Post Opening Project Evaluation

A14 Junctions 7-9 Kettering Bypass Improvement - One Year After

August 2017

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Executive summary

Scheme Description

The A14 Junctions 7-9 Kettering Bypass Improvement is a Highways England major scheme which was completed in May 2015. The scheme aimed to provide additional capacity by widening the existing carriageway from two to three lanes in both directions between Junctions 7-9.

The A14 is a strategic highway route which connects the M1 and M6 motorways in the Midlands with the A1, the M11 and the east coast ports near Felixstowe. In addition to the A14's strategic importance, the A14 also performs important local and regional functions, providing connections between Cambridge, Ipswich, and Kettering.

The section of the A14 around Kettering, in Northamptonshire, suffered from congestion and unpredictable journey times, with traffic merging/diverging with the A14 carriageway from important local routes including the A43, A509, and A6013. By improving this section of the A14, the scheme aimed to improve journey time reliability and contribute towards the region's local economy.

Scheme Objectives

Objective (Source: Client Scheme Requirements)	**Has the objective been achieved at One Year After?**
To support sustainable economic activity and local development plans	Too early to be conclusive.
To support and enhance the role of the current A14 Kettering Junctions 7-9 as a major (Trans-European Network) and inter-urban regional transport artery	✓
To reduce congestion and provide additional capacity, increase journey time reliability and ensure the safe and economic operation of the trunk road	✓
To support housing and job growth in the region	Too early to be conclusive.
To achieve a safety objective under which the 'after' collision numbers (per annum) on the J7-9 section of the A14 are no greater than those 'before' and the severity ratio is not increased	Too early to determine if the change is related to the scheme.
The scheme should improve journey time reliability by improving and better managing traffic flow conditions	✓
The scheme should reduce the effects of queuing on the slip roads on mainline flow	✓
To minimise the detrimental environmental effects of the scheme and offset by mitigation measures where technically feasible and economic to do so, taking account of costs, availability of funding and statutory obligations	✓

Key Findings

The Key Findings of this One Year After (OYA) opening evaluation of the A14 Junctions 7-9 Kettering Bypass Improvement scheme are:

- Observed traffic growth along the scheme section is lower than forecast.
- Average Speeds along the scheme section have increased post-scheme opening.
- Average journey times have reduced during all time periods along the scheme section.
- Journey time reliability as measured by variation in journey times has improved along the scheme section.

- Initial findings indicate that the collision record has improved, however the change is not statistically significant and therefore cannot be attributed to the scheme.
- Environmental impacts are in line with expectations.

Summary of Scheme Impacts at OYA

Traffic

Traffic Volumes

- Weekday traffic flows along the scheme section between Junctions 7-8 have increased by 7% (approx. 2,900 vehicles) along the westbound carriageway, and by 8% (approx. 3,400 vehicles) along the eastbound carriageway.
- Weekday traffic flows between Junctions 8 and 9 have increased by 4% (approx. 1,600 vehicles) along the westbound carriageway, and by 8% (approx. 3,000 vehicles) along the eastbound carriageway.

- The proportion of HGVs recorded along the A14 mainline carriageway has changed marginally between 2012 and 2016. However, the A43 north of the A14 and the A43 south of the A14 have experienced slight increases in the proportion of HGVs recorded, with approximately 4% more HGVs recorded along the A43 north and approximately 6% more along the A43 South.

Journey Times

- Eastbound journey times along the scheme section have reduced in all time periods, with an observed journey time saving per vehicle of approximately 14 seconds during the AM peak, and 17 seconds during the PM peak period.
- Westbound journey times along the scheme section have also reduced across all time periods, with an observed journey time saving of approximately 17 seconds in the AM peak, and 37 seconds in the PM peak period.

Reliability

- There has been a positive impact on journey time reliability (as measured by the variability of journeys) along the scheme section (Junctions 7-9).
- The scheme has had a limited impact on journey time reliability between Junctions 2-12.
- The benefit from the scheme section (Junctions 7-9) is concealed within the average journey times when considering the change in reliability for the longer route between Junctions 2-12.

Forecast vs. Outturn Traffic Flows and Journey Time Impacts

- The average journey times along the A14 mainline carriageway between, Junction 2 and 12, with and without the scheme were overestimated. As identified in this report, the appraisal overestimated the flows along the A14 mainline carriageway, which is consistent with the better than forecast journey time benefits.
- Forecasts of average ‘spot’ speeds indicate a forecast saving in average journey times across the scheme section.

Safety

- Collisions over the modelled area have reduced by an annual average of 15.8 Personal Injury Collisions (PICs) post opening, although statistical significance testing found this not to be statistically significant at this time.
- In the immediate scheme area, collision numbers increased marginally by 0.1 PICs which again is not statistically significant.
- The collision rate has reduced by approximately 4% post opening. However, statistical significance testing has demonstrated that the change in collision rates is not statistically significant.
- There has been a 3% reduction in the number of collisions across the modelled area which is better than the 1% forecast increase in collisions. However, there has been an observed 2% increase in the

number of collisions across the key links analysis area, which is higher than the forecast net reduction of 2%.
- Post scheme opening collisions show reductions in the seriousness of casualty injuries compared with those before.

Environment

- The impact on noise and air quality has been evaluated through examining the change in traffic flows. Based on observed changes in traffic flows, it is likely that local noise impacts are generally as expected. The air quality benefits for properties in proximity of the A14 carriageway are as expected.
- Although a net increase in carbon emissions was forecast, it has been lower than expected due to lower than expected traffic flows.
- The measures identified to mitigate the impact of the scheme on the surrounding landscape have been provided in line with proposals. The required translocation is assumed to have occurred during construction although species rich grassland is not receiving the maintenance required to ensure its success.
- Drainage systems have been installed as expected and appear to be working as required.
- Traveller views on embankments will remain open until planting has matured. No further care facilities were installed as a part of the scheme as there are two existing services within the limits of the scheme.

Summary of the Scheme Economic Performance

All in 2010 market prices, discounted to 2010		Forecast (£m)	Outturn (£m)
Costs	**PVC**	**£44.230m**	**£42.225m**
Benefits	Journey Time (TEE business and consumer users)	£257.978m	£202.008m
	Vehicle Operating Costs (VOC)	-£28.712m	-£17.461m
	Delay During Construction period & Future maintenance periods: Journey time and VOC impacts	-£10.923m	-£10.923m
	Safety Benefits	£17.302m	N/A
	Carbon Benefits	-£7.101m	-£3.232m
	Noise Benefits	£0.613m	£0.613m
	Air Quality	-£0.904m	-£0.904m
	PVB subtotal	**£228.253m**	**£170.101m**
	Indirect Tax	£17.46m	£10.618m
BCR (with indirect tax in PVB)		**5.6**	**4.3**

- The forecast monetised journey time benefit for the scheme was £257.978 million. The outturn monetary benefit over the 60-year appraisal period is £202.008m. This lower than forecast monetary benefit is primarily due to the lower than expected traffic growth anticipated in the original forecasts, in addition to the slower than forecast observed journey times.
- The forecast monetised safety benefit for the scheme was £17.302 million. The observed reduction in collisions in the post opening period was not statistically significant. Therefore, because the change in collision numbers cannot be confidently attributed to the scheme, no monetised value has been attributed to the observed changes in safety.
- Outturn Benefit Cost Ratio represents over £4 benefits for every £1 spent which represents very high value for money.

1. Introduction

1.1. The A14 Junctions 7-9 Kettering Bypass Improvement is a Highways England major scheme which was completed in May 2015.

1.2. This report presents a One Year After (OYA) opening evaluation of this scheme, and has been prepared as part of the Highways England Post Opening Project Evaluation (POPE) programme. The purpose of this report is to present the initial impacts of the scheme during the opening 12-month period. A Five Year After (FYA) opening evaluation of this scheme will be undertaken to present the impacts of the scheme during the opening five year period.

Scheme Context

1.3. The A14 is a strategic highway route which connects the M1 and M6 motorways in the Midlands with the A1, the M11 and the east coast ports near Felixstowe. Due to its links with the port of Felixstowe, the A14 is part of the Trans-European Network[1], and is the designated UK section of the Ireland – UK – Benelux highway link known as Project 13[2]. Because of the A14's strategic importance, the A14 has a high proportion of HGVs (Heavy Goods Vehicles).

1.4. In addition to the A14's strategic importance, the A14 also performs important local and regional functions, providing connections between Cambridge, Ipswich and Kettering. The section of the A14 around Kettering, in Northamptonshire, suffers from congestion and unpredictable journey times, with traffic merging/diverging with the A14 carriageway from important local routes including the A43, A509 and the A6013.

1.5. By improving this section of the A14, the scheme aimed to improve journey time reliability along the A14 between Junctions 7-9, and contribute towards the region's local economy.

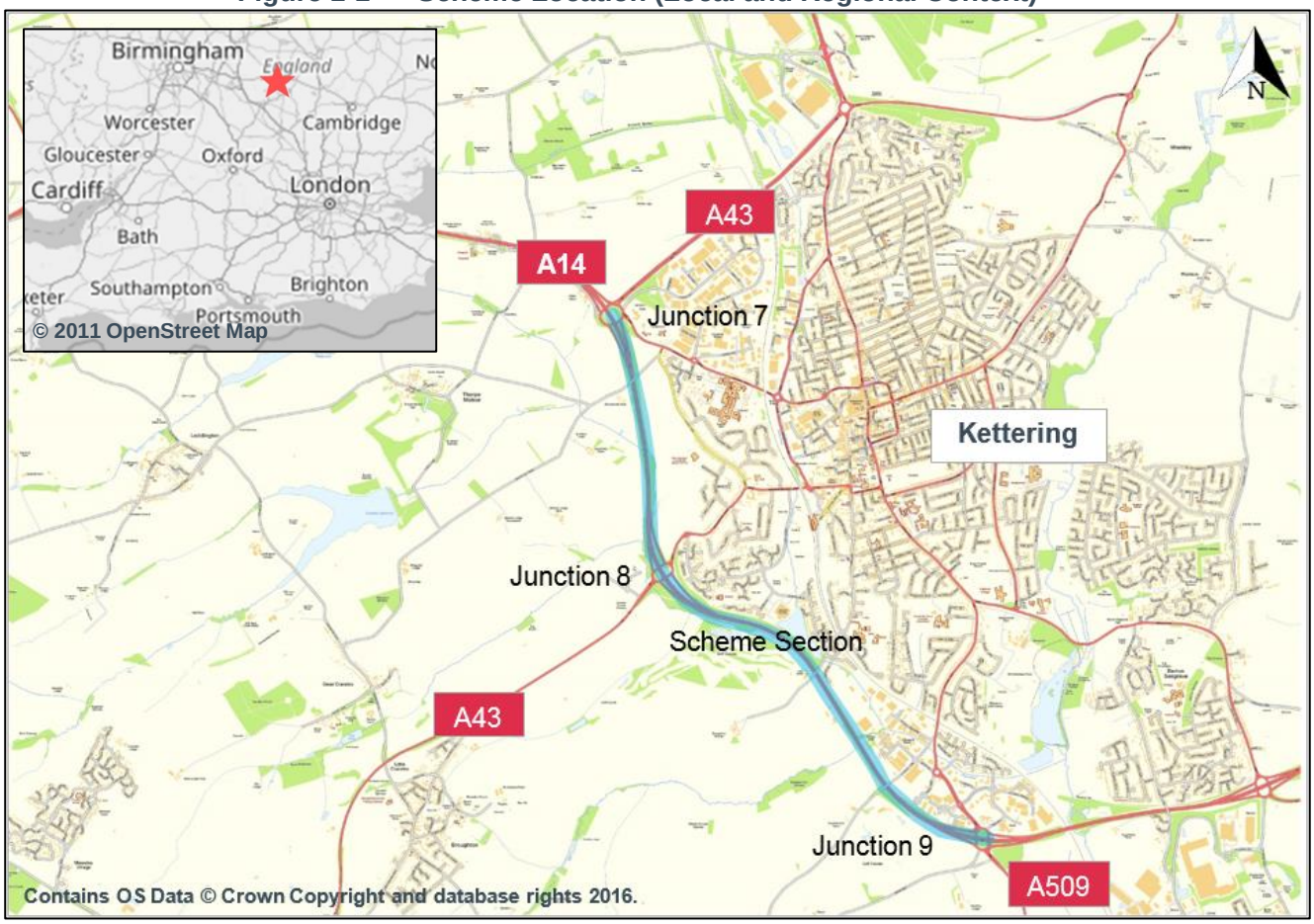
Scheme Location

1.6. The A14 Junctions 7-9 Kettering Bypass Improvement scheme lies to the lies to the south-west of Kettering, providing local, regional and strategic functions. Figure 1-1 shows the location of the scheme within the local and regional context.

[1] The Trans-European Transport Network (TEN-T) envisages coordinated improvements to primary roads railways, inland waterways, airports, seaports, inland ports and traffic management systems, providing integrated and intermodal long-distance, high-speed routes.

[2] Project 13 aims to connect Britain with Ireland and Northern Europe through investment in existing routes/ links between the North Sea ports of Felixstowe/ Harwich and Anglesey in North Wales, Liverpool in North West England and Dublin/Cork in Ireland.

Figure 1-1 Scheme Location (Local and Regional Context)



Existing Problem

1.7. The A14 between Junctions 7-9 is a dual 2 lane all purpose highway which forms part of the Trans-European Network linking the West Midlands, M6, M1 and A1 with the container port of Felixstowe. Consequently, the A14 carries a high proportion of HGVs (up to 20% of all traffic in some sections). In addition, the A14 between Junctions 7 and 9 also performs important local and regional functions, connecting Cambridge, Ipswich and Kettering.

1.8. The scheme section between Junctions 7 and 9 is one of the most congested sections of the A14, with closely spaced junctions linking other major road corridors (A43, A509, and A6). A significant proportion of the congestion along this section of the A14 (near Kettering) is caused by local traffic '*junction hopping'* between junctions.

Scheme Description

1.9. The A14 Junctions 7-9 Kettering Bypass Improvement scheme aimed to provide additional capacity by symmetrically widening the existing carriageway (from 2 to 3 lanes) in both directions between Junctions 7-9. The construction of an additional lane was accommodated within the existing highway boundary. No additional land take or statutory orders were required.

1.10. The additional lanes along the A14 was constructed immediately from the east of junction 7 (A43) to immediately west of junction 9 (A509). No additional work was undertaken

Scheme Objectives

1.11. The objectives of the scheme, as summarised from the Client Scheme Requirements (July 2013) were:

- To support sustainable economic activity and local development plans;
- To support and enhance the role of the current A14 Kettering Junctions 7-9 as a major regional (Trans-European Network) and inter-urban transport artery;
- To reduce congestion and provide additional capacity, increase journey time reliability and ensure the safe and economic operation of the trunk road;
- To support housing and job growth in the region;
- To achieve a safety objective under which the 'after' collision numbers (per annum) on the Junctions 7-9 section of the A14 are no greater than those 'before' and the severity ratio is not increased;
- To improve journey time reliability by improving and better managing traffic flow conditions;
- To reduce the effects of queuing on the slip roads on mainline flow;
- To minimise the detrimental environmental effects of the scheme and offset by mitigation measures where technically feasible and economic to do so, taking account of costs, availability of funding and statutory obligations; and
- Provide an additional lane in each direction to reduce traffic intensity, which should reduce frequency of incidents, improving reliability of journey times.

History

1.12. A brief history of the key events in the development of the scheme is provided in Table 1-1.

Table 1-1 Timeline of A14 Junctions 7-9 Kettering Bypass Improvement scheme

Date	Summary
2003	The 'London to South Midlands Multi-Modal Study' identified the need for improvements to the A14 from the M1 Junction 19 to the A1.
2010	In October 2010, the Department for Transport (DfT) publication 'Investment in Highways Transport Schemes' identified the A14 Kettering project as a 'future scheme' for delivery.
2011	The scheme was included in the Chancellor's 2011 Autumn Statement a start of works prior to the end of 2014/15.
2012	The March 2012 Budget announced a projected a start of works for this scheme in 2013/14.
2013	**Scheme construction** commenced on 11 November 2013.
2015	The third lane on both carriageways was **opened to traffic on 1st May 2015.**
2015	Overnight carriageway closures from 21st May 2015 – June 20th 2015 for re-surfacing.

Overview of POPE

1.13. Highways England are responsible for improving the strategic highway network (motorways and trunk roads) through 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 scheme's continued development.

1.14. When submitting a proposal for a major transport scheme, the Department for Transport (DfT) specifies that an Appraisal Summary Table (AST) is produced.

1.15. 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 Appendix A of this report.

1.16. POPE studies are undertaken for all Major Schemes to evaluate the strengths and weaknesses in the techniques used for appraising schemes. This process helps to identify

improvements which can be made in the future. For POPE, this is achieved by comparing information collected before and after the opening of the scheme, 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 Appendix A of this report.

Report Structure

1.17. Following this introduction, the report is divided into eight further chapters as follows:

- **Chapter 2** – Traffic Impact Evaluation;
- **Chapter 3** – Safety Evaluation;
- **Chapter 4** – Economic Evaluation;
- **Chapter 5** – Environmental Evaluation;
- **Chapter 6** – Accessibility and Integration Evaluation;
- **Chapter 7** – Conclusions;
- **Appendix A** – Appraisal Summary Table (AST) and Evaluation Summary Table (EST)
- **Appendix B** – Environment Information Requested;
- **Appendix C** – Glossary;
- **Appendix D** – Journey Time Reliability along A14 EB (J2-12);
- **Appendix E** – Journey Time Reliability along A14 WB (J2-12); and
- **Appendix F** – Tables and Figures in this report.

2. Traffic Impact Evaluation

Introduction

2.1. In order to evaluate the traffic flow, journey time and reliability impacts of the scheme, the following section considers:

- Sources of data;
- Summary of the traffic modelling approach and forecast assumptions;
- Background traffic changes;
- Observed traffic volume changes;
- Traffic flow forecasting accuracy;
- Journey time changes on the A14;
- Journey time changes forecasting accuracy; and
- Reliability impacts of the scheme.

Sources

2.2. The analysis of traffic in this section of the report draws upon from the following sources.

- Traffic volumes
  - Highways England permanent traffic counts for the A14 in the year before the start of construction (2012) and the year following completion (2016);
  - DfT data on national and regional traffic levels; and
  - Temporary traffic count surveys undertaken on local roads as part of this evaluation.
- Journey times
  - Journey time data was obtained from sat-nav[3] data from vehicles using the A14 along the full length of the scheme, in the year before the start of construction (2012) and the year following completion (2016).

2.3. The following documents have been used to source the traffic modelling forecasts:

- A14 J7-9 Kettering Bypass Widening Traffic Forecasting Report 47062030/TP/03 – (March 2013), (TFR)

Scheme modelling and Forecast Assumptions

2.4. As outlined in the Traffic Forecasting Report (TFR, 2013) the scheme modelling was based on the Scott Wilson Stage 2 (SW Stage 2) SATURN model.

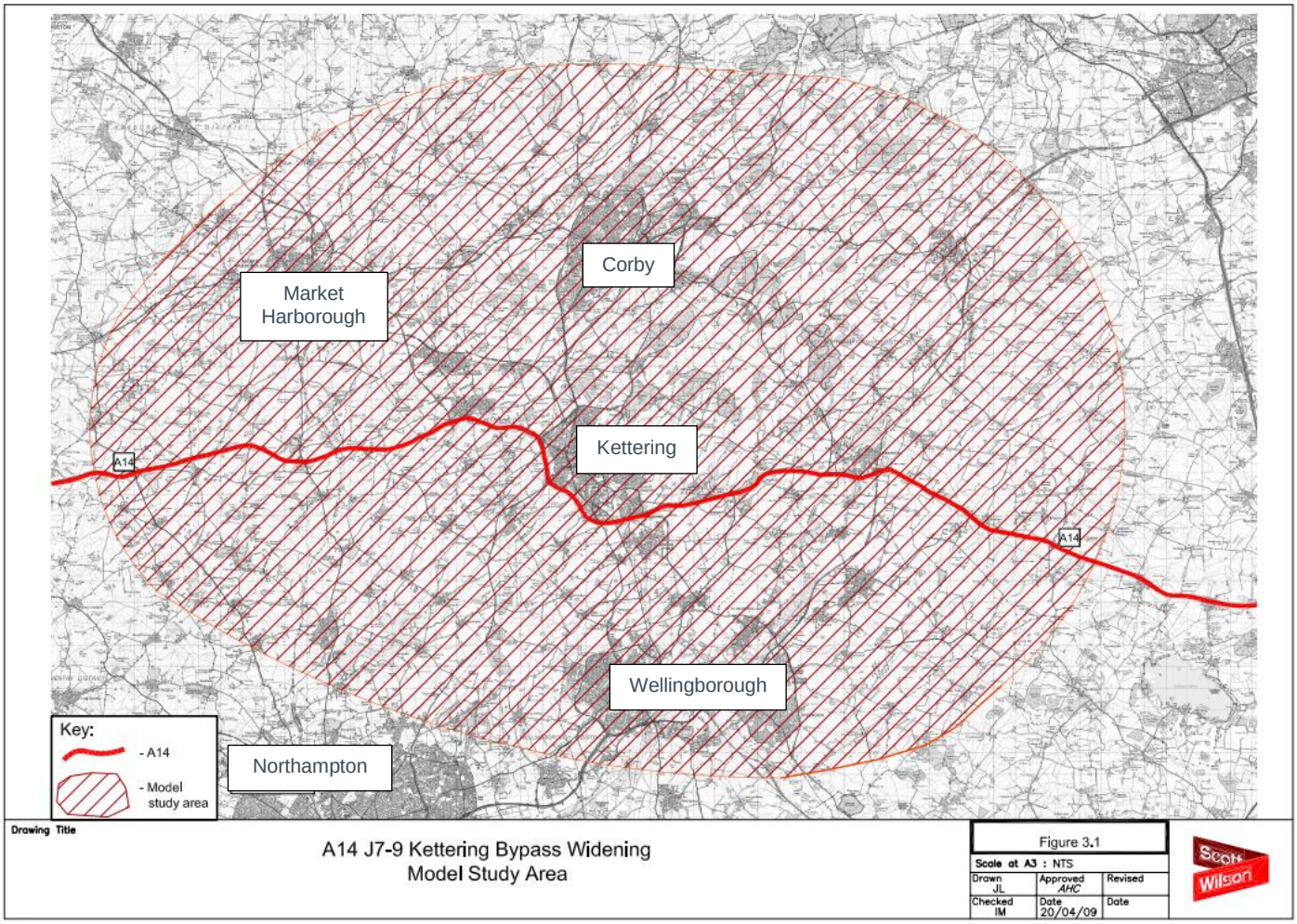
2.5. The model was developed for a study area that extended to M1 Junction 19 in the west; to immediately north of Corby in the north; to the A14 Junction 15 in the east and to immediately north of Northampton in the south. The study area included the towns of Kettering, Corby and Wellingborough.

2.6. The model included all the major routes within the study area, including the A14, A43, A6 and A6003, in addition to several minor and local roads. The highway networks were predominantly coded as a simulation (detailed) network within SATURN.

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

2.7. The Base Year Model study area is shown in Figure 2-1.

Figure 2-1 A14 J7-9 Kettering Bypass Model Study Area



2.8. The SW Stage 2 model was developed for the following time periods:

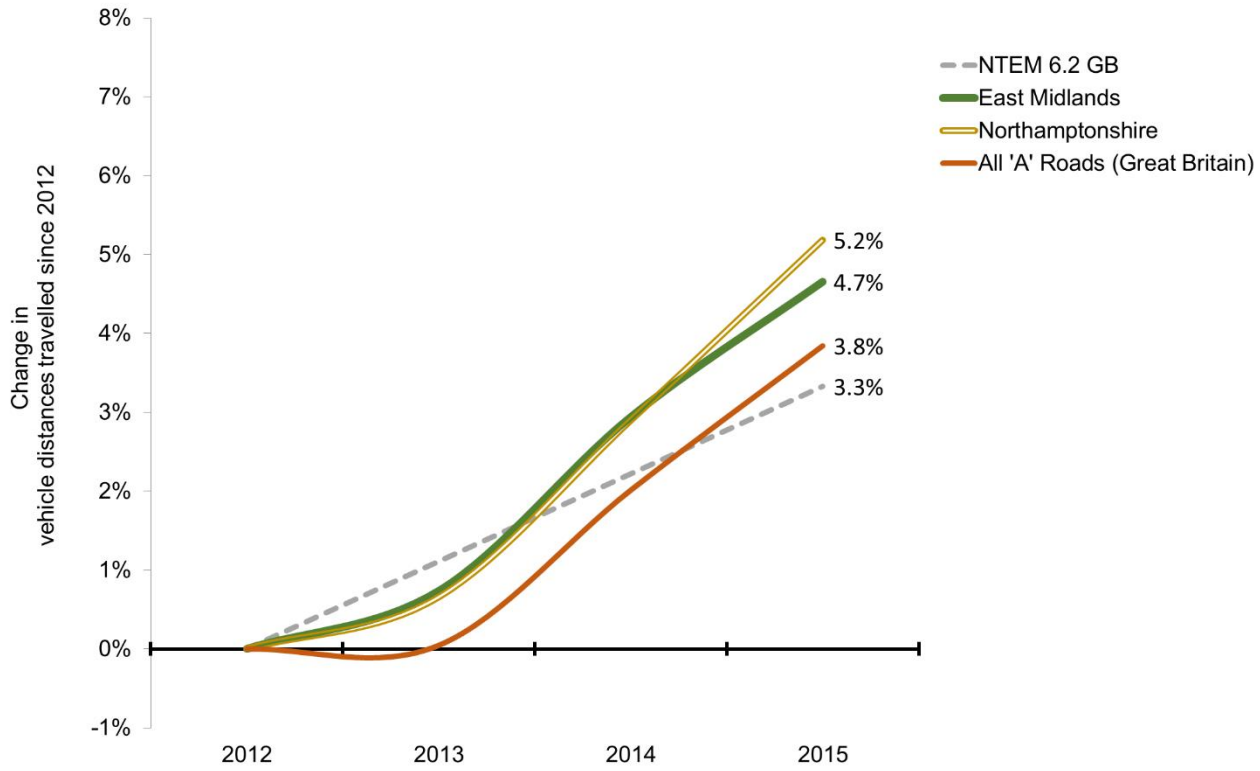
- AM Peak Hour (0800-0900);
- Average Inter Peak Hour (1000-1600); and
- PM Peak Hour (1700-1800).

Background Changes in National and Regional Traffic Trends

2.9. Historically in POPE scheme evaluations, the 'before' counts have 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 (NTEM) Local Growth Factors.

2.10. Trends in overall traffic levels, both regionally and nationally, are shown within DfT annual statistics for the total distance travelled (million vehicle kilometres). Figure 2-2 shows the changes by year in the period from 2012 (pre-scheme) to 2015 (the latest available date) for the region in which the scheme lies (Northamptonshire), for 'A roads' managed by Highways England, and for England as a whole.

Figure 2-2 National and Regional Trends[4]



2.11. The key points regarding National and Regional trends are:

- Overall traffic levels in Northamptonshire and the East Midlands have seen higher than forecast levels of traffic growth.
- In addition, all 'A' roads (in Great Britain) have experienced 3.8% traffic growth between 2012 and 2015, which is higher than forecast.

2.12. Figure 2-2 demonstrates that up to 5.2% of the observed change in traffic flows presented within this report may be due to background changes in traffic growth. However, the observed flows presented within this report have not been adjusted for background changes in traffic.

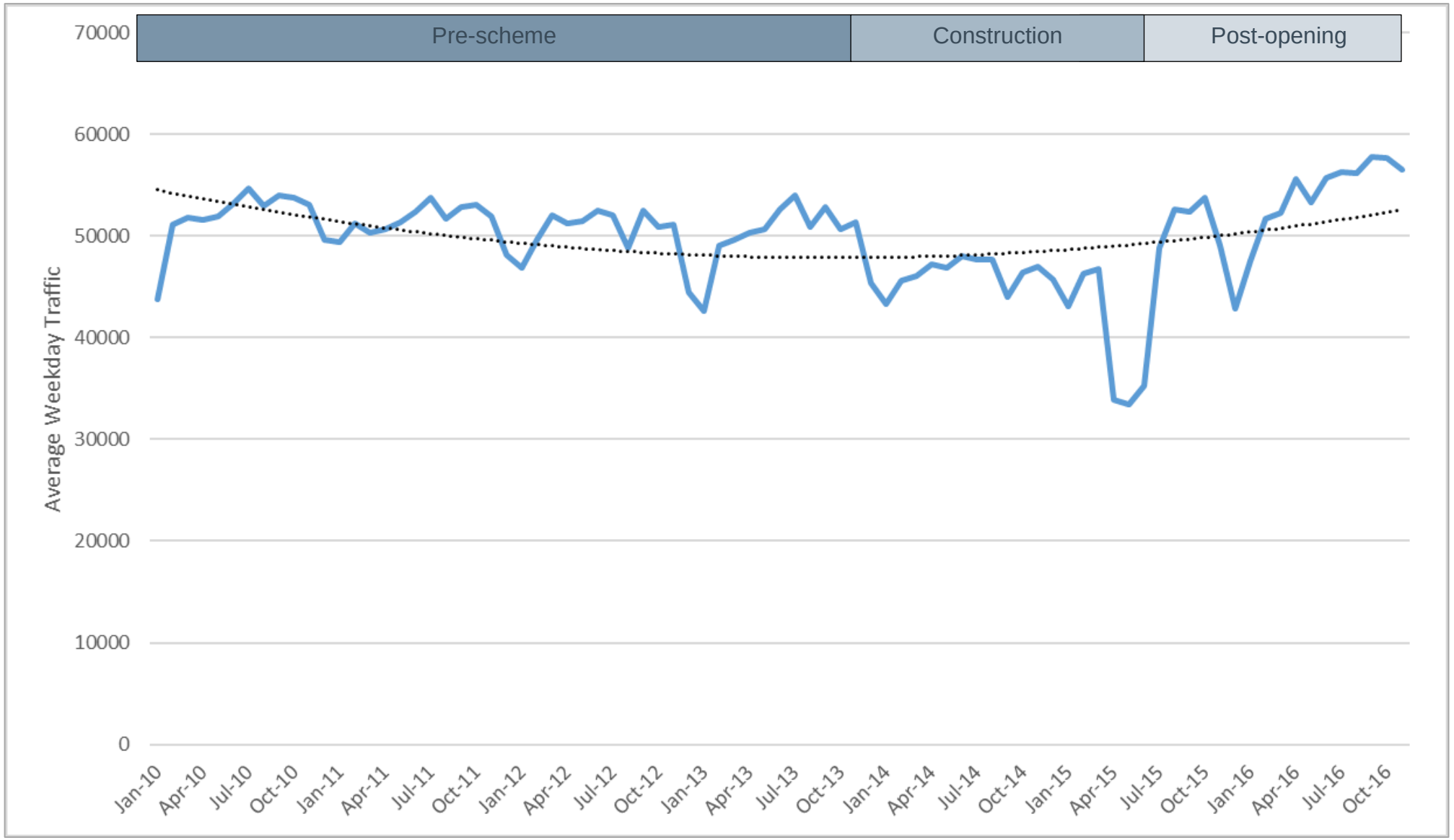
Long Term Traffic Trends on the A14

2.13. Before analysing the pre-scheme and post-opening observed traffic flows, it is important to understand that observed pre-scheme and post-opening traffic flows only provide an indication of traffic conditions at a point in time. Therefore, historical monthly and annual traffic flows have been considered in the vicinity of the scheme.

2.14. Figure 2-3 shows the long term monthly two-way average weekday traffic (AWT) flows along the A14 mainline carriageway west of Junction 7.

[4] Graph based on data in DfT tables TRA8905 and TRA4112

Figure 2-3 Long Term Two-way Average Weekday Traffic Flows along the A14 J6-7



2.15. Figure 2-3 illustrates that there is a degree of seasonal variation along the A14 mainline carriageway, with AWT flows highest during the summer months (June - August) and lowest during the winter months (November - January).

2.16. It is also evident from Figure 2-3 that AWT flows were affected during the scheme construction phase, with AWT flows lower between November 2013 and June 2015.

2.17. Table 2-1 outlines the yearly average AWT along the A14 mainline carriageway, west of Junction 7.

Table 2-1 Average Yearly AWT

Year	A14 Mainline Carriageway, north of Junction 7	
	AWT	Factor of change on 2010
2010	51,600	-
2011	51,400	1.00
2012	50,400	0.98
2013	50,000	0.97
2014	46,300	0.90
2015	43,600	0.84
2016	54,600	1.06

All figures rounded to nearest 100. Factors are calculated according to un-rounded counts

2.18. The 12-month yearly averages demonstrate that AWT flows along the A14 mainline carriageway decreased during the scheme construction period (November 2013 to May 2015) with AWT flows approximately 10% lower during 2014 (compared to 2010 AWT flows). However, Table 2-1 demonstrates that AWT flows have increased on average in the 12-month period following scheme construction, with AWT flows approximately 20% higher in 2016 compared to 2015.

Traffic Volume Changes

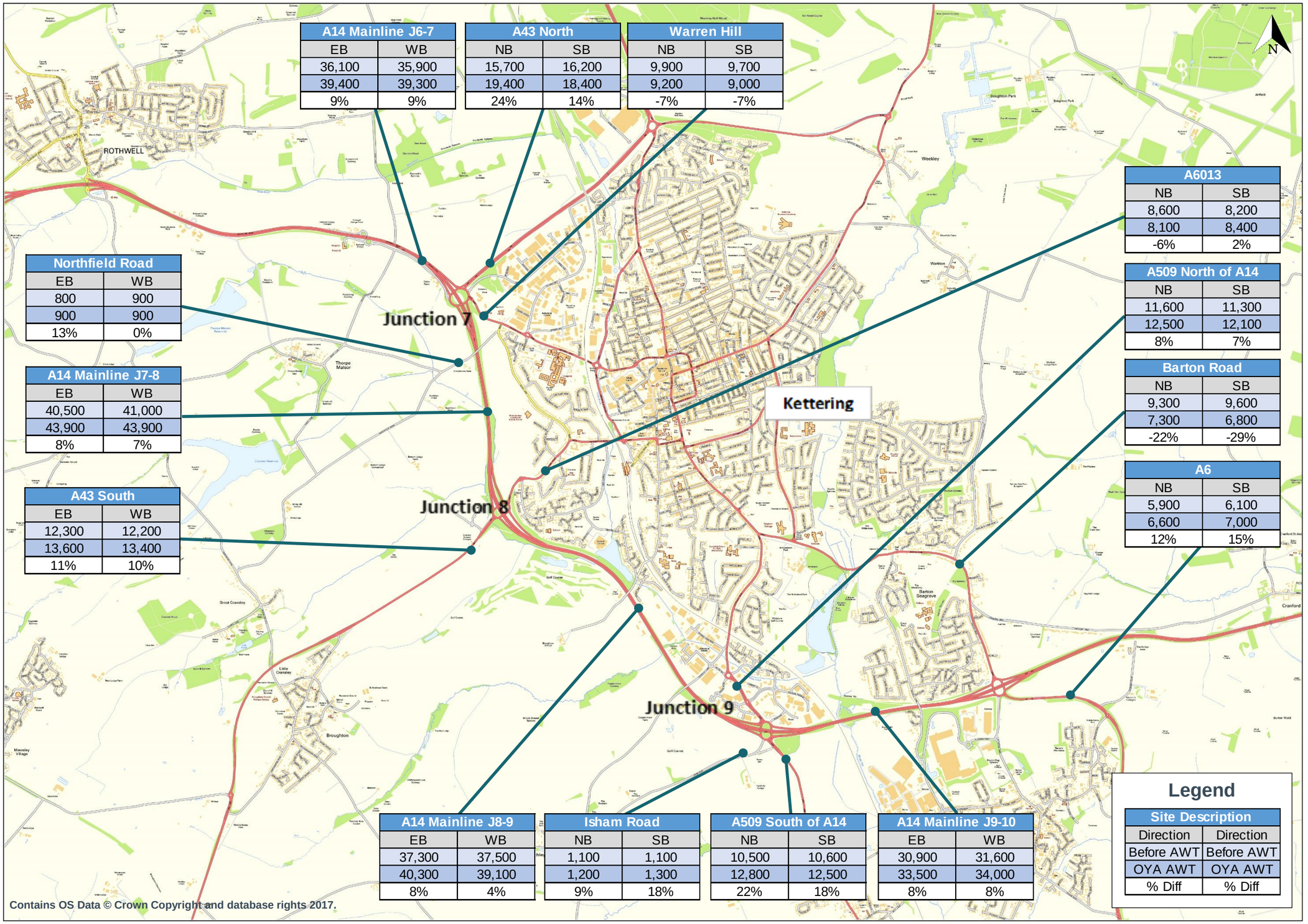
2.19. Observed AWT flows have been analysed along the A14 mainline between Junctions 7-9 and other strategic routes in the vicinity of the scheme. The AWT flows have been analysed for the locations shown in Figure 2-4, and for the time periods identified below:

- Pre-scheme: April 2012/ October 2012; and
- Post-scheme: October 2016

2.20. Observed pre-scheme (October 2012) and post-opening (October 2016) traffic flows along the A14 mainline carriageway downloaded from WebTRIS[5].

[5] Traffic count database developed by Highways England to hold data from traffic monitoring sites on the strategic road network.

Figure 2-4 Average Weekday Traffic (AWT) flows along the A14 mainline carriageway and other strategic routes.



A14 Mainline J6-7	
EB	WB
36,100	35,900
39,400	39,300
9%	9%

A43 North	
NB	SB
15,700	16,200
19,400	18,400
24%	14%

Warren Hill	
NB	SB
9,900	9,700
9,200	9,000
-7%	-7%

A6013	
NB	SB
8,600	8,200
8,100	8,400
-6%	2%

A509 North of A14	
NB	SB
11,600	11,300
12,500	12,100
8%	7%

Barton Road	
NB	SB
9,300	9,600
7,300	6,800
-22%	-29%

A6	
NB	SB
5,900	6,100
6,600	7,000
12%	15%

Northfield Road	
EB	WB
800	900
900	900
13%	0%

A14 Mainline J7-8	
EB	WB
40,500	41,000
43,900	43,900
8%	7%

A43 South	
EB	WB
12,300	12,200
13,600	13,400
11%	10%

A14 Mainline J8-9	
EB	WB
37,300	37,500
40,300	39,100
8%	4%

Isham Road	
NB	SB
1,100	1,100
1,200	1,300
9%	18%

A509 South of A14	
NB	SB
10,500	10,600
12,800	12,500
22%	18%

A14 Mainline J9-10	
EB	WB
30,900	31,600
33,500	34,000
8%	8%

Legend

Site Description	
Direction	Direction
Before AWT	Before AWT
OYA AWT	OYA AWT
% Diff	% Diff

NB: All figures rounded to nearest 100

2.21. The key points shown in Figure 2-4 are:

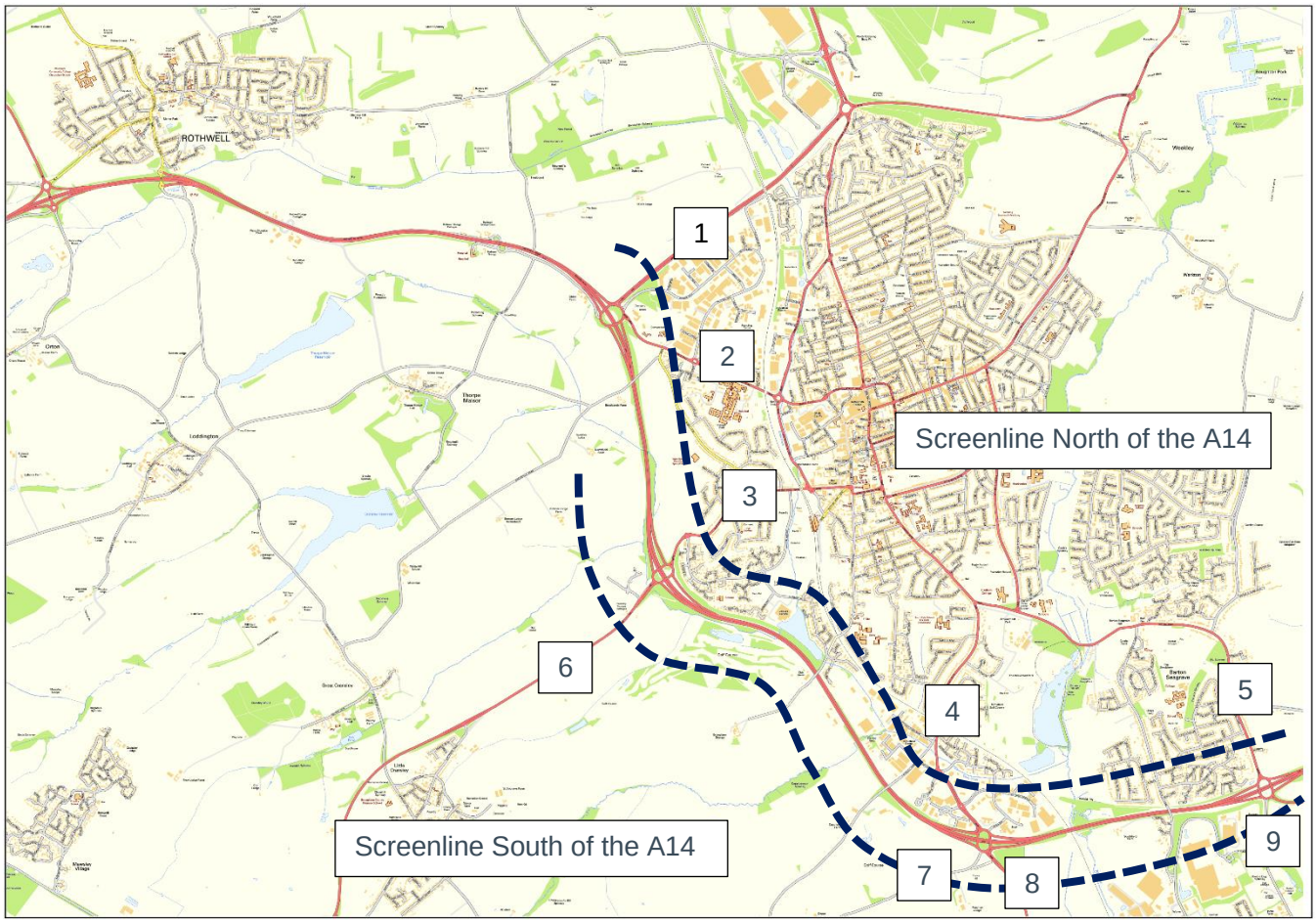
- AWT flows along the scheme section between Junctions 7-8 have increased by 7% (approx. 2,900 vehicles) along the westbound carriageway, AWT flows have increased by 8% (approx. 3,400 vehicles) along the eastbound carriageway.
- AWT flows along the scheme section between Junctions 8 and 9 have increased by 4% (approx. 1,600 vehicles) along the westbound carriageway, whilst AWT flows have increased by 8% (approx. 3,000 vehicles) along the eastbound carriageway.
- The observed levels of traffic growth along the A14 scheme section is greater than background traffic growth both regionally and on All 'A' Roads (Great Britain) during this period (as shown earlier in Figure 2-2). The observed growth reflects the impact of the additional capacity provided by the scheme between Junctions 7 and 9.
- In addition to the observed levels of traffic growth along the A14 mainline carriageway, the A43 north of Junction 7, and the A43 south of junction 8 have experienced an increase in traffic. The A43 north of the A14 has experienced an increase in two-way flows of approximately 18% (5,900 vehicles) whilst the A43 south of the A14 has experienced an increase in two-way flows of approximately 10% (2,500 vehicles).
- Despite the observed increase in traffic along the A43 and the A14 mainline carriageway, AWT flows along the A509 (north of the A14), the A6013, Warren Hill and Barton Road have all decreased post scheme opening. These roads are located to the north of the A14 carriageway which potentially indicates that fewer vehicles are bypassing the A14 mainline carriageway via local routes through Kettering.

Screenlines

2.22. In order to further consider the potential reassignment of vehicles as a result of the scheme, screenline analysis has been undertaken for the screenlines identified in Figure 2-5. Screenline analysis allows a better understanding of total vehicle movements across a wider corridor. The intention is to count vehicles at only one location for each journey they make.

2.23. Two screenlines have been identified for this scheme, one running to the north of the A14 scheme section, and one running to the south of the A14 scheme section. This analysis enables a comparison to be undertaken of how north-south movements on the major roads may have been affected by the scheme.

Figure 2-5 Screenline Locations



2.24. The results of the screenline analysis are shown in Table 2-2 for the screenline north of the A14, and Table 2-3 for the screenline south of the scheme.

Table 2-2 Screenline North of the A14

		Site	Description (north of A14)	Average Weekday Traffic		Pre-Scheme to OYA Change	Pre-Scheme to OYA %Change
				Pre-Scheme 2012	OYA 2016		
Northern Screenline	Two way flows	1	A43 North	31,900	37,800	5,900	16%
		2	Warren Hill	19,600	18,200	-1,400	-8%
		3	A6013 North	16,800	16,500	-300	-2%
		4	A509 North	22,900	24,600	1,700	7%
		5	Barton Road	18,900	14,100	-4,800	-34%
		Screenline Total		**110,100**	**111,200**	**1,100**	**1%**

2.25. The data presented in Table 2-2 demonstrates that:

- AWT flows north of the A14 have increased by 1,100 vehicles equating to a 1% increase in traffic flows;

- Most of this increase can be attributed to the increase in traffic along the A43 North, which has seen an increase of 5,900 vehicles (16% increase) and the A509 North, which has seen an increase of 1,700 vehicles (7% increase). Based on the reduction in traffic along other routes north of the A14, it is considered that the increase in traffic along the A43 North and the A509 is predominantly associated with the reassignment of traffic from other roads. It is likely that this increase in traffic is partly drawn from sites 2, 3 and 5. This indicates that perhaps more traffic is now accessing the A14 via Junctions 7 and 9.

Table 2-3 Screenline South of the A14

Site			Description (south of A14)	Average Weekday Traffic		Pre-Scheme to Post-Scheme Change	Pre-Scheme to Post-Scheme %Change
				Pre-Scheme 2012	Post-Scheme 2016		
Northern Screenline	Two way flows	6	A43 South	24,500	27,000	2,500	9%
		7	Isham Road	2,200	2,500	300	12%
		8	A509 South	21,100	25,300	4,200	17%
		9	A6	12,000	13,600	1,600	12%
		Screenline Total		**59,800**	**68,400**	**8,600**	**13%**

2.26. The data presented in Table 2-3 demonstrates that:

- Overall, AWT flows have increased by 13% south of the A14. The most significant change is on the A509 south, where an increase of 17% has been observed.
- The A43 South, Isham Road and the A6 have also experienced an increase in AWT flows. This suggests that the A14 carriageway is a more attractive route post-scheme opening, with the scheme providing additional carriageway capacity.

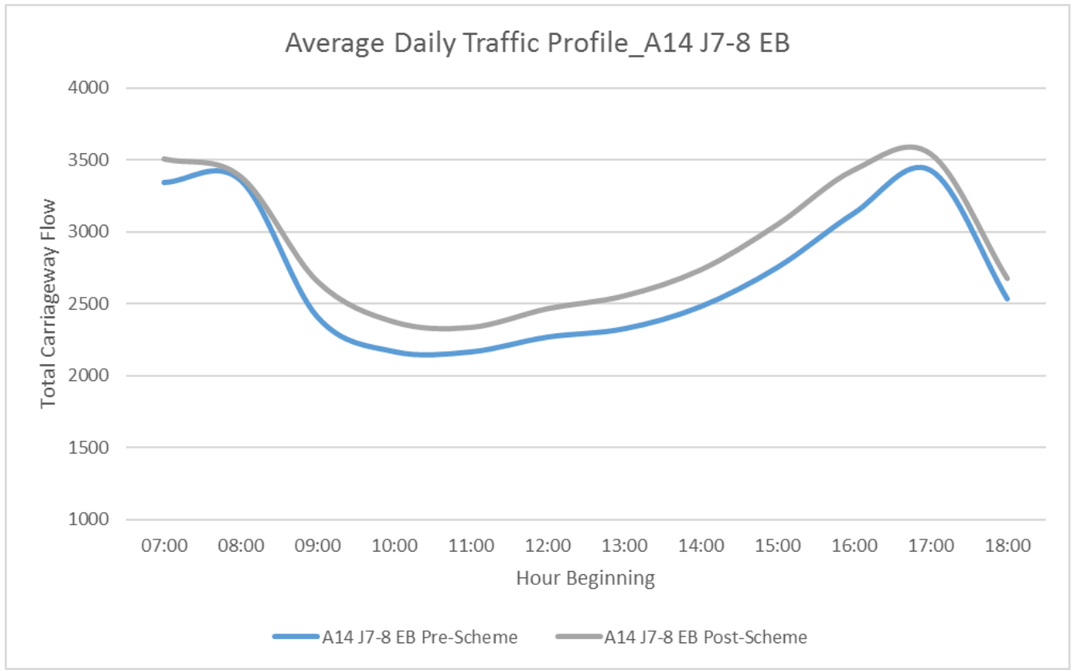
Average Daily Traffic Flow Profile

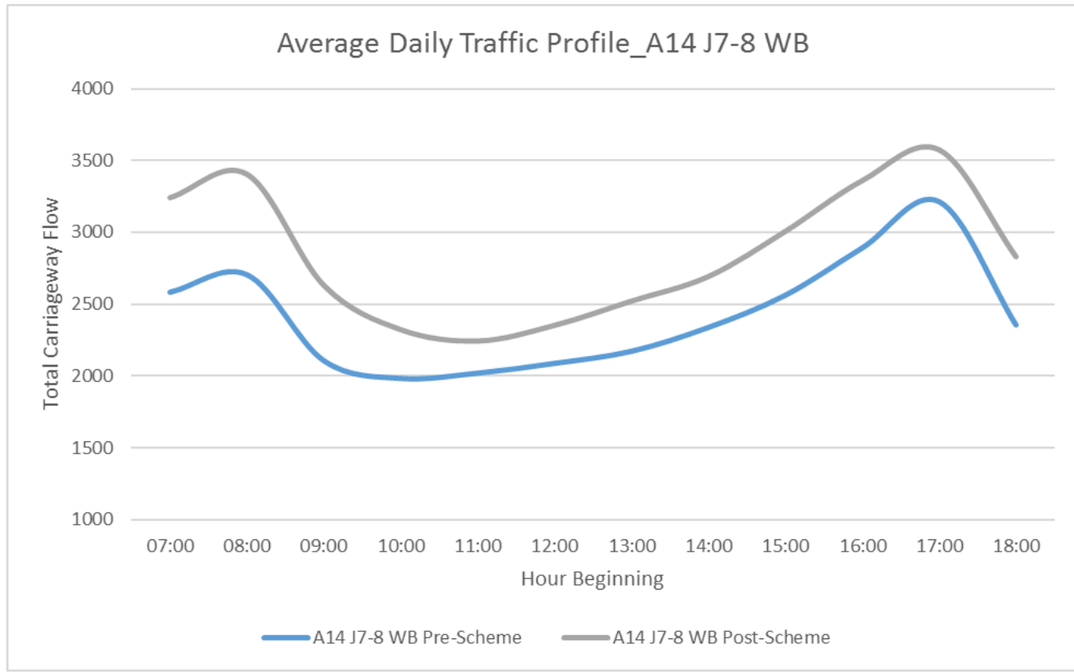
2.27. There has been an overall increase in AWT flows along the scheme section between Junctions 7-9. However, to determine the change during the busiest time periods, the average weekday traffic flow profile (EB and WB between J7-9) has been calculated (see Figure 2-6).

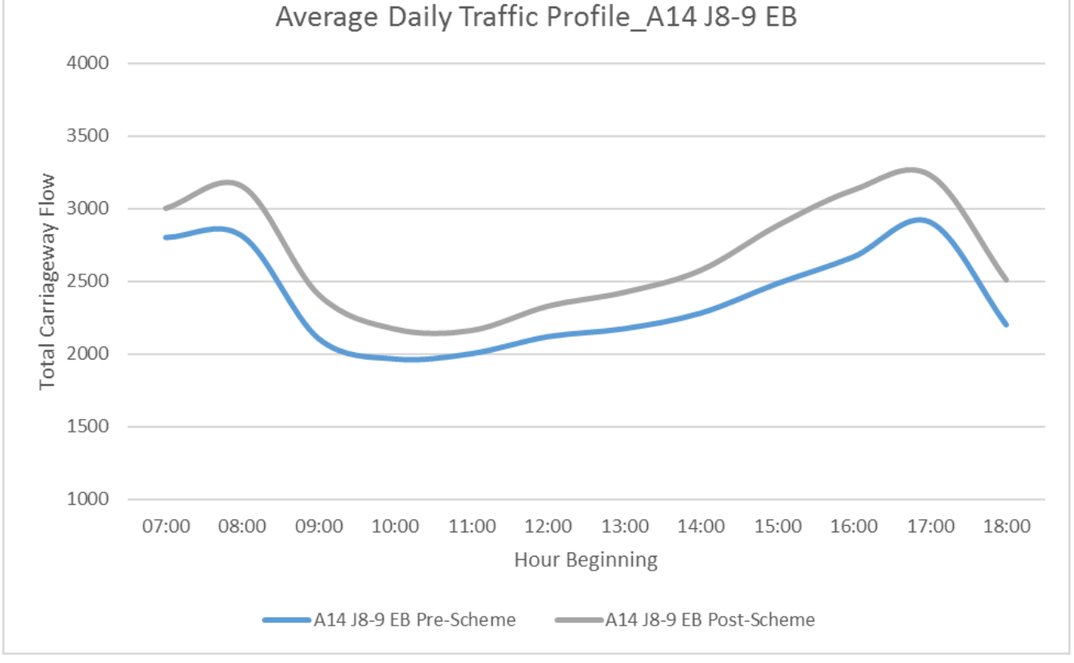
2.28. The key points shown in Figure 2-6 are:

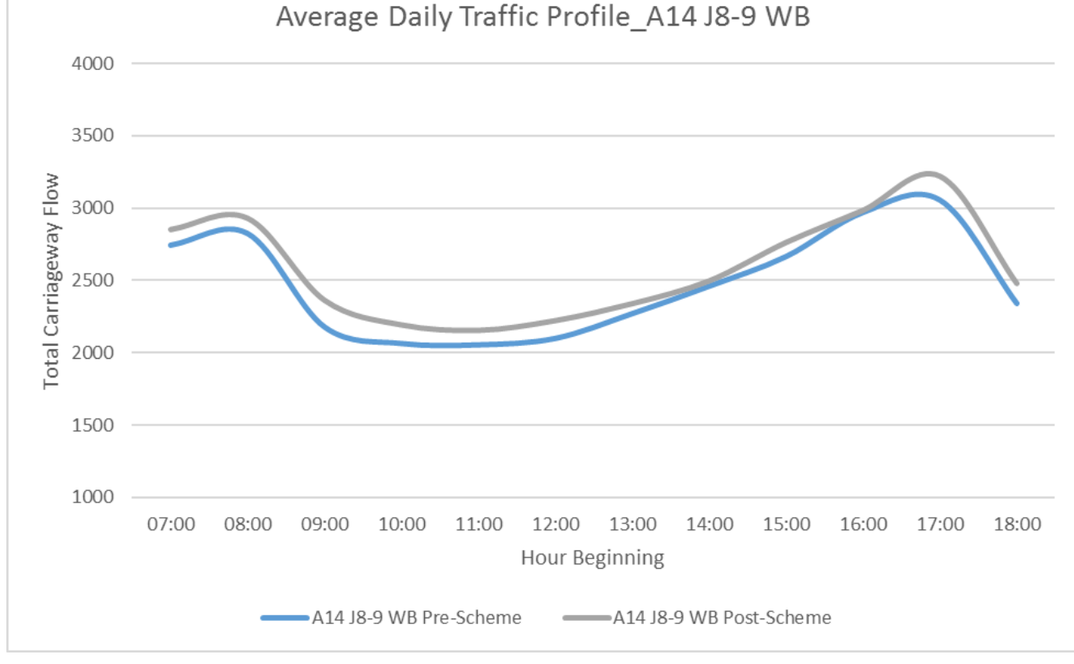
- The average weekday traffic profile indicates that prior to scheme construction, there was evidence of 'peak spreading'. This occurs when vehicles re-time their journeys to avoid high levels of congestion during the peak hours, or high levels of congestion increase journey times through the scheme section which extends the peak periods. This is particularly evident during the AM peak on the EB carriageway between J8-9, and during the PM peak on the WB carriageway between J8-9.
- A significant proportion of the overall increase in AWT flows along the A14 scheme section occurs during the AM and PM peak hour periods. This indicates that, post-opening, there is additional vehicular demand during the network peak hours. This suggests that the additional capacity provided by the scheme has drawn traffic from surrounding roads and time periods, with vehicles able to travel within the network peak hours.

Figure 2-6 Average Weekday Traffic Flow Profile









HGV Traffic Flows

2.29. The proportion of HGV's recorded along both the A14 mainline carriageway and other strategic routes has been analysed to determine the impact of the scheme on HGVs. It is important to consider the impact of the scheme on HGV's because the A14 carriageway is a key strategic route for HGV's, connecting the M1 and M6 motorways in the Midlands with the A1, the M11 and the east coast ports near Felixstowe.

2.30. A HGV is classified by vehicle length, with HGVs classed as a vehicle over 6.6m in length. Table 2-4 outlines the observed change in the proportion of HGVs recorded along the A14 and other strategic routes.

Table 2-4 Observed Change in Proportion of HGVs

Location	Direction	Pre Scheme 2012	Post Scheme 2016	Observed Change
A14 Mainline J6-7	EB	18%	18%	0%
	WB	19%	19%	0%
A14 Mainline J7-8	WB	19%	24%	5%
	EB	20%	22%	2%
A14 Mainline J8-9	EB	18%	16%	-2%
	WB	16%	17%	1%
A14 Mainline J9-10	EB	17%	17%	0%
	WB	18%	18%	0%
A43 South	EB	5%	12%	7%
	WB	5%	10%	5%
A43 North	NB	10%	15%	5%
	SB	11%	15%	4%
A509 South of A14	NB	12%	12%	0%
	SB	12%	10%	-2%
A509 North of A14	NB	8%	8%	0%
	SB	6%	8%	2%

2.31. It can be seen from Table 2-4 that the proportion of HGV's recorded along the A14 mainline carriageway has changed marginally between 2012 and 2016. However, the A43 north of the A14, and the A43 south of the A14 have experienced slight increases in the proportion of HGVs recorded, with approximately 4% more HGVs recorded along the A43 north and approximately 6% along the A43 South.

Traffic Forecasting

2.32. As outlined in the Traffic Forecasting Report (TFR, 2013) the scheme modelling was based on the Scott Wilson Stage 2 (SW Stage 2) model in SATURN.

2.33. The future demand for travel within the model study area was determined to be affected by several key factors. These included:

- Changes in the number of households;
- Changes in population and employment levels;
- Changes in the level of car ownership; and
- Changes to the local highway network.

2.34. Development specific information used to inform the model forecasting reports was provided by Northamptonshire County Council (NCC). However, as outlined within the Traffic Forecasting Report (TFR, 2013), there were significant quality problems associated with the data for employment sites and therefore only residential data was utilised, with employment growth calculated indirectly from the residential development data provided by NCC.

Residential

2.35. Table 2-5 provides a summary of the residential development proposals[6] used to inform the model forecasting reports for the period 2008-2021. In order to determine the accuracy of the model forecasting, the projected number of units to be constructed has been compared with the actual number of units constructed up until 2016.

Table 2-5 Summary of Residential Development Proposals

Development Description	Local Authority	Projected Number of Units Constructed Per Year									No of Units Constructed up to 2016
		2008	2009	2010	2011	2012	2013	2014	2015	2016	
Oakley Vale	Corby	1,021	317	318	317	0	0	0	0	0	1,973
Priors Hall	Corby	0	0	155	380	420	540	530	530	530	600
West Corby	Corby	0	0	0	0	0	0	100	380	586	0
Kettering Town Centre AAP	Kettering	0	0	0	75	75	100	100	100	100	0
East of Kettering	Kettering	0	0	0	50	350	350	350	350	350	0
Wellingborough East	Wellingborough	0	0	0	100	100	150	175	350	350	0
Land East of Eastfield Rd	Wellingborough	0	0	0	50	75	75	100	100	100	0
Upper Redhill	Wellingborough	0	0	0	0	100	200	350	350	350	0

2.36. Table 2-5 indicates that only two of the proposed residential development sites (with proposals for over 1,000 units up to 2016) used to inform the model forecasting have been constructed. Oakley Vale (1,973 units constructed) and Priors Hall (600 units constructed) are both located in Corby which is served from the south via the A43. None of the proposed residential development sites located in Kettering or Wellingborough have been bought forward for construction, however they remain live applications and are projected to be bought forward for construction in 2017 onwards.

2.37. In addition to the proposed residential sites identified within the TFR (2013), Kier Homes have constructed 210 residential units off Northampton Road in Kettering (north of Junction 8). This site was not identified within the TFR (2013), however, potential changes in traffic growth in proximity of Junction 8 may be associated with this development site.

Employment

2.38. As outlined above, there were significant quality problems associated with the data for employment sites and therefore employment growth was calculated indirectly from the residential development data provided by NCC. Whilst specific development sites have not been included in the model forecasting reports. It is important to consider the impact of both the North Kettering Business Park and Prologis Park employment and distribution site. Both sites are located to the north of Kettering adjacent to the A43.

2.39. North Kettering Business Park is a 30-acre mixed use development site, comprising of 45,000sq. ft of office development which is already occupied. Prologis Park is a 100-acre

[6] Only Proposed Residential Developments with proposals for over 1000 units up to 2016 have been included in Table 2-1.

development site with planning permission for a total of 2.15 million sq. ft of development, of which over 50% has already been constructed and is fully occupied.

Change in Population/ Car Ownership

2.40. The impact of changes in employment/ population levels, changes in car ownership and changes in the number of households are modelled at a national level through the National Transport Model (NTM) developed by the DfT, which itself incorporates the National Trip End Model (NTEM). The NTEM provides future year demand growth inputs, forming the starting point for national travel demand forecasting work.

2.41. Use of the TEMPRO database allows for the information contained within the NTM to be output in the form of forecast year trip end growth projections for car travel, thus allowing for local area traffic models to be developed on a consistent basis with regards to future year growth.

Changes to the Local Highway Network

2.42. The model forecasting reports included highways schemes that were either committed, or considered highly likely to occur within the study area within the period 2013-2028. The following schemes were included.

Table 2-6 Included Highways Schemes

Scheme Name and Description	DM/DS Scenario	Projected Opening Date	Status as of 2017
A43 Corby Weldon Link Road, located to the north of Kettering.	DM	2013	Opened in 2014
Various Improvements in Wellingborough associated with the WEAST development (2017). These include two new roads and two new bridges crossing the Midland Mainline and the River Ise in Wellingborough	DS	2016-2021	Construction started In March 2015.
Signalisation of A14 J8.	DM	2012	Scheme not yet completed
Signalisation of A14 J10 Eastbound off slip.	DM	2012	Scheme not yet completed
Various improvements in Kettering associated with the Kettering East development.	DM	2015-2021	Construction not yet started
The Isham to Wellingborough Bypass is proposed to run from the A14 Junction 9 roundabout in a southerly direction and re-join the A509 Kettering Road between Hill Top and Great Harrowden.	DS	2020	Construction not yet started
A14 Junction 10A and associated alterations to Junction 10	DS	2026	Construction not yet started
Signalisation of A14 J9 roundabout	DS	2024	Construction not yet started

2.43. Table 2-6 demonstrates that the DM model scenario included several highway schemes within the model study area which have not yet been constructed.

Model Forecast Years

2.44. The following forecast years were modelled:

- 2015 – Forecast year of scheme opening;
- 2017 – Interim year required for economic assessment of transport user costs during maintenance;
- 2021 – Interim year required for economic assessment;
- 2024 – Interim year required for economic assessment of transport user costs during maintenance; and
- 2030 – Scheme design year (15 years after opening).

2.45. The model forecasts have been undertaken for the Core Scenario Central Demand (CS) which was considered to be the most likely outcome in terms of demand and supply within the model area for the forecast year and therefore represent the most likely level of benefits arising from the scheme. The CS was based upon the assumption that all published plans for transport schemes would be implemented by the planned dates.

2.46. Traffic growth is not only influenced by demographic changes (i.e. population increase), it can also be affected by GDP growth and fuel price, both of which can affect car ownership and usage. TEMPRO trip end projections take into account the effect of these factors on car ownership, but future levels of GDP and fuel price are subject to significant national uncertainty.

2.47. To allow for this, WebTAG Unit 3.10.2 Section 5.6 recommends that analysis is undertaken for a range of outcomes. Application of the guidance effectively provides a high traffic growth forecast, referred to as CS High Demand, and a low traffic growth forecast, referred to as CS Low Demand. These scenarios will be considered later on in this report.

Model Forecast Scenarios

2.48. As identified earlier on in this report, the Forecast Model Core Scenario (Central Demand) was constructed in line with WebTAG guidance (WebTAG Unit 3.10.2, Section 5.6, April 2009). This accounts for national economic uncertainty by applying a range of ±2.5% around the Central Demand (i.e. the most likely forecast scenario) for one year ahead, rising with the square root of the number of years. Therefore, the following factors have been applied to the forecast DM matrices:

- Low Demand Growth Forecast:
  - 2012: -7.1% (-2.5%*√7)
- High Demand Growth Forecast:
  - 2012: +7.1% (+2.5%*√7)

2.49. As indicated in Table 2-7, the difference between the DM forecast (2012) and DM observed (2012) ADT flows along the scheme section ranges between -5% and -7%. This suggests that the Central Demand Forecasts have over-estimated ADT flows along the scheme section. However, the difference between DM forecast and DM Observed ADT flows is within the 2012 Core Scenario (Low Demand) range (-7.1%) which suggests that the forecast Low Demand projections for GDP and fuel price were more aligned with the observed ADT than the Central Demand scenario.

Forecast vs. Observed Traffic Flows

2.50. Forecast traffic flows are provided in the Traffic Forecast Report (2013) which provides flow forecasts for a 2015 opening year, and a 2030 future year for the Do Minimum (DM without Scheme) and Do Something (DS with Scheme) scenarios. To allow for comparison between the pre-scheme observed traffic data (2012) and the post-opening observed traffic data (2016), the forecast traffic flows have been adjusted using straight line interpolation.

2.51. Table 2-7 presents the modelled DM and DS ADT flows on the A14 mainline carriageway and compares them with the observed pre and post scheme traffic flows.

Table 2-7 Forecast and Observed (ADT) on A14 and other Strategic Routes

Location	Dir	Pre Scheme 2012			Post Scheme 2016			Increase with Scheme		
		DM Forecast	Observed Before	% Diff	DS Forecast	Observed After	% Diff	Forecast	Observed	Diff
A14 Mainline J6-7	EB	33,300	33,200	0%	35,500	36,500	3%	6%	9%	3%
	WB	34,400	32,900	-5%	37,000	36,000	-3%	7%	9%	2%
A14 Mainline J7-8	EB	39,800	37,500	-6%	44,900	40,200	-12%	11%	7%	-5%
	WB	39,700	37,500	-6%	44,400	39,000	-14%	11%	4%	-7%
A14 Mainline J8-9	EB	36,600	34,700	-5%	40,900	37,000	-11%	11%	6%	-4%
	WB	36,400	34,100	-7%	41,100	35,600	-15%	11%	4%	-7%
A14 Mainline J9-10	EB	28,900	28,700	-1%	31,300	31,200	0%	8%	8%	0%
	WB	32,100	29,100	-10%	34,600	31,400	-10%	7%	7%	0%
A43 South	EB	9,700	11,300	14%	10,800	12,500	14%	10%	10%	-1%
	WB	9,000	11,200	20%	10,300	12,200	16%	13%	8%	-4%
A43 North	NB	16,400	13,700	-20%	18,300	17,200	-6%	10%	20%	10%
	SB	15,800	14,000	-13%	17,500	16,400	-7%	10%	15%	5%
A509 South of A14	NB	10,400	9,500	-9%	12,700	11,600	-9%	18%	18%	0%
	SB	12,500	9,600	-30%	14,100	11,300	-25%	11%	15%	4%
A509 North of A14	NB	12,100	10,800	-12%	14,800	11,800	-25%	18%	8%	-10%
	SB	10,600	10,500	-1%	13,100	11,500	-14%	19%	9%	-10%

All figures rounded to nearest 100.

2.52. The results in Table 2-7 show:

- On the scheme section between Junctions 7 and 9, the model forecasted an increase of 11% between DM (2012) and DS (2016). The observed ADT demonstrates that traffic growth along the scheme section has been lower than forecast with the increase between observed DM (2012) and observed DS (2016) ranging between 4% and 7%.
- Despite traffic growth along the scheme section being lower than forecast, the observed ADT along the A14 between Junction 6-7 has experienced higher than forecast traffic growth, with the increase between observed DM (2012) and observed DS (2016) averaging 9% compared to the predicted increase of between 6% and 7%.
- There has been a larger proportionate increase in the number of vehicles travelling along the A43 North compared to forecast, with an observed increase of between 15% and 20% compared to a forecast increase of 10%. The additional observed increase in traffic along the A43 North could be associated with the increased levels of development at the North Kettering Business Park and Prologis Park employment and distribution site.
- The traffic forecasting has underestimated the number of vehicles travelling along the A43 South in both the 'with' and 'without' scheme scenarios.
- In the majority of cases where the DM observed flows were lower or higher than forecast, a similar trend is observed for the difference between forecast and observed DS flows.

2.53. As demonstrated, the observed traffic growth along the scheme section has been lower than forecast. To further evaluate this difference, the forecast and observed flows (DM and DS) have been compared for the following time periods (see Table 2-8):

- AM Peak Hour (0800-0900);
- Average Inter Peak Hour (1000-1600); and
- PM Peak Hour (1700-1800).

Table 2-8 Forecast and Observed Peak Hour Flows on A14 Scheme Section (7-9)

Location	Dir	Time Period	Pre Scheme 2012			Post Scheme 2016			Increase with Scheme		
			DM Forecast	Observed Before	% Diff	DS Forecast	Observed After	% Diff	Forecast	Observed	Diff
Junction 7-8	EB	AM Peak	3,200	3,400	6%	3,600	3,400	-6%	11%	0%	-11%
		Inter-Peak	2,500	2,400	-4%	2,800	2,600	-8%	11%	8%	-3%
		PM Peak	3,500	3,400	-3%	4,100	3,500	-17%	15%	3%	-12%
Junction 7-8	WB	AM Peak	3,400	2,700	-26%	3,800	3,400	-12%	11%	21%	10%
		Inter-Peak	2,500	2,200	-14%	2,800	2,500	-12%	11%	12%	1%
		PM Peak	3,500	3,200	-9%	4,200	3,600	-17%	17%	11%	-6%
Junction 8-9	EB	AM Peak	2,900	2,800	-4%	3,300	3,200	-3%	12%	13%	0%
		Inter-Peak	2,300	2,200	-5%	2,600	2,400	-8%	12%	8%	-3%
		PM Peak	3,200	2,900	-10%	3,900	3,200	-22%	18%	9%	-9%
Junction 8-9	WB	AM Peak	3,100	2,800	-11%	3,500	2,900	-21%	11%	3%	-8%
		Inter-Peak	2,300	2,300	0%	2,600	2,400	-8%	12%	4%	-7%
		PM Peak	3,200	3,100	-3%	3,700	3,200	-16%	14%	3%	-10%

All figures rounded to nearest 100.

2.54. The key points from Table 2-8 are:

- The traffic forecasting has overestimated the number of vehicles travelling along the A14 scheme section in both the 'with' and 'without' scheme scenarios, except for the EB carriageway between Junctions 7 and 8 during the AM Peak (2012).
- There has been a larger proportionate increase in the number of vehicles travelling along the A14 WB carriageway between Junctions 7-8 during the AM and Inter-Peak periods than forecast. With an observed increase of 21% and 12% compared to a forecast increase of 11%.

2.55. It is evident from Table 2-7 and Table 2-8 that the forecast levels of traffic growth along the scheme section has not occurred. This has resulted in traffic volumes along the A14 scheme section being between 7% and 11% lower than forecast during the AM, PM and Inter Peak periods.

Forecast vs. Observed HGV Percentages

2.56. As identified, the A14 is a strategic route which connects the M1 and M6 motorways in the Midlands with the A1, the M11 and the east coast ports near Felixstowe. Because of its links with the east coast ports near Felixstowe, it is part of the Trans-European Network, and is

the designated UK section of the Ireland – UK – Benelux highway link known as Project 13. The A14 is a strategic route for HGVs, and therefore it is important to consider the forecast impact of the scheme on HGV levels to the observed impact.

2.57. Table 2-9 presents the modelled DM and DS HGV percentages on the A14 mainline carriageway and other strategic links and compares them with the pre and post-opening HGV percentages.

Table 2-9 Forecast and Observed HGV Percentages on A14 and other Strategic Routes

Location	Dir	Pre Scheme 2012			Post Scheme 2016			Increase with Scheme	
		DM Forecast	Observed	% Diff	DS Forecast	Observed	% Diff	Forecast	Observed
A14 Mainline J6-7	EB	16%	18%	2%	16%	18%	2%	0%	0%
	WB	16%	19%	3%	15%	19%	4%	-1%	0%
A14 Mainline J7-8	WB	15%	19%	4%	14%	21%	7%	-1%	2%
	EB	14%	20%	6%	13%	22%	9%	-1%	2%
A14 Mainline J8-9	EB	13%	18%	5%	12%	15%	3%	-1%	-3%
	WB	14%	16%	2%	13%	16%	3%	-1%	0%
A14 Mainline J9-10	EB	13%	17%	4%	13%	17%	4%	0%	0%
	WB	13%	18%	5%	13%	18%	5%	0%	0%
A43 South	EB	9%	5%	-4%	9%	12%	3%	0%	7%
	WB	9%	5%	-4%	9%	10%	1%	0%	5%
A43 North	NB	11%	10%	-1%	11%	15%	4%	0%	5%
	SB	9%	11%	2%	9%	15%	6%	0%	4%
A509 South of A14	NB	11%	12%	1%	11%	12%	1%	0%	0%
	SB	11%	12%	1%	11%	10%	-1%	0%	-2%
A509 North of A14	NB	8%	8%	0%	8%	8%	0%	0%	0%
	SB	7%	6%	-1%	7%	8%	1%	0%	2%

2.58. The key points from Table 2-9 are:

- The forecast DM (2012) and forecast DS (2016) scenarios underestimated the percentage of HGVs along the A14 mainline carriageway (between Junctions 6 and 10). The observed HGV percentages along the mainline carriageway are between 2% and 9% higher than forecast.
- The scheme was forecast to reduce the percentage of HGVs along the scheme section by 1%, however, the observed HGV percentages demonstrate that the scheme has either had no impact or increased the percentage of HGVs by 2%, with the exception of the EB carriageway between Junctions 8 and 9.
- The A43 South and the A43 North have both experienced a higher proportionate increase in observed HGV percentages (between 4% and 7%) compared to the forecast increase (0%).

Journey Time Evaluation

2.59. This section considers the impact of the A14 Junctions 7 and 9 Kettering Bypass Improvement on journey times following the implementation of the scheme. Journey times are considered pre and post-scheme opening along the routes shown in Figure 2-7.

2.60. The journey time route between Junction 2 and Junction 12 of the A14 has been considered in line with the journey time forecasts extracted from the Traffic Forecasting Report. The journey time route along the scheme section (Junctions 7 to 9) has been considered separately to determine the impact of the scheme.

2.61. Journey time analysis comprises of:

- Analysis of pre-and-post-scheme opening average journey times and speeds between Junctions 2 and 12 of the A14, and along the scheme section (Junctions 7 to 9).

- A comparison of journey time reliability before and after the scheme opened between Junctions 2 and 12.

2.62. The journey time periods evaluated are in line with the 2009 SW Stage 2 model for the following time periods (by direction):

- AM Peak Hour (0800-0900);
- Average Inter Peak Hour (1000-1600); and
- PM Peak Hour (1700-1800).

2.63. Other time periods have also been considered:

- Weekday AM Shoulder (06:00-08:00, 09:00-10:00);
- Weekday PM Shoulder (16:00-17:00, 18:00-19:00);
- Overnight (20:00-06:00 Weekdays and 21:00-08:00 Weekends); and
- Weekend Peak (10:00-17:00 Saturday and 11:00 – 20:00 Sundays).

Figure 2-7 Journey Time Routes

Observed Journey Times

2.64. Pre-construction and post scheme opening journey time information has been obtained from satellite navigation data. This section analyses the change in journey times and speeds along the routes outlined in Figure 2-7.

2.65. Table 2-10 and Table 2-11 compare the pre-scheme and post-scheme average journey times along the scheme section (between Junctions 7 and 9) and the pre-scheme and post-scheme average journey times between Junction 2 and Junction 12 of the A14.

2.66. The following detailed observations can be made from Table 2-10.

- The EB journey times along the scheme section have experienced a reduction across all time periods, with an observed journey time saving of approximately 14 seconds during the AM peak, and 17 seconds during the PM peak period.
- Despite the observed reduction in journey times along the scheme section, the average EB journey times along the A14 carriageway (between Junction 2 and Junction 12) have experienced an overall increase in average journey times during the Inter peak (approximately 7 seconds) and PM peak periods (approximately 8 seconds). There has been no change in average journey times during the AM peak along the EB carriageway.
- The sections of the A14 which have experienced the greatest increase in average journey times are between Junctions 2-3, and Junctions 11-12. These sections of the A14 carriageway are unlikely to have received any of the benefits associated with the scheme.

2.67. The following detailed observations can be made from Table 2-11:

- The WB journey times along the scheme section have also experienced a reduction across all time periods, with an observed journey time saving of approximately 17 seconds in the AM peak, and 37 seconds in the PM peak period.
- The average journey times between Junction 2 and Junction 12 of the A14 (excluding the scheme section) indicate an observed increase in average journey times, with the WB carriageway between Junctions 2-3 and Junctions 11-12 experiencing the greatest increase.
- However, the significant reduction along the scheme section results in an overall journey time saving (between Junctions 2 and 12) of 2 seconds during the AM peak, and 25 seconds during the PM peak. The Inter peak period has experienced a nominal increase of 1 second.

2.68. Overall, the results indicate a reduction in the average journey times (across all time periods) along the scheme section, when comparing the pre-scheme observed journey times to the post-scheme observed journey times.

Table 2-10 Change in Journey Times Following Scheme Opening (EB)

		Direction	Pre-scheme (mm:ss)			Post-scheme (mm:ss)			Difference (seconds)[7]		
			AM	IP	PM	AM	IP	PM	AM	IP	PM
J7 to J9	Junction 7-8	EB	01:12	01:10	01:12	01:07	01:08	01:07	-5	-2	-5
	Junction 8-9	EB	01:56	01:54	01:58	01:47	01:48	01:46	-9	-5	-12
Total		**-**	**03:08**	**03:04**	**03:10**	**02:54**	**02:56**	**02:53**	**-14**	**-7**	**-17**
J2 to J12	Junction 2-3	EB	04:17	04:07	04:02	04:21	04:13	04:11	4	6	9
	Junction 3-4	EB	00:46	00:29	00:28	00:49	00:30	00:31	3	1	3
	Junction 4-6	EB	01:54	01:37	01:36	01:55	01:39	01:42	1	2	7
	Junction 6-7	EB	00:34	00:33	00:33	00:35	00:34	00:34	1	1	1
	Junction 7-8	EB	01:12	01:10	01:12	01:07	01:08	01:07	-5	-2	-5
	Junction 8-9	EB	01:56	01:54	01:58	01:47	01:48	01:46	-9	-5	-12
	Junction 9-10	EB	01:29	01:31	01:33	01:29	01:32	01:32	1	1	0
	Junction 10-11	EB	02:09	02:14	02:12	02:11	02:16	02:13	1	2	1
	Junction 11-12	EB	02:37	02:43	02:38	02:40	02:46	02:43	3	3	4
Total		**-**	**16:54**	**16:18**	**16:12**	**16:54**	**16:25**	**16:19**	**0**	**7**	**8**

[7] Note that a negative value represents a journey time saving and a positive value represents an increase in journey times.

Table 2-11 Change in Journey Times Following Scheme Opening (WB)

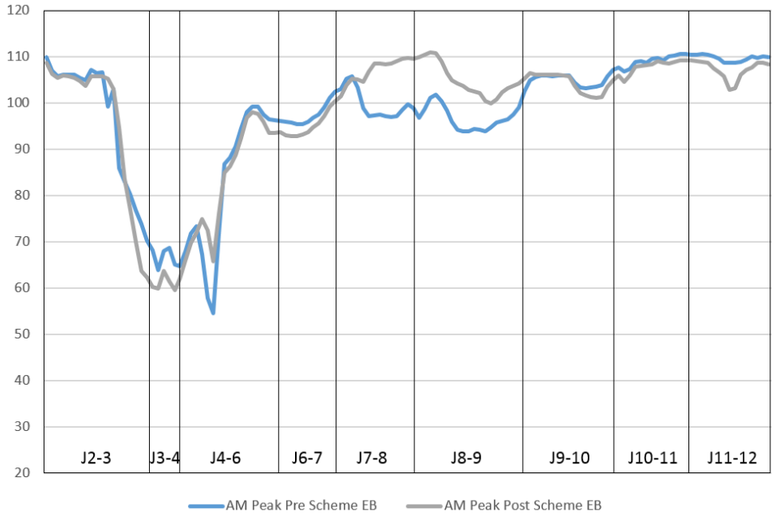
		Direction	Pre-scheme (mm:ss)			Post-scheme (mm:ss)			Difference (seconds)		
			AM	IP	PM	AM	IP	PM	AM	IP	PM
J7 to J9	Junction 7-8	WB	01:09	01:02	01:09	01:00	01:00	00:59	-9	-3	-9
	Junction 8-9	WB	02:22	02:12	02:32	02:14	02:06	02:04	-8	-6	-28
Total		**-**	**03:31**	**03:14**	**03:41**	**03:14**	**03:05**	**03:04**	**-17**	**-9**	**-37**
J2 to J12	Junction 2-3	WB	04:19	04:18	04:16	04:23	04:22	04:19	3	4	2
	Junction 3-4	WB	00:29	00:29	00:29	00:30	00:30	00:31	0	0	1
	Junction 4-6	WB	01:30	01:29	01:33	01:30	01:30	01:38	0	1	5
	Junction 6-7	WB	00:39	00:39	00:41	00:39	00:39	00:42	0	0	2
	Junction 7-8	WB	01:09	01:02	01:09	01:00	01:00	00:59	-9	-3	-9
	Junction 8-9	WB	02:22	02:12	02:32	02:14	02:06	02:04	-8	-6	-28
	Junction 9-10	WB	01:16	01:15	01:16	01:21	01:15	01:15	5	1	-1
	Junction 10-11	WB	02:27	02:25	02:25	02:30	02:27	02:26	2	2	1
	Junction 11-12	WB	02:46	02:45	02:44	02:50	02:46	02:46	4	1	2
Total		**-**	**16:58**	**16:34**	**17:05**	**16:56**	**16:34**	**16:40**	**-2**	**1**	**-25**

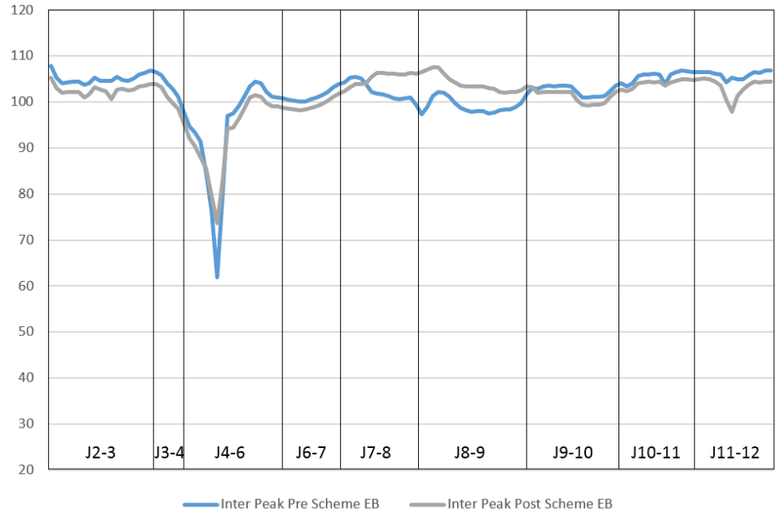
Speed by Distance Analysis

2.69. Analysis of the schemes impact on average journey times demonstrates significant reductions in journey times along the scheme section (Junctions 7-9), however, the average journey times have generally increased along other sections of the A14 carriageway. To further understand the impact of the scheme on average journey times, additional analysis has been undertaken to consider the change in average vehicle speeds along the A14 mainline carriageway between Junction 2 and Junction 12.

2.70. Table 2-8 (EB) and Table 2-9 (WB) show the average speeds (kph) along the A14 mainline carriageway (between Junction 2 and 12) before and after the scheme opened for the AM, PM and Inter Peak periods.

Figure 2-8 Average Speed (kph) along the A14 EB Carriageway





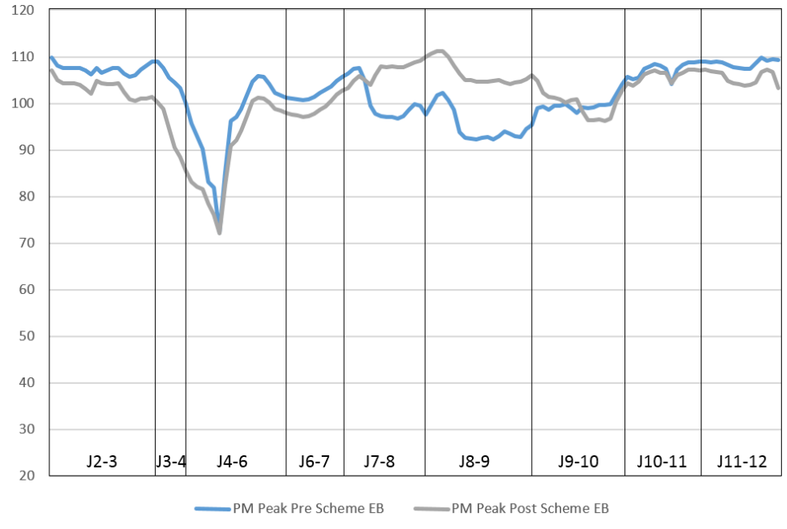
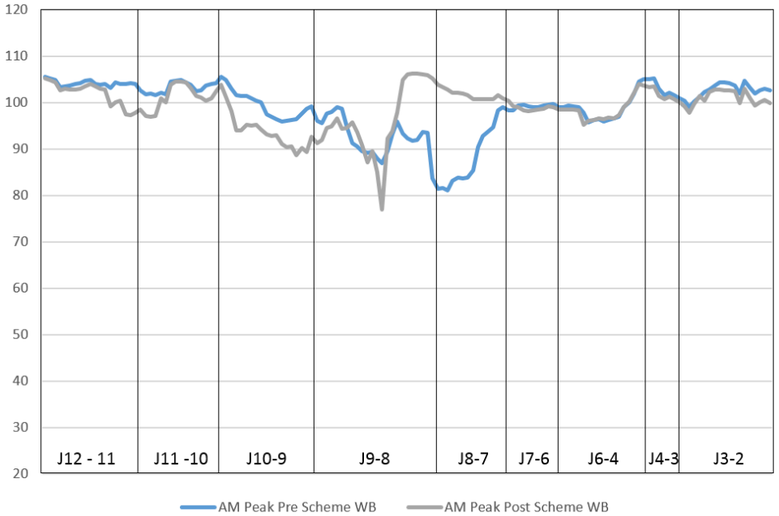
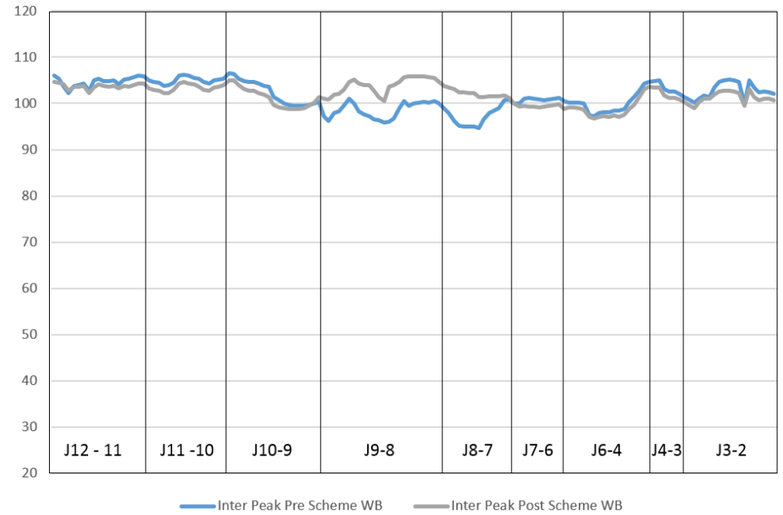
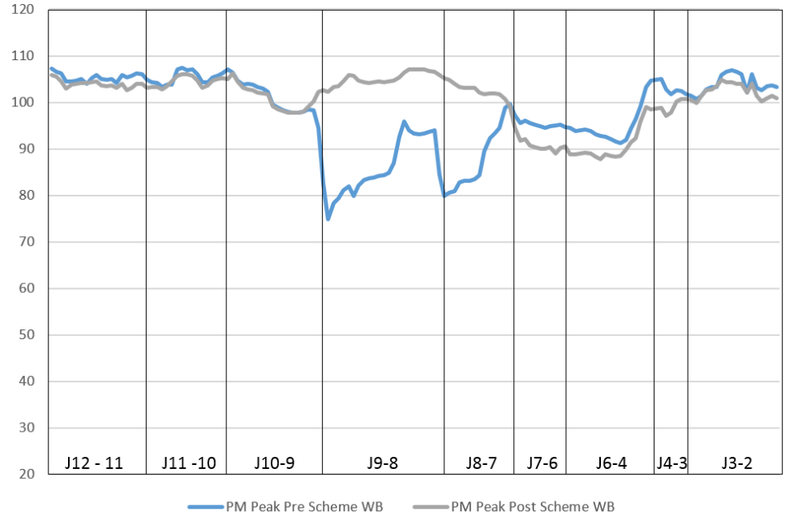


Figure 2-9 Average Speed (kph) along the A14 WB Carriageway







2.71. The following detailed observations can be made from Figure 2-8:

- The average speeds (kph) along the A14 mainline carriageway remain fairly consistent between the pre and post scheme construction periods, however, it is evident that average vehicle speeds have increased along the scheme section (J7-9) during the post-scheme construction period. This is to be expected due to the additional capacity provided by the scheme.
- In addition, it is evident that vehicle speeds reduce significantly along the EB carriageway between Junctions 3-6 in all time periods. This could be due to the limited carriageway spacing between these Junctions resulting in increased levels of merging/ diverging and therefore lower vehicle speeds. In addition, the EAR (2013) indicated that a high gradient climb along the eastbound carriageway would result in slower vehicle speeds.

2.72. The following detailed observations can be made from Figure 2-9:

- The average speeds (kph) along the A14 mainline carriageway remain fairly consistent between the pre and post scheme construction periods, however, it is evident that average vehicle speeds have increased along the scheme section (J7-9) during the post-scheme construction period. This is particularly evident during the PM Peak period where average vehicle speeds have increased by a minimum of approximately 10kph.

Journey Time Reliability

2.73. The Client Scheme Requirements identified journey time reliability as one of the Transport related objectives of the scheme, indicating that:

"The scheme should improve journey time reliability, by improving and better managing traffic flow conditions"

2.74. Reliability is measured by reference to the degree of variability in journey times and that variability is primarily influenced by congestion caused by weight of traffic (day-to-day variability) and congestion caused by incidents (incident related variability).

Route Stress Approach

2.75. Incident Cost-Benefit Assessment (INCA) software which quantifies the benefits of improved journey time reliability only includes incident rates applicable to motorways (D2M, D3M, and D4M). Therefore, as outlined in the Economic Appraisal Report, it was agreed during the appraisal process that INCA was not a suitable tool to use for the assessment of the A14 J7-9 Kettering Bypass Improvement scheme. A stress-based qualitative assessment was recommended instead.

2.76. The methodology for undertaking a stress-based journey time reliability assessment is set out in WebTAG unit 3.5.7. The stress based approach is essentially a proxy for changes in reliability measures.

2.77. The methodology calculated a stress value (ratio) for the A14 mainline links between J7–9, which is measured as a ratio of annual average daily traffic (AADT) to the Congestion Reference Flow (CRF).

2.78. The assessment was undertaken for four key links on the A14 mainline, between Junctions 7-8 in both directions and between Junctions 8-9 in both directions. The forecast stress based reliability assessment indicated that the majority of links would have a moderate to slight improvement in journey time reliability, as a result of the proposed A14 J7-9 Kettering Bypass Improvement scheme. Overall, a '*moderate beneficial'* ranking was assigned to the A14 links.

2.79. A summary of the forecast stress based reliability assessment for the scheme section (A14 Junctions 7-9) is presented in Table 2-12.

Table 2-12 Forecast Reliability Assessment Scheme Section (A14 Junctions 7-9)

Reliability Measures	J7-8 EB		J8-9 EB		J8-7 WB		J9-8 WB	
	AM	PM	AM	PM	AM	PM	AM	PM
DM Stress	95%	96%	85%	89%	101%	100%	90%	89%
DS Stress	75%	76%	75%	75%	75%	76%	75%	75%
Difference in Stress (DM-DS)	20%	21%	10%	14%	26%	24%	15%	14%

Route Stress Evaluation - Scheme Section

2.80. A stress based approach has been used to assess the reliability impacts of this scheme at OYA to make a comparison with forecasts.

2.81. The Stress Factor for a particular link is defined as the ratio of the Annual Average Daily Traffic (AADT) flow to the Congestion Reference Flow (CRF). The CRF is expressed as an AADT flow estimate at which a road is likely to be congested in the peak periods on an average day. DfT[8] Guidance states that only values between 75% and 125% should be considered and anything outside this range should be adjusted up or down to 75% or 125%.

2.82. The outturn stress based reliability assessment for the A14 mainline carriageway is presented in Table 2-13. Adjusted figures are presented in brackets.

Table 2-13 Outturn Reliability Assessment

	Observed	
	Before (2012) Route Stress	OYA (2016) Route Stress
J7-J8 EB	106%	77% (77%)
J8-9 EB	87%	61% (75%)
J8-7 WB	82%	72% (75%)
J9-8 WB	85%	59% (75%)

2.83. Table 2-13 demonstrates that route stress has reduced on all links along the scheme section indicating that the scheme has reduced the overall levels of congestion.

Journey Time Variability

2.84. The route stress approach doesn't reflect the variance in journey time by different time periods. Therefore, reliability is also evaluated based on the impact that the scheme has had on the variability of journey times.

2.85. In order to evaluate the impact of the A14 Junctions 7-9 Kettering Bypass Improvement scheme on journey time reliability, the 5th, 25th, 75th and 95th percentile journey times have been assessed, between Junctions 2 and 12 (in line with the TFR, 2013), across all time periods (see Appendix D and Appendix E).

[8] http://www.dft.gov.uk/pgr/economics/rdg/multimodal/anewdealfortrunkroadsinengla5491?page=7

2.86. The Figures presented in Appendix D and Appendix E compare the change in journey time reliability along the A14 mainline carriageway (EB and WB between Junctions 2-12) between pre-scheme and post-scheme construction.

2.87. The Figures presented in see Appendix D and Appendix E show that the A14 Junctions 7-9 Kettering Bypass Improvement scheme has had a nominal impact on journey time reliability between Junctions 2-12. However, as demonstrated in the Route Stress evaluation, route stress has reduced on all links along the scheme section indicating that the scheme has reduced the overall levels of congestion. In addition, journey time analysis demonstrated that the average journey times (across all time periods) along the scheme section have reduced when comparing the pre-scheme observed journey times to the post-scheme observed journey times.

2.88. This indicates that the scheme may have had a positive impact on Journey Time Variability along the scheme section (Junctions 7-9), however, it is considered that this may have been concealed within the average journey times (between Junctions 2-12) used to inform the figures presented in Appendix D and Appendix E.

2.89. Therefore, to demonstrate the impact of the scheme on Journey Time Variability, the change in journey time reliability along the scheme section (EB and WB between Junctions 7-9) is presented in Figure 2-10 and Figure 2-11.

Figure 2-10 Journey Time Reliability along A14 EB Carriageway (Between Junctions 7-9)

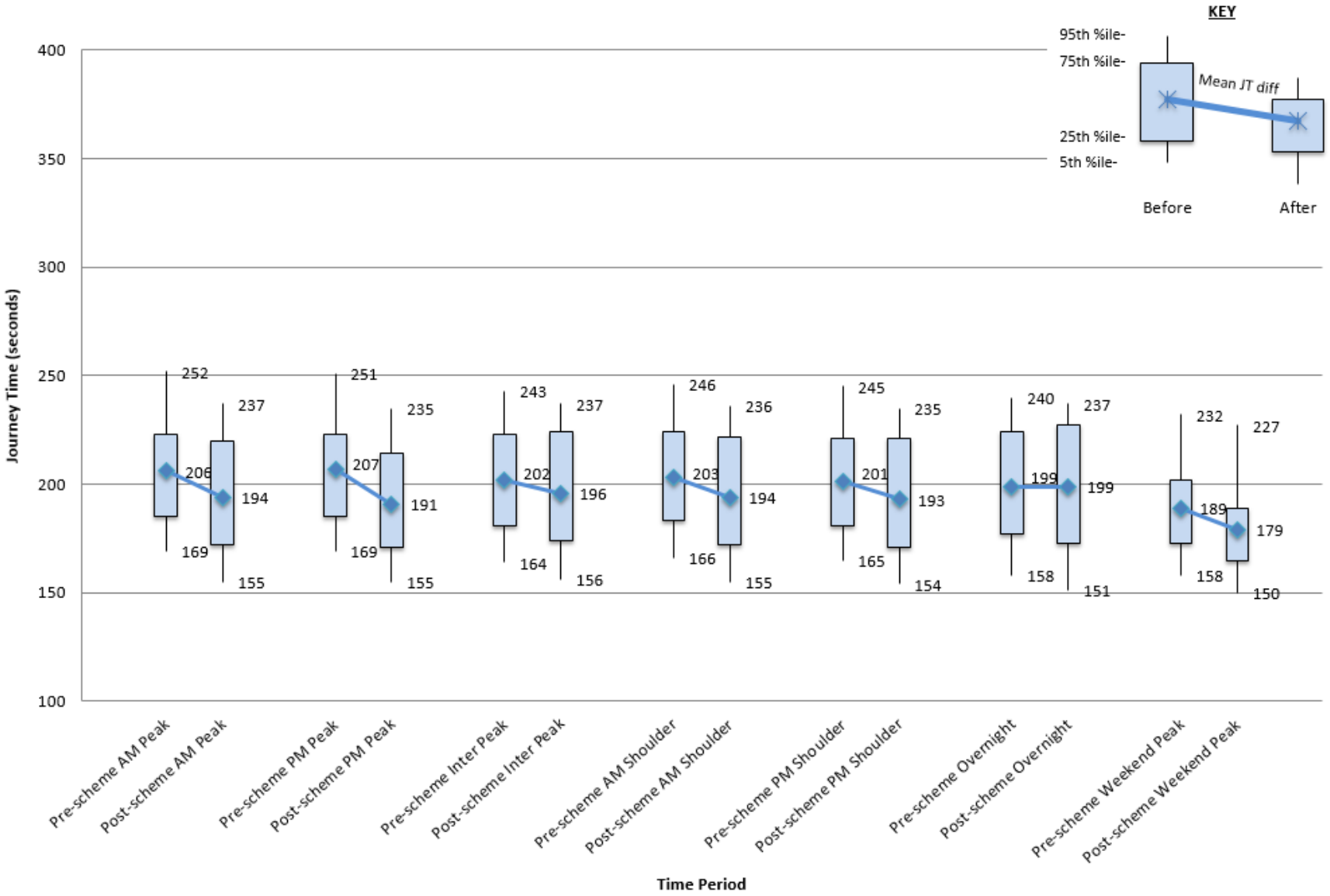
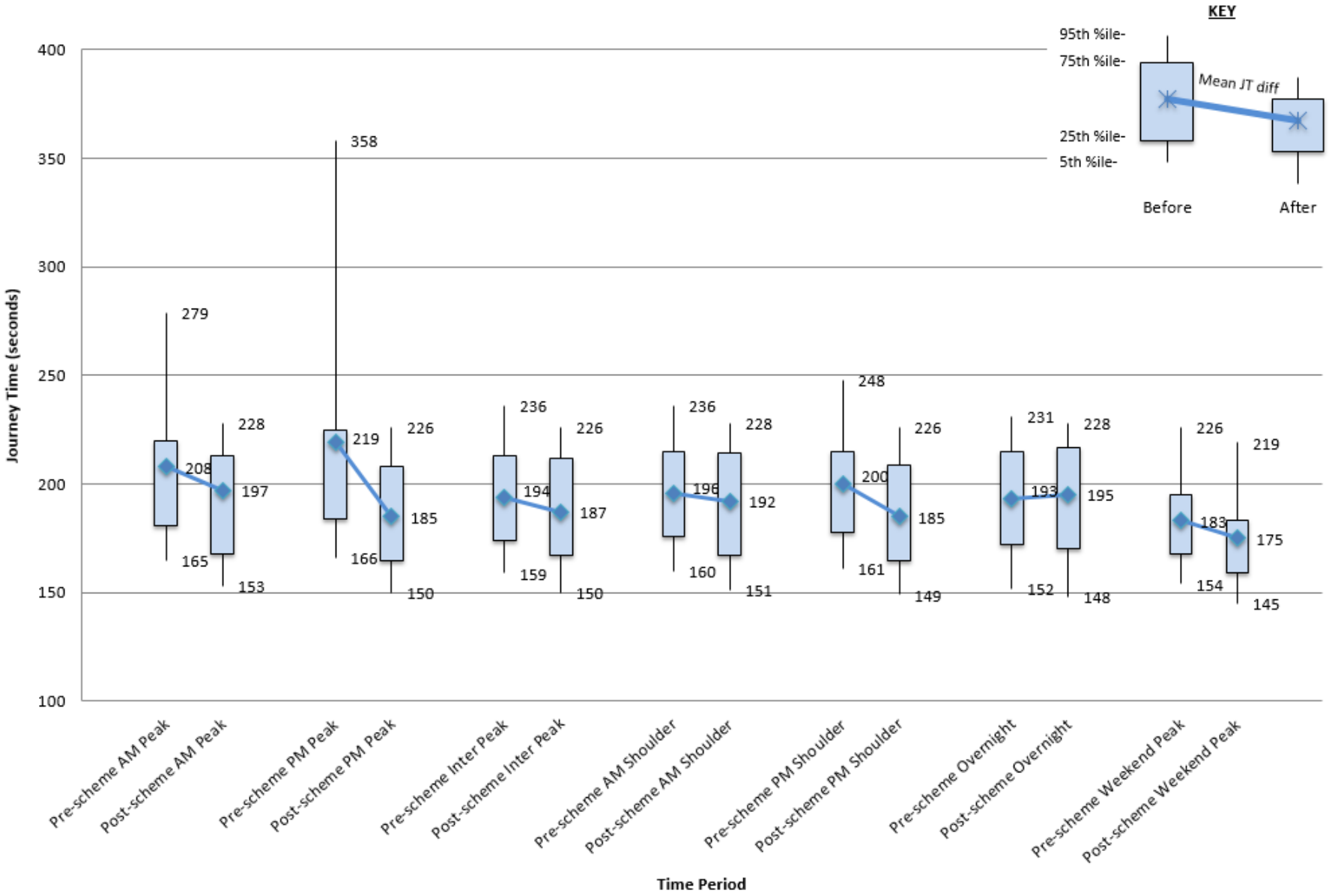


Figure 2-11 Journey Time Reliability along A14 WB Carriageway (Between Junctions 7-9)



2.90. Figure 2-10 demonstrates the impact of the scheme on Journey Time Variability along the EB carriageway between Junctions 7-9. The following key observations can be made from Figure 2-10:

- The scheme has had a positive impact on the 95th percentile journey times during all time periods, which indicates that during extreme circumstances, for example, high traffic volumes and collisions, the carriageway is operating better. This means that the A14 carriageway along the scheme section is more resilient.
- The scheme has had a positive impact on the mean journey times during all time periods, which indicates that the average journey times along the scheme section have reduced post-scheme opening.

2.91. Figure 2-11 demonstrates the impact of the scheme on Journey Time Variability along the WB carriageway between Junctions 7-9. The following key observations can be made from Figure 2-11:

- The scheme has had a positive impact on the 95th percentile journey times during all the individual time periods which indicates that during extreme circumstances, for example, high traffic volumes and collisions, the carriageway operates better. This means that the carriageway is more resilient.
- This is particularly evident during the PM Peak period where the 95th percentile journey time has reduced from 358 seconds to 226 seconds.
- The PM peak period has experienced the most significant change in journey time reliability, with the average 95th percentile journey time reducing from 358 seconds to 226 seconds, whilst the mean journey time has reduced by 34 seconds indicating that most vehicles are travelling between Junctions 7-9 in a shorter amount of time during the PM peak.

2.92. Overall, there has been a positive impact on Journey Time Variability along the scheme section (Junctions 7-9), with the mean journey times experiencing a reduction in the majority of time periods (both directions).

2.93. This demonstrates that the scheme impact on Journey Time Variability along the scheme section (Junctions 7-9) is concealed within the average journey times when considering the change in Journey Time Reliability between Junctions 2-12.

Journey Time Forecasting Accuracy

Strategic Route (Junctions 2-12)

2.94. Forecast journey times are provided in the Traffic Forecast Report. The Traffic Forecast Report provides average journey time forecasts for the Do Minimum (DM) and Do Something (DS) scenarios. Forecasts are compared with observed average journey times along the A14 mainline carriageway between Junction 2 and Junction 12 for the following time periods:

- AM Peak Hour (0800-0900);
- Average Inter Peak Hour (1000-1600); and
- PM Peak Hour (1700-1800).

2.95. Table 2-14 outlines the comparison between the DS forecast and post-scheme observed average journey times.

2.96. **Table 2-15** outlines the comparison between the DS forecast and post-scheme observed average journey times.

Table 2-14 DM Journey Time Forecasting Accuracy (Seconds)

Direction	AM Peak (Seconds)			Inter Peak (Seconds)			PM Peak (Seconds)		
	Forecast DM	Observed Pre-Scheme	Net Diff	Forecast DM	Observed Pre-Scheme	Net Diff	Forecast DM	Observed Pre-Scheme	Net Diff
EB	1283	1013	**-270**	1166	977	**-189**	1426	971	**-455**
WB	1341	1017	**-324**	1176	993	**-183**	1317	1025	**-292**

Table 2-15 DS Journey Time Forecasting Accuracy (Seconds)

Direction	AM Peak (Seconds)			Inter Peak (Seconds)			PM Peak (Seconds)		
	Forecast DS	Observed Post-Scheme	Net Diff	Forecast DS	Observed Post-Scheme	Net Diff	Forecast DS	Observed Post-Scheme	Net Diff
EB	1202	1014	**-188**	1112	985	**-127**	1282	979	**-303**
WB	1216	1016	**-200**	1112	995	**-117**	1192	1000	**-192**

2.97. Table 2-14 and Table 2-15 demonstrate that the traffic forecasting process has overestimated the average journey times along the A14 mainline carriageway between Junction 2 and 12 in both the DM and DS scenarios. As identified in this report, the TFR (2013) overestimated the ADT flows along the A14 mainline carriageway, which is consistent with the better than forecast journey time benefits.

Scheme Section (Junctions 7-9)

2.98. Forecast journey times were not provided in the Traffic Forecast Report for the scheme section (between Junctions 7 and 9). However, the Traffic Forecast Report does provide forecast DM and DS average 'spot' speeds between Junction 6 and Junction 10 for the following time periods:

- AM Peak Hour (0800-0900);
- Average Inter Peak Hour (1000-1600); and
- PM Peak Hour (1700-1800).

2.99. Table 2-16 outlines the comparison between the DM forecast and DS forecast average 'spot' speeds.

Table 2-16 Forecast Change in Average Speeds (Scheme Section) (kph)

	Direction	AM Peak (kph)			Inter Peak (kph)			PM Peak (kph)		
		Forecast DM	Forecast DS	Net Diff	Forecast DM	Forecast DS	Net Diff	Forecast DM	Forecast DS	Net Diff
J6 to J7	EB	84	84	**0**	88	88	**0**	86	85	**-1**
	WB	91	90	**-1**	87	86	**-1**	79	78	**-1**
J7 to J8	EB	82	100	**18**	84	100	**16**	77	94	**17**
	WB	51	100	**49**	83	100	**17**	74	93	**19**
J8 to J9	EB	87	105	**18**	87	102	**15**	80	97	**17**
	WB	85	104	**19**	87	102	**15**	80	97	**17**
J9 to J10	EB	99	97	**-2**	92	92	**0**	86	85	**-1**
	WB	89	88	**-1**	90	90	**0**	88	86	**-2**

2.100. As identified, the Traffic Forecasting Report did not provide Forecast Journey Times for the scheme section (between Junctions 7 and 9), however, the average 'spot' speeds outlined in Table 2-16 indicate a forecast saving in average journey times across the scheme section. This is consistent with the observed journey time savings along the scheme section as presented in Table 2-10 and Table 2-11 within this report.

Key Points – Traffic Impact Evaluation

Traffic Flows

- AWT flows along the scheme section between Junctions 7-8 have increased by 7% (approx. 2,900 vehicles) along the westbound carriageway, AWT flows have increased by 8% (approx. 3,400 vehicles) along the eastbound carriageway.
- AWT flows along the scheme section between Junctions 8 and 9 have increased by 4% (approx. 1,600 vehicles) along the westbound carriageway, whilst AWT flows have increased by 8% (approx. 3,000 vehicles) along the eastbound carriageway.
- In addition to the observed levels of traffic growth along the A14 mainline carriageway, the A43 north of Junction 7, and the A43 south of junction 8 have experienced an increase in traffic. The A43 north of the A14 has experienced an increase in two-way flows of approximately 18% (5,900 vehicles) whilst the A43 south of the A14 has experienced an increase in two-way flows of approximately 10% (2,500 vehicles).
- The average weekday traffic profile indicates that prior to scheme construction, there was evidence of 'peak spreading'. This occurs when road users re-time their journeys to avoid high levels of congestion during the peak hours, or high levels of congestion increase journey times through the scheme section which extends the peak periods. This is particularly evident during the AM peak on the WB carriageway between J7-8, and during the PM peak on the EB carriageway between J8-9.
- A significant proportion of the overall increase in AWT flows along the A14 scheme section occurs during the AM and PM peak hour periods. This indicates that, post-opening, there is additional vehicular demand during the network peak hours. This suggests that the additional capacity provided by the scheme has induced traffic, with vehicles able to travel within the network peak hours.
- the proportion of HGVs recorded along the A14 mainline carriageway has changed marginally between 2012 and 2016. However, the A43 north of the A14, and the A43 south of the A14 have experienced slight increases in the proportion of HGVs recorded, with approximately 4% more HGVs recorded along the A43 north and approximately 6% along the A43 South.

Journey Times

- The EB journey times along the scheme section have experienced a reduction across all time periods, with an observed journey time saving of approximately 14 seconds during the AM peak, and 17 seconds during the PM peak period.
- The WB journey times along the scheme section have also experienced a reduction across all time periods, with an observed journey time saving of approximately 17 seconds in the AM peak, and 37 seconds in the PM peak period.
- Despite the observed reduction in journey times along the scheme section, the average EB journey times along the A14 carriageway (between Junction 2 and Junction 12) have experienced an overall increase in average journey times during the Inter-peak (approximately 7 seconds) and PM peak periods (approximately 8 seconds).

- The average journey times between Junction 2 and Junction 12 of the A14 (excluding the scheme section) indicate an observed increase in average journey times, with the WB carriageway between Junctions 2-3 and Junctions 11-12 experiencing the greatest increase.

- The average speeds (kph) along the A14 mainline carriageway remain fairly consistent between the pre-and-post scheme construction periods, however, it is evident that average vehicle speeds have increased along the scheme section (J7-9) during the post-scheme construction period.

- The scheme has had a positive impact on the 95th percentile journey times during all time periods, which indicates that during extreme circumstances, for example, high traffic volumes and collisions, the carriageway is operating better. This means that the carriageway is more resilient.

- The scheme has had a positive impact on the mean journey times during all time periods, which indicates that the average journey times along the scheme section have reduced post-scheme opening.

Forecast vs. Outturn Flows and journey time impacts

- The traffic forecasting process has overestimated the average journey times along the A14 mainline carriageway between Junction 2 and 12 in both the DM and DS scenarios. As identified in this report, the TFR overestimated the ADT flows along the A14 mainline carriageway, which is consistent with the better than forecast journey time benefits.

- The Traffic Forecasting Report did not provide Forecast Journey Times for the scheme section (between Junctions 7 and 9), however, average 'spot' speeds indicate a forecast saving in average journey times across the scheme section.

Reliability

- The A14 Junctions 7-9 Kettering Bypass Improvement scheme has had a nominal impact on journey time reliability between Junctions 2-12.
- There has been a positive impact on Journey Time Variability along the scheme section (Junctions 7-9), with the mean journey times experiencing a reduction in the majority of time periods (both directions).
- This demonstrates that the scheme impact on Journey Time Variability along the scheme section (Junctions 7-9) is concealed within the average journey times when considering the change in Journey Time Reliability between Junctions 2-12.

3. Safety

Introduction

3.1. This section examines the impact of the scheme on safety and how successful the scheme has been in addressing the objective of improving safety. The focus of this objective is to reduce loss of life, injuries and damage to property resulting from transport collisions and crime. The Client Scheme Requirements (CSR) document reports that the scheme safety objective was:

"to achieve a safety objective under which the 'after' accident numbers (per annum) on the J7-9 section of the A14 are no greater than those 'before' and the severity ratio is not increased"

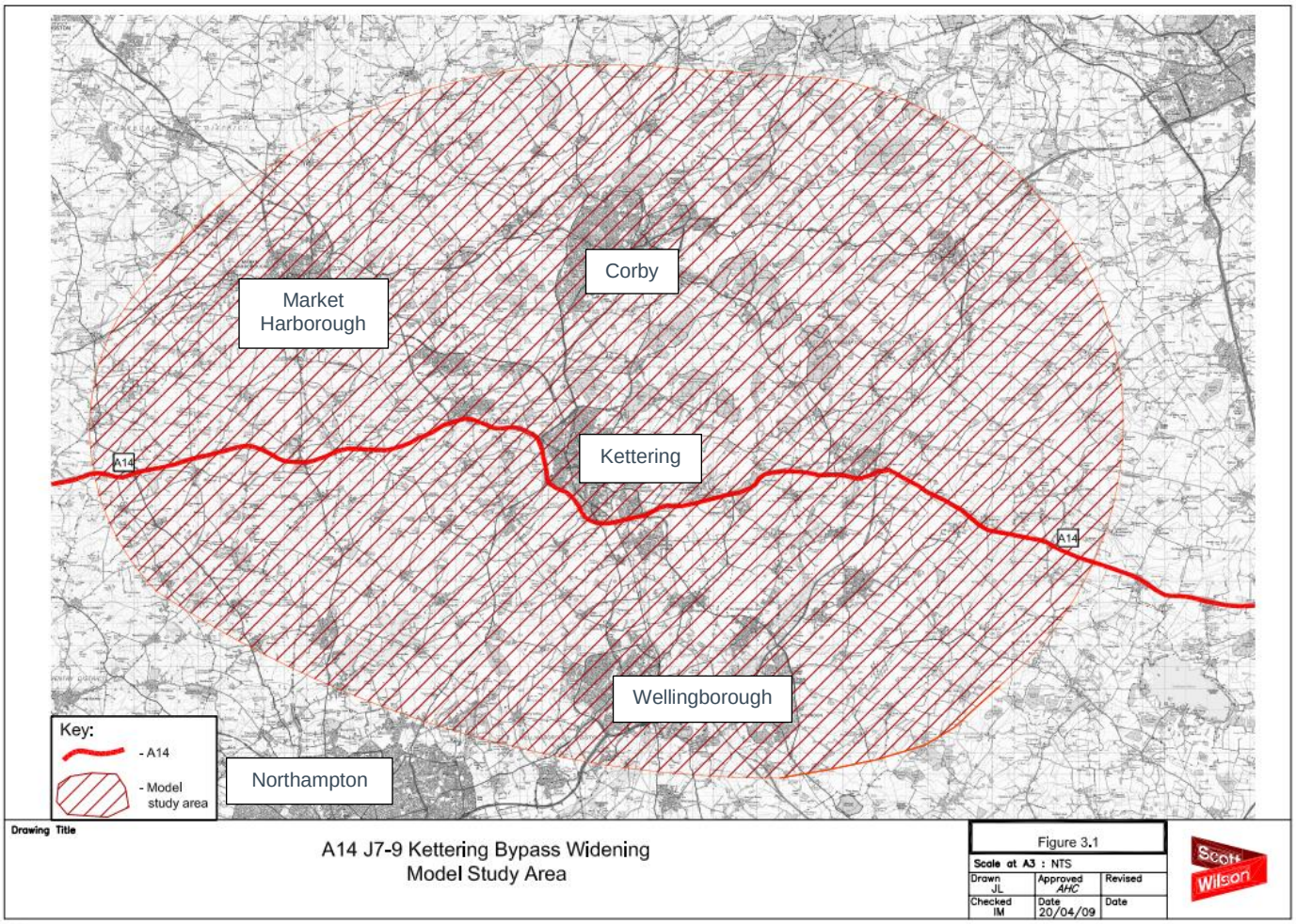
3.2. To assess the impact of the scheme on safety, this section of the report analyses changes in Personal Injury Collisions (PICs) occurring in the five-year period before the start of construction, compared to the available post-opening period. Evaluation of the scheme's impact on personal security has been undertaken with observations made during a site visit.

Forecast Data

3.3. Forecasts of the schemes impact on safety have been obtained from the A14 J7-9 Kettering Bypass Improvement Economic Assessment Report (February 2013). This section considers the change in the number of collisions, while the economic impact of these changes is considered later in the economy chapter of this report.

3.4. Personal Injury Collision (PIC) numbers and casualty numbers have been calculated for every link in the model network for every year in the appraisal period (2015 to 2074), and then summed to give total PIC and casualty numbers in the DM and DS scenarios by slight, serious and fatal casualties. The extent of the model area used in the collision analysis is shown in Figure 3-1.

Figure 3-1 Model Study Area used in Collision Analysis



Observed Data

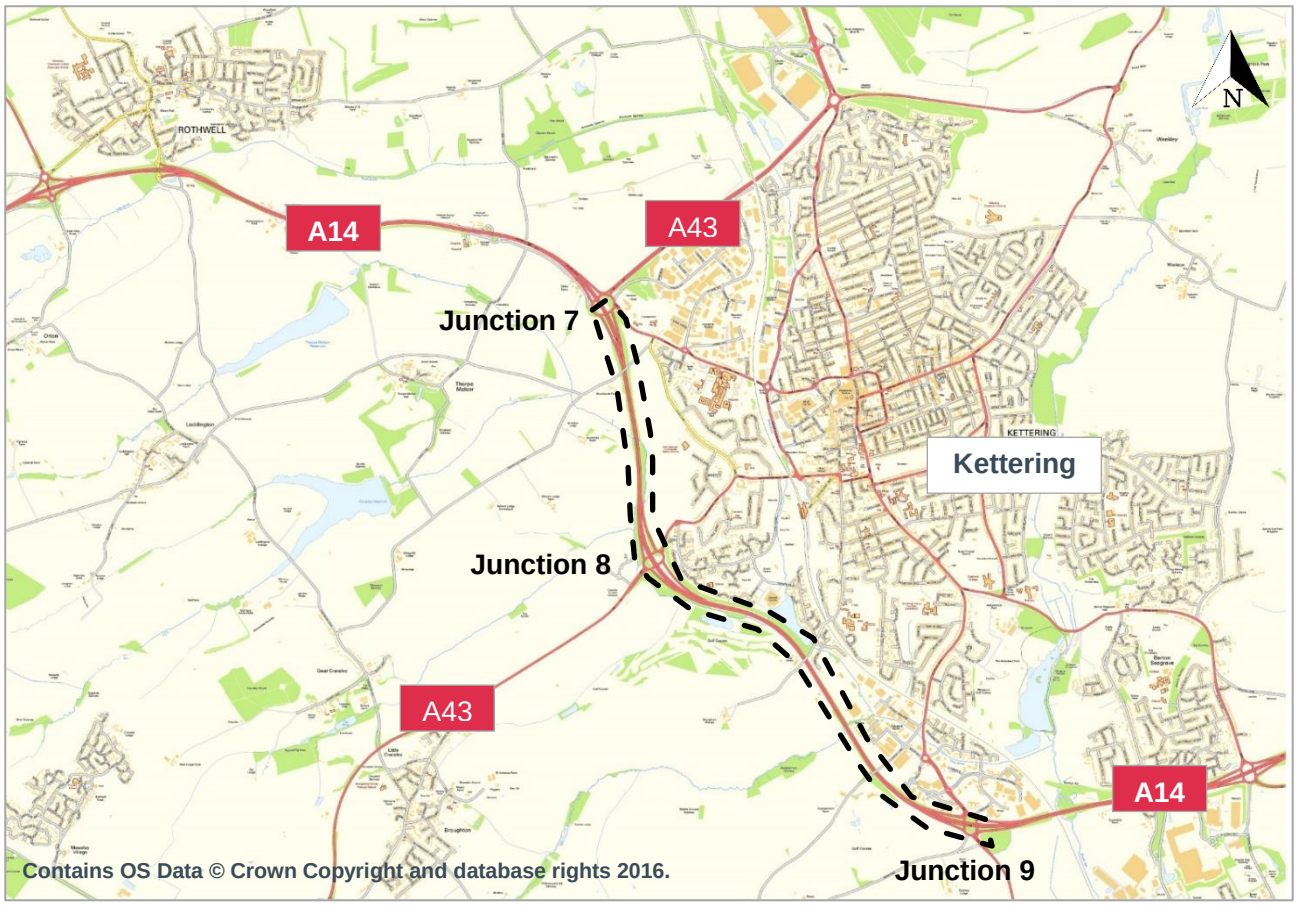
3.5. Collisions by their nature include a random element and are somewhat unpredictable events and therefore to ensure the scheme is the only significant change, pre-scheme collision data has been obtained for the most recent five years before construction. Collision data has been obtained from the DfT database for the model study area for the following time periods:

- **Pre-Scheme**: November 2008 to October 2013 (Five Years)
- **Construction**: November 2013 to June 2015 (20 Months)
- **Post-Scheme Opening**: July 2015 to June 2016 (12 Months)

3.6. The collision data is based on the records of PICs (i.e. collisions that involved injuries to one of more persons) recorded in STATS19 data collected by the police when attending collisions. Collisions that do not result in injury are not included in this dataset hence are not considered in this evaluation. Only 12 months of post-opening data has been used in this report and this should be considered when drawing conclusions.

3.7. In addition to examining the impact of the scheme over the larger study area, this report will also evaluate the impact of the scheme over the 'key links' analysis area which is focused on the key network routes within the vicinity of the scheme. The 'key links' analysis area is outlined in Figure 3-2 below.

Figure 3-2 Key Links Analysis Area used in Collision Analysis



Background Changes in Collision Reduction

3.8. It is widely recognised that for over a decade there has been a year-on-year reduction in the number of PICs on roads, even against the trend of increasing traffic volumes during much of the same period. The reasons for the reduction are wide ranging and include improved safety measures in vehicles and reduced number of younger drivers. This background trend needs to be considered when examining the changes in collision numbers. If the scheme has not been built, collision number in the area are still likely to have been influenced by wider trends and therefore reduced.

3.9. When the number of collisions in this area in the years before (pre-scheme) and after (post-scheme) the scheme was built are compared, the change in the number of collisions, once the change in the area is considered, can be primarily linked to the scheme. 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 would have dropped at the same rate as they did nationally during the same time period. This gives what is known as a "counterfactual" scenario. The counterfactual scenario (without scheme) scenario can be compared on a like for like basis with post-opening (with scheme) scenario. The difference between the numbers of collisions in these two scenarios can then be attributed to the scheme rather than the wider national trends. This result will inform the calculation of monetised safety benefits achieved by the scheme as discussed in the economy chapter of this report.

3.10. The counterfactual scenario compares the national collision data[9] in the period after the scheme opened to the pre-construction period. The most recent statistics available only extend to 2015. As a result, the average number of collisions occurring pre-construction (2009-2013) has been compared with the national average in 2015 (post-scheme construction). Table 3-1 illustrates that there has been a 7% reduction in collision numbers

[9] National trend data is sourced from DfT Table RAS10002.

on 'A' Roads between 2009 and 2015. This reduction has been applied to the pre-scheme opening collision numbers across the key links analysis area to create the counterfactual scenario.

3.11. Table 3-1 also illustrates that there has been an 7% reduction in collision numbers on 'All' Roads between 2009 and 2015, which has been applied to the pre-scheme opening collision numbers across the model study area to create the counterfactual scenario.

Table 3-1 Index of Change for Collision Numbers on 'A' Roads and All Roads

Year	'A' Roads		All Roads	
	Reported Number of Collisions (DfT Table RAS10002)	Average Number of Collisions	Reported Number of Collisions (DfT Table RAS10002)	Average Number of Collisions
2009	74,149	69,180	163,554	150,735
2010	70,274		154,414	
2011	69,889		151,474	
2012	67,166		145,571	
2013	64,423		138,660	
2015	64,280	64,280	140,056	140,056
	Counterfactual	**-7%**	**Counterfactual**	**-7%**

Observed Collision Numbers

3.12. This section analyses observed changes in the number of PICs following the implementation of the scheme and includes investigation of changes in the relative severity index.

3.13. In addition, to determine whether the changes in collision numbers observed before and after the scheme opened are statistically significant, a Chi-square test has been undertaken for the 'Model Study Area' and the 'Key Links' analysis area. This test uses the without scheme counterfactual collision numbers (pre-scheme) and post-scheme reported collision numbers to establish whether the changes are significant and related to the scheme, or are likely to have occurred by chance.

Model Study Area

3.14. Table 3-2 presents the change in collisions over the scheme modelled area since the scheme opened.

Table 3-2 Number of Collisions by Severity over Model Study Area

Period	Time Period		Collision Severity			Total	Annual Average				Severity Index
	From	To	Fatal	Serious	Slight		Fatal	Serious	Slight	All	
Pre-scheme	Nov/2008	Oct/2009	17	153	507	677	10.8	118.0	452.6	581.4	22%
	Nov/2009	Oct/2010	10	111	523	644					
	Nov/2010	Oct/2011	10	112	408	530					
	Nov/2011	Oct/2012	8	102	439	549					
	Nov/2012	Oct/2013	9	112	386	507					
	Application of without scheme counterfactual									540.2	
Post-scheme	Jul/2015	Jun/2016	8	123	392	523	8.0	123.3	393.1	524.5	25%
Total Annual Collision Saving										**15.8**	**-**

3.15. The results presented in Table 3-2 show:

- The annual average number of collisions over the Model Study Area have reduced by 15.8 PICs (-3%) since the scheme opened. Statistical significance testing (as detailed in the section below) found the annual collision reduction over the Model Study Area to not be statistically significant, meaning the collision reduction is likely to have occurred by chance alone and therefore the change in collision numbers cannot be attributed to the scheme.
- The Killed or Seriously Injured (KSI) proportion is the ratio of the number of collisions classed as serious or fatal compared to the total number of collisions. The pre-scheme KSI index over the Model Study Area was 22%. In the post-scheme period, the KSI index over the Model Study Area has increased to 25%.

Key Links Analysis Area

3.16. Table 3-3 presents the change in collisions over the key links analysis area since the scheme opened.

Table 3-3 Number of Collisions by Severity over Key Links Analysis Area

Period	Time Period		Collision Severity			Total	Annual Average				Severity Index
	From	To	Fatal	Serious	Slight		Fatal	Serious	Slight	All	
Pre-scheme	Nov/2008	Oct/2009	0	3	6	9	0.2	1.2	6.0	7.4	19%
	Nov/2009	Oct/2010	0	1	7	8					
	Nov/2010	Oct/2011	0	0	7	7					
	Nov/2011	Oct/2012	0	1	8	9					
	Nov/2012	Oct/2013	1	1	2	4					
	Application of without scheme counterfactual									6.9	
Post-scheme	Jul/2015	Jun/2016	0	1	6	7	0.0	1.0	6.0	7.0	14%
Total Annual Collision Saving										**-0.1**	**-**

3.17. The results presented in Table 3-3 show:

- The annual average number of collisions over the Key Links Analysis Area have increased by 0.1 PICs since the scheme opened. Statistical significance testing (as detailed in the section below) found the annual collision increase over the Key Links Analysis Area to not be statistically significant, meaning the increase in collisions is likely to have occurred by chance alone and therefore the change in collision rates cannot be attributed to the scheme.
- The pre-scheme KSI index over the Key Links Analysis Area was 19%. In the post-scheme period, the KSI index over the Key Links Analysis Area has decreased to 14%.

Road Safety Audit

3.18. A Stage 4a Road Safety Report (RSA) (12-month monitoring report) was produced in May 2017 as part of the routine collision monitoring/ Road Safety Audit procedure. The RSA evaluated 12 months[10] of observed collision data between Junctions 6-10 and reported the following findings:

- The post-scheme collision frequency is comparable to the pre-scheme collision frequency between Junctions 6-10. However, there is an exception between Junction 7 and Junction 8 (westbound) where the collision numbers have risen between pre and post-scheme from 0 collisions to 3 collisions. However, after interrogation of the STATS19 data, it was not considered that these collisions were related to the scheme.
- There is a slight rise in the number of collisions caused by vehicles changing lanes through the scheme section. This is to be expected due to the additional lane implemented as part of the scheme.

3.19. The Stage 4a RSA concluded that no additional common causation factors or trends were identified as a result of the scheme and therefore no firm conclusions can be drawn. However, the lane changing incidents should be monitored, and considered at the FYA stage.

[10] It should be noted that the Stage 4a RSA assessed different time periods over a different study area and therefore the findings reported will be different to those reported in this report.

Statistical Significance

3.20. To determine whether the change in the annual collision numbers observed before and after the scheme opened over the 'Model Study Area' and the 'Key Links Analysis Area' are statistically significant, a Chi-squared test has been undertaken.

3.21. A Chi-squared test has also been undertaken to determine if the change in the annual collision rate over the Key Links Analysis Area is statistically significant.

3.22. The statistical significance test for collision rates uses the without scheme counterfactual and post-opening number of collisions alongside AADT flows to establish whether the changes in collision rates are significant and likely to be related to the scheme or to have occurred by chance alone.

3.23. The statistical testing has demonstrated that the change in collisions, and the change in collision rates over the 'Model Study Area' and the 'Key Links Analysis Area' is not statistically significant and is likely to have occurred by chance, and not as a result of the scheme implementation.

3.24. The results of the Statistical Significance testing are presented in Table 3-4 below.

Table 3-4 Statistical Significance Summary

Analysis Area	Chi Square Value		Statistical Significance (Based on Critical Value of 3.84)
	Collisions	Collision Rates	
Key Links Analysis Area	0.002	0.007	Not Statistically Significant
Model Study Area	0.384	3.074	Not Statistically Significant

Forecast vs Outturn Collision Numbers

3.25. The EAR for the scheme reports a small change in collisions, with a 1% increase in the Model Study Area, and a 2% reduction in the Key Links Analysis Area. Relating to collision numbers, the AST (2013) states that:

"There are reductions in flow (and thus in the number of accidents) in the Kettering urban area where there are relatively higher numbers of pedestrians and cyclists. Flows increase on the A14 where there would be an increase in the number of accidents but where there are relatively low numbers of vulnerable road users"

3.26. The forecast DM and DS scenarios have been compared to the observed percentage change in collisions over both the Model Study Area and the Key Links Analysis Area. Table 3-5 shows that there has been a 3% reduction in the number of collisions across the Model Study Area which is better than the 1% forecast increase in collisions. In addition, there has been an observed 2% increase in the number of collisions across the Key Links Analysis Area, which is higher than the forecast net reduction of 2%.

Table 3-5 Comparison between Forecast and Observed Collisions[11]

Scenario		Model Study Area	Key Links Analysis Area
Forecast (Opening Year of 2015)	Do Minimum (without scheme)	573	4.7
	Do Something (with scheme)	578	4.6
	Net Impact	5	-0.1
	% Change	**1%**	**-2%**
Observed[12]	Do Minimum (without scheme)	581.4	7.4
	Do Minimum (Counterfactual without scheme)	540.2	6.9
	Do Something (with scheme)	524.5	7.0
	Net Impact	-15.8	0.1
	% Change	**-3%**	**2%**

3.27. However, it should be noted that the difference between the forecast collision saving (-0.1) and the observed collision saving (0.1) over the Key Links Analysis Area is negligible, and therefore it is not considered that the construction of the scheme has had a discernible impact on collision numbers.

Collision Rates

3.28. The number of collisions along a length of road and the ADT can be used to calculate a collision rate, known as PIC per million vehicle kilometres (mvkm). Interpretation of this rate can identify the impact of the scheme, and allows comparisons to be made which consider traffic growth. Table 3-6 compares the change in collision rates between the DM and DS scenario across the Key Links Analysis Area[13].

Table 3-6 Observed Collisions Rates per MVKM on Key Links

Scenario	Key Links Scheme Section
Do Minimum (without scheme)	0.108
Application of without scheme counterfactual rate	0.102
Do Something (with scheme)	0.097
Saving	**0.004 (4%)**

3.29. Table 3-6 shows that the observed collision rate along the Key Links scheme section was higher in the DM (without scheme) scenario than the DS (with scheme) scenario. In addition, the collision rate has reduced marginally by approximately 4% when comparing the DS (with scheme) scenario to the DM counterfactual rate. However, as outlined, statistical significance testing has demonstrated that the change in collision rates is not statistically significant, and may have occurred by chance, and not as a result of the scheme.

[11] Note that a negative value represents a Collision Saving and a positive value represents a Collison Increase.

[12] Based on 5 Years of Pre-scheme data and 15 Months of Post-Scheme data.

[13] Collision Rate analysis requires ADT flows to determine the scheme impact, therefore it is not possible to calculate the change in collision rates across the Model Study Area.

Fatalities and Weighted Index

3.30. The collision rate discussed previously and shown in Table 3-6 does not consider the severity of collisions. The Fatalities and Weighted Injuries (FWI) metric is calculated based on the numbers of fatal, serious and slight casualties as weighted proportions, to adjust for the severity.

3.31. The FWI for three years before and 12 months after the scheme opened are shown in Table 3-7 for the Key Links analysis area. It should be noted that these figures do not take into account background reductions in casualties or collisions.

Table 3-7 FWI on A14 Scheme Section

Period	FWI/collision	FWI/year	FWI/bvkm
Before (three years)	0.071	0.47	6.9
After (12 months)	0.031	0.22	3.1

3.32. The results show that the FWI metric per collision has decreased when comparing the pre-scheme scenario to the post-opening scenario. The FWI metrics per billion vehicle kilometres (bvkm) has reduced post scheme opening. This indicates that the seriousness of casualty injuries has decreased, although this reduction cannot be entirely attributed to the scheme.

Personal Security

3.33. 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 (for example, being attacked whilst broken down).
- In service areas/car parks/lay-bys (for example, vehicle damage while parked at a service station, being attacked whilst walking to a parked car).
- At junctions (for example, smash and grab incidents while queuing at traffic lights).

Forecast

3.34. The AST stated that the scheme had no elements which would impact on this sub-objective.

Evaluation

3.35. The scheme contained no elements which would impact on this sub-objective and therefore the OYA assessment of the schemes impact on personal security is scored as neutral.

Key Points – Safety

Collisions

- The annual average number of collisions over the Model Study Area have reduced by 15.8 PICs since the scheme opened. Statistical significance testing (as detailed in the section below) found the annual collision reduction over the Model Study Area to not be statistically significant.
- The Killed or Seriously Injured (KSI) proportion is the ratio of the number of collisions classed as serious or fatal compared to the total number of collisions. The pre-scheme KSI index over the Model Study Area was 22%. In the post-scheme period, the KSI index over the Model Study Area has increased to 25%.
- The annual average number of collisions over the Key Links Analysis Area have increased by 0.1 PICs since the scheme opened. Statistical significance testing (as detailed in the section below) found the annual collision increase over the Key Links Analysis Area to not be statistically significant.
- The pre-scheme KSI index over the Key Links Analysis Area was 19%. In the post-scheme period, the KSI index over the Key Links Analysis Area has decreased to 14%.

Collision Rate

- The observed collision rate along the Key Links scheme section was higher in the DM (without scheme) scenario than the DS (with scheme) scenario. In addition, the collision rate has reduced by approximately 4% when comparing the DS (with scheme) scenario to the DM counterfactual rate. However, statistical significance testing has demonstrated that the change in collision rates is not statistically significant.

Forecast vs. Outturn Collision Rate Savings

- There has been a 3% reduction in the number of collisions across the Model Study Area which is better than the 1% forecast increase in collisions. However, there has been an observed 2% increase in the number of collisions across the Key Links Analysis Area, which is higher than the forecast net reduction of 2%.

FWI Metric

- The FWI metrics per billion vehicle kilometre miles (bvkm) has reduced post scheme opening. This indicates that the seriousness of casualty injuries has decreased.

Security

- The scheme contained no elements which would impact on this sub-objective and therefore the OYA assessment of the schemes impact on personal security is scored as neutral.

4. Economy

Introduction

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

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

4.2. The economy sub-objectives are:

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

4.3. Scheme appraisal consists of an economic assessment to determine the scheme's value for money. This assessment is based on an estimation of costs and benefits from different sources:

- Transport Economic Efficiency (TEE) benefits (savings related to travel times and vehicle operating costs).
- Collisions costs (net impact related to number and severity of collisions).
- Costs to users due to delays during construction and future maintenance periods.
- Cost of building the scheme and;
- Cost of operating the scheme over its lifetime.

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

Sources

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

- A14 J7-9 Kettering Bypass Improvement Economic Assessment Report (EAR, 2013);
- DfT TUBA (Transport User Benefit Analysis) Program;
- Forecast Costs from P50;
- Outturn Costs from the Regional Finance Manager in March 2015;
- WebTAG guidance: Carbon impact, Fuel consumption; and
- PAR 6.3 guidance[14].

4.6. The appraisal report provides forecasts of the benefits for a 60 year appraisal period. All costs presented in the EAR and this chapter are in 2010 prices discounted to 2010 unless otherwise stated. This is in line with the price base as used in the EAR.

Present Value Benefits

4.7. The scheme appraisal considered the economic benefits of the scheme represented in terms of present value (present value benefits – PVB) for the aspects outlined in Table 4-1.

[14] Project Appraisal Report (PAR) is Highways England's standard approach to appraisal typically used for smaller schemes based on webTAG guidance on economic assessment. It provides a basis for POPE evaluations where is not appropriate to re-run full models.

4.8. Table 4-1 outlines the evaluation approach undertaken in this report. A 'yes' indicates that a particular element has been considered in this evaluation. A 'no' indicates that the forecast impact has been used in place of a full evaluation at this stage.

Table 4-1 Economic Benefits of Scheme (2010 prices and values)

Benefits in £m 2010 market prices, discounted	Forecast £m (EAR)	Evaluate?	Evaluation Approach
Journey Time (TEE business and consumer users)	£257.978m	Yes	Outturn journey time impacts in opening year can be calculated from observed data.
Vehicle Operating Costs (VOC)	-£28.712m	Yes	Net change in fuel consumption in opening year monetised to calculate a proxy outturn reforecast value of VOC.
Delay during Construction period & Future maintenance periods: Journey time and VOC impacts	-£10.923m	No	Not known at this stage and not within the remit of POPE to evaluate.
Safety Benefits	£17.302m	Yes	Based on observed reduction in collision numbers, if this is statistically significant.
Carbon Benefits	-£7.101m	Yes	Ratio between forecast and outturn opening year carbon impact used to calculate 60 year reforecast.
Noise Benefits	£0.613m	No	Small proportion of the overall scheme impacts so the economic impact has not been evaluated.
Air Quality	-£0.904m	No	Small proportion of the overall scheme impacts so the economic impact has not been evaluated.
Indirect tax impact as a benefit	£17.460m	Yes	Calculate outturn change in fuel consumption in the opening year and use ratio against forecast change to reforecast 60 year benefit.
Total PVB	**£245.712m**		

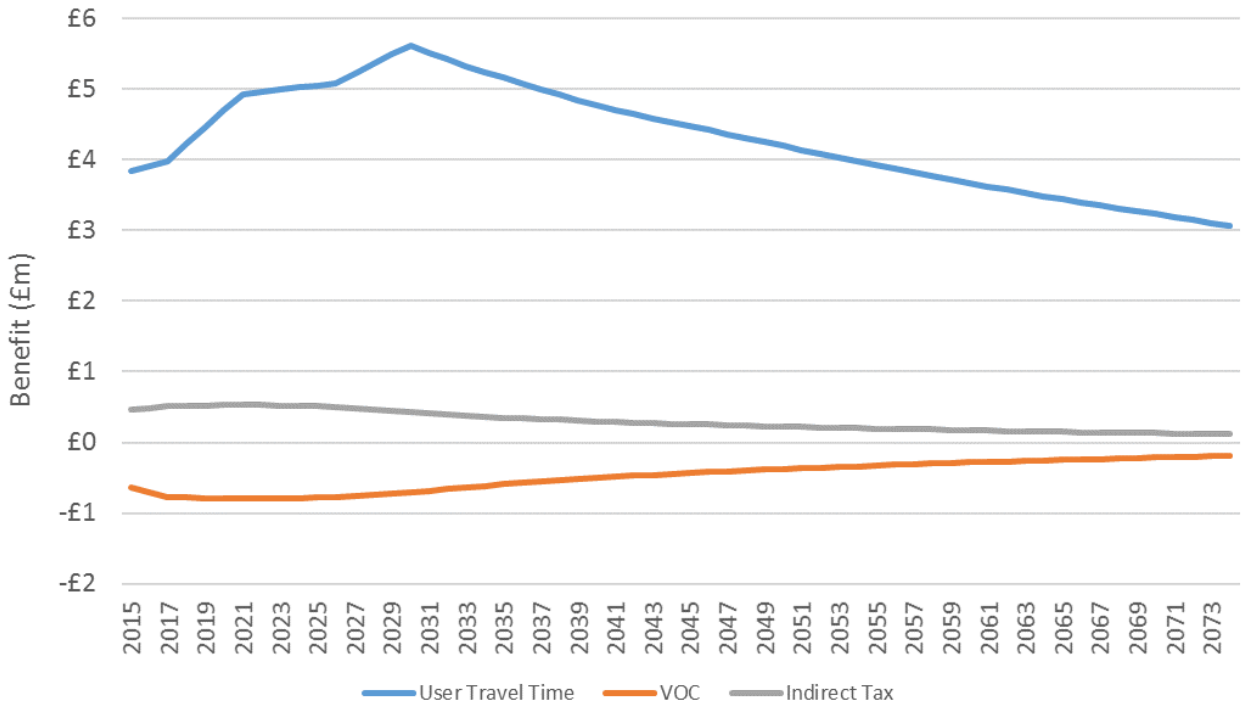
Note: All entries are in market prices, at present values discounted to 2010, in £ millions.

How are the Forecast Benefits Constructed?

4.9. The forecast scheme benefits outlined in Table 4-1 are presented graphically in Figure 4-1. This demonstrates that a significant proportion of the forecast scheme benefits were associated with the projected change in journey times.

4.10. Additional analysis of the TUBA forecasts provides a detailed account of the forecast journey time benefits over the 60-year scheme appraisal period (see Figure 4-1).

Figure 4-1 Forecast Journey Time Benefits over 60 Years (£m)



4.11. The key points from Figure 4-1 are:

- Only 1.5% of the journey time benefits were forecast to be achieved in the opening year (2015).
- The EAR stated that the journey time benefits were expected to increase up to 2030 in the Core Scenario. The impact of discounting is apparent after 2030, when there is a gradual reduction in the present value year benefits being accrued from the scheme.

Journey Time Benefits

Forecast

4.12. Forecast journey time benefits for this scheme were derived from the scheme's Stage 2 model (SW Stage 2) using the DfT TUBA (Transport User Benefit Analysis) program.

4.13. The following modelled time periods were annualised to inform the economic appraisal, and calculate the forecast journey time benefits over the model study area (including the scheme section between Junctions 7-9):

- AM Peak Hour (0800-0900);
- Average Inter Peak Hour (1000-1600);
- PM Peak Hour (1700-1800); and
- Off-Peak Period (0000-0700, 1900-2400).

4.14. The annual change in vehicle hours over the model study area was used to calculate the forecast economic benefits of the scheme.

Evaluation

4.15. The POPE methodology for evaluating the economic value of the journey time benefits is based upon comparing the observed opening year vehicle hour saving with the forecast opening year vehicle hour saving.

4.16. As identified, TUBA modelling for the scheme was based on the journey time benefits over the whole model area (see Figure 2-1). As demonstrated within this evaluation, there has been negligible impact on journey times over the full distance of the A14 between Junctions 2 and 12.

4.17. However, there has been a reduction in journey times along the scheme section (between Junctions 7-9) with an observed reduction across all time periods (both directions). Therefore, it is considered appropriate at the OYA stage to capture the monetary value of the journey time benefits for vehicles along the A14 scheme section (J7-9), because we are confident that the change in journey times along the scheme section is because of the scheme itself.

4.18. To calculate the economic value of the journey time benefits, the observed opening year vehicle hour saving is compared with the re-forecast opening year vehicle hour saving along the scheme section. However, it is not possible to use TUBA outputs to create a comparable re-forecast based on the scheme impact along the scheme section because TUBA is matrix based, and the outputs do not give any breakdown of the forecast impact by link or area.

4.19. The Traffic Forecasting Report provides forecast DM and DS average 'spot' speeds which indicate a forecast saving in average journey times across the scheme section. The average 'spot' speeds along the scheme section have been used to calculate a forecast opening year vehicle hour saving along the scheme section (see Section 2.98).

4.20. Savings have been considered for a 12-hour weekday profile for the following time periods:

- AM Peak Hour (0700-1000);
- Average Inter Peak Hour (1000-1600); and
- PM Peak Hour (1600-1900).

4.21. The 12-hour weekday profile has been annualised using the factors outlined within the EAR.

4.22. In order to calculate the opening year monetary benefit, the following assumptions have been made:

- Traffic already travelling along the scheme section (in the before period) receives the full journey time saving observed at the one year after stage;
- Any additional traffic receives half of the journey time benefits. This concept is known as the '*rule-of-a-half*' and is the standard approach for dealing with additional traffic; and
- Off-peak periods have been omitted as no forecasts were provided for these time periods along the scheme section.

4.23. Forecasts based on the TFR and observed opening year vehicle hour savings along the scheme section (Junctions 7-9) are outlined in Table 4-2 below.

Table 4-2 Opening Year Vehicle Hour Savings

A14 Junctions 7-9	Opening Year Vehicle Hour Saving (hours)
Forecast (TFR)	137,973
Observed (OYA)	62,346
% Difference	-55%

4.24. Table 4-2 demonstrates that the opening year observed vehicle hour saving is 55% lower than the reforecast opening year vehicle hour saving. This is consistent with the findings in

Section 2 of this report, which demonstrated that the scheme appraisal process over estimated traffic growth along the A14 mainline carriageway.

Monetisation of Journey Time Benefits

4.25. As identified, this evaluation has focused on the journey time benefits along the A14 scheme section (Junctions 7-9). The methodology outlined below was applied to the forecast and observed opening year vehicle hour savings in order to calculate a re-forecast 60 year journey time benefit to be included in the BCR.

- The observed vehicle hours saved in the opening year on the scheme section (Junction 7-9) was calculated using observed traffic flows, observed speeds and observed journey times.
- The forecast vehicle hours saved in the opening year on the scheme section (Junction 7-9) was calculated using forecast spot speeds and traffic flows taken from the TFR.
- The predicted monetary vehicle hour benefit was extracted from the EAR for the whole appraisal area.
- The ratio between the forecast opening year vehicle saving and the observed opening year vehicle saving along the scheme section (Junctions 7-9) was applied to the forecast opening year monetised benefit from the TUBA appraisal. This is based on the assumption that the journey time savings over the scheme section are representative of the wider model area.
- The Profile Method (in line with current POPE methodology) was then used to factor the observed opening year benefits to the full 60 year appraisal period.
- The Profile Method applies the absolute difference between the forecast and observed benefits in the opening year to the TUBA profile for the remaining appraisal period.
- The advantage of the Profile method is that it takes into account the difference between observed and modelled benefits in the first year as an absolute difference rather than proportionally. For example, observed benefits in the first year may be 50% higher than modelled but, in absolute terms, this difference may be much less significant in later years when benefits could be significantly higher.

4.26. The monetisation of the journey time benefits along the scheme section (Junctions 7-9) are outlined in Table 4-3. These results are conservative as they have been calculated using a 12-hour weekday profile over the scheme section.

Table 4-3 Forecast and Outturn Journey Time Benefits

Benefits in £m 2010 market prices, discounted	Forecast Opening Year (£m)	Outturn Opening Year (£m)	Forecast 60 Year Scheme Life (£m)	Outturn Reforecast 60 Year Scheme Life (£m)
Total	£3.835m	£1.733m	£257.978m	£202.008m

4.27. The TUBA assessment forecast that the monetary journey time benefits over the 60-year appraisal period would be £257.978m (2010 prices and values). Using the Profile Method, the outturn monetary benefit over the 60-year appraisal period is £202.008m.

4.28. This lower than forecast benefit is mainly due to traffic growth being lower than expected in the original forecasts, in addition to the speeds being slower than forecast.

Vehicle Operating Costs (VOC)

4.29. WebTAG guidance states that the use of the road system by private cars and trucks gives rise to operating costs for the user. For the majority of highway schemes, including this one, VOC and indirect tax are closely linked to changes in fuel consumption (from changes in speeds).

4.30. Changes in fuel consumption has a similar magnitude of impact on both VOC and indirect tax, but from opposite sides of the benefits balance. If there is an increase in 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.

4.31. For this scheme the ratio used for the reforecast indirect tax calculation has been applied to the monetary value for VOC.

4.32. Table 4-4 shows the forecast VOC impact reported in the EAR and the outturn calculated VOC for the scheme section (Junctions 7-9).

Table 4-4 Vehicle Operating Costs (VOC) Impact

£m 2010 prices discounted to 2010	Forecast (EAR)	Reforecast
Vehicle Operating Costs	-£28.712m	-£17.461m

4.33. This evaluation shows that the scheme will result in an increase in vehicle operating costs, however, the outturn reforecast is lower than forecast. The reduced costs are due to a lower than forecast increase in traffic along the A14 carriageway.

Safety Benefits

Forecast

4.34. Forecasts of the schemes impact on safety have been obtained from the A14 J7-9 Kettering Bypass Improvement Economic Assessment Report (February 2013), which detailed the forecast safety impact of the scheme. The forecast collision saving has been achieved by calculating the total cost of collisions on the network for the Do Something (DS) scenario and subtracting these from the total cost of collisions in the Do Minimum (DM) scenario.

4.35. The Economic Assessment Report (EAR) has calculated accident costs for every link in the model study area for every year within the appraisal period (2015 to 2074). The collision costs have then been summed to provide a total collision cost in the DM and DS over the whole appraisal period.

4.36. Personal Injury Collision (PIC) numbers and casualty numbers have also been calculated for every link in the model network for every year in the appraisal period, and then summed to give total PIC and casualty numbers in the DM and DS scenarios by slight, serious and fatal casualties.

4.37. As shown in Table 3-5 of this report; the predicted collision saving for the opening year was 0.1 PICs over the key links analysis area and a forecast collision dis-benefit of -5 PICs over the model study area.

4.38. The predicted collision saving over the 60-year scheme appraisal period was 25 PICs over the key links analysis area, and 403 PICs over the wider model study area. The EAR forecast the monetary safety benefits over the wider model study area, forecasting a total monetary safety benefit of £17.3 million.

Evaluation

4.39. Due to the forecast opening year collision dis-benefit over the model study area, the POPE methodology for evaluating the outturn safety benefits generates a substantial monetary benefit for the scheme due to the observed opening year collison saving.

4.40. However, the observed reduction in collisions in the post opening period was not statistically significant. Therefore, because the change in collision numbers cannot be confidently attributed to the scheme, no monetised value has been attributed to the observed changes in safety. Therefore, the corresponding monetary value used in the BCR calculation is £0.

Carbon Impact

Forecast

4.41. The impact of the scheme on greenhouse gases (change in carbon outputs) is considered in detail in the next chapter of the report. The Environmental Assessment Report reported that the scheme appraisal calculated the forecast impact of the scheme on Carbon emissions using the simple assessment approach described in DMRB for regional impacts (HA 207/07). In addition, vehicle emissions were calculated for all validated links within the model study area. Both assessments used the carbon emission estimates from TUBA, based on emissions from all links within the wider model study area.

4.42. During the scheme appraisal, a common detailed method was applied to the DMRB Assessment and the TAG Appraisal based on emissions calculations from the TUBA assessment, as reported in the Economic Appraisal Report.

Evaluation

4.43. A reforecast of carbon emissions for the DM and DS scenarios at OYA has been calculated using current DMRB methodology for Junctions 7-9. Outturn carbon emissions were calculated along the A14 carriageway between Junctions 7-9, using the same methodology for the DM and DS scenarios, using observed traffic flows, HGV proportions and speed data.

4.44. The scheme appraisal forecast a monetary dis-benefit of -£7.101 million over the 60-year scheme life. The POPE evaluation for monetising the outturn carbon impact is based on calculating the opening year net change in carbon emissions, then using the ratio method to calculate the monetised impact. The calculation of the carbon emissions is detailed later in this report.

4.45. Table 4-5 summarises the monetary impact of the carbon evaluation.

Table 4-5 Carbon Benefit (£m)

Carbon	Re-Forecast	Outturn
Net change in carbon tonnes within scheme links in 2016	18% increase	8% increase
Benefits in £m 2010 market prices, discounted to 2010	Re-Forecast	Outturn Re-forecast
60 years net impact	-£7.101m	-£3.232m

4.46. The evaluation of the scheme impact on carbon demonstrates that the scheme would result in a net increase in carbon emissions (8%), however, this is lower than the re-forecast increase of 18%. Therefore, the monetary dis-benefit is proportionately lower at -£3.232m over 60 years.

Indirect Tax Revenue Impact

Forecast

4.47. Indirect tax revenue is the expected change in tax revenue to the Government due to changes in the transport sector as a result of the scheme over the appraisal period. For the A14 Kettering Bypass scheme, the forecast indirect tax impact is derived from increases in mvkm travelled as stated in the Economic Assessment Report:

"The scheme would result in an increase in fuel use, which would increase indirect tax revenues"

4.48. This is also supported by the forecast change in traffic volumes shown in Chapter 2 of this report, which showed an increase in flows was expected following scheme opening leading to an increase in fuel consumption. A scheme may result in a change in fuel consumption due to the following reasons:

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

4.49. When this scheme was appraised, the impact of the scheme on net indirect tax revenue raised by central Government over the 60 year appraisal period was included as part of the benefits, rather than as part of the costs as had previously been the approach.

Evaluation

4.50. Indirect tax revenue for Government (presented as a benefit) is of similar magnitude, although in reverse, to the Vehicle Operating Costs (VOC) paid by users. Therefore, the evaluation approach to calculate the outturn impact uses the ratio between the forecast and outturn VOC benefits to calculate the outturn reforecast 60 years Indirect Tax impact (see Table 4-10).

Table 4-6 Indirect Tax Impact as a Benefit (60 years, £million, 2010 prices and values)

Benefits in £m 2010 market prices, discounted to 2010	Forecast (Wider Model Study Area)	Outturn reforecast (Key Links Analysis Area only)
60 years net impact	£17.460m	£10.618m

4.51. Table 4-6 demonstrates that indirect tax was forecast to be a significant benefit of the scheme. The reforecast outturn monetary benefit is lower than forecast at £10.618 million, however it remains a significant benefit for the scheme.

Summary of Present Value Benefits (PVB)

4.52. A cost benefit analysis of a major scheme requires all benefits to be considered for the whole of the appraisal period and they need to be expressed on a like-for-like basis, which is termed Present Value. This is the value today (or at a consistent date) of an amount of money in the future. In cost-benefit analysis, values in different years are converted to a standard base year by the process of discounting to allow comparison of benefits. A comparison of the forecast and outturn benefits is presented in Table 4-7.

Table 4-7 Summary of Present Value Benefits (PVB)

Benefit Stream	Benefits £m 2010 market prices, discounted to 2010		% Difference
	Forecast	Outturn Estimate	
Journey Time (TEE business and consumer users)	£257.978m	£202.008m	-28%
Vehicle Operating Costs (VOC)	-£28.712m	-£17.461m	-64%
Impact of delay during the construction period & Future maintenance periods: Journey time and VOC impacts	-£10.923m	-£10.923m	-
Safety Benefits	£17.302m	N/A	-
Carbon Benefits	-£7.101m	-£3.232m	-120%
Noise Benefits	£0.613m	£0.613m	-
Air Quality	-£0.904m	-£0.904m	-
Indirect tax impact as a benefit	£17.46m	£10.618m	-64%
Total PVB	**£245.712m**	**£180.719m**	**-36%**

4.53. The outturn benefits presented in Table 4-7 have been calculated by extending the first-year benefits to a 60-year benefit stream on a comparable basis with the forecasts. Our evaluation has demonstrated that the change in collision rates over both the wider model study area, and the Key Links Analysis Area is not statistically significant and is likely to have occurred by chance, therefore, the outturn monetary estimate for the scheme is not included in the economic evaluation and is reported as “Not Applicable”.

Scheme Costs

4.54. 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 (see Table 4-8 for 2010 investment costs). Investment costs are considered in terms of a common price base of 2010 for comparison with forecast. For comparison with the benefits, overall costs are expressed in terms of present value, termed Present Value Cost (PVC).

Table 4-8 Investment Costs in 2010 Prices (not discounted, £m)

£m (costs in 2010 market prices, not discounted)	Forecast	Outturn	% Difference
Investment Costs	£39.238m	£36.666m	**-7%**

4.55. This shows that the investment cost of the scheme was 7% below that forecast.

Present Value Costs (PVC)

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

4.57. This section compares the forecast costs of the scheme as of the start of the construction period with the actual spend as of March 2015 (the date the cost was provided by the Regional Finance Manager). Costs are also considered for the full appraisal period of 60 years to allow comparison with the benefits over the same period.

4.58. As covered previously, at the time which this scheme was appraised, the impact of the scheme on net indirect tax revenue raised by central Government over the 60-year appraisal period was included as part of the benefits, rather than as part of the costs as had previously been the approach.

4.59. Scheme costs in the appraisal also covered the future costs of Traffic-Related and Non-traffic related maintenance for the Do Minimum and Do Something scenarios. The additional infrastructure put in place by the scheme was forecast to have a higher maintenance cost than the existing (Do minimum) infrastructure. For evaluation purposes, the net difference in these costs have been assumed to be as the original forecast.

4.60. Table 4-9 presents the investment costs as Present Value for use in the BCR.

Table 4-9 Investment Costs as Present Value (£m)

Present Value £m (costs in 2010 market prices, discounted)	Forecast	Outturn
Investment Costs	£40.951m	£38.946m
Net impact on Future maintenance	£3.279m	£3.279m
Total PVC	£44.230m	£42.225m

Benefit Cost Ratio (BCR)

4.61. 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.

4.62. Projects with a BCR greater than 1 have greater benefits than costs; hence they have positive net benefits. The higher the ratio, the greater the benefits relative to the costs. It is to be noted that the BCR is insensitive to the magnitude of net benefits and therefore may favour projects with small costs and benefits over those with higher net benefits.

4.63. Table 4-10 compares the predicted and outturn costs and benefits. A column has been included to indicate whether the outturn reforecasts are likely to be a conservative estimate (due to the small appraisal area, but wide observed effect), or optimistic (due to the impact of reassigned traffic).

Table 4-10 Forecast vs. Outturn Benefit Cost Ratio (BCR)

All in 2010 market prices, discounted to 2010		Forecast (£m)	Outturn (£m)	Estimate
Costs	**PVC**	**£44.230m**	**£42.225m**	**-**
Benefits	Journey Time (TEE business and consumer users)	£257.978m	£202.008m	Conservative
	Vehicle Operating Costs (VOC)	-£28.712m	-£17.461m	Optimistic
	Delay During Construction period & Future maintenance periods: Journey time and VOC impacts	-£10.923m	-£10.923m	-
	Safety Benefits	£17.302m	N/A	-
	Carbon Benefits	-£7.101m	-£3.232m	Conservative
	Noise Benefits	£0.613m	£0.613m	-
	Air Quality	-£0.904m	-£0.904m	-
	PVB subtotal	**£228.253m**	**£170.101m**	**-**
	Indirect Tax	£17.46m	£10.618m	Optimistic
BCR (with indirect tax in PVB)		**5.6**	**4.3**	**Conservative**

4.64. It can be seen from Table 4-10 that the BCR is lower than forecast due to lower than expected journey time benefits and safety benefits. Although it should be noted that this is a conservative estimate based on the reforecast benefits calculated as part of this report. A BCR of 4.3 represents very high value for money according to DfT guidance.

4.65. 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 evaluations of the wider economic impacts, environmental, accessibility and integration objectives are covered in the following sections of the report.

Wider Economic Forecasts

4.66. It is inherently difficult to isolate wider economic impacts which could be attributed to the scheme. However, it is important to understand the socio-economic context in which the scheme opened and how the A14 Junctions 7-9 Kettering Bypass Improvement scheme may have assisted local and regional socio-economic aspirations.

Forecast

4.67. The AST for this scheme did not assess the wider economic impacts associated with the scheme and indicated that the scheme would not affect trips to or from a Regeneration Area.

Evaluation

4.68. As identified earlier on in this report, the A14 is a strategic highway route which connects the M1 and M6 motorways in the Midlands with the A1, the M11 and the east coast ports near Felixstowe. Due to its links with the east coast ports near Felixstowe, the A14 is part of the Trans-European Network, and is the designated UK section of the Ireland – UK – Benelux highway link known as Project 13. Because of the A14's strategic importance, the A14 has a high proportion of HGVs (Heavy Goods Vehicles).

4.69. Evidence presented in this report demonstrates that journey times and journey time reliability has improved along the scheme section. This will have benefits for freight and business users who may experience improved productivity due to reduced time spent on the road.

4.70. At this stage, there is no evidence to suggest that the scheme has increased enablement of development or employment. However, both the North Kettering Business Park and Prologis Park are located adjacent to the A43 (North of Kettering) which has experienced an increase in traffic post-scheme opening. Therefore, it is possible that the scheme may have improved the attractiveness of Kettering for economic development with the A14 Kettering Bypass scheme providing additional capacity, reducing journey times (along the scheme section J7-9) and improving access to both the midlands and the east coast ports near Felixstowe.

4.71. The overall assessment of the impact on of the scheme on the wider economy is neutral at this stage. Further assessment of the long-term impact of the scheme on the wider economy will be considered at the Five Years After POPE stage.

Key Points – Economy

Present Value Benefits

- The outturn journey time benefits of £202.008m are lower than the forecast journey time benefits of £257.978m. This is mainly due to the observed traffic flows being lower than forecast.
- The observed reduction in collisions in the post opening period was not statistically significant. Therefore, because the change in collision numbers cannot be confidently attributed to the scheme, no monetised value has been attributed to the observed minor changes in safety.
- The disbenefit from vehicle operating costs is less than forecast, due to the observed speeds and traffic flows being lower than forecast. The disbenefit from carbon is also less than forecast for similar reasons.
- Overall the outturn PVB is 36% lower than forecast.
- The outturn impact on indirect taxation of £10.618m is lower than forecast due to lower overall traffic levels (compared to forecast), and lower average speeds on the A14.

Costs

- Outturn investment costs were 7% lower than forecast at £36.7m.

Benefit Cost Ratio

- Taking indirect tax as a benefit, the scheme achieves a BCR of 4.3 which shows the scheme is delivering very high value for money.

Wider Economic Impacts

- Due to the inherent difficulty in isolating the wider economic impacts of the scheme, it has not been possible to conclude whether the scheme has had a direct impact on stimulating local economic activity. However, the increased capacity provided by the scheme is likely support development around Kettering.

5. Environment

Introduction

5.1. This section documents the evaluation of the impacts of the scheme on the environmental sub-objectives.

5.2. The objectives of this Scheme are outlined in Section 1 of this report.

Data Collection

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

- Appraisal Summary Table (AST) 2013
- Environmental Assessment Report (EnAR) February 2013
- As Built drawings
- Works Information
- Handover Environmental Management Plan (HEMP) July 2015
- Landscape site visit report October 2015
- Baseline Noise Report 2013
- Post Construction Noise Report July 2016
- Newsletter 5 (May 2015) from Highways England website

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

Site Inspections

5.5. A site visit was undertaken in August 2016. No photomontages were available in the EnAR for use as comparison views. All photographs taken for inclusion in this report were taken at this time.

Consultations

5.6. Table 5-1 lists the organisations contacted regarding their views on the impacts they perceive the road scheme has had on the environment, and whether they feel that the mitigation measures implemented have been effective.

Table 5-1 Summary of Environmental Consultation Responses

Organisation	Field of Interest	Comments
Environment Agency	Water	Response received and included in the water section of this chapter.
Natural England	Biodiversity	Requests for consultation was not sent due to there being no significant effect to consider.
English Heritage	Archaeology	Requests for consultation was not sent due to there being no significant effect to consider.
Kettering District Council	General	Responded with no comments.

Animal Mortality

5.7. The Managing Agent Contractor (MAC) has been consulted regarding animal mortality figures but has been unable to provide figures.

Traffic Forecasts and Evaluation

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

5.9. The EnAR predicted an increase in traffic using the A14 and associated congestion in the vicinity of Kettering between the years 2015 and 2030 in a Do Minimum (DM) scenario where no improvements are made to the A14. The introduction of the Do Something (DS) Scheme would provide additional capacity to the A14 route and would reduce congestion on the section between Junctions 7 and 9 in both directions. The introduction of the DS Scheme would result in local movements reassigning to the A14 route, and as such, is expected to result in a reduction of traffic through central Kettering.

5.10. No traffic speeds or percentage HGVs were included for comparison in the EnAR.

5.11. The traffic figures in Table 5-2, Table 5-3, Table 5-4 show the difference between forecast and observed AADT traffic flows, HGVs and speeds.

Table 5-2 With the Scheme (2016) Traffic Flows: Observed vs Forecast

Location	Direction	With Scheme 2016		
		OYA Forecast	OYA Observed	% Difference
A14 Mainline Junction 6-7	Eastbound	35,500	36,500	3%
	Westbound	37,000	36,000	-3%
A14 Mainline Junction 7-8	Westbound	44,900	40,200	-12%
	Eastbound	44,400	39,000	-14%
A14 Mainline Junction 8-9	Eastbound	40,900	37,000	-11%
	Westbound	41,100	35,600	-15%
A14 Mainline Junction 9-10	Eastbound	31,300	31,200	0%
	Westbound	34,600	31,400	-10%
A43 South	Eastbound	10,800	12,500	14%
	Westbound	10,300	12,200	16%
A43 North	Northbound	18,300	17,200	-6%
	Southbound	17,500	16,400	-7%
A509 South of A14	Northbound	12,700	11,600	-9%
	Southbound	14,100	11,300	-25%
A509 North of A14	Northbound	14,800	11,800	-25%
	Southbound	13,100	11,500	-14%

Table 5-3 Percentages of HGVs: Forecast and Observed

Location	Direction	With Scheme 2016		
		OYA Forecast	OYA Observed	% Difference
A14 Mainline Junction 6-7	Eastbound	16%	18%	2%
	Westbound	15%	19%	4%
A14 Mainline Junction 7-8	Westbound	14%	24%	10%
	Eastbound	13%	22%	9%
A14 Mainline Junction 8-9	Eastbound	12%	16%	4%
	Westbound	13%	17%	4%
A14 Mainline Junction 9-10	Eastbound	13%	17%	4%
	Westbound	13%	18%	5%
A43 South	Eastbound	9%	12%	3%
	Westbound	9%	10%	1%
A43 North	Northbound	11%	15%	4%
	Southbound	9%	15%	6%
A509 South of A14	Northbound	11%	12%	1%
	Southbound	11%	10%	-1%
A509 North of A14	Northbound	8%	8%	0%
	Southbound	7%	8%	1%

Table 5-4 Average speeds – pre-and-post scheme opening

Location	Pre-scheme average speed (kph)	Post-scheme average speed (kph)	% difference
Eastbound J7-8	102	108	5%
Westbound J7-8	95	102	7%
Eastbound J8-9	99	106	6%
Westbound J8-9	96	103	7%

Noise

Forecast

AST

5.12. The 2013 AST stated that less properties would experience a >68 dB noise increase with the scheme than without. People predicted to be annoyed by noise in 2030 due to the Scheme was predicted to be 770 and without the scheme 783.

Environment Assessment Report

5.13. The EnAR noted that with the Scheme in place, the majority of properties (97%) were predicted to experience a negligible increase in daytime traffic noise in the long term, from 2015 Do-Minimum to 2030 Do-Something. Approximately 2% of properties were predicted to experience a decrease in daytime traffic noise levels in the long term due to the Scheme. A single property was predicted to experience a minor increase in the long term and a small number of properties were predicted to experience no change.

5.14. The EnAR noted that the existing A14 mainline between Junctions 3 and 10 was surfaced with a 'low noise' pavement; therefore, the mainline A14 throughout the length of the Scheme is assumed to be 'low noise' in all assessment scenarios (i.e. the new surface would also be 'low noise').

5.15. The EnAR stated that environmental (acoustic) barriers would be provided in the eastbound verge from Junction 8 eastbound merge slip road. The barrier would be a 2.5m high reflective barrier.

Consultation

5.16. No response received for noise at the time of submission.

Evaluation

Post opening noise survey report (July 2016)

5.17. Highways England commissioned a post construction baseline noise surveys following the completion of the A14 Junction 7-9 Bypass Improvement scheme. The noise surveys and report complied with the A14 J7 – 9 Kettering Bypass Improvement Works Information by:

- Repeating the long-term noise measurements that were undertaken in 2009 at representative noise sensitive receptors (NSR) prior to the widening of the road;
- Determining the 2016 noise levels at these NSR;
- Undertaking several short-term noise measurements along the scheme to supplement coverage of the long-term survey locations;

- Presenting both the short-term and long-term data; and
- A total of eight long-term measurements and 14 short-term measurements were undertaken.

5.18. Conclusions of note for POPE are:

- The results in comparison to the original survey done were varied. The measured levels following implementation of the Scheme generally remain within 3dB of the measured and predicted levels without the Scheme with the exception of 2 locations where noise levels were more than 5dB lower than the measured levels prior to construction of the Scheme
- Most properties did not increase or decrease significantly.

OYA evaluation

5.19. POPE methodology assumes that if traffic conditions vary by the following amounts when compared with what was originally forecast in a particular year, then it would be assumed that the local noise impact is likely to be either 'worse than' or 'better than' expected;

- Traffic flows 25% more or 20% less, or
- Average speed is different by at least 10kph, or
- % HDV is different by at least 20%.

5.20. Table 5-2 shows that observed traffic flows at most measurement points are mostly as expected with better than expected flows at two measurement locations –A509 south of the A14, southbound (-25%) and A509 north of the A14 northbound (-25%), HGV percentages and speeds are as expected within the scheme when compared with those predicted for the Do Something scenario.

5.21. The Scheme design included the installation of an acoustic barrier east of the carriageway at chainage 6420-7900, where it will provide benefit to properties. The noise barrier is installed as required and is shown in Figure 5-1 below.

Figure 5-1 Noise barrier on the eastbound carriage from junction 8

5.22. Low noise surfacing was used as a part of the scheme. Benefits usually attained through its use are neutral as the replaced pre-scheme surfacing was low noise surfacing.

Table 5-5 Summary of Noise Evaluation

Origin of Assessment	Summary of Predicted Effects	Assessment
AST	Based on the facade with the highest noise level with Scheme, the number of properties in 2030 experiencing noise levels > 68 dB LAeq,18h are: - No-scheme: 53; Scheme: 20. Based on the facade with the highest noise level with the Scheme, 69% of properties undergo a negligible or minor increase in traffic noise and approximately 26% of properties experience a decrease, although for the majority the beneficial impact is negligible or minor. Within the 1km study area, one existing road would have a potentially significant change in traffic flows. No significant impact on night-time traffic-noise levels along the Scheme is predicted.	Neutral
EST	Traffic flows, percentage HGV and average speeds are in line with forecasts and noise generated by traffic along the scheme and on adjacent links is likely to be generally as expected. Two locations show observed traffic flows of between -20 and -25% below forecast which results in a better than expected evaluation.	As expected Better than expected for two locations

Local Air Quality

Forecast

AST

5.23. The 2013 AST stated that there were 3,248 residential properties within 200m of the Scheme and surrounding affected road links. It further stated that there were no Air Quality Management Areas in Kettering.

Environmental Assessment Report

5.24. The EnAR stated that the Scheme would have a negligible effect on local air quality. All receptors were predicted to experience a change in annual Nitrogen dioxide (NO2) and Particulate matter (PM10) of less than 1 µg/m³ for both NO2 and PM10.

5.25. Regional air quality would experience a negligible change as a result of the proposed Scheme, with a predicted decrease in emissions of Carbon dioxide (CO_2) by 0.1% in 2015 compared to the Do-Minimum scenario, while oxides of nitrogen (NOx) and PM10 would increase by approximately 1 and 2% respectively over the same period.

5.26. Within the air quality section of the EnAR, it is stated that the Scheme would result in a reduction in emissions per vehicle kilometre travelled due to an increase in average speeds, which increases fuel efficiency particularly among HGVs. It is noted that no traffic speeds or percentage HGVs were included for comparison in the EnAR, however, pre and post scheme speeds are recorded and discussed in the Traffic section of this report. Based on this, it is noted that there has been an increase in overall speeds within the scheme of between 5 and 7%.

5.27. As a result of improving vehicle design, it was expected that emissions of pollutants and particles from road traffic would decline significantly between pre-scheme implementation and the opening year. The Published Scheme would alleviate local congestion with subsequent reduction in emissions. The impact of the Scheme in terms of health effects on the local population and sensitive ecology would be positive. None of the air quality objectives would be breached as a result of the Scheme at residential properties or public

rights of way. It was expected that the majority of local residents would experience a reduction in exposure to traffic-related air pollution.

Consultation

5.28. Kettering District Council provided data from their air quality monitoring stations which are discussed below.

Evaluation

5.29. It is noted that no traffic speeds or percentage HGVs were included for comparison in the EnAR, however, pre and post scheme speeds and percentage HGVs are recorded and discussed in the Traffic section of this report. Based on this, it is noted that there has been an increase in overall speeds within the scheme of between 5% and 7% and HGVs show a difference of between -1% and 9% post scheme opening.

5.30. POPE methodology states that if observed after opening traffic flows identified by POPE vary by more than +/- 10%AADT; or by +/- 200HDV AADT; or daily speed by 10kph; or peak hour speeds by 20kph from those predicted in the ES, it would be assumed that local air quality is likely to be either 'worse than' or 'better than' expected.

5.31. Traffic flows are within normal parameters for air quality at six locations with eight locations showing a better than expected result and two locations showing a worse than expected result. Data from air quality monitoring stations has been received from the Kettering District council (presented in Table 5-6 below), shows that concentrations do seem to have dropped somewhat in 2015 compared to 2014, although there is a downward trend since 2010 (not attributable to the scheme).

Table 5-6 Annual Adjusted Mean NO2 Diffusion Tube Results (µg/m3) Diffusion Tube Location

Location	2008	2009	2010	2011	2012	2013	2014	2015
A14 Roundabout, Rothwell	16.6	16.8	25.0	17.2	20.1	26.0	23.2	17.9
Station Road, Burton Latimer	19.9	18.3	28.0	22.2	26.0	18.5	17.8	16.0
Newlands Street	26.6	26.4	37.6	31.0	31.3	19.6	20.1	17.3
London Road	23.1	23.1	34.2	26.7	30.4	20.4	18.7	16.0
Northampton Road	25.9	25.6	29.9	26.6	29.3	22.1	24.0	19.2

Table 5-7 Summary of Air Quality Evaluation

Origin of Assessment	Summary of Predicted Effects	Assessment
AST	There are 3,248 residential properties within 200m of the Scheme and surrounding affected road links. There are no Air Quality Management Areas in Kettering.	Neutral
EnST	Monitored concentrations of NO2 for 2010 to 2015 show a steady decrease which is not immediately attributable to the scheme. Traffic flows are varied but overall for the scheme, a result of as expected is determined for Air Quality	As expected overall Better than expected for eight locations and worse than expected for 2 locations

Greenhouse Gases

5.32. The assessment of the impacts of transport schemes on emissions of greenhouse gases is one of the environment sub-objectives. WebTAG notes that carbon dioxide (CO_2) is considered the most important greenhouse gas which is therefore used as the key indicator for the purposes of assessing the impacts of transport options on climate change. Changes in CO_2 levels are expressed in terms of equivalent tonnes of carbon released as a result of the scheme.

Forecast

5.33. The EnAR states that the scheme would increase emissions in the model study area by 0.1% in 2015 (forecast opening year). Since the time of the appraisal, guidance now states that the impact should be expressed in terms of Carbon which is 511 tonnes.

Table 5-8 Forecast Annual Emissions (Tonnes/Year)

Scenario [15]	CO	THC	NOx	PM10	Carbon
2015 DM	1,927	324	2,006	48	565,501
2015 DS	1,938	325	2,022	49	566,011
Change	**+11**	**+1**	**+17**	**+1**	**+511**
% Change	**+0.5**	**+0.3**	**+0.8**	**+1.7**	**+0.1**
2030 DM	2,607	409	2,129	56	575,057
2030 DS	2,627	411	2,153	57	575,781
Change	**+20**	**+2**	**+24**	**+1**	**+724**
% Change	**+0.8**	**+0.5**	**+1.1**	**+2.0**	**+0.1**

5.34. The Environmental Assessment Report reported that the scheme appraisal calculated the forecast impact of the scheme on Carbon using the simple assessment approach described in DMRB for regional impacts (HA 207/07). In addition, vehicle emissions were calculated for all validated links within the model study area. Both assessments used the carbon emission estimates from TUBA, based on emissions from all links within the wider model study area.

Outturn

5.35. A reforecast of carbon emissions for the DM and DS scenarios at OYA has been calculated using current DMRB methodology for Junctions 7-9 in order to provide a comparable base. Outturn carbon emissions were calculated using the same methodology for the DM and DS scenarios, using observed traffic flows, HGV proportions and speed data (Junctions 7-9). Carbon calculations have been undertaken using the DMRB regional air quality spreadsheet.

5.36. Table 5-9 shows the results from the carbon emission assessment.

Table 5-9 Carbon Evaluation

	Re-Forecast	Outturn
Do Minimum/ Without scheme	9,806	11,412
Do Something / with scheme	12,010	12,415
Net impact	2,204 (+18%)	1,003 (+8%)

[15] Carbon Emissions values are sourced directly from the Economic Assessment Report, these values are based on a TUBA assessment and therefore are a slight underestimate compared to values calculated using COBA or the Greenhouse Gases Appraisal tool.

5.37. The re-forecast carbon evaluation along the scheme section (Junction 7-9) forecast a net increase of 2,204 tonnes of carbon (+18%). The outturn carbon evaluation indicates that the scheme has resulted in a net increase of 1,003 tonnes of carbon (+8%), which is lower than forecast. This is because the observed traffic flows and speeds are lower than forecast.

5.38. The overall increase in carbon is due to the increase in traffic along the scheme section (Junctions 7-9) and the increased vehicle speeds associated with the additional carriageway capacity.

Landscape and Townscape

Forecast

AST

5.39. The 2013 landscape AST stated that there were arable fields to south of the A14 and open space and urban edge of Kettering to north. It noted that there would be a loss of screening vegetation during construction with increased views until mitigation vegetation matured. It further noted that it was not possible to reinstate all vegetation lost due to reduced soft landscape width and constraints of engineered earthworks treatments.

5.40. Overall, the landscape impact was predicted to be **slight adverse**.

Environmental Assessment Report

5.41. As an outcome of the assessment undertaken within the EnAR, the following key issues were noted:

Policy

- No statutory designated sites or sensitivities would be affected by the landscape mitigation proposals.
- The proposals would generate short term conflicts with general green space amenity policy considerations but would not compromise medium to long term policy objectives.
- The landscape mitigation proposals would aim to conserve and restore the integrity of landscape character areas in line with the objectives of national, regional and local policies and Northamptonshire's Landscape Character Assessment. The Scheme proposals would have a negligible influence on policy.

Landscape

- The physical footprint of the Scheme is wholly contained within the highway boundary, and therefore, would not physically affect contextual landscape/townscape features.
- Widening of the route would involve a net loss of highway vegetation with a consequent residual slight adverse impact on landscape character (adverse impact on the ability to integrate the road visually into its setting).

Visual

- The extent of the Zone of Visual Influence (ZVI) of the existing A14 and proposed Scheme were broadly similar, the proposals typically varied the nature of view rather than substantially alter the extent of influence.
- The introduction of gantries and additional lighting intensity would result in slight adverse impacts.
- The experience of view from the A14 itself would become more dominated by the highway as a result of the Scheme increasing the carriageway width, introducing acoustic fencing and the lighting and gantries detracting from the 'rural' experience from parts of the route.

Night time

- Night-time visual impacts would largely be limited to the existing illuminated context of the Kettering townscape and by the existing influence of the highway as an illuminated corridor. The influence of an increased intensity of lighting would, however, contribute to a slight adverse impact residual scoring. Such impacts would be most noticeable to residential properties on the immediate western edge of Kettering and to scattered properties to the west of the Scheme between Junctions 7 and 8.

Tranquillity

- Tranquillity, whilst already eroded by the existing A14 context, would experience further degradation associated with the existing corridor being expanded out from the highway. The increased visibility of the route in combination with an increased night-time influence of lighting would increase the visual influence of the highway.
- The increased noise levels between Junctions 8 and 9 would affect the perceived tranquillity. There would be an overall slight adverse impact on tranquillity.

5.42. The EnAR further stated that future changes in the landscape arising from known planning applications would be anticipated to moderate the influence of the Scheme in the vicinity of Junction 8.

5.43. Despite the relative proximity of the Scheme to a densely populated urban area, the influence of the Scheme proposals was relatively contained and contextualised by the existing influence of the A14.

5.44. The effectiveness of proposed mitigation, whilst constrained by space and slope profile would nonetheless exert a positive influence on the residual adverse impacts of the Scheme. Landscape design and planting regimes were to be developed for visual screening and habitat replacement, taking into account the confirmed earthworks solutions, road lighting designs, signs, drainage designs, and a new wetland area.

5.45. The May 2015 project update newsletter noted that a 3-year aftercare period on the soft estate carrying out various maintenance regimes including grass cutting, weed control and plant maintenance in order to meet the designed landscape objective e.g. visual screening and landscape integration would be undertaken.

5.46. Overall the Scheme would result in a **slight adverse** landscape impact and **slight adverse** visual impact.

Consultation

5.47. No response to consultation was received.

Evaluation

5.48. The landscape site visit report dated October 2015 concludes that there have been high plant failures in some plots and hedgerows, plant shelters were unsecured in some areas reducing their effective rabbit control function and species rich grassland plots had not received strimming as required.

Figure 5-2 Planting on the eastbound carriageway near the services between junction 8 and 9

5.49. It is understood that for the high plant failures, replacement planting was due to commence in November / December 2016. The report also noted that some areas had been planted in existing soil as the plots were not prepared in time for planting. These existing soils may have not been suitable for planting undertaken. Compact soil and loose sandy soil on banks were also noted as concerns related to plant failures.

5.50. The soils and landform as-built drawing confirm that in areas where slopes are 1:1.5, Geocell16 would be used. These slopes require 100mm of proprietary cellular geotextile over granular structural fill. Geocell was then placed on the slope and backfilled with 150mm of topsoil (including 50mm for settlement). The landscape site visit report confirmed that one area subject to Geocell installation required future monitoring due to lack of establishment.

[16] Geocell can be used to control erosion and ensures better resistance to the erosive effects of wind and water run-off.

Figure 5-3 Planting on the westbound carriage near junction 8

5.51. The site visit report also commented that there were areas where planting had not occurred based on additional vegetation that had been retained instead of cleared as originally proposed.

5.52. In areas where the scheme is on embankment there is a concern that some receptors are likely to still experience a longer term slight adverse effect because of the new gantries and lighting. Planting will take some time to screen new gantries if at all as shown in Figure 5-4 below.

5.53. The Handover Environmental Management Plan (HEMP) confirmed that the aftercare period for this scheme is three years with short and long term management proposals thereafter outlined in the HEMP. This evaluation notes that as maintenance still within the aftercare period appears to be patchy, continued focus will be required to ensure planting, screening and integration targets are ensured by the design year [17].

17 Design year is 15 years after scheme opening.

Figure 5-4 Scheme planting near junction 8 showing intrusive gantry

5.54. Based on the site visit undertaken for POPE in August 2016, the following can be concluded:

- Planting has been undertaken as shown in the as-built drawings.
- Weed control through strimming does not appear to have been undertaken with sufficient intervals to encourage species rich grassland to establish. This should be assessed again at FYA as it is too soon to determine whether species rich grassland is going to establish successfully.
- Plant failure percentage was higher than expected.

5.55. Based on the site visit and the notes in the landscape site observation report, it is clear that the scheme has had an impact on the surrounding landscape and screening functions previously in place. Plant failures, compact soils and lack of strimming will contribute towards slower than expected growth and plant failures. Based on this, the landscape evaluation at OYA is worse than expected.

Table 5-10 Summary of Landscape and Visual Evaluation

Origin of Assessment	Summary of Predicted Effects	Assessment
AST	Arable fields to south of A14/open space and urban edge of Kettering to north. Loss of screening vegetation during construction with increased views until mitigation vegetation matures. Not possible to reinstate all vegetation lost due to reduced soft landscape width and constraints of engineered earthworks treatments. Increased influence of highway infrastructure (lighting, acoustic fencing and gantries).	Slight adverse
EST	Planting for screening and integration has not progressed as much as would be expected at OYA. Compaction and lack of topsoil preparation together with higher than expected plant mortality results in a worse than expected evaluation at OYA.	Worse than expected

Townscape

5.56. Landscape and townscape effects were not separated out in the EnAR but excerpts from the report have been included for context.

5.57. The EAR stated that in the opening year, the impact on setting concluded that there would not be a direct impact on townscape due to the scheme. Year 15 impacts on townscape were considered to be negligible.

5.58. Night-time visual impacts would largely be limited to the existing illuminated context of the Kettering townscape and by the existing influence of the highway as an illuminated corridor. The influence of an increased intensity of lighting would, however, contribute to a slight adverse impact residual scoring. Such impacts would be most noticeable to residential properties on the immediate western edge of Kettering and to scattered properties to the west of the Scheme between Junctions 7 and 8.

5.59. The EnAR, under cumulative effects noted that there was a potential beneficial impact with the decrease in traffic on surrounding roads in nearby towns and villages, having beneficial cumulative impact on townscape, reducing community severance as well as decreasing noise and marginally improving air quality in some areas, particularly within Kettering.

Consultation

5.60. No consultation responses were received for Townscape.

Evaluation

5.61. Based on the evaluation under the landscape sub heading, it is assumed that there will be some effect on the townscape of receptors directly adjacent to the A14. However, as the scheme does not have a direct effect on the townscape within local villages / towns it is considered at OYA that impacts are **as expected**.

Table 5-11 Summary of Townscape Evaluation

Origin of Assessment	Summary of Predicted Effects	Assessment
AST	The scheme would not directly impact on townscape setting. The immediate urban edge of Kettering would however experience an adverse impact on context with increased visibility of elements of the A14. The implementation of the Scheme would be anticipated to benefit the townscape environment of surrounding areas but would also offer the potential for increased future development to take advantage of the increased road capacity.	Neutral
EST	Lack of progress of landscape planting for screening will have a minor effect on surrounding townscape although not sufficient to influence a change in assessment at this OYA stage, Townscape should be reconsidered at FYA.	As expected

Biodiversity

Forecast

AST

5.62. The 2013 AST predicted that, although outside the boundary and not directly affected, Southfield Farm Marsh SSSI and Slade Lake CWS would receive increased protection through improved drainage, run-off attenuation and treatment to minimise potential indirect effects. Direct impacts on habitats used by grass snake, great crested newt and common lizard would be addressed through sensitive working methodology including seasonal constraints, and habitats being reinstated. A reduced mosaic of habitats was predicted to occur which may cause fragmentation and slow recolonisation by these species. The planting strategy would discourage foraging barn owl wherever possible, to reduce the risk of collisions with traffic. Habitat enhancement opportunities for common lizard, grass snake, breeding birds and bats had been identified and would be implemented where possible. The overall impact was assessed as **slight adverse**.

Environmental Assessment Report

5.63. The EnAR stated that the A14 road verge between Junctions 7 and 9 was not designated, either statutorily or non-statutorily, for its importance to nature conservation. However, works on the road verge had been identified to have the potential to affect nearby nature conservation sites, including Southfield Farm Marsh SSSI and Slade Brook and Lake CWS, and therefore, mitigation had been proposed.

5.64. The report confirmed that the site supported breeding birds, common lizard and grass snake, and provided foraging habitat for barn owl. Badgers had been recorded foraging in several locations along the verge, and otters foraged on the Slade Brook Loddington Arm. Mitigation would be undertaken to minimise the risks of adverse effects on these species, and to ensure legislative compliance throughout construction.

5.65. The EnAR also stated that a capture and translocation programme would be undertaken to ensure that the Scheme did not result in injury or mortality to common lizard and grass snake. A method statement would be produced, and consultation with Natural England and the County Ecologist would be undertaken, to enable a suitable receptor site to be identified.

5.66. A method statement would be provided to enable works to proceed without risking injury or mortality to great crested newt, and to ensure legislative compliance with respect to this species. Given the unsuitability of the habitat affected and the small population present in the nearby ponds, along with the abundance of optimum unaffected great crested newt habitat within 50m of the breeding ponds, the risk of encountering newts during the works was low. The works were, therefore, not considered a risk affecting the favourable conservation status of great crested newt, and therefore, would not trigger the Habitats Regulations. On this basis, a European Protected Species licence would not be applied for to enable the works to proceed.

5.67. Finally, the report concluded that some opportunities existed for achieving biodiversity enhancement in line with national and local planning policy and HABAP (Highways Agency Biodiversity Action Plan) targets. Habitat enhancement measures for breeding birds, bats, reptiles and great crested newt were proposed.

Consultation

5.68. No consultation with Natural England was undertaken for this report due to no protected species licences being required during construction.

Evaluation

5.69. No monitoring was programmed to occur during the maintenance aftercare period and as such, no information has been provided to POPE which would enable biodiversity to be evaluated.

5.70. Locations of bird and bat boxes were confirmed as being in place as per the as-built drawings. Badger fencing is shown in place on the as-built drawings.

5.71. The EnAR lists requirements to be adhered to during construction such as the translocation of common lizard and grass snake, POPE has no information confirming whether this was undertaken successfully. Habitat creation through minimised vegetation site clearance and planting has occurred. Permanent loss to habitat through land take has occurred as expected.

5.72. Based on the limited information provided to POPE, it is assumed that the scheme effect on biodiversity is **as expected**, however, further information would be required to confirm this.

Table 5-12 Summary of Biodiversity Evaluation

Origin of Assessment	Summary of Predicted Effects	Assessment
AST	Although outside the boundary and not directly affected, Southfield Farm Marsh SSSI and Slade Lake CWS would receive increased protection through improved drainage, run-off attenuation and treatment to minimise potential indirect effects. Direct impacts on habitats used by grass snake, great crested newt and common lizard would be addressed through sensitive working methodology (method statements to be produced) including seasonal constraints, and habitats would be reinstated. A reduced mosaic of habitats may cause fragmentation and slow recolonisation by these species. The planting strategy will discourage foraging barn owl wherever possible, to reduce the risk of collisions with traffic. Habitat enhancement opportunities for common lizard, grass snake, breeding birds and bats have been identified and will be implemented where possible.	Slight Adverse
EST	Based on the limited information provided to POPE, it is assumed that the scheme will have an as expected effect on Biodiversity.	As expected but further information required to confirm

Cultural Heritage and Archaeology

Forecast

AST

5.73. The 2006 AST predicted that there would be no new land take thus no adverse effects on any existing heritage compromised by the existing A14. The overall impact assessment score was **neutral**.

Environment Assessment Report

5.74. The EnAR noted that the potential to encounter archaeological remains was low due to the limited excavations proposed being within the area of original construction disturbance. Therefore; no further assessment of the impacts of the Scheme on cultural heritage was required, unless the contractor needed to work outside the highway boundary.

5.75. It was expected that the scheme would have a **neutral** effect on Cultural Heritage

Evaluation

5.76. No further evaluation has been undertaken for Cultural Heritage based on the findings of the AST and EnAR submissions.

Table 5-13 Summary of Cultural Heritage Evaluation

Origin of Assessment	Summary of Predicted Effects	Assessment
AST	No new land take thus no adverse effects on any existing heritage compromised by existing A14.	Neutral
EST	No evaluation undertaken	-

Water Quality and Drainage

Forecast

AST

5.77. The 2013 AST stated that there was no loss of floodplain in the illustrative design. The addition of penstocks and silt traps would reduce risk of pollution to aquatic environment if maintained. The overall impact was assessed as **slight beneficial**.

Environmental Assessment Report

5.78. The EnAR stated that new surface water drainage systems would be provided, including surface water channels with limited use of linear drainage channels, kerbs and gullies and kerb drainage units. Surface water runoff volumes were predicted to increase as a result of the additional impermeable carriageway areas. In order to avoid an associated increase in flow of runoff, attenuation would be provided through the use of large diameter pipes. The new drainage pipes were proposed to be positioned under the existing central reserve or within the verge, depending on road geometry. Existing filter drains would be repositioned into the new verge.

5.79. Existing drainage ditches would be removed in some areas because of new earthworks. In such instances, runoff would be either piped within the earthworks or a new channel would be created within the construction berm.

5.80. Existing earthworks drainage systems would be maintained, where possible,

5.81. Based on the initial spillage risk calculations, it was considered that the risk to surface water from accidental spillages as a result of the scheme would be negligible.

5.82. Following the surface water assessment using the HAWRAT[18] tool, the routine road runoff was expected to generally have a negligible impact on dissolved copper and zinc concentrations. However, the results of the assessment for outfall 1 (at Brooklands Culvert) indicated that the river was failing the toxicity test for soluble copper due to the large area of road surface draining to this outfall, resulting in the requirement for additional mitigation which was proposed within the EnAR.

5.83. Based on the results of the hydraulic modelling the magnitude of impact on the floodplain and nature of surface water runoff was considered to be negligible. With the importance of attribute being low, this resulted in the significance of the potential effect being '**neutral**'.

Consultation

5.84. The Environment Agency responded with monitoring data from Cransley Arm Slade Brook. It is noted that this data is not a good indicator of construction or operational issues for water quality for the scheme as it is upstream of the site.

Evaluation

5.85. Based on a location in the EA water quality archive, a sample point downstream of the scheme on Slade Brook was accessed for this evaluation. The only decent parameter at this downstream site is turbidity which is a surrogate for suspended solids. It shows that there were a few peaks from the end of 2011 to the beginning of 2013 that may have coincided with the scheme build but since then turbidity is consistently low. Sediment is one of the water quality indicators that would be controlled with scheme mitigation, so this is showing that at least the operational scheme does not seem to be creating an issue downstream. It

[18] Highways Agency Water Risk Assessment Tool

is noted that copper and zinc monitoring were discontinued in 2010 which are useful indicators of road runoff.

5.86. No information has been provided to POPE that would change the evaluation of **as expected**.

Table 5-14 Summary of Water Quality and Drainage Evaluation

Origin of Assessment	Summary of Predicted Effects	Assessment
AST	No loss of floodplain in illustrative design. Addition of penstocks and silt traps would reduce risk of pollution to aquatic environment if maintained.	Slight beneficial
EST	Limited impact on the water environment.	As expected

Physical Fitness

Forecast

AST

5.87. The 2013 AST did not assess the effects on non/motorised users.

Environmental Assessment Report

5.88. The EnAR stated that the impacts from the Scheme on NMUs would generally be limited as the NMU survey showed low usage by such users. Further, the existing facilities would remain, with the hard strips along the A14 to be re-instated which could continue to be used by cyclists. The existing crossing provisions at the bottom of slip roads would not be reinstated and any cyclists would be encouraged, by signing, to cycle up the slip road and use the grade separated roundabout to the top of the merge slip road and then use the slip road to regain the 1m hard strip. There would be potential impacts on PRoW GD8 and VD46 due to the potential of reduced amenity.

5.89. The EnAR predicted no changes in journey time or distance length for most users (i.e. non-motorised users and pedestrians crossing the Scheme) – the existing crossing facilities would remain in their location and form.

- No new crossing points would be provided.
- Generally, no changes in amenity for walkers on PRoW.
- There is currently no equestrian provision close to the Scheme; therefore none would be affected.
- The main effect on cyclists would be the replacement of the current hard strip, which is signposted as a cycling lane, but with three, instead of two, adjacent lanes of potentially faster moving traffic.
- There was one PRoW crossing of the A14 (Brooklands culvert/underbridge).
- There were generally low levels of indicated NMU usage on the network.
- Main roads crossings of the A14 occurred at the three junctions (the A43 at Junctions 7 and 8, and the A509 at Junction 9), plus two unclassified local roads that may be used by local traffic, including cyclists and buses.

Consultation

5.90. No response to consultation was received for physical fitness.

Evaluation

5.91. No further evaluation has been undertaken for physical fitness based on the findings of the EnAR submission. POPE has not received any feedback on consultation required in EnAR to confirm whether the reported impacts on non-motorised users has been realised.

Table 5-15 Summary of Physical Fitness Evaluation

Origin of Assessment	Summary of Predicted Effects	Assessment
AST	No assessment undertaken	None
EST	No evaluation undertaken	-

Journey Ambience

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

Forecast

AST

5.93. The 2013 AST did not assess the effects on journey ambience.

Environmental Assessment Report

Traveller Views

5.94. The Scheme design would mitigate views of the Scheme from key receptors; integrate the Scheme into the landscape; and at the same time enhance ecological opportunities. The basic principle of the mitigation Scheme would be to attempt to reinstate a comparable extent of vegetation coverage and screening to that afforded by the existing highway vegetation. As a result, there would be limited opportunities to create open views across the countryside.

5.95. Operational impacts on vehicle travellers using the Scheme would include:

- Variable message signage on gantries.
- New lanterns on existing/replacement columns.
- Tree, shrub, hedgerow, woodland establishment along the route.
- Timber, 2.5m high, noise fencing.
- Reinforced earthworks treatments (including retaining walls and associated safety barriers).

Driver Stress

5.96. The EnAR stated that the removal of online vegetation to facilitate the Scheme would potentially increase the effects of low and direct sunlight on driver vision. This situation would improve as mitigation planting became established and matured.

5.97. The lengthening and improved geometry of junction slip roads and service station accesses would reduce driver stress associated with entering and leaving the Scheme and service stations.

5.98. The new third lane would result in traffic passing closer to the piers of Junction 8 and Pytchley and Broughton overbridges, which might increase driver fear of potential accidents.

5.99. The embankment slopes were to be steepened to an extent where they would require safety barriers (standard 610 mm high steel), in addition to that required for other criteria. This would also have a tunnelling effect for road users with associated height and safety perceptions.

5.100. The retention of lighting in the central reserve with improved luminaires would maintain an appropriate level of lighting for the widened road, thus maintaining safe driving conditions for night time journeys.

5.101. The installation of overhead gantries on the approach to the two-lane drop junctions, in combination with general route signage, would assist navigation. The combination of gantries, verge mounted signs and lighting columns would, however, increase visual clutter within the road corridor and potentially increase driver distraction.

5.102. The need for future roadworks could be accommodated with a greater degree of safety and continued traffic flow, provided for by the additional lane.

5.103. Journey reliability would increase with the development of the Scheme through an increase in traffic flow but with a greater increase in capacity.

5.104. Projected traffic figures for the Scheme design year identified a reduction in driver stress levels from high and moderate to low and moderate on both the eastbound and westbound carriageway in the 'am' peak, and high and moderate to moderate and low reductions in driver stress levels on both the eastbound and westbound carriageways in the 'pm' peak. Although the traffic flows were predicted to increase within the corridor, the extra lane was predicted to reduce the flow per lane and increase the average speed, which would in turn reduce driver stress into the low to moderate band.

Traveller Care

5.105. The EnAR did not assess traveller care although there are direct access service centres (DASCs) on both the east and west bound carriages within the scheme boundaries.

Evaluation

5.106. Table 5-16 summarises the evaluation of the various elements of journey ambience and the scheme's impact on this sub-objective.

Table 5-16 Summary of Journey Ambience Evaluation

Traveller Factor	Score	OYA evaluation
Views	None	Whilst views are limited, the potential for this to lessen over time through planting on embankments will take some time to take effect due to the apparent slow growth of planting in areas where views are currently open.
Driver Stress		There is an improvement in journey times on the A14 which will have reduced congestion and hence frustration for a large number of drivers. There hasn't been a significant reduction in collisions since scheme opening and as such this has not contributed to the reduction in driver stress.
Care		East and west bound DASCs are located within the scheme
Summary Score		**As expected.**

Key Points – Environment

Noise

- Based on changes in traffic flows it is likely that local noise impacts are generally as expected.

Local Air Quality

- Benefits for properties near the A14 are as expected. Based on POPE methodology, overall, traffic flows are as expected in six locations, better than expected in eight locations and worse than expected in 2 locations.

Greenhouse Gases

- The re-forecast carbon evaluation along the scheme section (Junction 7-9) forecast a net increase of 2,204 tonnes of carbon (+18%). The outturn carbon evaluation indicates that the scheme has resulted in a net increase of 1,003 tonnes of carbon (+8%), which is lower than forecast. This is because the observed traffic flows and speeds are lower than forecast.
- The overall increase in carbon is due to the increase in traffic along the scheme section (Junctions 7-9) and the increased vehicle speeds associated with the additional carriageway capacity.

Landscape and Townscape

- Landscape and townscape mitigation measures are generally provided in line with proposals. It is evident that the scheme has had an impact on the surrounding landscape and screening functions previously in place. Plant failures, compact soils and lack of strimming will contribute towards slower than expected growth and plant failures.

Biodiversity

- Species monitoring was not a requirement in the aftercare maintenance period. Requirements for translocation is assumed to have occurred during construction. Species rich grassland is not receiving the maintenance required to ensure its success.

Cultural Heritage

- No assessment undertaken.

Water

- Drainage systems have been installed as expected and appear to be working as required.

Physical Fitness

- No further evaluation has been undertaken for this report.

Journey Ambience

- Traveller views on embankments will remain open until planting has matured. No further care facilities were installed as a part of the scheme as there are 2 existing direct access service areas within the limits of the scheme.
- There is an improvement in journey times on the A14 which will have reduced congestion and hence frustration for a large number of drivers. There hasn't been a significant reduction in collisions since scheme opening and as such this has not contributed to the reduction in driver stress.

6. Social Impacts Evaluation

Introduction

6.1. WebTAG guidance, current at the time of scheme appraisal, described social impacts as those covering the human experience of the transport system, and its impact on the social factors which are not considered as part of the economic or environmental assessment. This includes the following social factors.

- Collisions
- Physical Activity
- Security[19]
- Severance
- Journey Quality
- Option and Non-Use Values
- Accessibility
- Personal Affordability

6.2. Collisions and security were considered in Section 3 of this report, and Physical Fitness and Journey Ambience in Section 5. This section considers the remaining social factors, and draws upon the Appraisal Summary Table (AST, 2013).

Physical Activity

6.3. See environment section of this report (Chapter 5).

Journey Quality

6.4. See environment section of this report (Chapter 5).

Access to Services, Severance and Option Values

6.5. The scheme AST stated that these sub-objectives were not assessed stating the following:

- Access to Services: - Social and distributional impacts are not assessed for major trunk road schemes;
- Severance: - The change in daily traffic flow is less than 30% on all links and DMRB does not therefore require an assessment of Severance, as such the impact can be considered as Neutral;
- Option Values: - No new transport modes or travel opportunities would be generated by the scheme; and
- Affordability: - The scheme will result in moderate large disbenefits across all income groups.

6.6. No further evaluation has been undertaken based on the above for these sub objectives.

[19] Security has been considered in the Safety Chapter of this report.

7. Conclusions

7.1. To conclude this evaluation, this section of the report summarises how the A14 Junctions 7-9 Kettering Bypass Improvement scheme is meeting the objectives specified in the Client Scheme Requirements.

7.2. Table 7-1 presents an evaluation of the scheme's objectives using the evidence presented in this report.

Table 7-1 Summary of the Schemes Success against Objectives at OYA

Objective	Has the objective been achieved?	
To support sustainable economic activity and local development plans	Due to the inherent difficulty in isolating the wider economic impacts of the scheme, it has not been possible to conclude whether the scheme has had a direct impact on stimulating local economic activity. However, the increased capacity of the A14 provided by the scheme is likely support development around Kettering.	Too early to be conclusive.
To support and enhance the role of the current A14 Kettering Junctions 7-9 as a major (Trans-European Network) and inter-urban regional transport artery	A14 scheme section (Junctions 7-9) provided with additional capacity.	✓
To reduce congestion and provide additional capacity, increase journey time reliability and ensure the safe and economic operation of the trunk road	Additional carriageway capacity along the A14 scheme section (Junctions 7-9) will reduce congestion whilst measurement of the average variability of journey times shows that reliability of journeys along the scheme section (Junctions 7-9) has improved.	✓
To support housing and job growth in the region	Due to the inherent difficulty linking these impacts to the scheme, it has not been possible to conclude whether the scheme has had a direct impact on stimulating local economic activity. However, the increased capacity provided by the scheme is likely support development around Kettering.	Too early to be conclusive.
To achieve a safety objective under which the 'after' collision numbers (per annum) on the J7-9 section of the A14 are no greater than those 'before' and the severity ratio is not increased	Initial results show that the number of collisions in the immediate area has reduced compared against that before and the severity measurement of these collisions has decreased post-scheme opening. However, it is too early at this stage to be confident in the findings.	Too early to determine if the change is related to the scheme.
The scheme should improve journey time reliability by improving and better managing traffic flow conditions	Overall, Journey Time Reliability along the scheme section (Junctions 7-9) has improved, with the average journey times experiencing a reduction in the majority of time periods (both directions).	✓
The scheme should reduce the effects of queuing on the slip roads on mainline flow	Additional carriageway capacity along the A14 scheme section (Junctions 7-9) will reduce the impact of vehicle queues on the slip roads on the mainline flow.	✓

To minimise the detrimental environmental effects of the scheme and offset by mitigation measures where technically feasible and economic to do so, taking account of costs, availability of funding and statutory obligations	Landscape mitigation measures including planting schedules have been broadly implemented as anticipated. Compact soils and lack of ongoing maintenance will contribute towards slower than expected growth. However, it is not considered that forecast environmental impacts of the scheme have materially changed.	✓

Appendices

Appendix A. Appraisal Summary Table (AST) and Evaluation Summary Table (EST)

Table 1. Appraisal Summary Table (AST)

A14 Junctions 7-9 Bypass Improvement Scheme						
	Impacts	**Summary of Key Impacts**	**QUANTITATIVE MEASURE**	**Qualitative**	**Monetary 3(NPV)**	**Distributional 7-pt scale/ vulnerable grp**
Economy	Business users & transport providers.	The average journey time along the A14 J7-9 length in the opening year is reduced from 5.75 minutes to 3.98 minutes (a saving of 106 seconds) in the peak hours. In the inter-peak period, an average journey time of 4.30 minutes is reduced to 3.80 minutes (a saving of 30 seconds). The scheme results in time savings for business users and transport providers of 112,000 person-hours in the opening year. [TUBA analysis].	Value of journey time changes(£) £140m Net journey time changes (£) 0 – 2 min £107.6m | 2-5 min £32.5m | >5min £0.4m	Beneficial	£129.2m	N/A
	Reliability impact on Business users	The widening of the carriageway from D2AP to D3AP reduces the flow per lane on the A14. This reduces the variability of speeds (and hence journey times), thereby making journey times more predictable (reliable).	The No-scheme stress would be in the range 89% 101%. The With-Scheme stress would be in the range 75%-76%. [EAR]	Moderate Beneficial	-	
	Regeneration	The Scheme would not affect trips to or from a Regeneration Area.		Neutral	-	
	Wider Impacts		Not Assessed	N/A	-	
Environment	Noise	Based on the facade with the highest noise level with Scheme, the number of properties in 2030 experiencing noise levels > 68 dB LAeq,18h are:- No-scheme: 53; Scheme: 20. Based on the facade with the highest noise level with the Scheme, 69% of properties undergo a negligible or minor increase in traffic noise and approximately 26% of properties experience a decrease, although for the majority the beneficial impact is negligible or minor. Within the 1km study area, one existing road would have a potentially significant change in traffic flows. No significant impact on night-time traffic-noise levels along the Scheme is predicted. [Env Assessment]. There are large adverse distributional impacts on communities that are relatively affluent. Large noise benefits are concentrated among the low income groups. [SDI Report]	People annoyed by noise in 2030 due to the Scheme (Total population in Assessment 6,219) No-scheme: 783 annoyed; Scheme: 770 annoyed Change in population annoyed: -13 (decrease)	Neutral	PVB (Residential) +£0.6M	Large Beneficial
	Local Air Quality	There are 3,248 residential properties within 200m of the Scheme and surrounding affected road links. There are no Air Quality Management Areas in Kettering. [Env Assmt] There are moderate to large benefits in the lower and the highest income groups. There are large adverse impacts in the second highest income communities. [SDI Report]	PM10: 168 properties "losers"; 3,028 properties negligible change; 22 properties "winners". NO2: 221 properties "losers"; 2,468 properties negligible change; 529 properties "winners".	Neutral	-£0.9m	Large Beneficial
	Greenhouse Gases	There is a net disbenefit overall due to increases in travel distance with the Scheme. [EAR]	Change in non-traded carbon over 60y (CO2e) +150,000 MtCO2e Change in traded carbon over 60y (CO2e) +500 MtCO2e	Adverse	-£7.1m	
	Landscape	Arable fields to south of A14/open space and urban edge of Kettering to north. Loss of screening vegetation during construction with increased views until mitigation vegetation matures. Not possible to reinstate all vegetation lost due to reduced soft landscape width and constraints of engineered earthworks treatments. Increased influence of highway infrastructure (lighting, acoustic fencing and gantries).	-	Slight Adverse	-	
	Townscape	The scheme would not directly impact on townscape setting. The immediate urban edge of Kettering would however experience an adverse impact on context with increased visibility of elements of the A14. The implementation of the Scheme would be anticipated to benefit the townscape environment of surrounding areas but would also offer the potential for increased future development to take advantage of the increased road capacity.	-	Neutral	-	
	Heritage of Historic resources	No new land take thus no adverse effects on any existing heritage compromised by existing A14.	-	Neutral	-	
	Biodiversity	Although outside the boundary and not directly affected, Southfield Farm Marsh SSSI and Slade Lake CWS would receive increased protection through improved drainage, run-off attenuation and treatment to minimise potential indirect effects. Direct impacts on habitats used by grass snake, great crested newt and common lizard would be addressed through sensitive working methodology (method statements to be produced) including seasonal constraints, and habitats would be reinstated. A reduced mosaic of habitats may cause fragmentation and slow recolonisation by these species. The planting strategy will discourage foraging barn owl wherever possible, to reduce the risk of collisions with traffic. Habitat enhancement opportunities for common lizard, grass snake, breeding birds and bats have been identified and will be implemented where possible.	-	Slight Adverse	-	
	Water Environment	No loss of floodplain in illustrative design. Addition of penstocks and silt traps would reduce risk of pollution to aquatic environment if maintained.	-	Slight Beneficial	-	
Social	Commuting and Other users	The average journey time along the A14 J7-9 length in the opening year is reduced from 5.75 minutes to 3.98 minutes (a saving of 106 seconds) in the peak hours. In the inter-peak period an average journey time of 4.30 minutes is reduced to 3.80 minutes (a saving of 30 seconds). The scheme results in time savings for commuters of 106,000 person-hours and 'other users' have time savings of 244,000 person-hours in the opening year. [TUBA analysis].All social groups benefit. The greatest share of benefits is experienced by the higher income groups. The lowest income group experiences a moderate benefit.[SDI]	Value of journey time changes(£) £117.7m Net journey time changes (£) 0-2 min £96.1m | 2-5min £21.6m | >5min -£0.06m	Beneficial	+£89.1m	Moderate Beneficial
	Reliability impact on Commuting and Other users	The widening of the carriageway from D2AP to D3AP reduces the flow per lane on the A14. This reduces the variability of speeds (and hence journey times), thereby making journey times more predictable (reliable).	The No-Scheme stress would be in the range 89%-101%. The With-Scheme stress would be in the range 75%-76% [EAR]	Moderate Beneficial	-	
	Physical Activity	Scheme is unlikely to involve any alteration to rights of way or alter the movements of non- motorised users with the exception of temporary closures to PRoWs affected by the works for safety of the public and the workforce (rather than diversions).	n/a	Neutral	-	
	Journey Quality	Positive increase in traveller care due to improvement in signage spacing and quality. Traveller views would be adversely impacted during construction, becoming a neutral impact by year 15 of operation, allowing for maturation of mitigation planting. Traveller stress would be reduced through reduction in frustration, fear of accidents and route uncertainty as a result of increased route capacity and enhanced signage information.	n/a	Large beneficial	-	
	Accidents	There are reductions in flow (and thus in the number of accidents) in the Kettering urban area where there are relatively higher numbers of pedestrians and cyclists. Flows increase on the A14 where there would be an increase in the number of accidents but where there are relatively low numbers of vulnerable road users. Personal injury accidents (PIA) saved and the monetary evaluation are totalled across all roads within traffic model study area. [EAR] There are forecast to be beneficial impacts (in terms of casualty reductions) for all users. The number of accidents is too small to allow a statistically meaningful SDI analysis [SDI].	Number of PIA saved over 60 years: 403. Number of casualties saved: . Deaths = -1 Serious = 142 Slight = 493	Beneficial	+£17.3m	N/A
	Security	The Scheme has no elements which would impact on Security.	n/a	Neutral	-	N/A
	Access to Services	Social and distributional impacts are not assessed for major trunk road schemes.	n/a	N/A	-	N/A
	Affordability	The Scheme will result in moderate to large disbenefit across all income groups. [SDI]	n/a	Moderate Adverse	-	Moderate Adverse
	Severance	The change in daily traffic flow is less than 30% on all links and the DMRB does not therefore require an assessment of Severance. As such, the impact can be considered neutral. An SDI analysis of the impact is also not therefore necessary. [SDI] The scheme will not affect access to/travel along the scheme [Env Assmnt]	n/a	Neutral	-	N/A
	Option Values	No new transport modes or travel opportunities would be created by the Scheme.	n/a	Neutral	-	
Public Accounts	Cost to Broad Transport Budget	Capital Investment Outturn Costs of £64 million supplied by HA in August 2012. The PVC includes capital, maintenance and operating costs. [EAR]	The costs of capital investment, operating and maintenance (totalling £85.4M) are funded by Central Government. developer contributions or on revenues/fares.	Adverse	£82.2m	
	indirect Tax Revenues	The Scheme would result in an increase in fuel use, which would increase indirect tax revenues. [EAR]. The ITR raised is available to be spent to the benefit of society.		Beneficial	£102.3m	

Table 2. Evaluation Summary Table (EST)

	Impacts	Summary of Key Impacts	QUANTITATIVE MEASURE	Monetary £(NPV)	EST score
Economy	Business users & transport providers.	The scheme has had a positive impact on the mean journey times during all time periods, which indicates that the average journey times along the scheme section (Junction 7-9) have reduced post-scheme opening.	Value of journey time changes(£) £202.008m Net journey time changes (£)	£202.008m	
	Reliability impact on Business users	Improvements in day to day variability in journey times along the A14 scheme section (Junctions 7-9).		-	
	Regeneration	n/a	n/a	-	n/a
	Wider Impacts	n/a	n/a	-	n/a
Environment	Noise	As expected.		£0.613m	As expected
	Local Air Quality	Benefits for properties near the A14 are as expected. Overall, traffic flows are 'as expected' in six locations, 'better than expected' in eight locations and 'worse than expected' in 2 locations.		-£0.904m	Likely to be better than expected
	Greenhouse Gases	The re-forecast carbon evaluation along the scheme section (Junction 7-9) forecast a net increase of 2,204 tonnes of carbon (+18%). The outturn carbon evaluation indicates that the scheme has resulted in a net increase of 1,003 tonnes of carbon (+8%), which is lower than forecast.	Change in non-traded carbon over 60y (CO2e) - Change in traded carbon over 60y (CO2e) -	-£3.232m	Better than expected
	Landscape	Landscape and townscape mitigation measures are generally provided in line with proposals. It is evident that the scheme has had an impact on the surrounding landscape and screening functions previously in place. Plant failures, compact soils and lack of strimming will contribute towards slower than expected growth and plant failures.	-	-	As expected
	Townscape	n/a	-	-	n/a
	Heritage of Historic resources	n/a	-	-	n/a
	Biodiversity	Species monitoring was not a requirement in the aftercare maintenance period. Requirements for translocation is assumed to have occurred during construction. Species rich grassland is not receiving the maintenance required to ensure its success.	-	-	Likely to be as expected
	Water Environment	Drainage systems have been installed as expected and appear to be working as required.	-	-	As expected
Social	Commuting and Other users	As for business users above.	Value of journey time changes(£) Net journey time changes (£)	Included with business	
	Reliability impact on Commuting and Other users	Improvements in day to day variability in journey times. Monetised benefits combined with business above.		Included with business	
	Physical Activity	n/a		-	n/a
	Journey Quality	Improved journey times on the A14 have reduced congestion and driver frustration. There hasn't been a significant reduction in collisions since scheme opening and as such this has not contributed to the reduction in driver stress. Slow planting growth on embankments currently affect driver views. Overall impact as expected.		-	As expected
	Accidents	The annual average number of collisions over the Model Study Area have reduced by 15.8 PICs since the scheme opened. The annual average number of collisions over the Key Links Analysis Area have increased by 0.1 PICs since the scheme opened. Results are not statistically significant.	7.5 collisions in opening year (10%)	N/A	
	Security	n/a	n/a	-	
	Access to Services	n/a	n/a	-	
	Affordability	n/a	n/a	-	As expected
	Severance	The scheme has not impacted severance.	n/a	-	As expected
	Option Values	n/a	n/a	-	
Public Accounts	Cost to Broad Transport Budget	Investment cost was 7% lower than expected. Ongoing operating costs assumed as forecast.		£42.225m	
	Indirect Tax Revenues	The outturn impact on indirect taxation is lower than forecast due to lower overall traffic levels (compared to forecast), and lower average speeds on the A14.		£10.618m	

Appendix B. Environment Information Requested

Standard list of information required to evaluate the environmental sub-objective

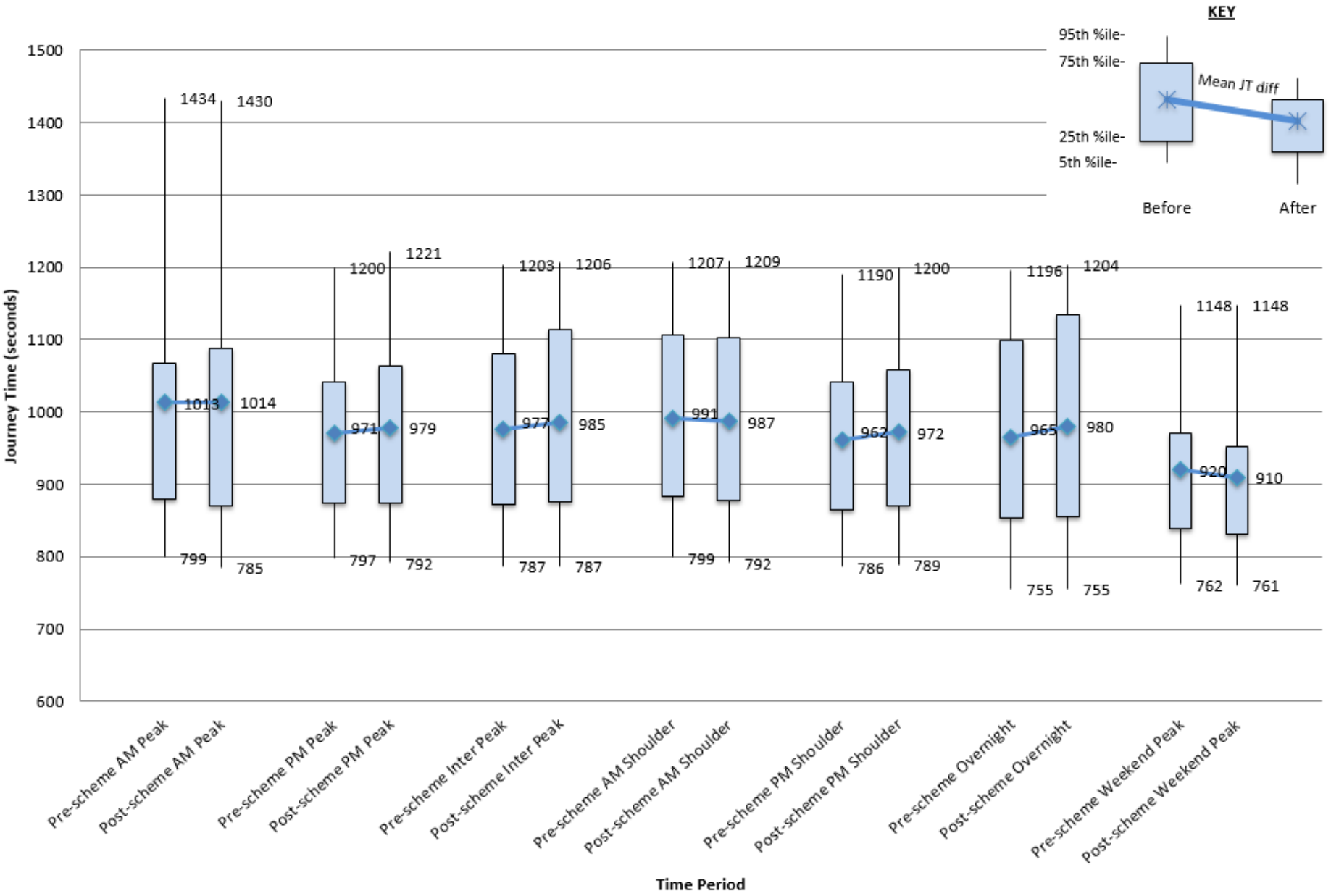
Requested Information	Response
Environmental Assessment Report	Received EnAR, figures and technical reports
AST	Received
Any amendments/ updates/addendums etc to the ES or any further studies or reports relevant to environmental issues. Have there been any significant changes to the scheme since the ES.	Baseline noise report and noise survey report
'As Built' drawings for landscape, ecological mitigation measures, drainage, fencing, earthworks etc. Preferably electronically or on CD.	Received
Copies of the Landscape/Ecology Management Plan or Handover Environmental Management Plans	Received
Contact names for consultation	None
Archaeology - were there any finds etc. Have any Archaeological reports been written either popular or academic and if so are these available?	None received – not a requirement in the EnAR
Have any properties been eligible for noise insulation?	None received
Has any post opening survey or monitoring been carried out e.g. for ecology/biodiversity or water quality and if so would copies of the reports be available?	None received
Animal Mortality Data	No response received
Pre scheme Non Motorised User (NMU) Audit or Vulnerable User Survey	None received
Copy of NMU post opening survey	None received,
Employers Requirements Works Information - Environment sections	Received
Health and Safety File – Environment sections	Received
Construction Environment Management Plan (CEMP)	Not received
Landscape and Ecology Aftercare Plan (LEAP) and / or Landscape and Ecology Management Plan (LEMP)	None received
Handover Environmental Management Plan (HEMP)	Received
The Road Surface Influence (RSI) value of any low noise surface installed	Received

Appendix C. Glossary

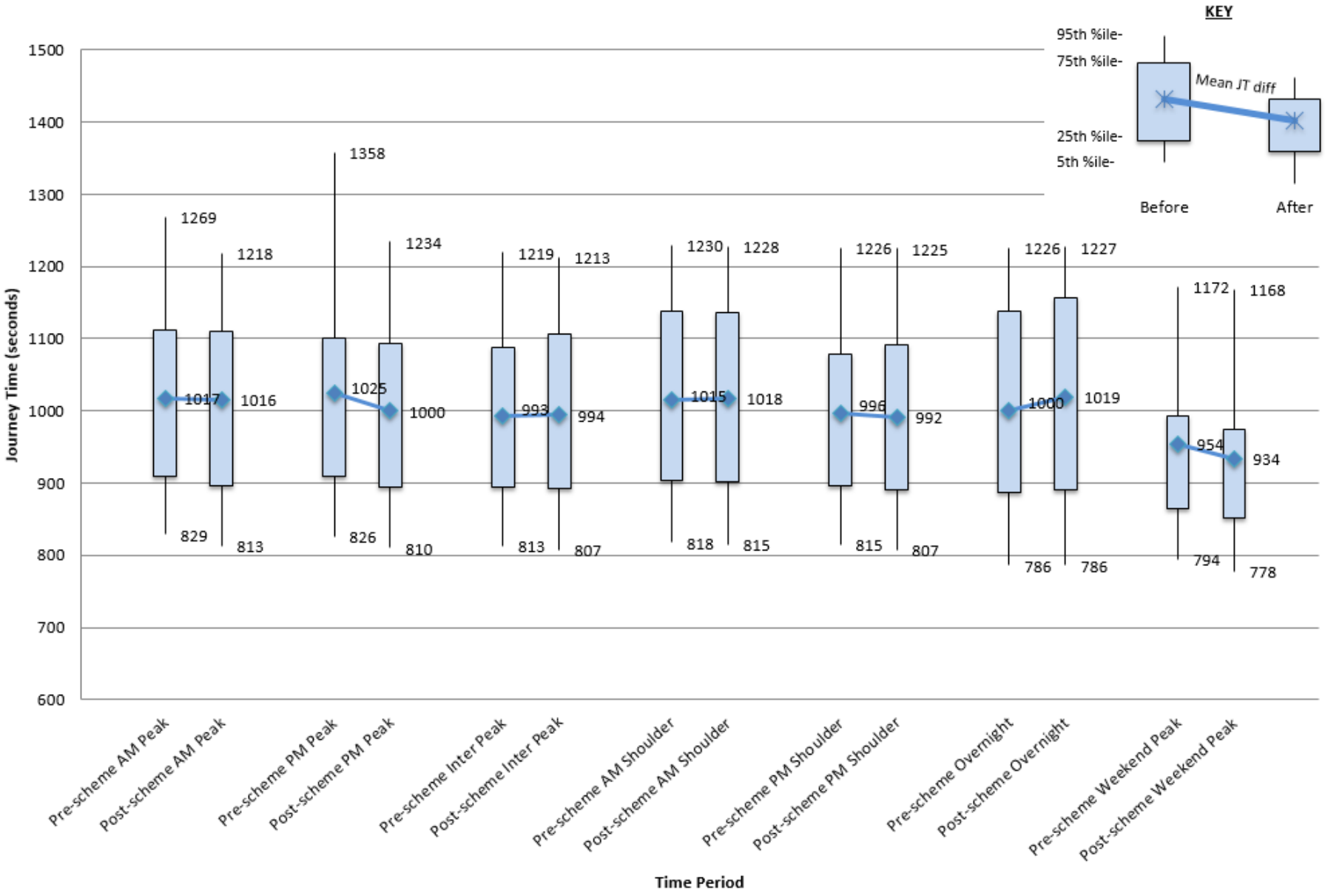
Term	Meaning
AADT	Average of 24 hour flows, seven days a week, for all days within the year.
AQMA	Air Quality Management Area
AST	**Appraisal Summary Table** This records the impacts of the scheme according to the Government's five key objects for transport, as defined in DfT guidance contained on its Transport Analysis Guidance web pages, WebTAG
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
Chi-square	A statistical method assessing the goodness of fit between a set of observed values and those expected theoretically.
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 of 2010 was used in the appraisal and used in this report.
Do Minimum (DM)	In scheme modelling, this is the scenario which comprises only the existing road network and other committed schemes.
Do Something (DS)	In scheme modelling, this is the scenario detailing the planned scheme plus improvement schemes that have already been committed
EAR	Economic Assessment Report
EnAR	Environment Assessment Report
EIR	Economic Impact Report
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.
FWI	Fatal & Weighted Injuries This figure is a combined measure of casualties based on the numbers of fatal, serious and slight casualties. It is weighted by severity of injuries, with fatalities having the highest weighting.
FWI/bvkm	FWI measure by volume of traffic
HEMP	Handover Environmental Management Plan
INCA	**Incident Cost Benefit Assessment** can be used to estimate the benefits of reduce delay and travel time variability caused by unforeseen incidents that reduce capacity such as breakdowns, accidents and debris on the carriageway and major disruptions such as spillages.
KSI	Killed or Seriously Injured
MAC	Managing Agent Contractor
MtCO2e	Million metric tons of carbon dioxide equivalent
NMU	Non-motorised User
OYA	One Year After
PIC	**Personal Injury Collision** Data on these is obtained from records of road collisions collected from by police officers attending accidents.
PIC/mvkm	Ratio of PIC to the level of travel measured in **million vehicle kilometres** (mvkm)

Present Value	Present Value is the value today of an amount of money in the future. In cost-benefit analysis, values in differing years are converted to a standard base year by the process of discounting giving a present value.
PVB	**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 Cost
RSA	Road Safety Audit
Screenline	Screenlines are an analysis technique used to consider the potential reassignment of vehicles as a result of a new road scheme.
SNCI	**Site of Nature Conservation Interest** Designations used by local authorities in England for sites of substantive local nature conservation value
TFR	Traffic Forecasting Report
Traveller Care	In the context of journey ambiance, this covers aspects such as cleanliness, level of facilities, information and the general transport environment.
WEBTAG	Department for Transport's website for guidance on the conduct of transport studies at http://www.webtag.org.uk/

Appendix D. Journey Time Reliability along A14 EB (J2-12)



Appendix E. Journey Time Reliability along A14 WB (J2-12)



Appendix F. Tables and Figures in this Report

Figures

Tables