POPE of LNMS

M1 Junction 28 - A38(T) Eastbound Approach (Minor Improvements) LNMS Evaluation Report

Highways Agency

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HIGHWAYS AGENCY

Safe roads, reliable journeys, informed travellers

An executive agency of the Department for Transport

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Glossary

Term	a.k.a.	Definition
Accessibility	-	Accessibility can be defined as 'ease of reaching'. The accessibility objective is concerned with increasing the ability with which people in different locations, and with differing availability of transport, can reach different types of facility.
Appraisal Summary Table	**AST**	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**
Automatic Traffic Count	**ATC**	An automated method of recording the volume (and sometimes classification) of vehicles passing a particular point on a road.
Average Daily Traffic	**ADT**	The 24 hour total traffic flow on an average day over a certain time period (Monday – Sunday)
Benefit Cost Ratio	**BCR**	Benefit Cost Ratio is a ratio identifying the relationship between cost and benefits of a proposed project
Discounting	-	A technique used to compare costs and benefits that occur in different time periods and is the process of adjusting future cash flows to their present values to reflect the time value of money, e.g. £1 worth of benefits now is worth more than £1 in the future. A standard base year needs to be used which is 2002 for the appraisal used in this report
Dis-benefit	-	A negative benefit or something that detracts from the performance.
Evaluation Summary Table	**EST**	In **POPE** studies, this is a summary of the evaluations of the **TAG** objectives using a similar format to the forecasts in the **AST**
First Year Rate of Return	**FYRR**	First Year Rate of Return is the ratio of money gained on an investment relative to the amount of money invested.
Highways Agency	**HA**	An Executive Agency of the **DfT,** responsible for operating, maintaining and improving the strategic road network in England
Journey Time Database	**JTDB**	A HA database of average vehicle journey times on the trunk road network
Local Network Management Scheme	**LNMS**	LNMS are improvement schemes where total overall estimated cost (including design, land, works, supervision, risk and VAT) is less than £10 million. They are categorised by the Government under Safety, Economy, Accessibility, Integration and Environment

Managing Agent Contractor	**MAC**	Responsible for the operation, maintenance, and improvement of the motorway and trunk road network of a HA area
Microprocessor Optimised Vehicle Actuation	**MOVA**	Self-optimising control system for traffic signals. MOVA maintains the optimum approach green time and control strategy to suit prevailing traffic conditions to minimise queuing.
New Approach to Appraisal	**NATA**	Used for transport scheme appraisal since 1998
Project Appraisal Report	**PAR**	A key document summarising the need for a project, plus its costs and benefits (including those that cannot be quantified in monetary terms)
Personal Injury Collision	**PIC**	A term commonly used to refer to road accidents
Post-Opening Project Evaluation	**POPE**	Before and after monitoring of all highway schemes in England
Present Value of Costs	**PVC**	Present Value of Costs is a term used in cost-benefit analysis and project appraisal that refers to the discounted sum, or Present Value, of a stream of costs associated with a project or proposal
Severance	**-**	Community severance is the separation of adjacent areas by road or heavy traffic, causing negative impact on non-motorised users, particularly pedestrians
-	**STATS 19**	A database of injury accident statistics recorded by police officers attending accidents
Traffic Database System	**TRADS**	Traffic count database developed by the HA, to hold data from traffic monitoring sites on the strategic network

1. Introduction

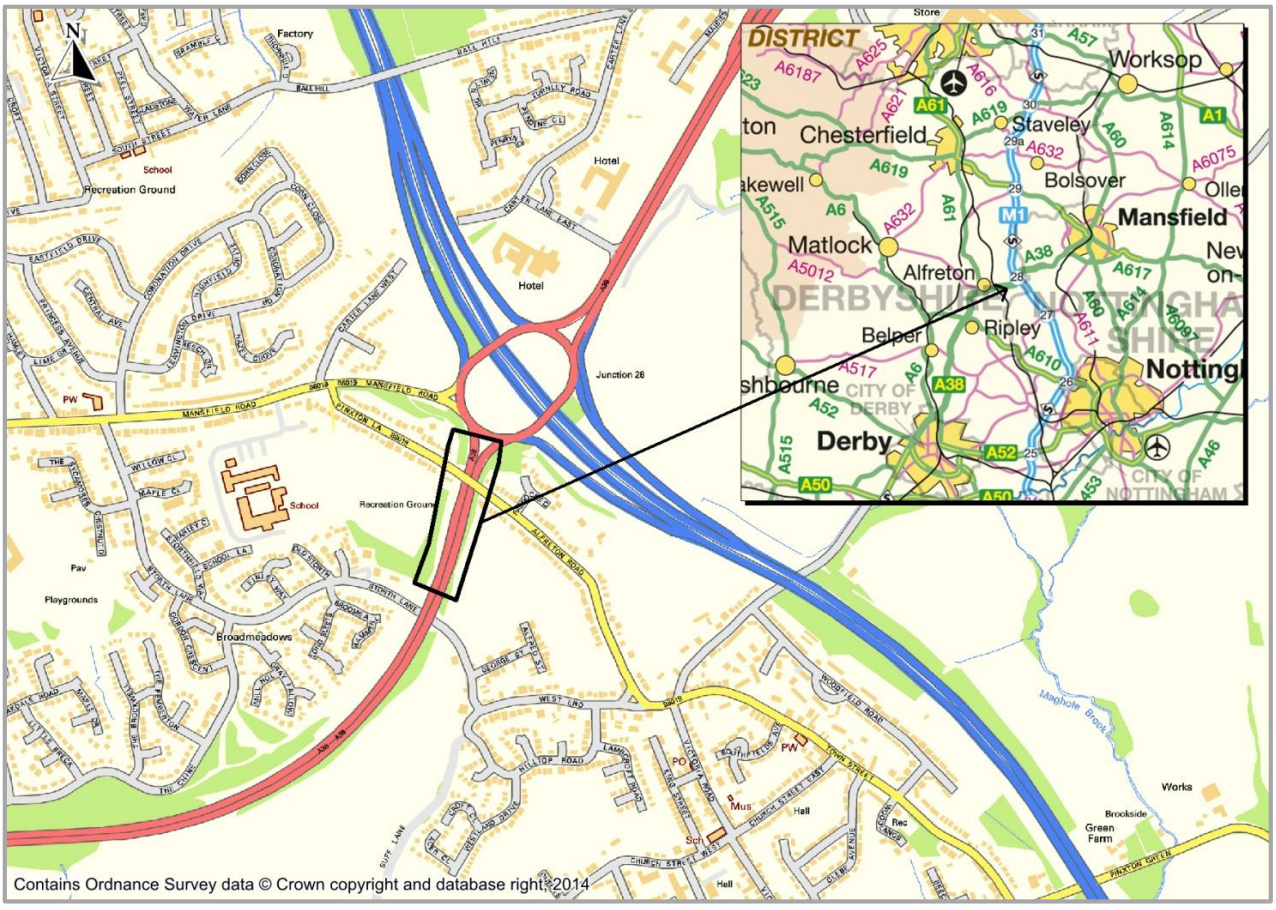
Background

1.1. This report is the Post-Opening Project Evaluation (POPE) of the **M1 Junction 28 – A38(T) Eastbound Approach (Minor Improvements)** Local Network Management Scheme (LNMS). This will be referred to throughout this report as M1 J28 – A38 Eastbound Approach LNMS or "the scheme".

1.2. Junction 28 of the M1 is located to the east of the town of Alfreton, Derbyshire, and comprises a grade separated junction with a signal controlled roundabout located above the motorway. The scheme involved improvements to the A38 eastbound approach to the motorway junction.

1.3. The A38 is a dual carriageway at this section and increases to three lanes on approach to the roundabout at Junction 28. It is a busy road of local significance as the A38 connects key locations such as Derby, Ripley and Alfreton to the M1 motorway. **Figure 1-1** displays the location of the scheme.

Figure 1-1 Scheme Location



1.4. The AMScott Hotspot Review 2006 Study (July 2008) stated that there were delays of 3 – 4 minutes per vehicle during peak times along the A38 eastbound approach to the roundabout. These delays were experienced despite improvements which were installed as part of a scheme which was completed

in March 2006, when a third lane was introduced to ease congestion. The layout of the eastbound carriageway following these works comprised three lanes, with the third (the nearside) 70 metres in length.

1.5. To tackle these ongoing congestion issues, the M1 J28 – A38 Eastbound Approach LNMS, which is the focus of this report, involved the lengthening of this nearside lane to 200 metres.

1.6. It is initially understood that the scheme began construction in August 2010 and opened in October 2010. However, following analysis of journey time data (in Section 4 of this report), it appears that construction took slightly longer than anticipated and continued in to November.

Purpose of This Report

1.7. As part of an ongoing programme, whereby the Highways Agency (HA) evaluates the impacts of trunk road schemes, Atkins is commissioned to undertake post-opening evaluations of LNMS with an implementation cost of between £25k and £10m.

1.8. This report specifically sets out the results of the POPE of the M1 J28 – A38 Eastbound Approach LNMS. More specifically, this report examines the economic and safety impacts resulting from the improvements, with consideration also given to the main environmental, accessibility and integration impacts.

1.9. It is intended that the findings from this report will feed into a wider summary of the outcomes of POPE. This is a document (namely the LNMS Annual Evaluation Report) produced in the fourth quarter of each year outlining the key messages from the entire POPE of LNMS process.

2. Scheme Detail

Introduction

2.1. This section of the report outlines the pre-scheme and post-scheme layout of the scheme area, using photos, diagrams and site observations to illustrate the changes made to the highway network. In addition, this section contains the views and feedback on the scheme from key stakeholders.

Background

2.2. The M1 J28 – A38 Eastbound Approach LNMS involved the lengthening of the nearside lane approach to the roundabout from 70 metres to 200 metres. **Table 2.1** summarises the scheme details. The full Appraisal Summary Table (AST) from the PAR is included in **Appendix A**.

Table 2.1 – Summary of M1 J28 – A38 Eastbound Approach LNMS

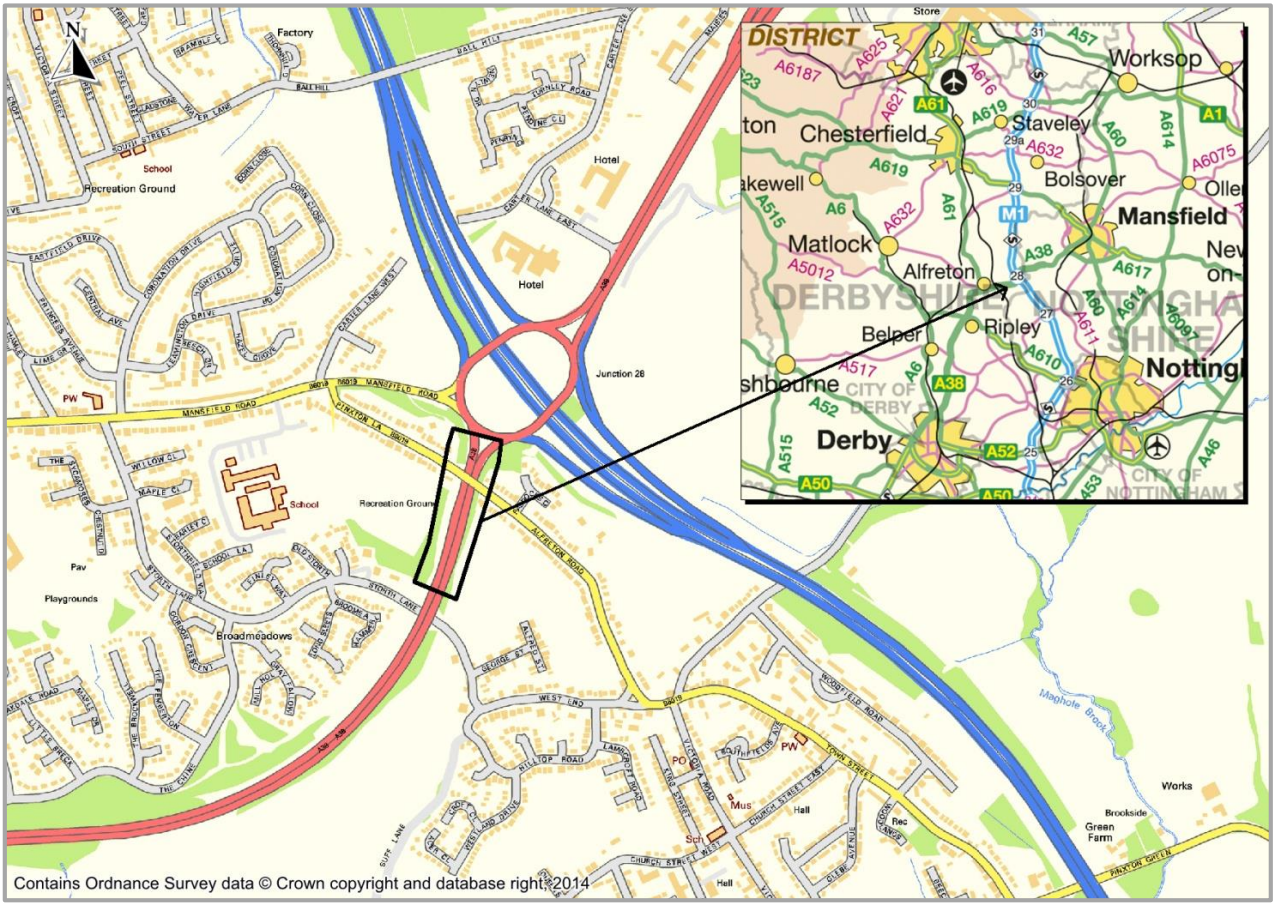
Scheme name	**M1 J28 – A38 Eastbound Approach LNMS**
Area	7
Opening date	November 2010
Category	Economy
Reason for scheme	During peak times, journey time delays of around 3 – 4 minutes were being experienced on the A38 eastbound approach to Junction 28 of the M1. The congestion during peak periods occurred despite efforts to reduce delays with a scheme which was completed in 2006. This scheme introduced a third lane, with the latest LNMS scheme increasing the length of this lane.
Objectives	To reduce journey times during the peak periods by easing delays.
History	The LNMS Evaluation Report for the M1 Junction 28 Capacity Improvement Scheme, which was produced by Atkins in 2008, provides information on the previous works to improve the junction. The improvements to the A38 eastbound approach were operational by March 2006 and constituted the wider works on the M1 from Leicester at Junction 21 to Chesterfield at Junction 30. As part of this, both A38 approaches to Junction 28 underwent works which sought to reduce congestion at peak times and improve journey times. The works included: • Providing a segregated left-turn lane to the M1 South from the A38 east approach; • Providing an extra entry lane on the A38 west approach to the junction. As part of this, lane destination markings were altered; • Installing MOVA signals to the junction to improve traffic flow; • Enhancing pedestrian facilities around the junction; and • Implementing high-friction surfacing on the A38 approaches.

	The report suggests that these works were informed by a study which provided short-term solutions for the M1 from Junction 21 to Junction 30. The study by AMScott, released in 2008, subsequently recommended that the additional third lane be extended to provide the three lanes from 200 metres back from the junction-improvements that were made as part of this scheme. This allows drivers to negotiate their designated lane and minimises late lane changes near to the junction.
Alternative options	The PAR suggests that AMScott considered altering traffic signals, signs and road markings to address capacity issues, but that these were not thought to be appropriate options at the time.

Location

2.3. The scheme is located near Alfreton, Derbyshire, at Junction 28 of the M1 and involves widening of the A38 eastbound approach. The A38 runs alongside Alfreton and across the motorway junction towards Sutton-in-Ashfield. **Figure 2-1** shows the location of the scheme.

Figure 2-1 Scheme Location



2.4. The local residents of surrounding areas such as Alfreton, South Normanton and Somercotes are likely to be frequent users of the A38, which can be used to access Derby as well as the M1 for wider destinations. Additionally, the A38

represents a decision point in connecting Derby to the north east, as one can travel on the A38 or on the alternate A50/M1 route.

2.5. On the east arm of the A38 at Junction 28 is the East Midlands Designer Outlet, which is also likely to generate traffic on the A38.

Pre-Scheme Opening

2.6. Prior to the opening of the scheme in November 2010, the A38 eastbound approach to the junction consisted of three lanes, with the nearside lane running 70 metres back from the junction.

2.7. **Figure 2-2** shows a Google Street View image of the A38 eastbound approach taken in 2009, before the construction of this scheme. As the photograph shows, there are two lanes at this point: the left is marked for M1 north, A38 and B6019, while the right is marked for the use of A38 and M1 south. Just north of the B6019 Alfreton over-bridge, the third lane is introduced to the left, which is designated for the M1 north and the B6019. The middle lane is marked for M1 north and the A38, and the right lane remains as before, for use of the A38 and M1 south.

Figure 2-2 Pre-Scheme Layout (2009)

2.8. The layout may have added to the issues at the location, which consisted of congestion and journey time delays, particularly during peak periods. The

AMScott report found that queuing in the nearside lane just before the junction resulted in the path to the middle lane becoming blocked.

2.9. However, the report also states that this is countered to some extent by drivers who wish to use the middle lane travelling in the offside lane instead until changing to the middle lane immediately before the junction. Where congestion occurs here, the problem is likely to have been exacerbated by the blocking of the middle lane, as it is likely it was not used to full capacity.

Post-Scheme Opening

2.10. The scheme involved the extension of the nearside lane to 200 metres. The image shown in **Figure 2-3** was taken at the same location as presented in **Figure 2-2**, and shows that the third lane has been extended further away from the junction.

Figure 2-3 Post-scheme Layout (2011)

2.11. **Figure 2-4** is an image, which was also captured during 2011, following the construction of the scheme. The image shows that the final lane designation markings which were utilised close to the junction in the 2009 photograph are now placed earlier on the route, at the point where the third lane is introduced. The final lane markings are therefore visible for a longer distance, meaning that late lane changes by drivers are likely to be minimised.

2.12. The left-hand lane and the middle lane are designated for drivers wishing to travel on the M1 northbound, although the left lane can also be used for the B6019. Both the middle lane and the right hand lane can be used for the A38. The right lane is also to be used for the M1 southbound.

Figure 2-4 Post-Scheme Layout – Lane Markings (2011)

2.13. The PAR also states other works which were completed as part of the scheme, such as associated barrier and street lighting works. Other works include earthworks and the re-grading of the retaining wall at the verge.

Local Schemes

2.14. There have been a number of other schemes constructed in the vicinity of Junction 28. The construction dates of these schemes have been compiled in **Table 2.2**, for the purpose of understanding whether these schemes may have had an impact on the evaluation of this scheme.

2.15. As shown in the programme timeline in **Table 2.2**, the following nearby schemes have been introduced or are in the process of being implemented:

- **M1 J25 – J28 Widening (Complete May 2010):** This scheme involved works to widen the M1 between Junction 25 and Junction 28;
- **M1 J28 – J31 Smart Motorways (Complete Autumn 2015):** This scheme involves work to the M1 to convert it to a “smart motorway”, which aims to reduce congestion by varying speed limits;

- **M1 J28 – J31 Barrier Works (Complete Summer 2014):** Barrier replacement works will be undertaken, which will see the installation of a concrete barrier;
- **A38 Little Eaton Pinch Point (Complete September 2014):** The A38/A61 Little Eaton roundabout will see the provision of new lanes and traffic signals; and
- **A38 Markeaton Pinch Point (Complete October 2014):** Similarly, this scheme, taking place at the A38/A52 Markeaton junction, involves increasing the number of lanes and installing traffic signals. This scheme is linked to the A38 Little Eaton Pinch Point scheme, and construction will begin upon completion of these works at the Little Eaton roundabout.

2.16. **Table 2.2** shows that the M1 J25 – J28 Widening scheme opened near to the beginning of the construction of this scheme. The M1 widening scheme opened in May 2010, while the construction of the M1 J28 – A38 Eastbound Approach LNMS did not begin until August of the same year.

2.17. The timeline below shows that although other highways projects took place in the years before, it seems that no major construction occurred in the years immediately following the opening of the M1 J28 – A38 Eastbound Approach LNMS. There have been, however, consistent works to the surrounding area from 2013 until present, as shown in **Table 2.2**.

2.18. The impact of these other schemes on traffic flow around the scheme will be considered in detail in Section 3.

Table 2.2 – Nearby Schemes and Associated Construction Dates

Scheme	2010					2013				2014				2015			
	Jan - Mar	Apr - Jun	Jul - Sept	Oct - Dec	-----	Jan - Mar	Apr - Jun	Jul - Sept	Oct - Dec	Jan - Mar	Apr - Jun	Jul - Sept	Oct - Dec	Jan - Mar	Apr - Jun	Jul - Sept	Oct - Dec
M1 J25-28 Widening																	
M1 J28 – A38 EB Approach LNMS																	
M1 J28-31 Smart Motorway																	
M1 J28-31 Barrier Works																	
A38 Little Eaton Pinch Point																	
A38 Markeaton Pinch Point																	

Site Observations

2.19. A site visit was undertaken during the AM peak (07:00 – 09:00) on Thursday 12th June 2014.

2.20. The scheme elements were observed to be installed as described in the PAR, with the third lane extended and associated lane markings and signage in place.

2.21. The conditions on the day of the site visit were normal, with good weather and no special events occurring in the area. Some queuing was observed on the eastbound approach at around 07:45, but traffic appeared to be moving well and although there was a relatively high volume of traffic, journey times were reasonably short.

2.22. It was estimated that vehicles passing through the eastbound approach were experiencing lower journey times than stated in the PAR. By 08:15, just 30 minutes after the queuing was observed, there were no queues and little to no residual traffic after the traffic signal green time phase, leaving the eastbound approach relatively quiet.

2.23. Traffic appeared to be moving freely, which may be due to the success of the scheme. However, another possible reason could be due to the road works relating to the two Pinch Point schemes identified in **Table 2.2**, which could have detracted drivers from taking this route. Drivers may have altered their normal travel patterns and timings to avoid congestion.

Stakeholder Feedback

2.24. While the analysis in this report can consider the quantifiable impact of this scheme based on empirical data, it is also worth considering the opinions of major stakeholders of the scheme. For example, a scheme may save journey times in practice, but if this saving isn't perceived, the scheme may not be as successful as first thought.

2.25. The major stakeholder contacted for feedback on the M1 J28 – A38 Eastbound Approach LNMS is the Highways Agency project sponsor, who was approached and asked to give feedback on how the scheme is currently operating and whether it has, in their opinion, satisfied its objectives. A response was received from the Integrated Delivery Team (IDT) project manager for the scheme, who is also a local resident. Their response is as follows:

A-One+

2.26. Response from Richard Waterfield, IDT project manager at A-One+:

"As the IDT Project Manager for the scheme, and living in the locality of this junction, and speaking to a number of people who use this road and junction on a daily basis, I can provide commentary on how it is performing post scheme opening.

"The scheme, without question, **immediately reduced congestion** on the approach to the EB A38 to M1 J28. **During peak times there are still**

queues that build up, **however these are nowhere on the scale that they were before** the A38 was widened at this location. Outside of peak times, there is very little in the way of congestion or queues building up on the EB approach to J28."

"However! Given the location of the scheme, in that it is metres from the M1 NB entry slip at J28, **any incident on the M1 NB very quickly causes heavy congestion** and a blockage on the M1 J28 circulatory which then of course **blocks the exit from the A38 EB onto the roundabout** and thereby causes queuing along this stretch of A38."

"The current ongoing **smart motorway scheme** which runs from M1 J28 is also having a big congestion and queuing impact on the M1 J28 circulatory and A38 EB, particularly during peak times when the M1 NB is subject to almost daily queuing.""

3. Traffic Volumes

Introduction

3.1. This section of the report considers the impact that the M1 J28 – A38 Eastbound Approach LNMS has had on traffic volumes.

Data Source

3.2. As scheme planning and construction is a process that takes a number of years, it is important to understand how traffic volumes have changed over time and whether this will impact the way the scheme performs. To understand this, data from a count site on the Highways Agency (HA) TRADS database has been assessed. This Automatic Traffic Count (ATC) site is located on the A38 eastbound approach to Junction 28 and provides a large dataset as it has been active for a long period of time, although it is worth noting that there is no data available for the year 2011, except for the month of December. This has not been included so to avoid showing an unreliable average for this year.

Traffic Volume – Yearly Flows

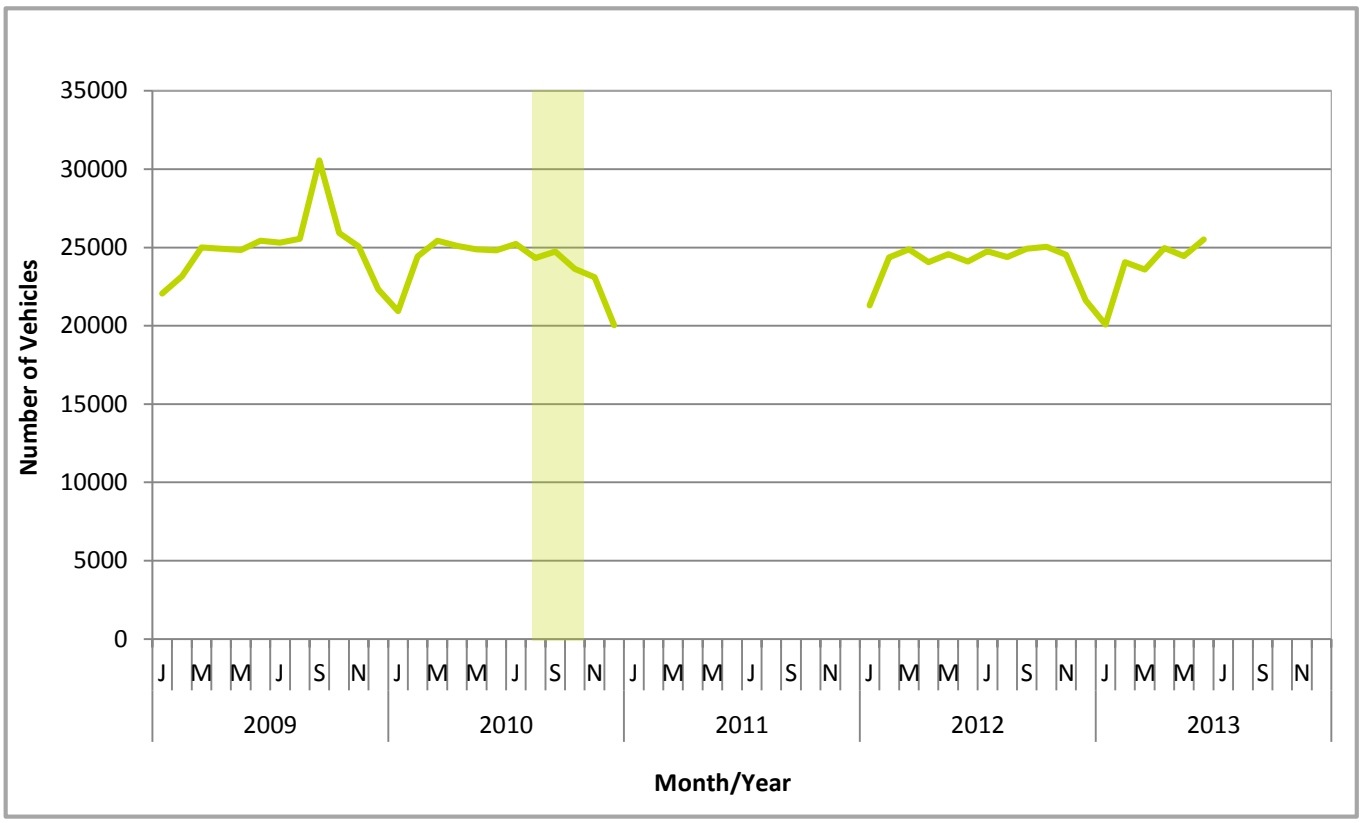
3.3. So that traffic flows can be considered over time, Average Daily Traffic (ADT) per month has been taken from the TRADS database, on the A38 eastbound approach to M1 J28. This has been obtained for the period 2009 – 2013, due to data availability, and is shown in **Figure 3-1**. The construction period is highlighted.

3.4. The key points from **Figure 3-1** are as follows:

- Traffic volumes for the A38 eastbound approach remained fairly constant across the period from pre-scheme to post-scheme, despite a number of local schemes taking place (schemes referenced in Section 2);
- The A38 is subject to fairly typical seasonality in terms of traffic volumes, with troughs in winter. The graph does not generally show evidence of the route being affected by local events or attractions above normal seasonality; and
- Traffic volumes remain at around 25,000 per month, except for an anomaly during summer 2009, where traffic peaked.

Figure 3-1 shows that volume of traffic has not changed, despite the presence of other schemes as presented in **Table 2.2**. For this reason, the evaluation will proceed as if no other schemes have affected the outcomes of the M1 J28 – A38 Eastbound Approach LNMS.

Figure 3-1 Monthly ADT Flows (2009 – 2013)



Traffic Volume – Daily Traffic Patterns

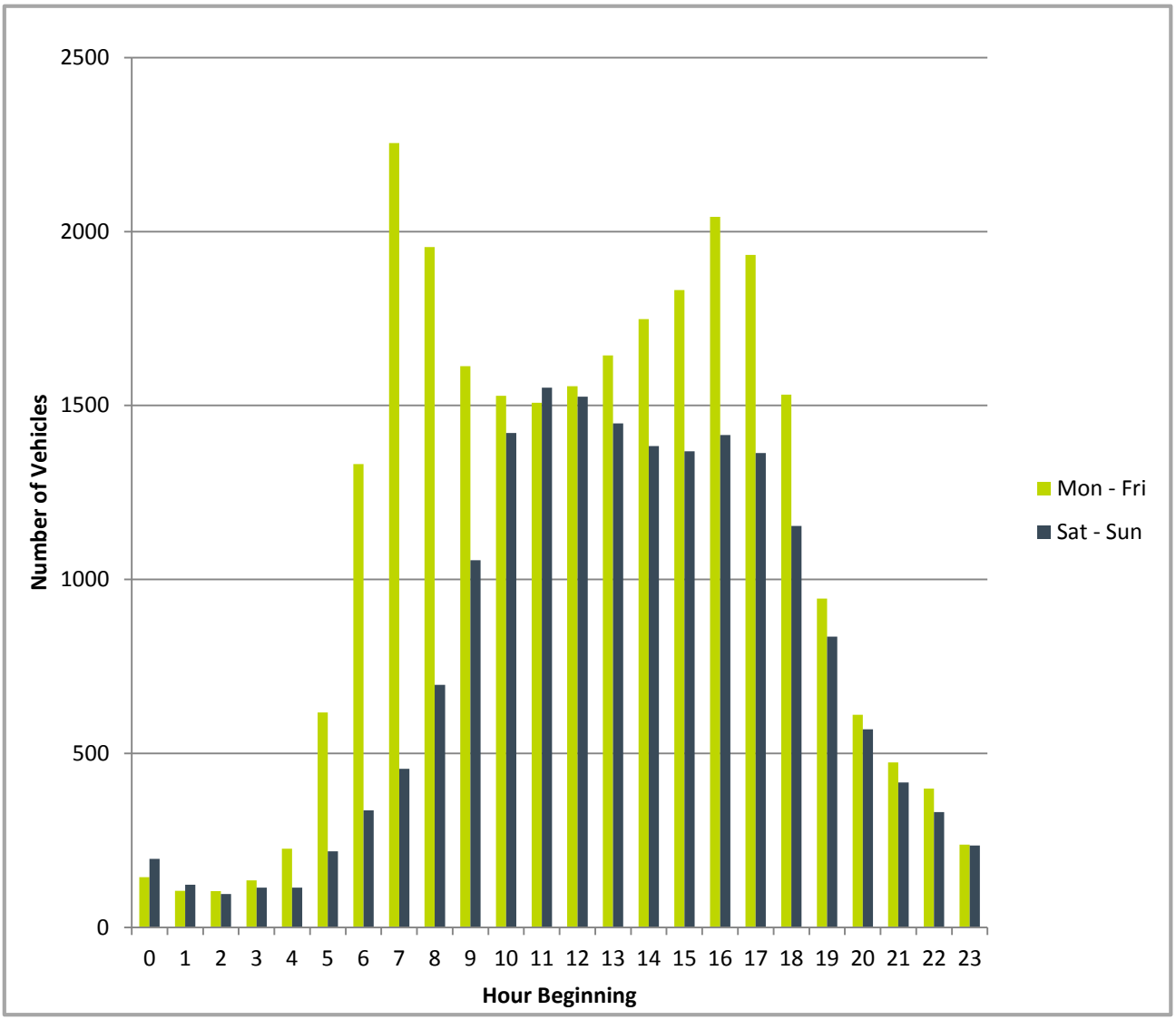
3.5. TRADS data has also been analysed in the format of daily flows, to understand daily variation and to establish the profile of traffic and any tidal behaviour. As data was not available for 2011, the one year after analysis for traffic volumes has been based on one year from January 2012.

3.6. **Figure 3-2** shows these daily flows and average values for weekdays and weekends are shown separately on this graph. Key points to note from **Figure 3-2** are as follows:

- The profile for Monday – Friday is fairly typical, with two peak periods - one during the morning, and one during the evening;
- The peak period during the morning is from 07:00 – 09:00;
- The peak period during the evening is from 16:00 – 18:00; and
- The profile for weekends is also fairly typical, with traffic peaking at around 11:00.

3.7. Similar patterns were also observed prior to the scheme.

Figure 3-2 Daily Flows (January – December 2012)



Summary

3.8. The TRADS data shows that the A38 eastbound follows a typical daily profile, with peaks during the morning and evening on weekdays. Traffic volumes have remained fairly consistent since 2009.

3.9. As no data exists for 2011, it is assumed that traffic levels are the same as 2012, as no other schemes were under construction during either 2011 or 2012, hence they should show similar traffic patterns.

3.10. The fact that the flows have remained constant from 2009 to 2013 while other schemes have been constructed and implemented in this period suggests that these schemes had little to no impact on this LNMS scheme. Therefore, the analysis will continue as if the other schemes have not had any impact on the volume of traffic passing through the junction from the A38 eastbound approach.

4. Journey Time Analysis

Introduction

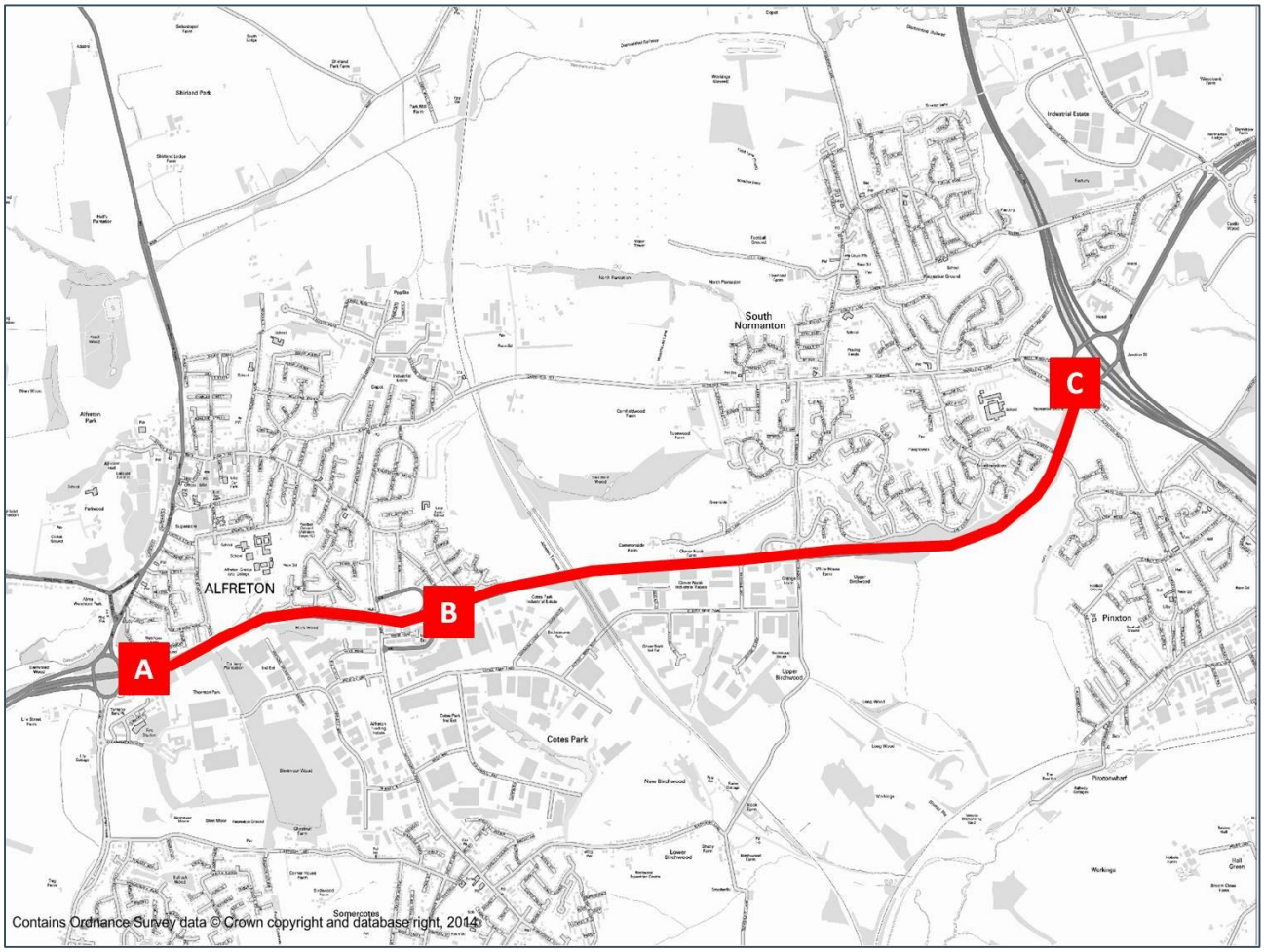
4.1. This section compares journey times before and after the scheme opening, in order to understand whether the scheme achieved its aim of reducing journey times to the junction.

Data Sources

4.2. For the journey time analysis, data was taken from the Highways Agency's Journey Time Database (JTDB). Satellite navigation (sat nav) data was also obtained to verify this and to inform pre- and post-scheme journey times. The sat nav data is available from some motorists who use satellite navigation devices and allow their data to be used anonymously for the purpose of generating travel statistics. This data can provide crucial intelligence on the operation of the highway network. The data also has the benefit of being historic, so that it is possible to retrieve pre-scheme journey time data after the scheme has opened.

4.3. The geographical areas used for both data sources is shown in **Figure 4-1**. The JTDB information runs from point A to point C, due to the availability of data, while the satellite navigation data runs from point B to point C.

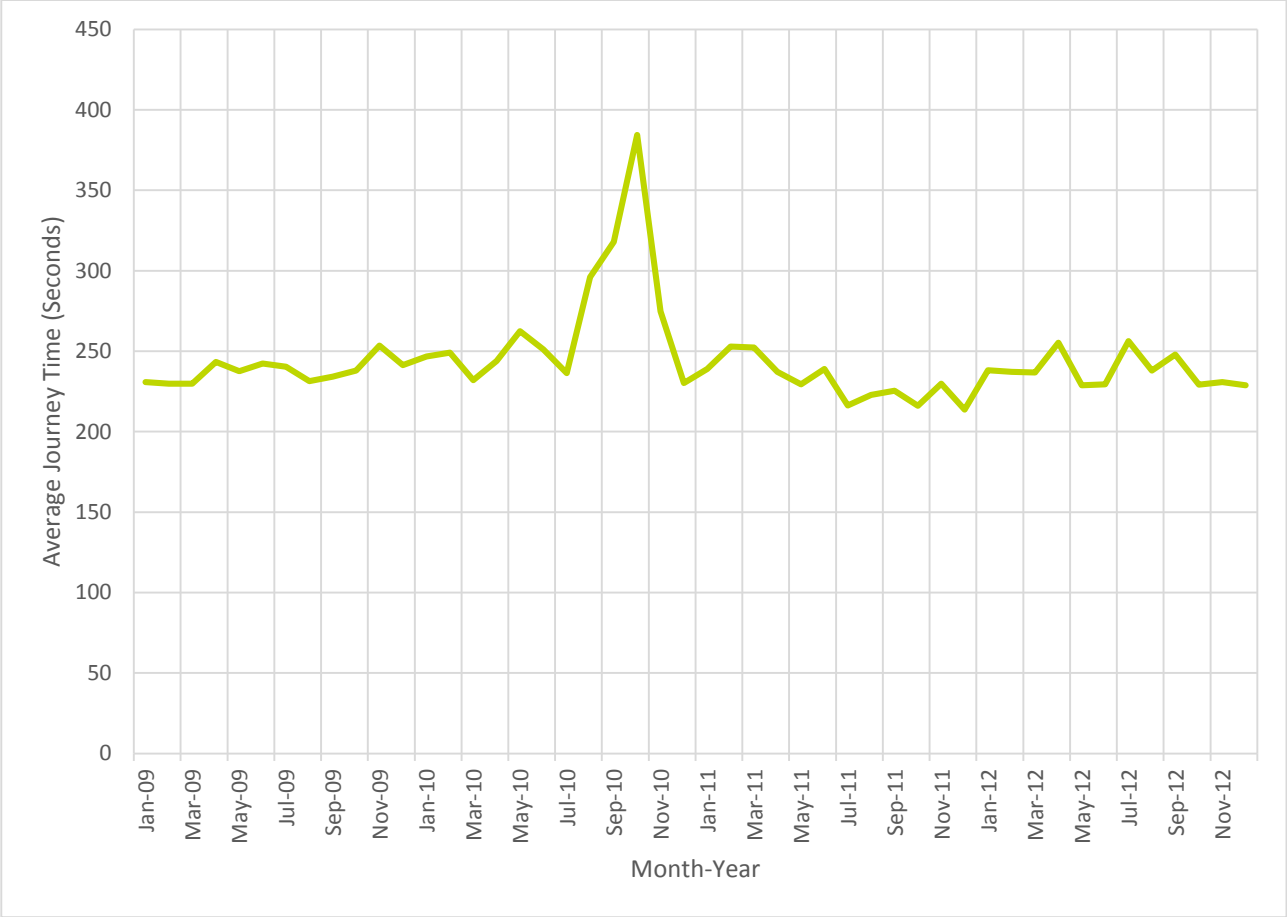
Figure 4-1 Journey Time Areas



Journey Time Database

4.4. JTDB data was used to understand what has happened over time and during construction in terms of journey times. **Figure 4-2** shows average travel times for a weekday.

Figure 4-2 Journey Times- JTDB



4.5. The data shows that journey times were longer during the construction period, which was to be expected. However, these longer journey times continued in to November, even though it was initially believed that the scheme had opened in October. From December onwards there is a lower, more consistent figure. Therefore, the JTDB seems to suggest that the scheme may have opened later than originally thought- sometime during November. This will be used to inform our detailed satellite navigation analysis.

Satellite Navigation Data

4.6. Satellite navigation data was obtained in order to understand the patterns suggested by the JTDB more thoroughly and to provide a more detailed analysis.

4.7. Due to the apparent longer construction period suggested by the JTDB, the 'after' period data was taken from 01/12/2010 – 30/11/2011, avoiding the month

of November 2010 (the scheme opening date). The ‘before’ period comprises 01/08/2009 – 31/07/2010.

4.8. To analyse where journey time benefits or dis-benefits had occurred, data was divided into several time periods. These were chosen by studying diurnal flow TRADS data to provide six clear datasets in which the volume of traffic was similar. These were as follows:

- Overnight;
- AM Peak (weekday);
- PM Peak (weekday);
- Weekend Day;
- Inter-Peak (weekday); and
- Ramping (ramping up and ramping down in traffic flows, sometimes referred to as shoulder peaks. This is the period just before or after weekday AM and PM peaks when traffic volumes are still relatively high but increasing/decreasing from peak conditions).

Journey Time Comparison

4.9. This section compares journey times experienced one year before the scheme and one year after the scheme, as per the dates stated in Paragraph 4.7. **Table 4.1** shows this data by each time period.

Table 4.1 – Comparison of Pre- and Post-Scheme Journey Times

Time Period	Pre-Scheme Average Travel Time (mm:ss)	Post-Scheme Average Travel Time (mm:ss)	Difference in Average Travel Time (mm:ss)
Overnight	02:34	02:38	+00:04
AM Peak	05:41	04:15	-01:26
PM Peak	05:12	05:24	+00:12
Weekend Day	02:28	02:33	+00:05
Inter-Peak	03:19	03:21	+00:02
Ramping	02:56	03:38	+00:42

Negative values indicate a journey time saving and hence a benefit. Positive values indicate an increase in journey time and hence a dis-benefit. These points are also applicable to other tables in this report.

4.10. Journey time benefits of more than ten seconds are highlighted in green while dis-benefits are shown in grey. Only changes of over 10 seconds are analysed, as these are likely to show a more substantial change above natural fluctuations.

4.11. **Table 4.1** shows that overnight journey times are 2:34 minutes pre-scheme, which provides an indication of free-flow journey times. This is matched by the weekend day and ramping periods, which may have also been fairly free-flowing. There is clearly a substantial delay in the AM and PM peaks, with pre-scheme journey times in excess of five minutes. Some (albeit smaller) delays are experienced in the inter-peak period, with journey times of around three minutes.

4.12. The change from pre- to post-scheme during the AM peak is substantial, with vehicles experiencing around half the delay compared to before the scheme was implemented. However, some delay is still being experienced, as the outturn journey time is still higher than the pre-scheme free-flow. There are small increases in journey times experienced during the PM and ramping periods. Following the scheme opening, journey times have increased slightly, albeit by less than five seconds per vehicle in most periods and hence this is not significant. During the AM peak, where journey time delays were experienced pre-scheme, there has been a clear benefit.

Calculation of Annual Vehicle Hour Benefits

4.13. The process of annualising the journey time savings involved using traffic flows and hours per week to convert to annual vehicle hours saved, bearing in mind the proportion of time over the year each time period comprises. The total resulting vehicle hour savings are summarised in **Table 4.2**.

Table 4.2 – Comparison of Pre- and Post-Scheme Journey Times

Time Period	Difference in Average Travel Time (mm:ss)	Hours in week	Average flow	Annual Vehicle Hours Saved
AM Peak	-01:26	10	2104.9	-26.147.5
PM Peak	+00:12	10	1987.8	3445.5
Ramping	+00:42	15	1269.7	11554.5
Total				-11,147

4.14. The dis-benefits realised in the PM and ramping periods are outweighed by the larger benefits achieved during the AM peak. Overall, across the three time periods, the scheme has resulted in an annual vehicle hour saving of -11,147.

4.15. Although a journey time saving, the PAR predicted a higher saving of 80,196 hours during the opening year, but the scheme has not performed to this level. However, the PAR suggests that the AM peak would show the greatest saving, which matches these results. As predicted, there were no savings overnight or during the inter-peak period, or during the weekend day (these time periods used in the PAR are roughly similar to the ones used to obtain sat nav data but caution must be exercised).

4.16. The PAR also states that the PM peak should see journey time benefits. As shown in **Table 4.1**, the PM peak instead experiences increased journey times after the scheme, as does the ramping period.

4.17. The dis-benefits shown in some time periods are surprising. It is very uncommon for a scheme to add capacity and have a negative impact on journey times in some periods. One possible explanation is that the signal timings at this junction could have changed since the scheme was implemented.

4.18. Therefore, in order to understand the dis-benefits that are occurring in some of the time periods, the MAC was contacted to ascertain whether any changes to the signals were made as part of this scheme, which might help to explain the increase in journey times. The points made by the MAC were as follows:

- Although no changes were made as part of the scheme, the MOVA controlled signals at Junction 28 had not been validated and had been experiencing issues for a period of time; and
- A high volume of traffic and congestion on the M1 leads to the junction becoming blocked due to a longer green-time phase for the M1 northbound off-slip.

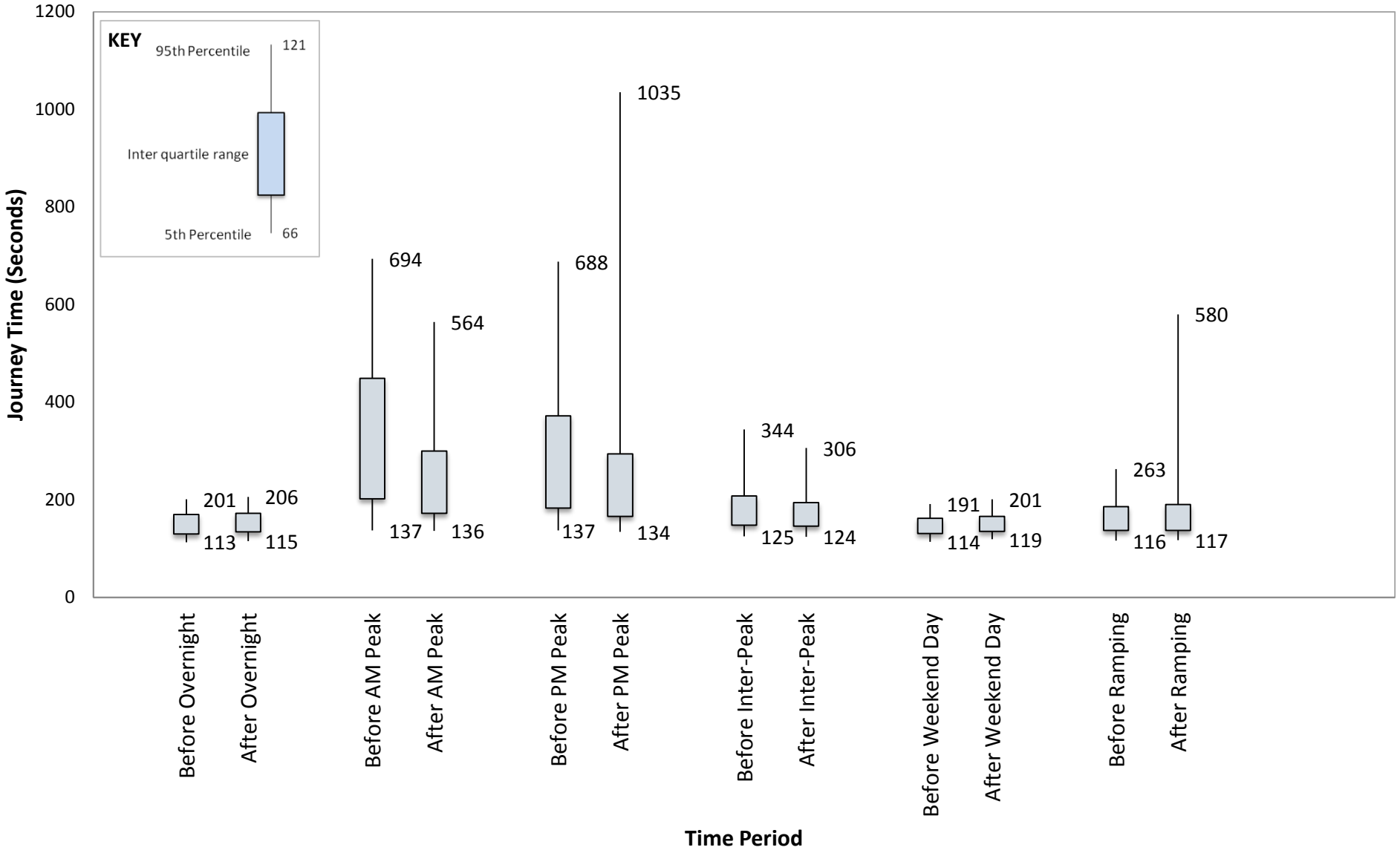
4.19. A faulty MOVA system could mean that the signals are not working optimally and hence potentially cause delays on the A38 eastbound approach. Additionally, the congestion caused by the M1 could be a result of the widening scheme on the motorway, as there will be more traffic using the M1 now than prior to the scheme. As such there is likely to be more traffic using the off-slip, which, if controlled by MOVA, is likely to result in longer green-time for this arm to avoid queues building on to the motorway. However, unfortunately no TRADS data exists to examine whether more traffic is present on this off-slip. Overall, due to the benefits received in the AM peak, the scheme has been successful at reducing average journey times to the junction from this arm.

Journey Time Reliability

4.20. The journey times retrieved from sat nav data were analysed to understand journey time reliability, and whether this has improved since the scheme opened.

4.21. **Figure 4-3** shows the results of the reliability analysis. While some time periods show that reliability has remained relatively unchanged since the construction of the scheme, such as the overnight period, others show larger differences.

Figure 4-3 Journey Time Reliability



4.22. **Figure 4-3** illustrates that all periods show an interquartile range which is either better than pre-scheme or the same following the scheme. The minimum journey times remain consistent before and after also. Therefore, we can be confident that for most users, reliability is either the same or has improved. Having said that, a small number of drivers may experience even longer journey times delays compared to before the scheme was built. This issue appears to be due to days on which extreme congestion occurred, which is best demonstrated by the 95th percentile, which worsens most noticeably during the PM peak and ramping periods and has improved during the AM peak period. In general, reliability has improved, which means this can be scored as beneficial in the EST.

Summary

4.23. This section has discussed journey times and reliability along the A38. Although there have been benefits in the AM peak, these are undermined somewhat by dis-benefits occurring during the PM peak and ramping periods.

4.24. It is unusual for a widening scheme to experience dis-benefits in some time periods, but these results are likely to have been impacted by congestion issues on the neighbouring M1 and associated traffic signal problems at Junction 28. The signals specialist at the MAC suggested that a build-up of traffic on the M1 northbound off-slip quickly results in congestion at the junction on other arms as the signals attempt to alleviate issues on the slip road. The IDT Project Manager concurred in the stakeholder feedback, making similar observations that congestion on the M1 impacts on Junction 28. The MAC also stated that the traffic signal issues were never resolved. With more ongoing works taking place and planned for the M1, the problems with the signals could be solved in future. This is likely to be the explanation for the dis-benefits in journey times in some time periods, as widening schemes are unlikely to cause longer journey times without changes to either traffic signals or flows.

4.25. With these nearby issues explained, it is clear that while there are dis-benefits in some time periods, the junction is likely to have experienced even greater dis-benefits if this widening scheme had not gone ahead, as the new layout should make more efficient use of any green time allotted to the A38 eastbound approach.

4.26. Despite these issues, the scheme has still been successful for both annual vehicle hour reduction overall and for improved journey time reliability, due to the improvements demonstrated in the AM peak.

5. Safety Impacts

Introduction

5.1. A critical component of any highway scheme is safety. Irrespective of whether a scheme is intended to reduce accidents or not, it is imperative to consider the safety record pre- and post-scheme to understand whether the scheme has had an impact on accidents.

5.2. Although this is an economy scheme, with the main benefits being attributed to a decrease in congestion and journey times, it was predicted that the scheme would also have a beneficial impact on safety. The PAR predicted a saving of one Personal Injury Collision (PIC) during the opening year, and therefore a total of 63 accidents[1] saved over the whole assessment period. This means that although this is classified as an economy scheme, and the majority of the scheme's benefits will be in journey times, a small proportion of benefits were expected from safety aspects. This section seeks to understand whether this was achieved by comparing pre- and post-scheme accident data.

5.3. More specifically, this chapter:

- Observes any changes to the number, location and causation of PICs;
- Establishes whether the scheme has achieved its predicted accident saving of one accident during the opening year; and
- Determines whether the scheme has resulted in an overall safety benefit or dis-benefit.

5.4. A conclusion regarding the level of accident change due to the scheme is drawn.

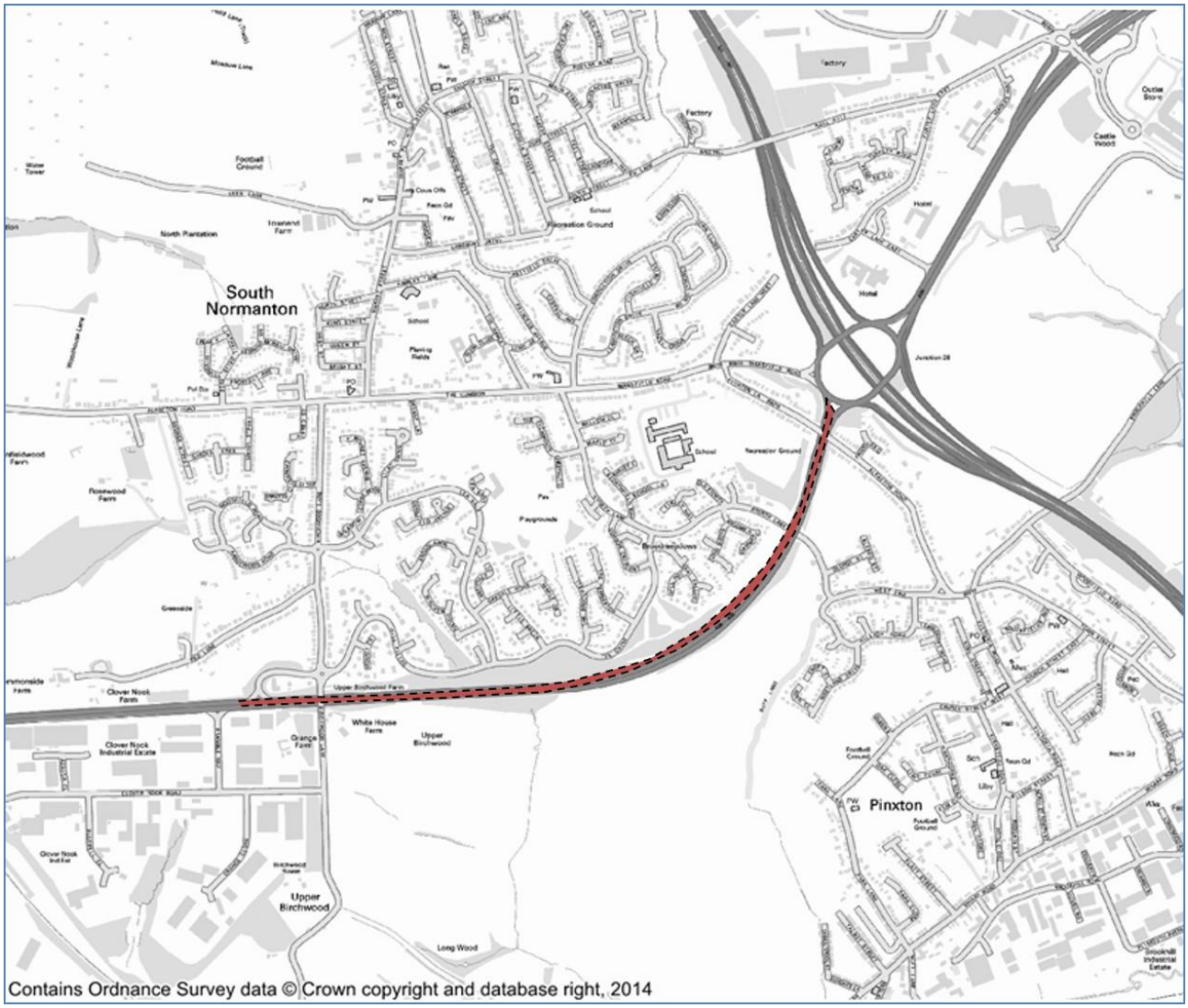
Data Sources

5.5. Accident data was requested from the MAC in STATS19 format in order to look at the period five years before the scheme was implemented.

5.6. The area over which accidents are considered is shown as the red highlighted area in **Figure 5-1**. The geographic area covered is along the A38 eastbound approach to the M1 junction, from the B6019 Clover Nook Junction to the stop line of the roundabout at Junction 28. This area was used in the PAR and has been reconstructed to analyse accidents recorded in the STATS19 data.

[1] All references to accidents in this report refer to Personal Injury Collisions (PICs).
The accident data referred to in this report has not necessarily been derived from the national validated accident statistics produced by Department for Transport (DfT). As such, the data may subsequently be found to be incomplete or contain inaccuracies. The requirement for up-to date information and site specific data was a consideration in the decision to use non-validated data and, as it is sourced from Local Processing Units through the Managing Agent Contractors or Asset Support Contractors, it is sufficiently robust for use in this context.

Figure 5-1 Accident Analysis Area



Comparison of Pre- and Post-Scheme Accidents

5.7. The appraisal summary table (AST), which was completed as part of the PAR, claims that driver forward visibility would be improved by the scheme, which included verge clearance. Therefore, reaction times will be improved. The PAR states that several accidents which occurred before the scheme was constructed involved rear shunts and lane swerve manoeuvres. This logic led to the forecast of one accident saved in the opening year.

5.8. The PAR covers the evidence used to support the decision to proceed with the scheme, effectively outlining the business case. However, once a PAR has been completed and agreed, there can be a time delay before the start of scheme construction.

5.9. The delay between collecting evidence for a scheme and starting construction means that the accident data used to evidence the situation before the scheme is often dated. In this case, the accident data in the PAR covered a date range up to March 2009, meaning there is a gap in accident data between this date and the beginning of scheme construction in August 2010, during which time the accident rate could have changed.

5.10. As such, to understand just the impact of the scheme, a five year pre-construction accident analysis represents a better comparison to the outturn accident rate than the PAR data.

5.11. Data has thus been analysed from the period of August 2005 up to the end of July 2010. **Table 5.1** shows this data by each year before construction. The main points to note from **Table 5.1** are as follows:

- A total of 25 accidents occurred during the five years before construction – a pre-scheme accident rate of 5.0;
- One fatal and one serious accident occurred during this period, but the majority of accidents were classed as slight in severity (Severity Index of 8%); and
- The accidents were distributed over the five years, although the most accidents occurred during the year after August 2008.

5.12. It is worth noting that the initial implementation of the third lane occurred in 2006, along with alterations to the signals at the roundabout. This may have had an impact on the number of accidents, which was reduced from 2006 – 2007.

Table 5.1 – Five Years Pre-Construction

12 Month Period From	Fatal	Serious	Slight	Total
01/08/2005	0	0	6	6
01/08/2006	1	0	4	5
01/08/2007	0	1	2	3
01/08/2008	0	0	8	8
01/08/2009	0	0	3	3
Total	1	1	23	**25**
			Pre-Scheme Accident Rate	**5.0**
			Severity Index	**8%**

Construction Period

5.13. During the construction period, which took place between August and November 2010, two accidents occurred within the analysis area. Both of these happened during August and were classed as slight. One of these occurred within the road works area but appears to have involved an animal as the cause rather than the works. The construction period has not been included in this analysis.

Post-Scheme

5.14. The number of accidents saved has been analysed, by comparing the pre-scheme accident data in **Table 5.1** with post-scheme data. **Table 5.2** shows the number of accidents which occurred during the post-scheme period- a three-year period from December 2010.

5.15. The pre-scheme data shows that there was an average of 5.0 accidents per year, yet post-scheme there has been an average of 5.7 accidents, resulting in an increase in accidents of 0.7 per year since scheme opening.

5.16. There has been an increase of 10% in the Severity Index. However, there has been a reduction in fatal accidents, as no fatalities occurred during the post-scheme period.

Table 5.2 – Post-Scheme

12 Month Period From	Fatal	Serious	Slight	Total
01/12/2010	0	0	6	6
01/12/2011	0	0	1	1
01/12/2012	0	3	7	10
Total	0	3	14	17
			Post-Scheme Accident Rate	**5.7**
			Saving	**-0.7**
			Severity Index	**18%**

5.17. **Figure 5-2** compares the location of pre- and post-scheme accidents. The top figure shows the accidents which occurred before the scheme opened while the bottom figure shows the accidents which occurred during post-scheme period. The plots are coded according to the severity of the accident.

5.18. **Figure 5-2** shows that, during the pre-scheme period, a cluster of accidents occurred at the Clover Nook junction, which joins the A38 eastbound approach to Junction 28. This is also where the fatal accident occurred.

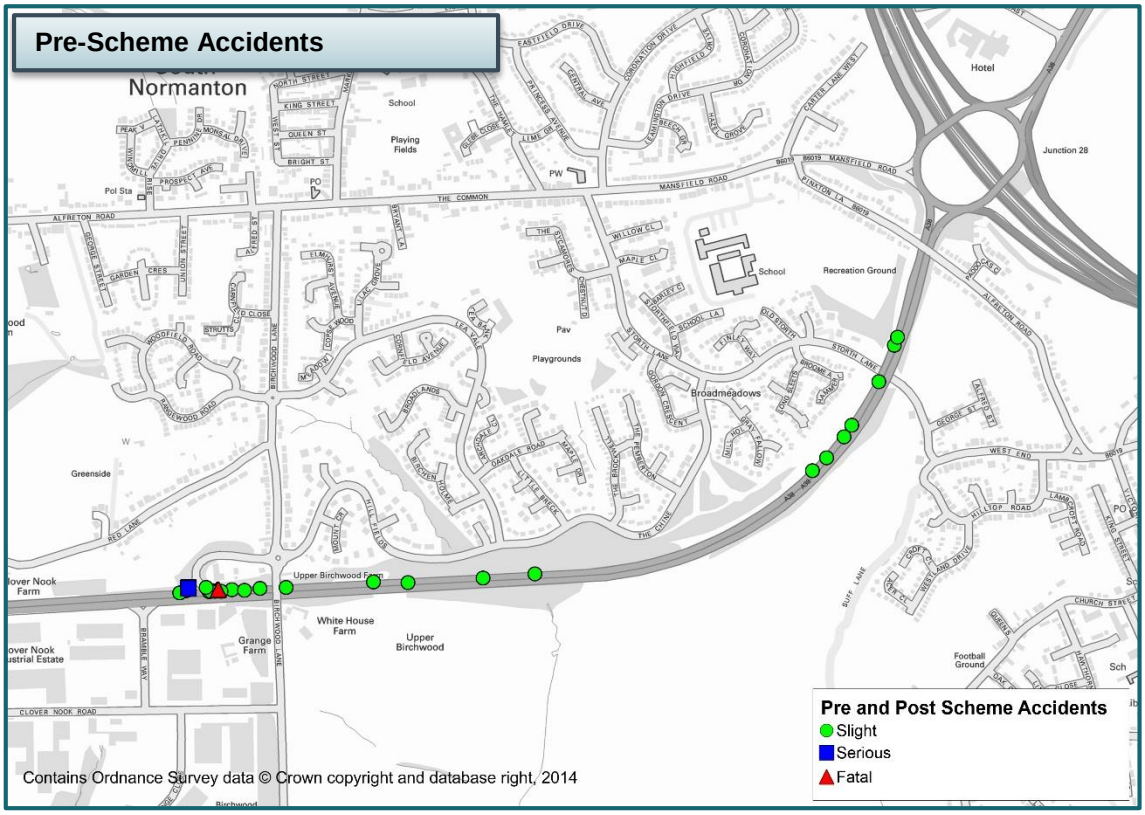
5.19. The AMScott report states that queue lengths of two or three miles had been experienced regardless of the time of day before the improvements made in 2006. This means that traffic would have been queuing past the Clover Nook junction. The report also states that queues were erratic. This uncertainty could have led to a higher number of accidents at the Clover Nook junction, with speeds and congestion at varying levels at any time of day, making it difficult for traffic to join the A38 from the on-slip at Clover Nook. The reduction in accidents at this cluster site could therefore be attributed to both of the widening schemes which have occurred at Junction 28.

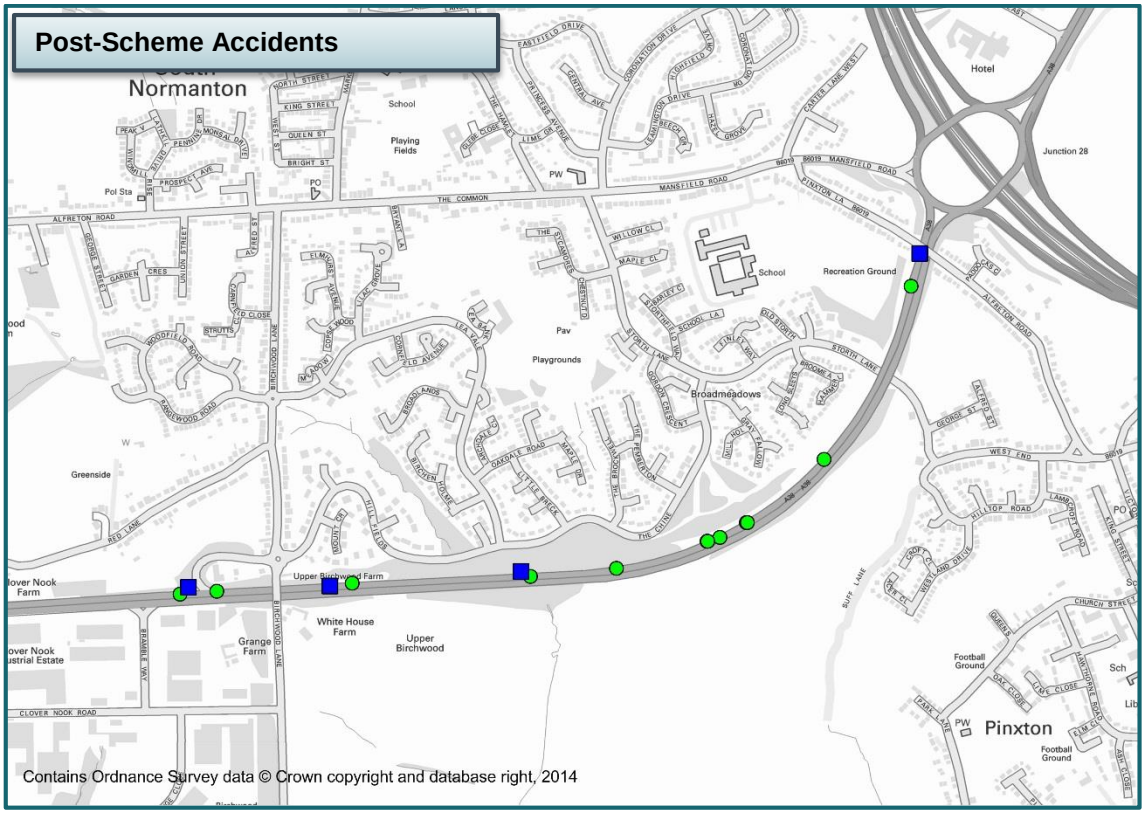
5.20. The AMScott report suggests that delays of three to four minutes were still experienced during peak periods after 2006, meaning that traffic was queuing for approximately one mile- the distance to the Clover Nook junction. Despite these queues, the report states that they only occurred during peak times, which might offer some more consistency in traffic queues and flow at this location.

5.21. The PAR stated that a number of pre-scheme accidents were lane swerve manoeuvres and shunt type accidents. There are, in fact, slightly more accidents relating to ‘slowing, stopped, waiting or moving off’ manoeuvres (4.0 per year compared with 3.2 per year pre-scheme), which would imply that these types of accidents have not decreased with the implementation of the scheme.

5.22. The accident rate has barely changed from pre- to post-scheme beyond natural fluctuations. There has been a slight increase in accidents, and therefore this element is classed as a slight dis-benefit.

Figure 5-2 Pre- and Post-Scheme Accidents





Summary

5.23. While the scheme aimed to reduce accidents, there appears to be little evidence of this occurring during the post-scheme period. There was instead a slight increase in accidents.

6. Economy

Introduction

6.1. This section of the report takes the journey time and safety impacts reported in Sections 4 and 5, and considers the monetary value of these impacts. These monetised benefits are then compared to the cost of scheme construction to inform the following two measures of value for money:

- **First Year Rate of Return (FYRR):** This is a measure of the scheme's first year benefits as a proportion of the scheme cost. It is given as a percentage and informs the percentage of the scheme costs recouped in the opening year. The FYRR given is evidence-based and a primary finding of this report; and
- **Benefit Cost Ratio (BCR):** This is a measure of all the benefits that the scheme is likely to accrue over its workable life divided by the scheme cost over its life. This can only be a prediction, as this is a one year after opening report and it is not known how the scheme will perform in the future. However, this forecast is revised from that provided in the PAR based on the first year evidence.

6.2. All monetised figures in this section are quoted in 2002 prices, discounted to opening year, unless otherwise specified.

PAR and Outturn Comparison

6.3. The evidence provided in this report has been analysed to evaluate the scheme costs and economic benefits of the scheme provided in the PAR and to calculate the outturn costs and scheme benefits.

6.4. **Table 6.1** provides this comparison between the PAR and Outturn costs and benefits of the scheme. It also includes the opening year and scheme life costs and benefits of the scheme. The journey time and accident benefits of the scheme discussed earlier in the report have been monetised using standard value of time and accident values from WebTAG. This is undertaken to understand whether the monetised scheme benefits offset the cost of scheme implementation and assess the overall value for money of the scheme.

Table 6.1 – PAR and Outturn Comparison

		PAR	Outturn
Opening Year (2012)	Total Cost	£1.152m	£1.379m
	Opening Year Accident Saving (number)	1	-0.7
	Opening Year Accident Saving (£)	£0.089m	-£0.059m
	Opening Year Vehicle Hours Saving (number)	-80,196	-11,147
	Opening Year Journey Time Benefits (£)	£1.044m	£0.145m
	FYRR	98%	6%
Scheme Life (60 years)	Costs	£1.152m	£1.379m
	Safety Benefits	£4.791	-£3.194m
	Journey Time Benefits	£57.016m	£5.662m
	BCR	49.5	2.9

6.5. The key points to note from **Table 6.1** are as follows:

- The total cost was slightly higher than predicted in the PAR - the scheme cost a total of £1.379m;
- While the PAR stated that there would be an accident saving of one accident per year, the post-scheme data shows a small dis-benefit of -0.7, which results in a monetary dis-benefit of -£0.059m;
- While a total of 80,196 vehicle hours were predicted to be saved, only 11,147 vehicle hours were actually saved during the opening year;
- This leads to a monetary journey time benefit of £0.145m, compared to the £1.044 predicted benefit;
- The scheme was predicted to have recouped almost the entire cost of the scheme during the opening year. The scheme instead reclaimed 6%;
- Over the scheme life, the PAR stated a figure of £4.791m safety benefits, although this is more likely to be a loss of £3.194m; and
- The outturn BCR was 2.9, compared with a predicted BCR of 49.5.

Summary

6.6. The scheme has not satisfied the monetary benefits it sought to achieve. Journey time benefits were achieved, although these were not to the extent predicted in the PAR, and the slight increase in accidents led to a dis-benefit in terms of monetary safety benefits. Although the number of accidents did not change dramatically, the total dis-benefits attributed to this were small in comparison to the journey time benefits.

6.7. While the scheme has not performed to its predictions, the journey time benefits outweigh the accident dis-benefits and so the scheme does deliver benefits overall, shown by the BCR of 2.9.

7. Environment, Accessibility and Integration

Introduction

7.1. This section of the report presents information relating to the New Approach to Appraisal (NATA) objectives of environment, accessibility and integration. This information will be compared to the forecasts made in the PAR's Appraisal Summary Table (AST) (provided in **Appendix A**). These comparisons are used to score the scheme against the NATA objectives based on first year observed findings, and are recorded in the Evaluation Summary Table (EST). This can be found in **Appendix B**.

Environmental Impacts

7.2. One environmental factor was considered to be applicable in the AST, which predicted that journey ambience would improve as part of the scheme. The PAR states that wider lane approaches to the roundabout would improve capacity and reduce frustration and stress, as queues would be shorter in length. This impact was classed as **moderate beneficial**.

7.3. The site visit confirmed that while some queuing occurred during the AM peak period, traffic moved well and journey times were shorter than stated in the PAR pre-scheme. This is reaffirmed by the sat nav journey time data and the stakeholder feedback received. However, this may not be the case during the PM peak, as delays are still being experienced during this period.

7.4. Accidents have marginally increased, which will have a slight negative impact on journey ambience. This is likely to be offset by the fact that better advanced signing helps reduce driver stress to find the right lane.

7.5. On balance, journey ambience has been scored in the EST as **slight beneficial**.

7.6. Even though the scheme involved verge clearance, this clearance did not have an impact on any protected species or breeding birds and did not affect local habitats and hence biodiversity has been scored as **neutral** in the EST.

7.7. All other environment sub-objectives have been assessed as being **not applicable.**

Accessibility Impacts

7.8. The scheme, being on the mainline A38 dual carriageway, has no measures aimed at improving accessibility. Therefore, all impacts have been classed as **not applicable**.

Integration Impacts

7.9. The scheme makes no reference to wider policies nor does it link with transport interchange facilities, so all impacts are **not applicable**.

8. Conclusions

Introduction

8.1. This section draws conclusions of the report and seeks to understand whether the scheme satisfied its objectives.

Conclusions

8.2. The M1 J28 – A38 Eastbound Approach LNMS aimed to reduce journey time delays during the peak periods. An additional benefit was expected in the form of an accident saving.

8.3. This report has considered pre-scheme and post-scheme data for factors including journey times and safety, with a view to understanding whether this scheme achieved its aims.

8.4. A small safety benefit was expected, with a saving of one accident during the opening year predicted. The outturn result showed that there were slightly more (0.7) accidents during the post-scheme period, and the Severity Index was higher.

8.5. There was a reduction in journey times during the AM peak, but journey times increase during the PM peak and ramping periods. The AM peak saving was substantial at 1 minute 26 seconds per vehicle. Roughly halving the delay seen in this period. The increases in journey time in the other periods are smaller, and when annualised the AM peak benefits outweigh the dis-benefits in the PM and ramping periods, leaving the scheme with an overall journey time benefit.

8.6. Journey time reliability has increased in general, although a small proportion of drivers will experience extended journey times.

8.7. It is possible that the scheme is impacted by wider issues, causing the negative findings in some time periods. Stakeholder feedback and conversations with the MAC produced similar responses - a high volume traffic exiting the M1 on to Junction 28 quickly results in congestion on the roundabout. Additionally, this problem may be exacerbated by problems with the traffic signals. The MAC stated that there are some faults in the signals at Junction 28, and these have not been resolved. The MOVA system is likely to move green time away from the A38 arm in response to the increased flow on the M1 since the widening scheme, and so this may contribute to the scheme performance.

8.8. If these conclusions are correct, this would suggest that without the M1 J28 – A38 Eastbound Approach LNMS increasing the capacity, the situation at the junction would be worse than reported. If the A38 arm is receiving less green time at the signal, then having 3 lanes of traffic at the stop line will increase its efficiency during this green time. Therefore, however this scheme performs, it is likely that the scheme has helped to facilitate an improved situation at Junction 28 than there would be without the additional capacity.

Appendices

Appendix A. AST

OBJECTIVE	Sub-Objective		Qualitative Impact	Quantitative Measures	Assessment
ENVIRONMENT	Noise		Not applicable	N/A	N/A
	Local Air Quality		Not applicable	N/A	N/A
	Greenhouse Gases		Not applicable	N/A	N/A
	Landscape		Not applicable	N/A	N/A
	Townscape		Not applicable	N/A	N/A
	Heritage and Historical		Not applicable	N/A	N/A
	Biodiversity		Not applicable	N/A	N/A
	Water Environment		Not applicable	N/A	N/A
	Physical Fitness		Not applicable	N/A	N/A
	Journey Ambience		Better facilities through wider lane approaches to roundabout, improving capacity, reduced stress, frustration through shorter queues.	-	Moderate Beneficial
SAFETY	Accidents		By extending the 3 lane approach capacity from 70m to approx. 300m in advance of the roundabout, including central reserve widening and extensive verge clearance will improve driver forward visibility and thus reaction times on approaching the junction. A number of existing accidents involve rear shunts and lane swerve manoeuvres and it is expected that these will be reduced. Whilst accident reduction is not anticipated to be substantial it has been valued as minimal (1 per year).	63 accidents saved.	£3.638m Accident PVB
	Security		Not applicable	N/A	N/A
ECONOMY	Public Accounts		None	None	£0.875m
	All Users & Providers		None	Reduction in journey time delays	£39,660.062m All Users + Providers PVB…
	Reliability	DDV	Improved reliability through reduced queuing	Improved reliability through reduced queuing	£0.000m DDV PVB
		IRV	Improved reliability through reduced queuing	Improved reliability through reduced queuing	Moderate Beneficial
	Wider Economic Impacts		Not applicable	N/A	N/A
ACCESSIBILITY	Option Values		Not applicable	N/A	N/A
	Severance		Not applicable	N/A	N/A
	Access to Transport System		Not applicable	N/A	N/A
INTEGRATION	Transport Interchange		Not applicable	N/A	N/A
	Land Use Policy		Not applicable	N/A	N/A
	Other Government Policies		Not applicable	N/A	N/A

Appendix B. EST

OBJECTIVE	Sub-Objective		Qualitative Impact	Quantitative Measures	Assessment
ENVIRONMENT	Noise		Not applicable	N/A	N/A
	Local Air Quality		Not applicable	N/A	N/A
	Greenhouse Gases		Not applicable	N/A	N/A
	Landscape		Not applicable	N/A	N/A
	Townscape		Not applicable	N/A	N/A
	Heritage and Historical Resources		Not applicable	N/A	N/A
	Biodiversity		No impact on protected species	-	Neutral
	Water Environment		Not applicable	N/A	N/A
	Physical Fitness		Not applicable	N/A	N/A
	Journey Ambience		Some improvements to journey times, particularly during the AM peak. However, benefits were not as substantial as predicted in the PAR.	-	Slight Beneficial
SAFETY	Accidents		The accident rate has increased slightly since the completion of the scheme. Accident rates before the scheme were observed as 5.0 per annum in the pre-construction period. Post-scheme, there have been 5.7 accidents per annum.	-42 accidents saved	-£3.194m Accident PVB
	Security		Not applicable	N/A	N/A
ECONOMY	Public Accounts		None	None	£1.379m
	All Users & Providers		Reliability has improved in the AM peak	Improved reliability through reduced	£0.000m DDV PVB
	Reliability	DDV	Reliability has improved in the AM peak.	Improved reliability through reduced queuing	£0.000m DDV PVB
		IRV	Reliability has improved in the AM peak.	Improved reliability through reduced queuing	Slight Beneficial
	Wider Economic Impacts		Not applicable	N/A	N/A
ACCESSIBILITY	Option Values		Not applicable	N/A	N/A
	Severance		Not applicable	N/A	N/A
	Access to Transport System		Not applicable	N/A	N/A
INTEGRATION	Transport Interchange		Not applicable	N/A	N/A
	Land Use Policy		Not applicable	N/A	N/A
	Other Government Policies		Not applicable	N/A	N/A