reinstatement/ enhancement measures appear to have been implemented broadly as expected. Overall, the extent of the new planting associated with strip-widening is considered to have potential benefits in relation to wildlife corridors and habitat connectivity in the long term.</p> <p>However, any potential (or actual) better than expected effects are detracted from by the poor coverage, establishment, and condition of the plant stock and unless the maintenance regime is not corrected in the near future, it is unlikely that either existing or new habitats will establish successfully and enhance or diversify the ecology of the M25 corridor in the long term as intended.</p>	As expected

Water Quality and Drainage

Forecast

AST

- 5.200 The AST stated that no additional floodplain land would be utilised by the scheme and that despite an increase in highway area, additional flow attenuation and treatment included as part of the scheme would result in Slight Beneficial impact overall.

Updated AST

- 5.201 The ASTR states that the final water quality and hydrology design meets the contract requirements for water quality and exceeds the requirements of HA standard procedures. The design was further noted to have used HA216/ 06 (from the HAs Design Manual for Roads and Bridges) to ensure that spillage containment and pollution control provision were to the required standards.
- 5.202 It was also noted that supplementary to this, there had been existing commitments as cited in the ES for the scheme and agreements with the EA during previous discussions. The ASTR reports that it is considered that this has resulted in a final design that provides both spillage containments and pollution control at every outfall, and a numerical assessment of the final design is reported to show that the design provides an improvement on the existing situation overall.
- 5.203 Finally, the ASTR notes that there is one location where embankment widening has encroached onto a floodplain; however, it is stated that this has been compensated for through design and the excavation of an area on the River Roding floodplain.
- 5.204 The ASTR concluded that the final design has provided attenuation and treatment along the scheme such that the AST assessment remains **Slight Beneficial**.

Environmental Statement

- 5.205 The ES noted that the proposed Scheme would increase the width of the M25 motorway, and would provide an extra lane to the existing highway in both the clockwise and anti-clockwise directions; this would result in an increase in the area to be drained, and therefore an increase in both the volume and the amount of contamination in the runoff generated.
- 5.206 The ES also noted that the motorway generated potentially contaminated runoff which was then discharged to surface waters via outfalls. Little flow balancing or treatment was provided in the existing scheme, and only two balancing ponds were in existence within the scheme at the time (2007).
- 5.207 The proposed drainage design intended to expand the capacity of these two balancing ponds and provide a further new balancing pond at Junction 29. The drainage system was to collect runoff from the whole motorway, and would, where physical constraints allowed, incorporate treatment in the form of bioretention systems, ponds and filter drains. Containment of accidental spillage would be provided within each catchment of the highway through the use of spillage containment chambers prior to outfall or in-line isolation valves associated with oversized pipes.
- 5.208 The ES also assessed the Scheme in terms of surface water quality, runoff flow attenuation, and the groundwater resource:

Surface water quality

- 5.209 Considering spill risk assessment and routine contaminant build up, assessment indicated that the surface water features would be able to cope with the increased mass of pollutants associated with the increase in highway area, and that this would result in a neutral impact.

Runoff flow attenuation

- 5.210 The ES stated that the provision of runoff flow attenuation within the design would represent an improvement over the existing, baseline, system. In addition, no additional areas of flood plain were to be developed. As such, the impact to flood risk within the watercourses local to the Scheme was considered to be Neutral at worst, but more likely to be Slight Beneficial.

Groundwater resource

- 5.211 As there was no discharge to ground from the existing Scheme/ predicted from the proposed Scheme and there was to be very limited exploitation of the areas of unconfined Minor Aquifer toward the southern end of the scheme, the impact on both the existing and potential future groundwater resource was considered to be neutral.
- 5.212 The ES predicted that the overall impact of the Scheme on the water environment would be **Slight Beneficial**.

Consultation

- 5.213 The Environment Agency (EA) commented that:
- *Throughout the development of the scheme design and subsequent design changes (particularly in respect of drainage), the EA were satisfied that the development would not have an adverse impact on local watercourses, floodplains or the groundwater/ aquifer. The EA noted that this was achieved through balancing new and existing flows from the carriageway, off-setting losses of floodplain storage capacity, inclusion of pollution control (including increased control for more sensitive outfalls), and using piling techniques that minimised risks to groundwater. In sensitive groundwater areas and where the works posed higher groundwater risks, a monitoring programme with the contractor was agreed with the EA to check for impacts on the local groundwater quality.*
 - *Some of the greatest environmental risks occur during the construction phase and the EA found the M25 DBFO-JV environment team to be very competent, maintaining strong environmental controls to minimise environmental risks from the works. The close working*

relationship between the M25 DBFO-JV and EA was important to ensuring the environmental risks were minimised.

- *An unforeseen impact arose near to J29 where, following piling works, contaminated groundwater was found in the road drainage system and continued flowing into the system at a low rate from an unknown source. To avoid pollution of the local watercourse, this effluent was isolated and tankered from site. The effluent is now being treated through a reed bed system and the contractor is currently (as of December 2013) in discussion with the EA to obtain a water discharge permit to discharge the treated effluent into the local watercourse.*
- *The EA were satisfied that the agreed designs would adequately mitigate adverse impacts on the water environment and in some cases, such as the pollution control measures, the measures were deemed an improvement on the previous controls. The EA also noted that since construction was completed, an incident on the carriageway resulted in a large spill of an organic liquid fertiliser; all of this liquid was noted as being contained within the balancing ponds, thereby protecting the local watercourse.*
- *In terms of surface water features being able to cope with the increased mass of pollutants associated with the increase in highway area, the EA stated that this was taken into account in the scheme design and assessment to ensure that the receiving watercourses could accommodate any increase in pollutant load without adversely affected the status/quality of the watercourse.*
- *The EA are unaware of any changes to water quality in local watercourses/ aquifers as a result of construction, but noted that the on-going biological monitoring by M25 DBFO-JV would hopefully provide useful evidence as to any changes in local watercourses in the future.*

Evaluation

- 5.214 The ASTR states that at the single location where embankment widening encroached onto the River Roding floodplain, this has been compensated for via design and the excavation of an area of the floodplain, noting that due to the geology beneath this section and the lack of soak away provision, there is no anticipated risk to groundwater at this location.
- 5.215 During site investigation activities on site, contaminated land was discovered associated with the original attenuation pond design at Bush Grove. Further testing identified an area of private land outside the highway boundary to be “clean”, and the alternative design proposal utilised this area to house the underground tanks that replaced the original design for the attenuation pond. The alternative design was reviewed by the Environment Agency (EA), and the pipe manufacturer reviewed the test results to confirm that the pipes and tanks were suited to the new area.
- 5.216 Also, and utilising private land outside the highway boundary, Pond 1727 replaced the tender design which involved attenuation tanks in the verges. The pond allows the drainage to attenuate the discharge volume as per the requirement of the EA, but allowed the removal of attenuation tanks from inside the current HA boundary.
- 5.217 At Codham Hall, part of the alternative design solution comprised the replacement of storage pipes with a balancing pond (and associated access track) to provide attenuation.
- 5.218 The design changes from the ES have been reviewed by a combination of desk studies and site visits, and there is no reason to suppose that the ASTR assessment of the design changes should not be considered by POPE to be a valid reflection of the situation on site.
- 5.219 This is confirmed by the positive response to consultation received from the EA, who consider the agreed designs to adequately mitigate any adverse impacts on the water environment and in some cases, to provide an improvement over the previous controls.
- 5.220 In terms of drainage, all facilities noted during the OYA site visits generally appeared to be clear of vegetation/ litter/ detritus, with no evidence to suggest that they are unable to function in any way other than as expected.

- 5.221 In terms of attenuation, balancing ponds and associated inlets/ outlets and spillways¹² generally appeared to be clear and able to operate as expected and marginal/ pollution treatment planting appeared to be healthy where established, and no evidence of pollution was observed during the site visits – this is illustrated by **Figure 5-14** below.

Figure 5-14 – Balancing ponds clear of vegetation, with healthy marginal/ pollution treatment planting



- 5.222 The 2012 LEMP noted that natural colonisation by Reedmace (*Typha latifolia*) and Common Reed (*Phragmites australis*) had the potential to have a detrimental effect on other wetland plants, and that the litter/ detritus produced by these plants had the potential to reduce the operational capacity of the ponds in absence of management; it is considered by POPE that this remains to be a valid assessment and that although the operational capacity of the ponds did not appear to be compromised at the time of the site visits, appropriate and ongoing management and maintenance is required to ensure that this continues to be the case and it would be appropriate to review this aspect at FYA.
- 5.223 A degree of algal growth was observed within a small proportion of the balancing ponds, although the levels of growth did not appear to be having a significantly detrimental effect on the aquatic and marginal planting at the time of the OYA site visits (see **Figure 5-15** below); it should be noted, however, that continued ongoing maintenance and management of algae will be required to prevent any such problems arising in the future.

Figure 5-15 – Algal growth is present within a small proportion of balancing ponds



- 5.224 Although the planting proposals around the ponds appear to have been broadly implemented as expected, these plots are not better than average in terms of the planting coverage, establishment, and condition as discussed in the landscape section, above - see **Figure 5-16** below, where it can be seen that the unmaintained nature of these plots is affecting access to (and may also be interfering with) Pollution Control Devices (PCDs) and associated equipment.

¹² Spillway: a channel for carrying away excess water.

Figure 5-16 – Unmaintained planting plots potentially affecting access to drainage/ water attenuation equipment and PCDs



- 5.225 Other than the positive comments made by the EA in their response to consultation, no information was received at OYA to indicate whether any incidents had occurred that may have affected the drainage system, and no information regarding the on-going biological monitoring by M25 DBFO-JV referred to by the EA in their response to consultation (or any other water quality monitoring information) has been made available to POPE for this evaluation.
- 5.226 Based on the ASTR, site visits and the information provided by the EA, it is concluded that the overall, direct effect of the scheme on water quality and drainage is likely to be as expected during normal scheme operation.
- 5.227 However, it should also be noted that there may be the potential for indirect and adverse impacts on water quality should a pollution incident occur, as rapid PCD access could be problematic at selected balancing ponds where the lack of management/ maintenance of the planting plots on disturbed ground has resulted in excessive weed growth; this is considered likely to impede access, if required, in the event of a pollution incident.
- 5.228 The Surface and Groundwater chapter of the draft HEMP noted that PCDs and attenuation philosophy was implemented to minimise the impact of the discharge of water to the environment and local areas, but made no mention of biological monitoring or ongoing management/ maintenance; it is therefore considered that the establishment and maintenance of the planting plots around the balancing ponds, and the results of any monitoring thereof, should be considered further at FYA when the final version of the HEMP is available.

Table 5-15 – Evaluation Summary: Water Quality and Drainage

Origin of Assessment	Summary of Effects on Water Quality and Drainage	Assessment
AST	No additional floodplain land utilised by the scheme. Despite an increased highway area additional flow attenuation & treatment included as part of the scheme would result in slight beneficial impacts.	Slight Beneficial
EST	Although embankment widening did encroach onto the River Roding floodplain, this was compensated for via design; it is considered that due to the geology beneath this section and the lack of soak away provision, there is no anticipated risk to groundwater at this location. The EA consider the agreed designs to adequately mitigate any adverse impacts on the water environment and in some cases, provide an improvement over the previous controls. Based on this and the FYA site visit, it is likely that the overall effect of the scheme on water quality and drainage is Slight Beneficial.	As expected

Physical Fitness

Forecast

AST

- 5.229 The AST stated that the scheme would have no direct effect on the activity duration of pedestrians and cyclists, as no changes to existing Non-Motorised User (NMU) facilities were proposed. Overall, the impact was assessed by the AST as Neutral.

Updated AST

- 5.230 The ASTR reports that although there have been minor (albeit unspecified) changes to the Public Rights of Way (PRoW) outside of the route, these did not conflict with the ES. The ASTR also stated that the scheme would have no direct effect on the activity duration of pedestrians and cyclists, as there were no changes to NMU facilities.

Environmental Statement

- 5.231 The ES predicted that neither NMU crossing points nor adjacent NMU routes within the study area would be affected by the Scheme once the construction phase had been completed. The operation of the Scheme was considered not to have a permanent direct effect on any NMU routes, and would therefore have no effect on travel patterns or journey times after the Scheme had been constructed. The Scheme proposals provided no reduction or increase in the degree of severance of the Public Right of Way (PRoW) network and as such, the overall effect of the Scheme on NMUs was considered to be Neutral.

Consultation

- 5.232 No responses were received relating to this topic.

Evaluation

- 5.233 The ASTR considers that the AST assessment of Physical Fitness remains a valid reflection of the final design.
- 5.234 POPE is unaware of any further information that may be available in terms of the minor (unspecified) changes to the PRoW outside of the route referred to by the ASTR; however, the combination of desk studies and site visits undertaken as part of POPE methodology has found no reason to suppose that the ASTR assessment should not be considered to be a valid reflection of the situation on site and that there were no significant changes to NMU facilities.
- 5.235 No NMU survey has been undertaken specifically for this study, and POPE is not aware of any NMU audits or Vulnerable User Studies undertaken for this scheme.
- 5.236 The sections of the PRoW network viewed during the OYA site visits appeared to be capable of performing generally as expected, although no direct evidence of PRoW use was observed.
- 5.237 It is concluded that the effects of the scheme on physical fitness are likely to be generally as expected, as there has been no reduction or increase in the degree of severance of the PRoW network; the overall effect of the Scheme on NMUs is therefore considered to be neutral and **as expected**.

Table 5-16 – Evaluation Summary: Physical Fitness

Origin of Assessment	Summary of Effects on Physical Fitness	Assessment
AST	The Scheme would have no direct effect on the activity duration of pedestrians and cyclists because there are no changes to existing NMU facilities.	Neutral
EST	There has been no reduction or increase in the degree of severance of the PRoW network, and no significant change to NMU facilities.	As expected

Journey Ambience

Forecast

AST

- 5.238 The journey ambience sub-objective considers traveller care (facilities and information), traveller views, and traveller stress (frustration, fear of potential accidents, and route uncertainty).
- 5.239 The AST stated that the scheme would affect more than 10,000 people, but would not provide any additional traveller facilities or have any impact on existing traveller facilities. The AST also stated that although traveller views would be worsened, driver stress would be reduced overall as a result of improvements in route uncertainty. The overall impact of the scheme was assessed by the AST as Large Beneficial.

Updated AST

- 5.240 As detailed in the Landscape sub-objective the majority of gantries were re-positioned and single span-gantries were “combined” to form super-span gantries during detail design.

Environmental Statement

- 5.241 The ES predicted that the impact on traveller views would be **Slight Adverse**
- 5.242 The Scheme was generally predicted to have a **beneficial** impact on driver stress because the impact of widening the carriageway (Do Something) was much less than the impact arising from the Do Minimum (minus Scheme) scenario. Although the magnitude of the impact on driver stress varied depending on which scenario was referred to, based solely on the number of hours that were predicted to experience high, moderate or low levels of driver stress, the ES demonstrated that:
- The Do Something scenario for Section 4 alone would have a Slight Adverse effect on driver stress compared to the base year and a Moderate Beneficial when compared to the Do Minimum scenario. The entire M25 Widening programme would have a Slight Adverse effect on driver stress.
 - Throughout the entire assessment, the A (clockwise) carriageway was assessed as having higher levels of driver stress than the B (anticlockwise) carriageway.

Consultation

- 5.243 No responses were received in relation to this topic.

Evaluation

- 5.244 The ASTR reports that amendments made to the gantry design were not anticipated to change the AST score for Journey Ambience, and considered the AST assessment to remain a valid reflection of the final design.
- 5.245 In terms of Traveller Views, the overall increase in size from single-span to super-span gantries could potentially be considered worse than as predicted by the ES, but it is considered that signing is a part of the expected traveller experience and as such, the effects of the gantry amendments on Traveller Views are not significant in isolation.
- 5.246 However, although the landscape proposals have been implemented broadly as expected, in terms effective establishment and maintenance of these mitigation measures, the coverage, establishment, and condition of the planting plots at the time of the OYA site visits indicate that any visual amenity function of the landscape mitigation measures may not be developing as expected; consequently, it is considered that Traveller Views are likely to be **worse than expected**.
- 5.247 In terms of the impact of the scheme on Traveller/ Driver Stress, it is considered that the increased capacity of the M25 is likely to provide more opportunities for the safe overtaking of slower vehicles and a greater likelihood of free flowing traffic; consequently, the scheme is

considered likely to have resulted in a reduction in the degree of driver frustration, and therefore driver stress.

- 5.248 As noted by the traffic chapter of this report, Journey Times have improved with average journey times for each peak period consistently lower than the pre-scheme journey times along the length of the scheme; the observed pattern of journey time savings is the same for both the clockwise and anti-clockwise directions, with significant journey time savings achieved in the evening peak hour when compared to the morning peak hour; it is considered that this is likely to have had a beneficial impact on driver stress.
- 5.249 As noted by the safety chapter of this report, there has been a 42% decrease in the average number of collisions along the scheme post opening, and the severity of collisions has also reduced; this may have had a beneficial impact on driver stress in terms of fear of accidents.
- 5.250 Please see the traffic sections of this report for a full discussion of accident data and journey times, summaries of which are also provided in **Table 5-17** below.
- 5.251 At the time of the site visits, the route appeared to be well signed (as illustrated in **Figure 5-17** below) with junctions providing safe access and egress points to and from the M25; where not overgrown, route verges were observed to be generally litter free.

Figure 5-17 – New Super-span Gantry Exhibiting Clear, informative Signage



- 5.252 No changes regarding Traveller Care were proposed as part of the final design, and none were identified during the OYA site visits; consequently, this aspect has not been evaluated further.
- 5.253 Based on the information presented in this evaluation, it is concluded that the effects of the Scheme on Journey Ambiance are likely to be **worse than expected** in terms of visual amenity (Traveller Views), but as expected in terms of Traveller Stress and Traveller Care.
- 5.254 **Table 5-17** summarises the evaluation of the scheme's impact on Journey Ambiance.

Table 5-17 – Summary of Journey Ambience Evaluation

Traveller Factor	OYA Score	OYA evaluation
Views	Worse than expected	Signing is considered to be a part of the expected traveller experience, and the effects of the gantry amendments are not considered to be significant in isolation. The poor establishment, maintenance, and condition of the landscape proposals at the time of the OYA site visits indicate that the impact of the scheme in terms of visual amenity is likely to be worse than expected.
Stress	As expected	The additional carriageway increases the capacity of the M25, facilitating free-flowing traffic by providing more opportunities for the safe overtaking of slower vehicles. The route is well signed and the junctions provide safe access and egress points to and from the M25. Average journey times for each peak period are consistently lower than the pre-scheme journey times along the length of the scheme; the observed pattern of journey time savings is the same for both the clockwise and anti-clockwise directions, with significant journey time savings achieved in the evening peak hour when compared to the morning peak hour. There has been a 42% decrease in the average number of collisions along the section post scheme opening, and the severity of collisions has also reduced post opening.
Care	As expected	No change.

Origin of Assessment	Summary of Effects on Journey Ambience	Assessment
AST	The Scheme would affect >10,000 people. It does not provide additional or impact on existing traveller facilities. Traveller views would be worsened. Driver stress would be reduced overall as a result of improvements in route uncertainty.	Large Beneficial
EST	Signing is a part of the expected traveller experience and consequently, the effects of the gantry amendments are not considered to be significant in isolation. However, the coverage, establishment, and condition of the planting plots at the time of the site visits suggests that the visual amenity functions of the landscape mitigation measures may not be developing as expected. The additional carriageway increases the capacity of the M25, facilitating free-flowing traffic by providing more opportunities for the safe overtaking of slower vehicles.	Slight Beneficial (worse than the Large Beneficial score expected) Traveller Views are worse than expected. Traveller Stress and Traveller Care are as expected.

Key Points – Environment

Noise

- Observed 2-way AADT Traffic Flows are between 3% and 15% lower than forecast throughout the scheme; the impact of the scheme on the noise climate is therefore considered to be as expected.

Local Air Quality

- Observed 2-way AADT Traffic Flows are 3% lower than forecast between Junctions 27-28; the impact of the scheme on air quality is therefore considered to be as expected between Junctions 27-28.
- The absolute number of vehicles is less than predicted by between 15,500 (12%) and 19,900 (15%) AADT through the remainder of the scheme, and these percentage differences are considered to be significant; the impact of the scheme is therefore considered to be better than expected between Junctions 28-30.

Greenhouse Gases

- The net proportionate increase in carbon emissions for traffic on the M25 scheme section observed is 1%; lower than the re-forecast 8% increase. This is due to the observed overall increase in traffic and speeds being lower than expected.

Landscape

- Changes brought about by the final design, including clearance, geotechnical solutions, changes to proposed planting, gantry positions (including types and sizes), and off-site features, are evident along the length of the scheme.
- Extended slope re-grades, ponds and bunds in the final design have led to net additional off-site land-take, with new land-take within existing open farmland or areas of scrub and young woodland. The new off-site plots are generally large compared with the on-site motorway verge plots and the reinstatement measures therein are considered to make a significant contribution to the landscape and environmental objectives of the scheme as a whole.
- Some of the additional land-take supports planting that will assist in filtering and reducing views of the motorway and associated vehicular movement, and re-establishing physical connections between disparate blocks of woodland. The extent of the new planting associated with strip-widening is considered to ultimately have beneficial benefits in relation to the motorway corridor as it sits within the broader landscape.
- The beneficial effects of design changes are tempered by the adverse impacts of the gantry optimisation process; although gantries were optimised as far as possible in relation to landscape and visual impacts, the mitigation planting has not offset the overall negative impact of the gantry relocations and the increase in gantry size from single-span to super-span.
- It is considered that the design changes have not materially changed the landscape or visual impact of the scheme as predicted by the ES, and the overall AST score would not be altered from Slight Adverse as a result of the design changes alone.
- Other than the design changes noted above, landscape mitigation measures in the form of planting proposals appear to have been broadly implemented as expected.
- In terms of implementing management regimes to ensure effective establishment and maintenance of the landscape mitigation measures, the coverage, establishment, and condition of the plant stock at the time of the site visits indicates that the environmental functions of the planting plots are not developing well and that unless the maintenance regime is corrected in the near future, it is unlikely that the planting plots will achieve their targets by Design Year.

Key Points – Environment

Heritage

- There is no evidence to suggest that the impact of the scheme on any statutory or non-statutory designated feature is anything other than as expected.
- Works within areas designated as having the potential for the recovery of Pleistocene deposits were subject to an archaeological watching brief by a Palaeolithic specialist.
- Regarding publication and deposition of archaeological reports and finds, technical reports are under review at the time of this evaluation and all are due to be published/ submitted to journals and deposited along with all finds with the various County Council's Heritage Environmental Records for future reference. A popular archaeological report, Archaeological Discoveries on the M25 Junctions 27 to 30, has been published.
- Although archaeological reports have yet to be published and deposition of any finds remains to be undertaken, all other aspects of the proposed mitigation phases appear to have been addressed. The effects of the scheme on archaeology and built heritage are considered to be slight adverse, as expected.

Biodiversity

- Despite the changes evident along the length of the scheme, advance ecological mitigation works regarding species and in terms of habitat manipulation/ reinstatement/ enhancement measures appear to have been implemented broadly as expected.
- Overall, the extent of the new planting associated with strip-widening is considered to have potential benefits in relation to wildlife corridors and habitat connectivity in the long term.
- Potential, better than expected effects are detracted from by the poor coverage, establishment, and condition of the plant stock observed during the site visits and unless the maintenance regime is not corrected in the near future, it is unlikely that either existing or new habitats will establish successfully and enhance or diversify the ecology of the M25 corridor in the long term as intended.
- Animal mortality figures suggest that there were no significant changes in the effects of the scheme on the mortality rates of the recorded species from the start of construction through to, and including, the first year of operation.

Water

- Although embankment widening did encroach onto the River Roding floodplain, this was compensated for via design; 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 information provided, the FYA site visit, and the information provided by the EA, it is likely that the overall effect of the scheme on water quality and drainage is slight beneficial, as expected.

Physical Fitness

- POPE is not aware whether there have been any NMU audits or Vulnerable User Studies undertaken for this scheme, but there is no evidence to suggest that there has been any reduction or increase in the degree of severance of the PRoW network or any significant change to NMU facilities.

Journey Ambience

- The coverage, establishment, and condition of the planting plots at the time of the site visits suggests that the visual amenity functions of the landscape mitigation measures may not be developing as expected.
- The additional carriageway increases the capacity of the M25, facilitating free-flowing traffic by providing more opportunities for the safe overtaking of slower vehicles.
- Average journey times for each peak period are consistently lower than the pre-scheme journey times along the length of the scheme; the observed pattern of journey time savings is the same for both the clockwise and anti-clockwise directions, with significant journey time savings achieved in the evening peak hour when compared to the morning peak hour.
- There has been a 42% decrease in the average number of collisions along section post scheme opening, and the severity of collisions has also reduced post opening.

6. Accessibility and Integration

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

Accessibility

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

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

Option Values

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

Forecast

- 6.4 For the objective regarding option values, the AST states that 'the scheme would not result in any new option values'. As such the AST forecast a score of 'neutral' for this objective.

Evaluation

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

Access to the Transport System

- 6.6 WebTAG states that access to the transport system is strongly influenced by the two key variables; access to a private car and proximity to a public transport service. This sub-objective considers whether the scheme has had an impact on these two variables.

Forecast

- 6.7 The scheme appraisal stated that 'Access to the Transport System would not be affected by the scheme' and forecast a score of 'neutral' for this objective.

Evaluation

- 6.8 The scheme has not affected the availability of private car or the provision/proximity of public transport. As such, the outturn evaluation for this objective is same as forecast i.e. neutral.

Severance

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

Forecast

- 6.10 The scheme appraisal stated that 'No change in severance as there is no change in routes used to connect community facilities'. The forecast impact for this sub objective is 'neutral'.

Evaluation

- 6.11 The outturn evaluation is consistent with the AST forecast of 'neutral'. There has been no change in routes to community facilities and with the exception of changes to traffic flows on local roads, there has been no impact on movements and activities within communities.

Integration

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

Transport Interchange

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

Forecast

- 6.14 The AST states that 'There are no Transport Interchange variables with the Scheme'. The AST forecast a neutral impact for this sub objective.

Evaluation

- 6.15 With regard to highway schemes, this sub-objective will only be applicable in certain cases where an interchange between different modes forms part of the scheme, such as a park and ride facility; therefore it is concluded that this scheme has no impact on this sub-objective.

Land Use Policy

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

Forecast

- 6.17 The scheme forecast an AST rating of neutral with regards to the integration with local, regional and national policy.

Evaluation

- 6.18 **Table 6.1** presents a summary of the relevant policies and how the scheme integrates with these policies.

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

	Policy/Document	Relevant Policy Objective/Reference	Relevant Scheme Impacts	Alignment
	Thurrock Council's Thurrock Transport Strategy 2013-2026	<p>The Thurrock Transport Strategy describes Thurrock Council's transport strategy. Relevant strategic aims include:</p> <ul style="list-style-type: none"> • To improve accessibility to services, especially education, employment and hospitals; • To encourage a modal shift away from the private car to walking, cycling and public transport, especially to work and school; • To minimise traffic growth; • To improve air quality, particularly in Air Quality Management Areas, in line with National Air Quality Strategy objectives; • To reduce carbon dioxide emissions from transport; • To reduce the number of people killed or seriously injured in Road traffic accidents; • To create a safer environment for road users, especially those who are more vulnerable; and • To promote economic regeneration by reducing congestion. 	<ul style="list-style-type: none"> • Initial information suggests that the scheme has improved safety along the scheme section and the scheme has also reduced accidents in the wider area. • Traffic along the scheme section has increased post opening. • Journey time reliability has improved • The scheme delivers congestion relief. • The scheme resulted in an increase in carbon, contrary to a specified policy objective. 	Partially
Regional Policy	East of England Plan: The Revision to the Regional Spatial Strategy for the East of England (2008) (revoked 2013)	<p>The overall objectives of the RSS were:</p> <ul style="list-style-type: none"> • To realise the economic potential of the region and its people; and • To improve and conserve the region's environment. <p>The objectives of regional transport strategy included:</p> <ul style="list-style-type: none"> • To manage travel behaviour and the demand for transport to reduce the rate of road traffic growth and ensure the transport sector makes an appropriate contribution to reducing greenhouse gas emissions; • To enable the provision of the infrastructure and transport services necessary to support existing communities and development proposed in the spatial strategy; and • To improve access to jobs, services and leisure facilities. 	<ul style="list-style-type: none"> • The scheme resulted in an increase in carbon, contrary to a specified policy objective. • 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. 	Partially
	Mayor of London Transport Strategy	<p>The goals of the draft Transport Strategy are:</p> <ul style="list-style-type: none"> • To support economic development and population growth; • To enhance the quality of life of all Londoners; • To improve the safety and security of all Londoners; • To improve transport opportunities for all Londoners; and • To reduce transport's contribution to climate change and improving its resilience and supporting delivery of the London 2012 Olympic and Paralympic Games and its legacy. 	<ul style="list-style-type: none"> • Initial information suggests safety has improved along the scheme section and wider area resulting from fewer collisions since scheme opening. • The scheme supports economic development through improved reliability. 	✓
	Essex Transport Strategy: the Local Transport Plan for Essex (June 2011)	<p>The Essex Transport Strategy seek to achieve five broad outcomes:</p> <ul style="list-style-type: none"> • Provide connectivity for Essex communities and international gateways to support sustainable economic growth and regeneration; • Reduce carbon dioxide emissions and improve air quality through lifestyle changes, innovation and technology; • Improve safety on the transport network and enhance and promote a safe travelling environment; • Secure and maintain all transport assets to an appropriate standard and ensure that the network is available for use; and • Provide sustainable access and travel choice for Essex residents to help create sustainable communities. 	<ul style="list-style-type: none"> • The scheme supports economic development objectives by improving the reliability of the strategic transport network. • The scheme resulted in an increase in carbon, contrary to a specified policy objective. • Number of collisions has reduced along the scheme section and wider area since scheme opening leading to improved safety. 	Partially
National Policy	The Future of Transport: a Network for 2030	<p>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.</p> <p>The Strategy is build around three themes:</p> <ul style="list-style-type: none"> • Sustained investment; • Improvements in transport management; and • Planning ahead. <p>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.</p> <p>Widening of M25-Six schemes is listed amongst the "The Highways Agency programme of major projects".</p>	<ul style="list-style-type: none"> • The scheme is part of a series of improvement measures along the M25, and as such provides an improved road network to cater for the increased traffic along the corridor. • The scheme was on the programme of major projects. • Reliability has improved as a result of the scheme. The improved scheme section has resulted in some re-routeing away from the local network indicate the improved choices that travellers are now able to make. 	✓
	Action for Roads - A network for the 21st century (July 2013)	<ul style="list-style-type: none"> • 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. 	<ul style="list-style-type: none"> • 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. • The scheme resulted in an increase in carbon, contrary to a specified policy objective. 	Partially

Key Points – Accessibility and Integration

Accessibility

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

Integration

- The scheme has not had an impact on the provision of public transport interchange as expected.
- The scheme integrates well with the objectives set out in regional policies and contributes to improving the reliability of the transport system in region. The scheme's impact on Land Use and Other Government Policies is therefore considered to be beneficial.

7. Appraisal Summary Table & Evaluation Summary Table

Appraisal Summary Table

- 7.1 The AST is a brief summary of the main economic, safety, environmental and social impacts of a highway scheme. **Table 7-1** presents the AST for the M25 J27-30 Widening scheme.
- 7.2 The AST presents a brief description of the scheme, a statement detailing the problems that the scheme planned to address, and makes an assessment of the scheme's predicted qualitative and quantitative impacts against the following core NATA objectives:
- **Environment** – an estimate of the impact of the scheme on factors such as noise, local air quality, landscape, biodiversity, and water;
 - **Safety** – measured reduction in the number and severity of collisions and qualitative assessment of impacts on security;
 - **Economy** – Estimated impact of the scheme upon journey times, vehicle operating costs, scheme costs, journey time reliability and wider economic impact;
 - **Accessibility** – A review of scheme impact upon access to the public transport network, community severance, and non-motorised user impact; and
 - **Integration** – A description of how a scheme is integrated with wider local planning, regional and national policy objectives.

Evaluation Summary Table

- 7.3 The EST was devised for the POPE process to record a summary of the outturn impacts against the NATA objectives, compared to the predictions in the AST.
- 7.4 Drawing on the results presented in this report, **Table 7-2** presents the EST for the scheme. An assessment of each of the objectives at the OYA stage is given. Where possible, the format of the EST mirrors the appearance and process of the AST to enable direct comparison between the two.

Table 7-1 - Appraisal Summary Table (AST)

OBJECTIVE	SUB-OBJECTIVE	QUALITATIVE IMPACTS	QUANTITATIVE IMPACT	ASSESSMENT
Environment	Noise	213 properties have been considered. 7 properties would have an increase of 1-3 dB(A), 160 properties would have a decrease of 1-3dB(A), 6 properties would have decrease of 3-5dB(A) & 40 properties would have no change in noise levels in the year 2027 due to low noise surfacing.	Total people annoyed: DM = 443, DS = 451, Scheme annoys 8 more people	PVB (Residential)= £-90,568 (disbenefit)
	Local Air Quality	Scheme has overall low adverse impact due to relatively low increases in traffic flows & speeds & low number of properties within 50m of Scheme. All AQ Strategy objectives expected to be achieved with & without the Scheme in opening year (2012) & subsequent years. The majority of properties affected by the Scheme are on the Brentwood bypass, where increase in pollutant concentration is marginal (<0.01ug/m3 average for NO2). AQ objectives are met in all 9 AQMAs in 2012.	Changes in PM ₁₀ : 170 properties improvement; 134 properties deterioration; 841 properties no change. Changes in NO ₂ : 1118 properties experience deterioration	PM ₁₀ = 4.93 NO ₂ = 19.82
	Greenhouse Gases	The Scheme results in net increase in carbon emissions over the 60 year appraisal period, compared to the Do-Minimum scenario due to more vehicles. The increase is less than 0.03%.	Carbon Emissions change (tonnes) 60 year = 142,894. Opening yr = 1,783	Net Present Value of Emissions (60 yrs) = - £4.944m
	Landscape	The M25 landscape value ranges from ordinary-good (J27-28), poor-good (J28-29), poor-ordinary (J29-30). Loss of screening & increased surfacing, earthworks, gantries & structures all negatively impact on landscape. The no. of lighting columns would increase but with better spillage control.		Slight Adverse
	Townscape	No Townscape features would be affected as settlements are well separated from the road.		Neutral
	Heritage of Historic Resources	Slight adverse impacts to 15 known archaeological sites & areas of general archaeological potential. Slight adverse impacts to 98 listed buildings. Neutral impacts to 2 Scheduled Ancient Monuments, 4 Registered Parks and Gardens, 8 Conservation Areas and 4 Historic Woodlands.		Slight Adverse
	Biodiversity	Scheme would result in slight beneficial impacts for River Roding, other amphibians, otters, water voles & common aquatic invertebrates as a result of improved motorway drainage. Slight adverse impacts to bats & birds from increase in habitat edge effects & changes in noise/light pollution.	N/A	Slight adverse
	Water Environment	No additional floodplain land utilised by the scheme. Despite an increased highway area additional flow attenuation & treatment included as part of the scheme would result in slight beneficial impacts.		Slight beneficial
	Physical Fitness	The Scheme would have no direct effect on the activity duration of pedestrians and cyclists because there are no changes to existing NMU facilities.	Journeys of >30 mins/day = 0 people. Total no. people walking/cycling: N/A	Neutral
	Journey Ambience	The Scheme would affect >10,000 people. It does not provide additional or impact on existing traveller facilities. Traveller views would be worsened. Driver stress would be reduced overall as a result of improvements in route uncertainty.		Large Beneficial
Safety	Accidents	The existing M25 has a better accident record than the national average rate, which has been used to assess the widened motor way. There is a consequential increase in the number of accidents.	Accidents +1999, Deaths +30, Serious injuries. +174, Slight injuries +3225	PVB -£80.1M
	Security	Slight beneficial impact on security due to improved surveillance/signage/landscaping.	0 users affected	Slight Beneficial
Economy	Public Accounts	The widening scheme produces benefits to users of £687M. Business user benefits account for nearly ¼ of the total, the remaining ¼ being consumer benefits. Exchequer costs total £377M offset by increased indirect tax revenues of £40.5M.		PVB £686.7M PVC £337.1M NPV £349.6M, BCR 2.04
	TEE (Consumers, Business and Exchequer Costs)			
	Reliability			
Wider Economic Impacts	The assessment of the transport spin-off benefits suggests the widening of the M25 would not have a significant impact on job creation. The calculated value of -74 jobs is insignificant within the context of the current job climate in the Thames Gateway Region.		Neutral	
Accessibility	Option Values	The Scheme would not result in any new option values.		Neutral
	Severance	No change in severance as there is no change in routes used to connect community facilities.	0 people affected	Neutral
	Access to the Transport System	Access to the Transport System would not be affected by the Scheme.		Neutral
Integration	Transport Interchange	There are no Transport Interchange variables with the Scheme.		Neutral
	Land Use Policy	8 transport and 1 countryside policy would be supported by the Scheme. 8 transport and 5 countryside policies would be hindered by the Scheme.		Neutral
	Other Government Policies	Key policies on preservation of archaeology (PPG15, PPG16), preservation of land, air & water (PPS23) & improvement of noise (PPG24) hindered. Key policy on pollution control (PPG25) helped.		Neutral

Table 7-2 - Evaluation Summary Table (EST)

OBJECTIVE	SUB-OBJECTIVE	QUALITATIVE IMPACTS	QUANTITATIVE IMPACT	ASSESSMENT
Environment	Noise	Observed 2-way AADT Traffic Flows are between 3% and 15% lower than forecast at all locations.	-	As expected
	Local Air Quality	Observed 2-way AADT Traffic Flows are 3% lower than forecast between Junctions 27-28. Observed 2-way AADT Traffic Flows are 12% and 15% lower than forecast between Junctions 28-29 and Junctions 29-30 respectively. The absolute number of vehicles is less than predicted by 15,500 and 19,900 AADT at each respective location and as the shortfall in both these figures is greater than 1,000 AADT, the percentage differences are considered to be significant.	-	As expected between Junctions 27-28 Better than expected between Junctions 28-30
	Greenhouse Gases	There is an increase in carbon emissions post opening compared to pre-scheme scenario. But the increase in emissions observed is lower than what was forecast to occur.		Better than expected
	Landscape	The beneficial effects of design changes are tempered by the adverse impacts of the gantry optimisation process; although gantries were optimised as far as possible in relation to landscape and visual impacts, the mitigation planting has not offset the overall negative impact of the gantry relocations and the increase in gantry size from single-span to super-span. It is therefore considered that the design changes have not materially changed the landscape or visual impact of the scheme as predicted by the ES, and the overall AST score would not be altered from Slight Adverse as a result of the design changes alone. Other than the design changes noted above, landscape mitigation measures in the form planting proposals appear to have been broadly implemented as expected. In terms of implementing management regimes to ensure effective establishment and maintenance of the landscape mitigation measures, the coverage, establishment, and condition of the plant stock at the time of the site visits indicates that the environmental functions of the planting plots are not developing well and that unless the maintenance regime is corrected in the near future, it is unlikely that the planting plots will achieve their targets by Design Year.	-	Worse than expected
	Townscape	No Townscape issues were identified in the alternative design reports, and no changes from the AST regarding Townscape were identified during the site visits.	-	As expected
	Heritage of Historic Resources	There is no evidence to suggest that the impact of the scheme on any statutory or non-statutory designated feature is anything other than as expected. Where works were proposed outside of the highway boundary, programmes of advance archaeological investigation works were developed during the production of the Archaeological The need for works within the highway boundary were targeted by a full comparison of the geological profile, plans of the existing M25 cross-sections and detailed indicative design cross-sections (at 10m intervals) along the proposed route. A popular archaeological report, Archaeological Discoveries on the M25 Junctions 27 to 30, has been published by the HA (2013). All aspects of the proposed mitigation phases appear to have been addressed.	-	As expected
	Biodiversity	Despite the changes evident along the length of the scheme, advance ecological mitigation works regarding species and in terms of habitat manipulation/ reinstatement/ enhancement measures appear to have been implemented broadly as expected. Overall, the extent of the new planting associated with strip-widening is considered to have potential benefits in relation to wildlife corridors and habitat connectivity in the long term. However, any potential (or actual) better than expected effects are detracted from by the poor coverage, establishment, and condition of the plant stock and unless the maintenance regime is not corrected in the near future, it is unlikely that either existing or new habitats will establish successfully and enhance or diversify the ecology of the M25 corridor in the long term as intended.	-	As expected
	Water Environment	Although embankment widening did encroach onto the River Roding floodplain, this was compensated for via design; it is considered that due to the geology beneath this section and the lack of soak away provision, there is no anticipated risk to groundwater at this location. The EA consider the agreed designs to adequately mitigate any adverse impacts on the water environment and in some cases, provide an improvement over the previous controls. Based on this and the FYA site visit, it is likely that the overall effect of the scheme on water quality and drainage is Slight Beneficial.	-	As expected
	Physical Fitness	There has been no reduction or increase in the degree of severance of the PRoW network, and no significant change to NMU facilities.	-	As expected
Safety	Journey Ambience	Signing is a part of the expected traveller experience and consequently, the effects of the gantry amendments are not considered to be significant in isolation. However, the coverage, establishment, and condition of the planting plots at the time of the site visits suggests that the visual amenity functions of the landscape mitigation measures may not be developing as expected. The additional carriageway increases the capacity of the M25, facilitating free-flowing traffic by providing more opportunities for the safe overtaking of slower vehicles.	-	Traveller Views are worse than expected. Traveller Stress and Traveller Care are as expected.
	Accidents	At the OYA stage there is no statistical evidence that the scheme has had an impact on safety within the study area. As such the monetised safety impact is reforecast to be £0m. This should be revisited at FYA.	-	Too early to conclude
Economy	Security	The scheme did not affect the provision of security facilities.	-	As expected (Neutral)
	Public Accounts	Outturn construction costs were lower than forecast, and changes to indirect tax were also lower than forecast.	Reforecast PVC based on OYA study: -£243.3m, BCR :1.3	Worse than expected
	TEE	The outturn journey time savings are lower than forecast.	Outturn Journey time benefits : £204.5m	Lower than expected
	Reliability	Journey time reliability has improved as a result of the scheme.	Outturn reliability benefits : £77.6m	PVB £77.6M
Accessibility	WEI	The scheme is likely to facilitate the wider economic benefits.	-	As expected (Neutral)
	Option Values	No impact on option values	-	As expected (Neutral)
	Severance	The scheme has not affected the provision of infrastructure.	-	As expected (Neutral)
Integration	Access to the Transport System	No direct change in public transport provision as a result of the scheme.	-	As expected (Neutral)
	Transport Interchange	The scheme has not had an impact on the provision of transport interchange facilities.	-	As expected (Neutral)
	Land Use Policy & Other Gov't Policies	The scheme aligns with national, regional and local policies in improving journey times and increasing the regions connectivity.	-	As expected (Neutral)

8. Conclusions

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

Scheme Specific Objectives

8.2 **Table 8-1** presents an evaluation of the scheme's objectives using the evidence presented in this study.

Table 8-1 – Success against Scheme Objectives

Objective	Has the scheme objective been achieved?	
Deliver trunk road improvements	The scheme has provided additional lane in both directions to cater for increased traffic	✓
Improve journey time reliability	Journey time reliability has improved along the scheme section in both directions. This is evident from the hourly variation in journey times being less variable in the peak hours.	✓
Improve safety	The scheme has resulted in fewer collisions post scheme opening.	Too early to conclude at this stage.
Reduce congestion	The scheme has provided improved journey times and journey time reliability and delivered congestion relief along the scheme section.	✓

8.3 **Table 8-1** shows that with the data available at this one year after stage, the scheme is achieving some of its objectives. For those objectives where it is stated that it is too early to conclude further investigation will be done at the Five Years After stage.

8.4 The following conclusions can be made from the analysis presented in this evaluation:

- Traffic on M25 between J27 and J29 has increased by 1% between pre-scheme and post opening, whereas there has been a 1% reduction between J29 and J30.
- Observed traffic flows are consistently lower than the forecast traffic flow changes. This is due to an over estimation of traffic growth in the appraisal. The general pattern of traffic flow changes is consistent between forecast and observed.
- Average journey times along the scheme section have reduced compared to pre-scheme, though the reduction in journey times has not been as high as was forecast in the appraisal.
- An improvement in journey time reliability has been observed since the scheme opened.
- There has been a reduction in the annual average number of collisions observed in the collision data; the scheme appraisal forecast an increase in collisions across the study area with the scheme in place.
- Economic benefits are lower than forecast due to the observed journey time benefits being lower than forecast.
- The long term impacts of the scheme are likely to be affected by the completion of the ongoing schemes on the M25 and the implementation of the controlled motorway along the scheme itself.

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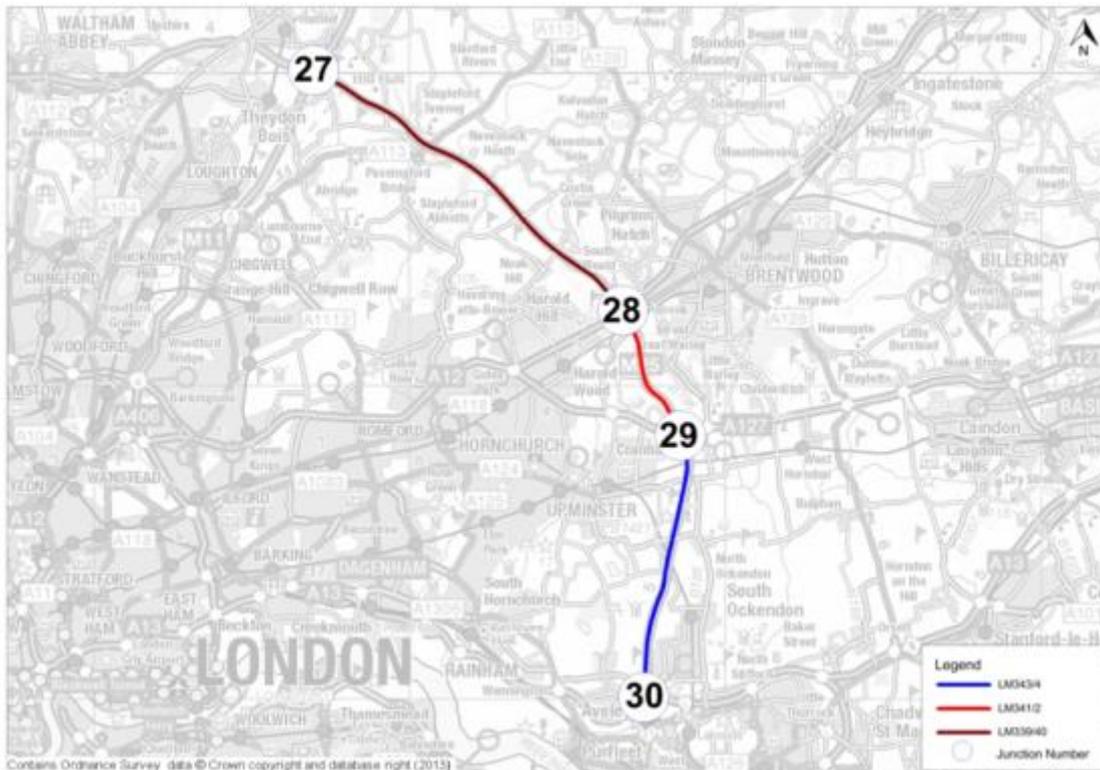
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Appendix B M25 Journey Time Sections

Table B.1 – M25 Journey Time Sections

Link ID	Link Description	Link Length (km)
LM339/40	M25 J27 to M25 J28	12.57
LM341/2	M25 J28 to M25 J29	3.81
LM343/4	M25 J29 to M25 J30	8.83

Figure B.1 – Journey Time Sections on M25 between J27 and J30



Appendix C Information requested for Environment Evaluation

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

Environment Specific Requirements	OYA Response
Environment Statement (ES) or Stage 3 Scheme Assessment Report (SAR) or Environmental Assessment Report (EAR) including Environmental Masterplan (EMP) drawings.	M25 Widening Section 4 (Junctions 27 to 30) Environmental Statement, including Volume 1 and sub-objective Technical Reports and Figures (November 2007) provided.
AST.	Provided (October 2007 version).
Any amendments / updates, additional surveys or reports since the ES / SAR / EAR.	Noise and Vibration reports (June 2009, January 2010 and August 2010) provided.
Any changes to the schemes since the ES / SAR / EAR e.g. to lighting and signs, retention of material on site in earthworks in the form of landscape bunds or other, or to proposed mitigation measures.	Alternative Design Reports
As built drawings for landscape/ biodiversity/ environmental mitigation measures/ drainage/ fencing/ earthworks etc.	Partial 'As Built' Section 4 Environmental Masterplan drawings (October 2010) provided.
Construction Environment Management Plan (CEMP), Landscape and Ecology Aftercare Plan (LEAP), Landscape Management Plan (LMP) or Handover Environmental Management Plan (HEMP).	Draft HEMP provided.
Health and Safety File – Environment sections (to include all environment As-Built reports).	Not received
Relevant Contact Names for consultation.	-
Archaeological Reports (popular and academic).	Popular publication provided; Archaeological Discoveries on the M25 J27-10 (Highways Agency, 2013) provided.
The Road Surface Influence (RSI) value of any low noise surface installed.	Not received
The insulation performance properties of any noise barriers installed (The BS EN 1794-2 result provided by the noise barrier manufacturer).	Not received
List of properties eligible for noise insulation.	Not received
Employers Requirements Works Information - Environment sections.	Not received
Reports for any pre/ post opening survey and monitoring work e.g. for noise, biodiversity, water quality).	Provided as follows: <ul style="list-style-type: none"> • M25 DBFO Widening Sub-sections 4A and 4B Landscape & Ecology Monitoring Plan, 1st Annual Report (February 2012); • M25 DBFO Widening Sub-sections 4A and 4B Landscape & Ecology Monitoring Plan, 6-Monthly Establishment and Maintenance Report (July 2012);and • M25 DBFO Widening Junction 27-30 Annual Landscape & Ecology Monitoring Report (December 2012).
Animal mortality data.	Provided by the Managing Agent.
Pre or Post opening Non-motorised User (NMU) Audits or Vulnerable User Surveys.	Not applicable
Information may be available regarding environmental enhancements to streetscape/townscape for bypassed settlements	Not applicable
Scheme Newsletters/ publicity material/ Award information for the scheme.	Provided and available on HA web page.

Additional documents obtained:

C.1.1 The following documents were used regarding Sub-section 4A specifically:

- Ecological Design (March 2009).
- Gantry Amendments Landscape and Visual Impact Report (June 2009).
- Noise and Vibration Design (June 2009).
- Land Contamination Technical Summary Report (July 2009).
- S4A Alternative Proposal Report for Clockwise Embankment Re-grade 168245-168350 and Detention Basin 1683 (August 2009).
- S4A Alternative Proposal Report for Clockwise Embankment Re-grade 162150-162270 (August 2009).
- S4A Alternative Proposal Report for Clockwise Embankment Re-grade 163500-163640 (August 2009).
- S4A Alternative Proposal Report for Clockwise Embankment Re-grade 164160-165280 (August 2009).
- S4A Alternative Proposal Report for Clockwise Embankment Re-grade 163780-163960 (August 2009).
- S4A Alternative Proposal Report for Clockwise Embankment Re-grade 165500-165960 (August 2009).
- S4A Alternative Proposal Report for Clockwise Embankment Re-grade 166950-167490 (August 2009).
- Series 3000 Appendices: Landscape and Ecology (October 2009).
- Design Appraisal Summary Report (May 2010).
- S4A Alternative Proposal Report for Anti-clockwise Bush Grove Pond, Now Tank (May 2012).
- S4A Alternative Proposal Report for Anti-clockwise Embankment Re-grade 164130-165280 (May 2012).

C.1.2 The following documents were used regarding Sub-section 4B specifically:

- Noise and Vibration Design (January 2010).
- Initial Use Assessment (January 2010).
- Water Quality and Hydrology Design Report (March 2010).
- Gantry Visual Assessment (May 2010).
- S4B Alternative Proposal Report for Pond 1727 (May 2010).
- S4B Alternative Proposal Report for Codham Hall Bund – Addendum to Certificate 1587A (May 2010).
- S4B Alternative Proposal Report for Embankment Re-grades between CH 170875-171825 and Tank 1714 (May 2010).
- S4B Alternative Proposal Report for Anti-clockwise Embankment Re-grade between CH 170000-170950 and Tank 1706 (May 2010).
- S4B Alternative Proposal Report for Embankment Re-grades between CH 167970-168620 and Pond 1683 (May 2010).
- Ecological Design (October 2010).
- Alternative Proposal: Upminster Bund (December 2010).
- Series 3000 Appendices: Landscape and Ecology (May 2012).

C.1.3 The following documents were used regarding Sub-section 4C specifically:

- Noise and Vibration Design (August 2010).
- Initial Use Assessment (August 2010).
- Ecological Design (Issue date not specified, noted within text as being prepared in November/ December 2010).

- Gantry Visual Assessment (February 2011).
- Water Quality and Hydrology Design Report (May 2011).
- Series 3000 Appendices: Landscape and Ecology (May 2012).

C.1.4 The following document was also used regarding Sub-section 4B and Sub-section 4C:

- Alternative Proposal Report for Locating Lighting Columns within the Central Reserve at Brook Street and Codham Hall Viaducts and to the Limit of the Associated Slip Roads, Revision D (March 2010).

Table C.2 – Parish Councils and Wards contacted for comment

Organisation	Field of Interest	Comments at FYA
Theydon Mount Parish Council	General	Did not respond to the invitation to provide feedback.
Theydon Bois Parish Council	General	Did not respond to the invitation to provide feedback.
Theydon Garnon Parish Council	General	Did not respond to the invitation to provide feedback.
Stapleford Tawney Parish Council	General	Did not respond to the invitation to provide feedback.
Lambourne Parish Council	General	Did not respond to the invitation to provide feedback.
Epping Upland Parish Council	General	Did not respond to the invitation to provide feedback.
Stapleford Abbots Parish Council	General	Did not respond to the invitation to provide feedback.
Stanford Rivers Parish Council	General	Did not respond to the invitation to provide feedback.
Epping Town Parish Council	General	Did not respond to the invitation to provide feedback.
Navestock Parish Council	General	Did not respond to the invitation to provide feedback.
Ward of Aveley & Uplands	General	Did not respond to the invitation to provide feedback.
Ward of West Thurrock and South Stifford	General	Did not respond to the invitation to provide feedback.
Ward of Ockendon	General	Did not respond to the invitation to provide feedback.
Ward of Belhus	General	Did not respond to the invitation to provide feedback.
Ward of Warley	General	Did not respond to the invitation to provide feedback.
Ward of Brentwood West	General	Did not respond to the invitation to provide feedback.
Thurrock Borough Council	General	Did not respond to the invitation to provide feedback.
London Borough of Havering	General	Did not respond to the invitation to provide feedback.
Brentwood Borough Council	General	Did not respond to the invitation to provide feedback.
Essex County Council	General	Did not respond to the invitation to provide feedback.
Thames Chase Community Forest	Landscape, biodiversity & physical fitness	Did not respond to the invitation to provide feedback.
GreenArc	Landscape, biodiversity & physical fitness	Did not respond to the invitation to provide feedback.
Essex Wildlife Trust	Biodiversity	Did not respond to the invitation to provide feedback.

Appendix D Photographic Record of Scheme

Figure D.1 – Photomontage view south from F46: Predicted Day One View



ES Landscape Technical Report (July 2007)



OYA (August 2013)

Although the gantry has shifted slightly as a result of the gantry optimisation process and a verge mounted lighting option was adopted for the main carriageway design throughout the majority of the scheme, visual effects are broadly as predicted.

Figure D.2 – Photomontage view north from F58: Predicted Day One View



ES Landscape Technical Report (July 2007)



OYA (August 2013)

The increased land-take resulting from strip widening and the effects of the gantry optimisation process in terms of both location and the change from single-span to super-span gantries are clearly visible from Footpath 58.

Figure D.3 – Photomontage view south from F60: Predicted Day One View



ES Landscape Technical Report (July 2007)



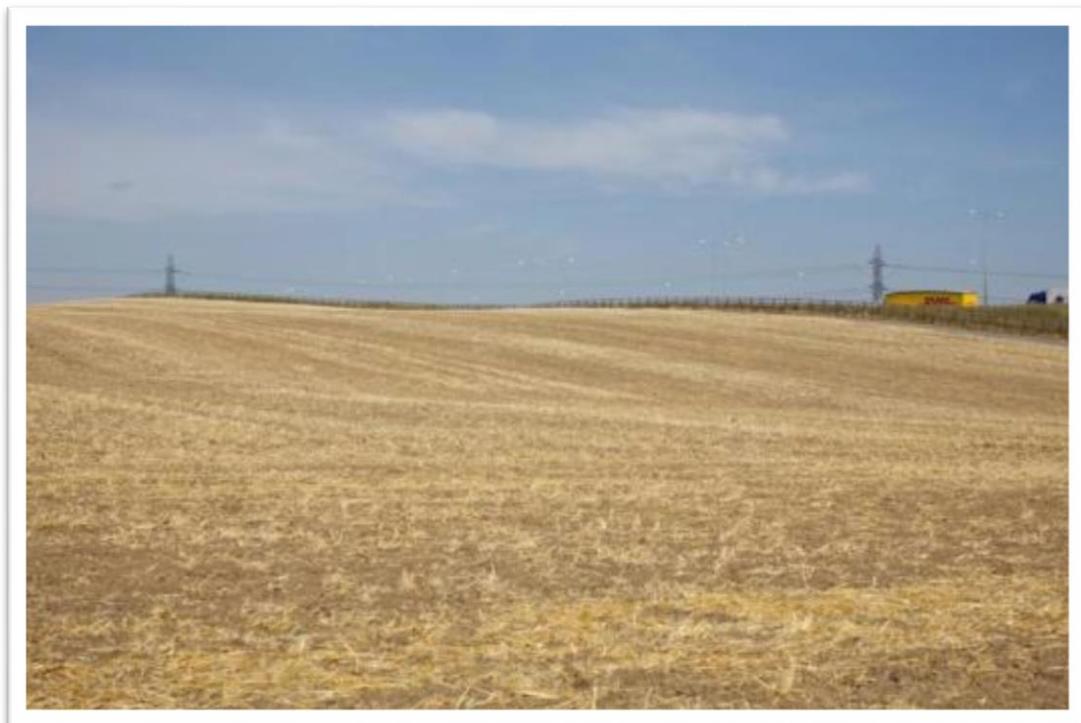
OYA (August 2013)

At the south-eastern quadrant of Junction 29, it can be seen that the gantry has shifted slightly and has changed from a single-span gantry to a super-span gantry as a result of the gantry optimisation process. Although additional development has taken place outside of the widening scheme, the visual effects of the scheme are broadly as predicted at this location.

Figure D.4 – Photomontage view north from F65a: Predicted Day One View



ES Landscape Technical Report (July 2007)



OYA (August 2013)

The alternative design of the Upminster bund has been profiled to match the open, undulating landscape, and has been run into the existing motorway embankment to provide a greater cross-sectional area that has been planted; this is a clear improvement over the predicted landscape and visual impact of the scheme.

Figure D.5 – Photomontage view south from F72: Predicted Day One View



ES Landscape Technical Report (July 2007)



OYA (August 2013)

Despite an MS3 signal being located here as a result of the gantry optimisation process, the visual effects are broadly as predicted.

Figure D.6 – View looking directly at the M25 western carriageway from eastern section of Footpath F20 (Stapleford Tawny CP Ref. 18)



ES Landscape Technical Report (July 2007)



OYA (August 2013)

At the time of the POPE site visits, injurious/ other weeds comprised between 35-85% of the total vegetative cover at most grassland plots throughout the scheme.

Figure D.7 – Views looking across farmland of motorway on embankment from The Lodge, Albyns Lane (P28)



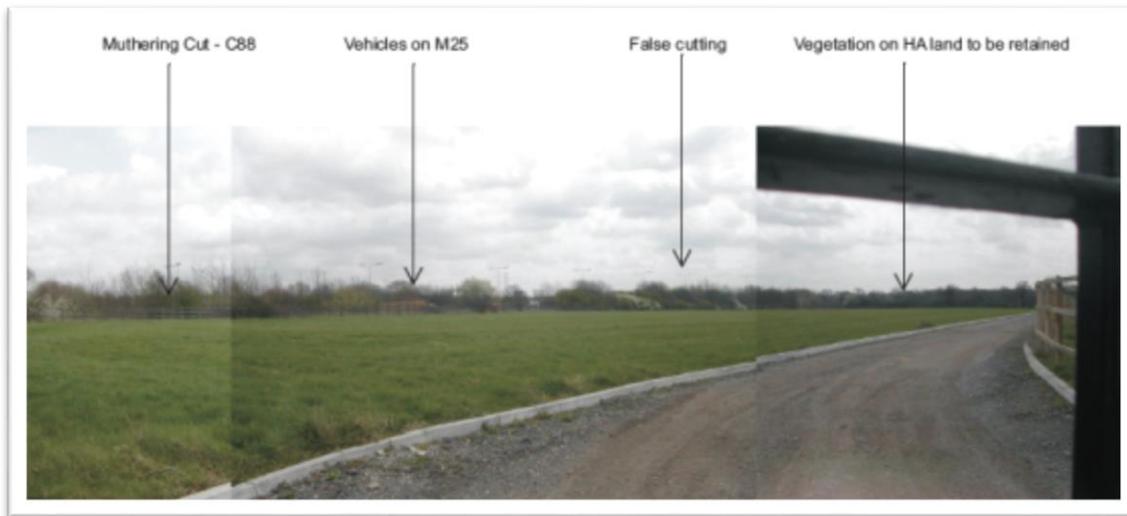
ES Landscape Technical Report (July 2007)



OYA (August 2013)

Although the changes brought about by the final design are evident throughout, the design changes have not materially changed the landscape or visual impact of the scheme.

Figure D.8 – Views looking south from rear of Middle Brook Farm (P41)



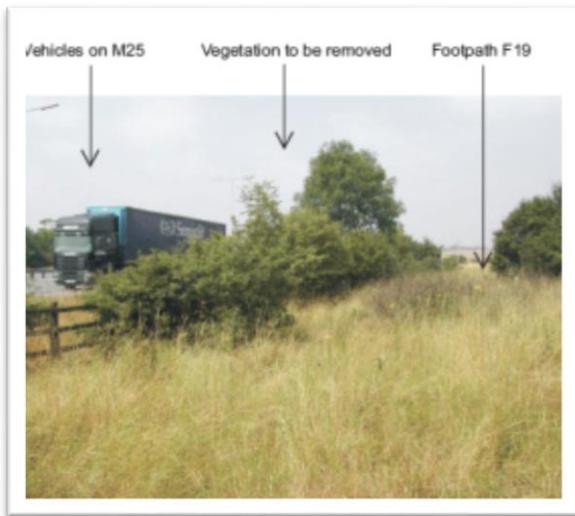
ES Landscape Technical Report (July 2007)



OYA (August 2013)

Adverse effects resulting from the change from single-span to super-span gantries as a result of the gantry optimisation process are likely to be evident at selected locations along the scheme. Although gantries were optimised as far as possible in terms of landscape and visual impacts, the associated optimised gantry mitigation planting has not offset the overall negative effect of the gantry relocations and the increase in size from single to super span gantries.

Figure D.9 – Views looking north from Footpath F19 (Stapleford Tawney CP Ref. 24)



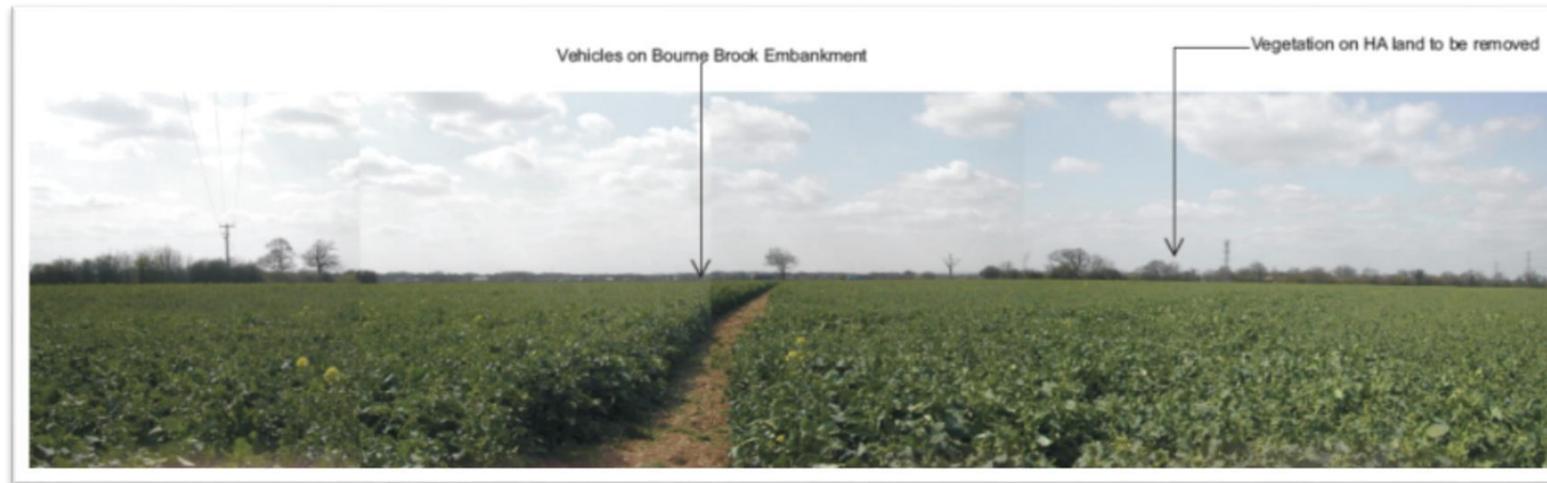
ES Landscape Technical Report (July 2007)



OYA (August 2013)

Although strip widening has increased the predicted land-take at selected locations, the impact of the scheme on adjacent footpaths is not generally considered to be significant and as such, impacts on NMUs are likely to be as expected.

Figure D.10 – Views looking south from Footpath F34 (Navestock 31) CP Ref. 24



ES Landscape Technical Report (July 2007)



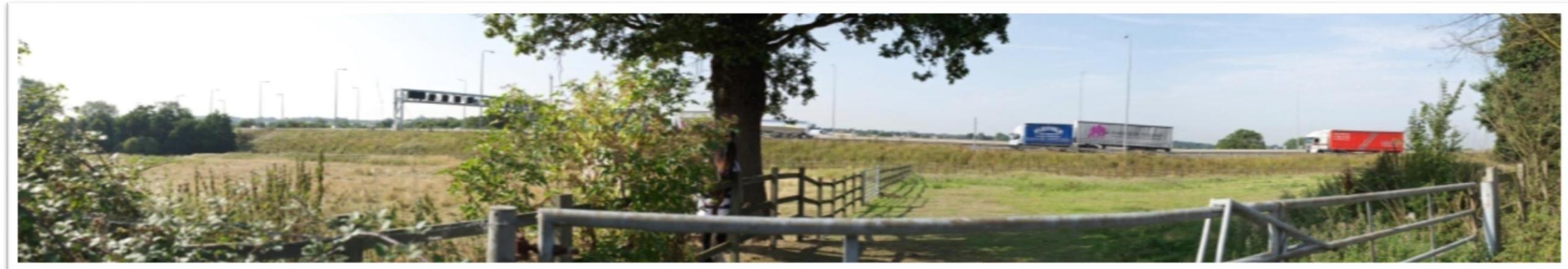
OYA (August 2013)

The ES stated that a significant area of vegetation would be retained on the clockwise side of the Bourne Brook embankment; although this is the case to the right of the view, part of the area stated as being retained was removed (centre, centre left) and has been replaced with new planting, scattered trees and grassland. This is an adverse impact of the as-built response to the ES landscape commitments, as high-sided vehicular movements are now likely to be more prominent (visible) within the landscape.

Figure D.11 – Direct open views west of M25 on embankment from road R3b



ES Landscape Technical Report (July 2007)



OYA (August 2013)

Although adverse effects resulting from the change from single-span to super-span gantries may be evident from selected viewpoints with direct and open views of the M25 corridor, the design changes in isolation have not materially changed the overall landscape or visual impact of the scheme. Although gantries were optimised as far as possible in terms of landscape and visual impacts, the associated optimised gantry mitigation planting has not offset the overall negative effect of the gantry relocations and the increase in size from single to super span gantries.

Figure D.12 – 077, Footpath within Belhus Woods Country Park



ES Landscape Technical Report (July 2007)



OYA (August 2013)

Although changes from the ES in the final design are evident along the scheme, these design changes alone have not materially changed the landscape or visual impact of the scheme.

Figure D.13 – Open views looking north from Tyler's Wood (O12)



ES Landscape Technical Report (July 2007)



OYA (August 2013)

Previously open and direct views of the M25 are screened by the maturing Thames Chase Community Forest at Tyler's Wood.

Figure D.14 – Views looking south across Cranhill Golf Course towards the M25 on embankment (124a)



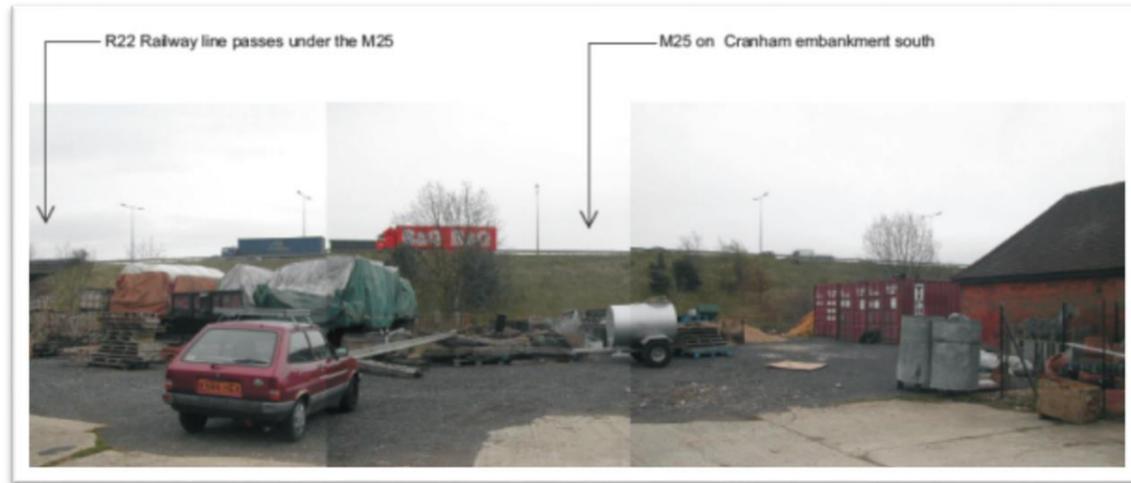
ES Landscape Technical Report (July 2007)



OYA (August 2013)

Although gantries were optimised as far as possible in terms of landscape and visual impacts, the associated optimised gantry mitigation planting has not offset the overall negative effect of the gantry relocations and the increase in size from single to super span gantries.

Figure D.15 – Views looking directly east towards the western carriageway from Frank's Farm (P123)



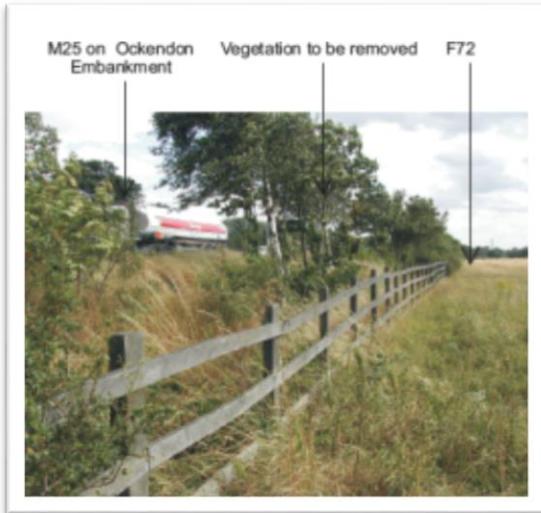
ES Landscape Technical Report (July 2007)



OYA (August 2013)

Large trees have been planted to provide initial screening to the piled retaining wall at Frank's Farm. These are in addition to the continuous belt of existing planting along this section which when combined with the large trees, equates to the depth of planting specified in the ESPs.

Figure D.16 – Views looking south on Footpath F72



ES Landscape Technical Report (July 2007)



OYA (August 2013)

Widening has resulted in the loss of some verge-side vegetation, and significant weed growth is evident where the ground has been disturbed during construction operations.

Appendix E 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.
ATC	Automatic Traffic Count
AAWT	Annual Average Weekday Traffic. As AADT but for five days (Monday to Friday) only.
AWT	Average Weekday Traffic. As ADT but for five days (Monday to Friday) only.
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.
Bvkm	Billion Vehicle Kilometres
COBA	Cost Benefit Analysis. A computer program which compares the costs of providing road schemes with the benefits derived by road users (in terms of time, vehicle operating costs and accidents), and expresses the results in terms of a monetary valuation. The COBA model uses the fixed trip matrix unless it is being used in Accident-only mode.
CRF	Congestion Reference Flow
DfT	Department for Transport
Discount Rate	The percentage rate applied to cash flows to enable comparisons to be made between payments made at different times. The rate quantifies the extent to which a sum of money is worth more to the Government today than the same amount in a year's time.
Discounting	Discounting is a technique used to compare costs and benefits that occur in different time periods and is the process of adjusting future cash flows to their present values to reflect the time value of money, e.g. £1 worth of benefits now is worth more than £1 in the future. A standard base year needs to be used which is 2002 for the appraisal used in this report.
DM	Do Minimum. In scheme modelling, this is the scenario which comprises the existing road network plus improvement schemes that have already been committed.
DMRB	Design Manual for Roads and Bridges
DS	Do Something. In scheme modelling, this is the scenario detailing the planned scheme plus improvement schemes that have already been committed.
EA	Environment Agency
EIR	Economic Impact Report
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 Years After
HA	Highways Agency. An Executive Agency of the DfT, responsible for operating, maintaining and improving the strategic road network in England.
HGV	Heavy Goods Vehicle
INCA	Incident Cost Benefit Analysis. A spreadsheet based program which calculates the benefits of reduced delay and travel time variability.
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.

Terms	Definition
LNS	Low Noise Surfacing
MAC	Managing Area Contractor Organisation normally contracted in 5-year terms for undertaking the management of the road network within a HA area.
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.
ONS	Office for National Statistics
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.
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
RSA	Road Safety Audit
RSI	Road Surface Index
SAM	Scheduled Ancient Monument
SSSI	Site of Special Scientific Interest
STATS19	A database of injury collision statistics recorded by police officers attending collisions.
TAR	Transport Appraisal Report
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.
TIS	Traffic Impact Study
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/