ITEM 10

North Yorkshire County Council

Transport, Economy and Environment Overview and Scrutiny Committee

5 September 2012

Work Programme Report

1. Purpose of Report

This report asks the Committee to:

a. Note the information in the report;

b. Confirm, amend, remove or add to the list of matters shown on the work programme.

2. **Annex 1** shows the Committee's future work programme. Members are asked to review the programme and suggest any items to be added, removed or amended.

3. **Minerals & Waste Development Framework Task Group**
At the meeting of the Transport, Economy & Environment O&SC meeting on the 17 July 2012 Members agreed to receive the notes of the Minerals & Waste Development Framework Task Group meetings. Please find the notes of the meeting on the 21 May 2012 attached as Annex 2.

4. **Special meeting 15th August 2012**
On the 15th August 2012 the Transport, Economy & Environment O&SC held a special meeting with Roger Wantling of the Highways Agency to look at issues surrounding the A64. Further information was requested on:

I. **A copy of the Highways Agency report on the Hopgrove Roundabout**
The draft report is attached as Annex 3

II. **Sequencing of the traffic lights on Hopgrove Roundabout**
Feedback will be provided to the Committee as soon as it is available.

III. **Any information available on a Rillington bypass scheme**
The A64 Rillington Bypass scheme remains on hold. It is not in any current programme for future delivery or development by the Highways Agency.

IV. **Costs associated with the Brambling Fields scheme**
This update report is contained in Annex 4 and has been printed separately for the rest of the agenda. It contains exempt information as defined in paragraph 3 of Part 1 of Schedule 12A to the Local Government Act 1972 as amended by the Local Government (Access to Information)(Variation) Order 2006.

5. **Recommendations**

Members are recommended to:

a. Note the information in this report;

b. Note the information in Annex 3 and 4

c. Agree the Committee’s work programme and suggest items to be added or amended

Bryon Hunter
Scrutiny Team Leader
County Hall
NORTHALLERTON

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Date:	August 2012
Report presented by:	Lorraine Laverton
Background documents:	None
Annexes:	Annex 1: Work Programme Annex 2: Minerals & waste Development Framework Notes Annex 3: Highways Agency report on Hopgrove Roundabout

TRANSPORT, ECONOMY AND ENVIRONMENT OVERVIEW & SCRUTINY COMMITTEE
FORWARD WORK PROGRAMME 2012/13

SUBJECT	PURPOSE/OBJECTIVE	REPORT FROM	MEETING DATE
Consultation, progress and performance monitoring reports			
Corporate Director and / or Executive Member update	Regular update report as available each meeting	David Bowe C Cllr Chris Metcalfe C Cllr Gareth Dadd	Each meeting as available
Civil Parking Enforcement Final Business Case	For comment	Tom Bryant	5 Sept 2012
Flood Risk Management Strategy	For comment	Mark Young	5 Sept 2012
Street Lighting	Update report	Paul Gilmore	5 Sept 2012
Winter Maintenance Service	Regular update report on the winter maintenance service	Mike Roberts	5 Sept 2012
The use and management of Unsurfaced, Unclassified Roads (UUR)	Response of consultation for comment before presentation to the Executive	Doug Huzzard	7 Nov 2012
Climate Change Strategy and Action Plan	Update report on performance against the action plan	Neil Irving	7 Nov 2012
Small Steps Big Difference – NYCC Internal Environmental campaign	Update report	Lesley Dale	7 Nov 2012
Airport Consultative Committee representatives	Annual report by the County Council's representatives on: Leeds/Bradford International Airport Durham and Tees Valley Airport Robin Hood Airport	Cllrs Cliff Trotter, David Jeffels and Chris Pearson	7 Nov 2012
Improving habitats for biodiversity	Progress report on pilot schemes in North Yorkshire schools / Tenant Farms	Matt Millington	7 Nov 2012
Public Rights of Way	Overview of the Public Rights of Way Service, including future issues.	Aidan Taylor	7 Nov 2012
North Yorkshire County Council's policy on energy use in schools	Overview of actions that NYCC undertakes to encourage schools to reduce their carbon footprint, in particular heating; use of new technologies such as Biomass.	Peter Bright	7 Nov 2012

Economic Development		Various	23 January 2013
Community Transport Funding	Discussion Paper	John Laking	23 Jan 2013
Member working groups			
Working group on the Minerals and Waste Development Framework	To contribute to the preparation of new spatial planning policies for minerals and waste.	Working group Chair is Cllr John Blackburn	Notes of meetings will be appended to the Work programme report
Vehicle Activated Signs protocols	To contribute to the review of VAS protocols	County Councillors David Jeffels, Michael Heseltine, Robert Heseltine, Mike Jordan, John Savage	5 September 2012
Possible overview reports and presentations from external partner organisations			
Finance Yorkshire	Finance Yorkshire offers seedcorn finance, business loans and equity-linked finance for businesses in or relocating to the Yorkshire and Humber region		To be scheduled
Rail services	To give an update on current and planned rail services affecting North Yorkshire. Feedback from Rail User Group	Rail operating companies Rail User Group	To be scheduled
Promoting access to our heritage	To give an overview and promote discussion	English Heritage	To be scheduled

Committee meeting dates 2012 –5 September, 7 November, 23 Jan 2013, 17 April 2013

Mid cycle briefing dates 2012 –17 Oct, 20 Dec 2012

North Yorkshire County Council Transport, Economy & Environment Overview and Scrutiny Committee

Member Working Group on the Minerals and Waste Development Framework

Notes of Meeting held at County Hall, Northallerton on 21st May 2012

<u>Present</u>

Cllr John Blackburn
Cllr Geoff Webber
Cllr Heather Moorhouse
Cllr David Ireton
Cllr John Fort
Cllr John McCartney

Rob Smith, Team Leader, Plans and Technical Services

Vicky Perkin, Head of Planning Services

Lorraine Laverton Corporate Development Officer

Apologies

Cllr Gareth Dadd
Cllr Michael Heseltine
Cllr Mike Knaggs

Progress update - Minerals

- Updating of evidence base documents
- Completion of British Geological Survey work on sand and gravel resources and minerals safeguarding
- Completion of Managing Landscape Change project
- Development of draft minerals objectives
- Working towards minerals policy options consultation
- Further consultation work:
    - Aggregates industry workshop
    - One to one meetings with stakeholders – ongoing
    - Marine aggregates – Work under way to develop this with other planning authorities

Progress update – Waste

- Updating of evidence base documents
- Commissioning of work on waste arisings and capacity
- Development of draft waste vision
- Working towards waste issues consultation
- Further consultation work
    - Citizens Panel workshops on waste visioning
    - One to one meetings with stakeholders – ongoing
    - Waste vision consultation leaflet

Members were updated on:

- The development of the waste vision
- Summary of responses to waste vision
- Development of the minerals objectives
- Summary of responses to mineral objectives
- Next steps for minerals options stage
- Next steps for waste issues
- National Planning Policy Framework – including the duty to cooperate
- Implications for the M&WDF
    - NYCC is an important supplier of minerals both at regional & inter-regional scale
    - Important movements of waste
    - Coordination and cooperation on these issues will be important
    - 15 adjoining minerals and waste planning authorities
    - Need for a project plan review – planned to be presented to Executive later in 2012
    - Likely to add to project timescales

*** Action - Revised waste vision and draft minerals objectives - To be circulated to Members for comment**

Comments from Members

- Maps show area of resource still in the ground. Stokesley / Guisborough shows potential resources – should the strategy show that we should consider diversifying into other areas and not just remain in the traditional areas?
- Key that landowners are on board when looking at large schemes coming forward
- Upgrade on A1 skewed the figures for consumption in North Yorkshire
- Potash mining in Scarborough area positive for area but needs to take into consideration transport infrastructure.
- Allerton park – the outcome (whatever it is) will have an impact on what might be needed for the future. Strategy needs to reflect this – with alternative plans depending on outcome.
- Members suggestions on engaging with members of the public included:
    - Local interest goups
    - Trade conference
    - Chamber of commerce
- Members agreed that the next meeting should focus on the minerals options consultation stage of the M&WDF

*** Action – Draft M&WDF minerals options paper to be circulated prior to next meeting**

Date of next Working Group Meeting – Agreed as 10:00am Tuesday 24th July 2012

ANNEX 3

Highways Agency
Draft report on
A64 Hopgrove Roundabout

HIGHWAYS AGENCY

Safe roads, reliable journeys, informed travellers

POPE of LNMS
A64 Hopgrove Roundabouts

June 2012

An executive agency of the Department for Transport

Notice

This document and its contents have been prepared and are intended solely for Highways Agency's information and use in relation to POPE of LNMS.

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Document history

Job number:			**Document ref:**			
Revision	Purpose description	Originated	Checked	Reviewed	Authorised	Date
Rev 1.0	1st Draft	SBo	SBu	EH	PR	27/6/12
Rev 2.0	Final	SBo	RF	EH	PR	31/7/12

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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.
Advanced Cycle Stopline	-	An advanced cycle stop line at a signalled junction is a marked and signed area in front of the stop line of traffic signals, which gives cyclists a safe, visible area to wait, where they are segregated from other traffic. It allows cyclists to move ahead before other vehicles, making it safer for cyclists to turn left or right
Annual **A**verage **D**aily **T**raffic	**AADT**	The 24hr total traffic flow for the average day of the year
Appraisal **S**ummary **T**able	**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 **T**raffic **C**ount	**ATC**	An automated method of recording the volume (and sometimes classification) of vehicles passing a particular point on a road.
Average **D**aily **T**raffic	**ADT**	The 24hr total traffic flow on an average day over a certain time period (Monday – Sunday)
Average **W**eekday **T**raffic	**AWT**	The 24hr total traffic flow on an average weekday over a certain time period (Monday – Friday)
Benefit **C**ost **R**atio	**BCR**	**Benefit Cost Ratio** is a ratio identifying the relationship between cost and benefits of a proposed project.
Bank **H**oliday **M**onday	**BHM**	UK Public Holidays that fall on a Monday.
Capitalisation	**-**	The process by which benefits for a scheme are factored to give an estimate for the appropriate appraisal period.
Chi-Square	**-**	A statistical test to determine whether the observed values of a variable are significantly different from those expected on the basis of a null hypothesis. Variables are categorised to determine whether a distribution of scores is due to chance or experimental factors and tests whether one variable is independent of another.
Department **f**or **T**ransport	**DfT**	A Government department whose objective is to oversee the delivery of a reliable, safe and secure transport system that responds efficiently to the needs of individuals and business whilst safeguarding our environment. The **Highways Agency** is an executive of the **DfT.**
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.

Term	a.k.a.	Definition
Evaluation **S**ummary **T**able	**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 **Y**ear **R**ate of **R**eturn	**FYRR**	**First Year Rate of Return** is the ratio of money gained on an investment relative to the amount of money invested.
Highways **A**gency	**HA**	An Executive Agency of the Department for Transport **(DfT),** responsible for operating, maintaining and improving the strategic road network in England.
Killed or **S**eriously **I**njured	**KSI**	A term used to describe the number of people killed or seriously injured as a result of **PIAs.**
Journey **T**ime **D**atabase	**JTDB**	A Highways Agency database of average vehicle journey times on the trunk road network
Local **N**etwork **M**anagement **S**cheme	**LNMS**	LNMS are improvement schemes whose 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 **A**gent **C**ontractor	**MAC**	Responsible for the operation, maintenance, and improvement of the motorway and trunk road network of a HA area.
New **A**pproach **t**o **A**ppraisal	**NATA**	Used for transport scheme appraisal since 1998
Non **M**otorised **U**ser	**NMU**	Includes pedestrians, cyclists, horse riders and disabled people, whose needs must be addressed. An NMU audit considers the specific needs of these road users.
Optimism Bias	**-**	Is a demonstrated systematic, tendency for project appraisers to be overly optimistic, and in effect, results in an underestimation of scheme costs. The base cost estimate is adjusted to account for optimism bias in order to obtain more accurate cost estimates.
Paramics	**-**	Microsimulation software for the modelling of highway networks
Project **A**ppraisal **R**eport	**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 **I**njury **A**ccident	**PIA**	A term commonly used to refer to road accidents
Post-**O**pening **P**roject **E**valuation	**POPE**	Before & after monitoring of all highway schemes in England.
Public **R**ight **o**f **W**ay	**PRoW**	**Public Rights of Way** are highways that allow the public a legal right of passage
Present **V**alue of **C**osts	**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.
Risk Allowance	**-**	**Risk** refers to identifiable future situations that could result in an over spend or under spend occurring. The base cost estimate is adjusted to account for risk in order to obtain more accurate cost estimates.
Severance	**-**	Severance is the separation of adjacent areas by road or heavy traffic, causing negative impact on non-motorised users, particularly pedestrians.
-	**STATS19**	A database of injury accident statistics recorded by police officers attending accidents.
Traffic **D**atabase **S**ystem	**TRADS**	Traffic count database developed by the Highways Agency, to hold data from the countries traffic monitoring sites.
Transport **U**ser **B**enefit **A**ppraisal	**TUBA**	DfT software used to carry out transport economic appraisal

1. Introduction

1.1. This report is the Post-Opening Project Evaluation (POPE) of the A64 Hopgrove Roundabouts Local Network Management Scheme (LNMS).

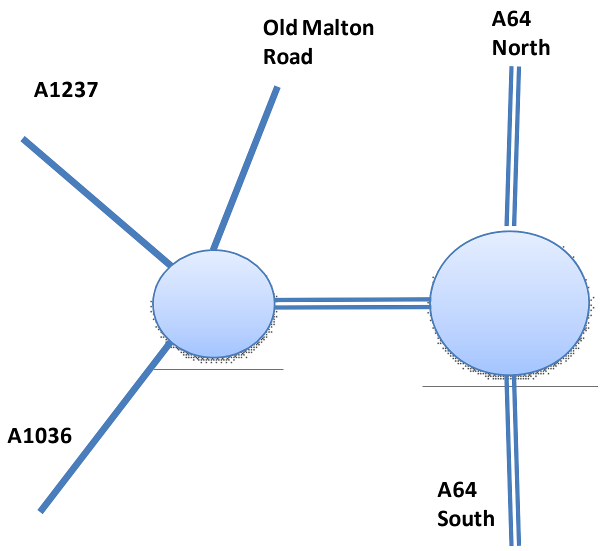
1.2. This Highways Agency (HA) scheme involved a number of permanent improvements to the Hopgrove junction, including widening of the approach roads, widening the roundabouts and the installation of traffic signal control on both roundabouts in order to reduce congestion. The details of the scheme are included in more detail in Section Two of this report.

1.3. Improvement works started in December 2008 and the scheme opened in October 2009.

Location and scheme background

1.4. The Hopgrove junction is located on the A64 Trunk road to the east of York, within the City of York local authority boundary. It forms the junction between the A64 and the A1237 and A1036 that lead to York.

1.5. The junction is a double roundabout arrangement made up of a large 3-arm roundabout on the A64 with a dual carriageway link that heads west towards the smaller 4-arm roundabout that connects the A1237 and A1036. This western roundabout is named the Malton Road roundabout. The fourth arm on the Malton Road roundabout is a cul-de-sac called Old Malton Road that is very lightly used by traffic and provides access to a small number of properties and Beechwood Caravan Park.



1.6. The A64 is the link between Leeds, York, the A1(M) and Scarborough on the east coast. It is dual carriageway between the A1(M) and Hopgrove although there are a number of single carriageway sections along the remainder of the route. The A64 also acts as the south and east sections of the outer York ring road while the A1237 single carriageway completes the ring road to the north and west of York. The Hopgrove roundabouts are at a key location where the northern ring road (A1237) meets the A64. The A1036 is the direct route into York city centre from this direction.

1.7. The dual carriageway section of the A64 ends just to the north-east of the Hopgrove scheme and the road is then mainly single carriageway to Scarborough.

1.8. Prior to scheme construction there were two priority controlled roundabouts located on a similar footprint to the existing scheme. The level of peak period delays at the junction led to the HA carrying out a series of studies to improve the junction. The A64 route is also affected by seasonal congestion problems because of the traffic heading for Scarborough, Whitby and the North Yorkshire Moors National Park during the summer months. This tourist traffic can lead to large delays at the junction and on the A64 nearby.

1.9. In addition to existing problems the HA was also concerned about the traffic implications of the nearby land use developments, particularly at Monks Cross that has accesses on to both the A1237 and the A1036 to the west of Hopgrove.

1.10. Existing problems, plus background traffic growth forecasts and local land use development led the HA to carry out a technical review of the junction in 2002. Various scheme options were considered and the end result was the proposal of a three stage approach that would be constructed between 2006 and 2018, in response to increasing traffic levels.

1.11. The scheme that is the subject of this evaluation is the first stage of the proposed junction improvement but no further development of the subsequent stages has taken place and they are not included on any work programme so it was assumed in the appraisal that this scheme would have a standard 60 year scheme life. The implemented scheme includes:

- Signalisation of every approach road and the two roundabouts;
- Widening of every approach road and the connecting link road between the roundabouts;
- Pedestrian and cycling facilities; and
- Environmental mitigation measures.

1.12. The scheme is located in HA Area 12 that covers Yorkshire. The scheme location and surrounding area are shown in Figure 1.1.

Figure 1.1 – Scheme Location

Scheme categorisation

1.13. Each LNMS is assigned a category according to which of the New Approach to Appraisal (NATA) objectives it is primarily focused on delivering against. This is usually outlined in the Project Appraisal Report (PAR) for the scheme; however, in this case a PAR was not completed for the scheme that was finally implemented.

1.14. In the absence of a PAR we have marked the A64 Hopgrove scheme as an economy scheme. This was done because the scheme's primary purpose is to reduce journey times and improve transport economic efficiency. Small safety benefits were also predicted for this scheme but they amounted to less than 4% of the economy benefits.

1.15. The outturn cost of the A64 Hopgrove scheme (£7.2m in 2002 prices) means that the scheme has been classified as a 'Large' LNMS, which is anything costing between £1m and £10m. This means that the POPE evaluation is carried out to a greater depth of analysis than the smaller schemes in the LNMS programme.

Scheme objectives

1.16. The key scheme objectives were as follows:

- To improve traffic congestion and journey times at the junction;
- To increase capacity to cope with forecast increases in traffic volume and nearby land use developments; and
- To improve road safety.

Purpose of this report

1.17. As part of an ongoing programme to evaluate the impacts of trunk road schemes, we undertake POPE of LNMS on those schemes with an implementation cost of between £25k and £10m. The aim of this process is to:

- Quantify the outturn benefits, disbenefits and costs accruing from new schemes and to ascertain which schemes offer the greatest value for money;
- Develop the pre-scheme appraisal processes and ensure that accurate predictions are made about the possible impacts of highway schemes on safety, economy, environment, accessibility and integration in the future; and
- Enable the HA to select schemes that offer the greatest value for money and that are the most effective solutions to problems on the trunk road network.

1.18. This report specifically sets out the results of the POPE of the A64 Hopgrove Roundabouts improvement in accordance with the POPE methodology. POPE is based on an evaluation of the scheme's outturn impacts against the five core New Approach to Appraisal (NATA) objectives as listed below:

- **Economy** – concerned with improving the economic efficiency of transport, for example, journey time savings and reliability;
- **Safety** – concerned with reducing the loss of life, injuries and damage to property resulting from transport incidents and crime;

- **Environment** – reducing the direct and indirect impacts of transport facilities on the physical and social environment of both users and non-users;
- **Accessibility** – concerned with people's ability to reach different locations and facilities by different modes, and the ease with which they can do so; and
- **Integration** – aims to ensure that all decisions are taken in the context of the Government's integrated transport policy.

1.19. Furthermore, this report presents the following:

- A comparison of the 'before' and 'after' traffic volumes at the junction to illustrate how overall traffic conditions have changed following scheme opening;
- An outline of changes in the number of accidents at the junction following scheme opening;
- A comparison of predicted and outturn environment, accessibility and integration impacts;
- A summary of scheme performance from the perspective of key stakeholders engaged in the original scheme development including the HA Project Manager;
- The appraisal which forecast the benefits of the scheme. Where required, values are converted to 2002 prices and discounted to the opening year; and
- An Evaluation Summary Table (EST) based on the outturn impacts of the scheme using a methodology consistent with the appraisal undertaken prior to the scheme opening.

Structure of this report

1.20. Following on from this introduction, the remainder of the report is structured as follows:

- **Section 2 – Scheme Detail:** Provides details of the scheme including photos illustrating the scheme's key features;
- **Section 3 – Data Collection and Stakeholder Feedback:** Contains an outline of the data which has informed the evaluation and the responses from key stakeholders regarding the scheme;
- **Section 4 – Traffic Impacts:** Outlines the traffic changes in the study area;
- **Section 5 – Safety Impacts:** Outlines the safety impacts of the scheme through analysis of personal injury accidents;
- **Section 6 – Economy:** Summarises the value for money of the scheme by comparing the scheme costs and benefits;
- **Section 7 –** Environment, Accessibility and Integration Issues: Summarises the scheme's impacts on these issues; and

- **Section 8 – Conclusions and Recommendations:** Summarises the impact of the scheme based on the data available to this evaluation.

1.21. It is intended that the findings from this report shall feed into a wider summary of the outcomes of POPE of LNMS in the annual report.

2. Scheme detail

Key scheme features

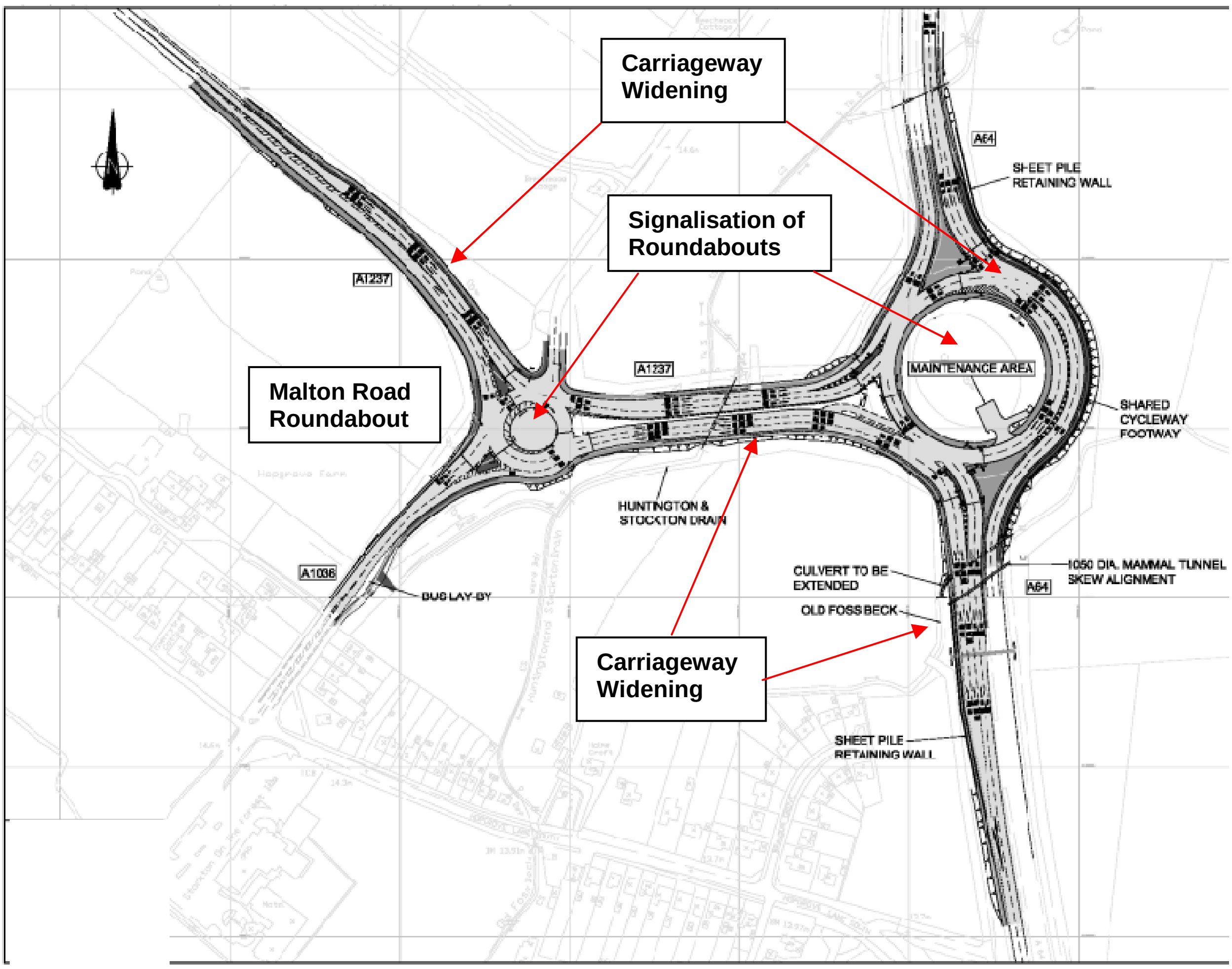
2.1. This section of the report outlines the measures introduced by the A64 Hopgrove Roundabouts improvement following the scheme implementation.

2.2. Figure 2.1 is a pre-scheme aerial photograph showing the number of lanes and the priority controlled roundabouts and Figure 2.2 shows the proposed scheme layout (provided by the scheme designer, AECOM) and Figure 2.3 shows part of the completed scheme.

Figure 2.1 – Pre-scheme aerial view

© GeoPerspectives

Figure 2.2 – Post-scheme layout



2.3. These figures show that the basic layout of the junction has been retained but the approach roads, the connecting link road and the circulating carriageways have been widened and traffic signals installed. The A64 approaches have been widened from two lanes on both approaches to four lanes northbound and three lanes southbound. The circulating carriageway has been increased to 4 lanes on the southbound, east side of the A64 roundabout but retained as two lanes on the northbound, west side.

2.4. The central link road connecting the two roundabouts has been increased from two lanes to three lanes in both directions and the A1237 approach has been flared out to two lanes to increase the capacity through the signals.

Figure 2.3 – A64 South approach showing widened carriageway and traffic signals

2.5. The scheme had very few facilities for non-motorised users prior to scheme construction but a number of features have now been added. There are dropped kerbs for pedestrians at the Malton Road roundabout so that pedestrians walking between Old Malton Road, the A1237 and the A1036 can take advantage of the breaks in traffic provided by the new signals, although there are no controlled pedestrian push-button facilities or pedestrian crossing stages within the signal timings.

2.6. There is also a new shared cycleway/footway on the east side of the A64 roundabout, although this does not link with any other cycle or pedestrian facilities. This feature was included in the design to provide some future-proofing, in case cycle routes or paths were ever installed alongside the A64. No such schemes are currently in the HA's work programme, however it does provide an off-road facility for cyclists that are currently using the main carriageway to negotiate the junction more safely, but they then have to return to the main carriageway on the other side.

2.7. The stop lines at the traffic signals have also been located to allow Advanced Cycle stop lines to be installed at a later date, with the minimum of redesign and construction. There are no further footways or crossing facilities at the junction.

2.8. Maintenance areas have also been provided as part of the scheme, two within the central island of the A64 roundabout and one at the eastern end of the link road central reserve.

2.9. Environmental mitigation measures were included in the scheme design. A mammal tunnel was installed to aid otters and other mammals to cross beneath the road to reduce the potential for road related animal mortality. Planting and noise barriers were also part of the scheme.

Site visit

2.10. A site visit to inspect the scheme was undertaken on Friday 23 March 2012. The site visit found that the scheme measures all appeared to be in place as described in the appraisal and traffic was integrating very well with the new layout.

2.11. The site visit found that there was a large volume of traffic using the junction but minimal delay and limited queuing was observed on all arms of the junction, although the site visit was carried out in the inter peak period when queues were not expected. There were no queues observed at the end of each green light stage of the signals, i.e. there was no build up of queues over time, and no issues were observed with the way that traffic was using the junction.

2.12. The scheme is crossed by two watercourses (Old Foss Beck and the Huntingdon and Stockton Drain) that are both in culverts underneath the carriageway and a mammal (otter) tunnel was also provided as part of the scheme. Planting and landscaping were included in the scheme so an environmental specialist also attended the site visit to verify that the environmental works had been completed and to evaluate their success.

Summary

- The scheme appears to have been implemented as per the proposals set out in the appraisal;
- The traffic appears to be integrating well with the scheme; and
- An off-peak site visit found traffic to be flowing smoothly on all arms of the junction with minimal delay and limited queuing.

3. Data collection and stakeholder feedback

3.1. This section provides details on the data used to undertake an evaluation of the A64 Hopgrove Roundabouts scheme. Specifically, this section is split into:

- A list of the sources of data used to evaluate this scheme; and
- An overview of the feedback from the key stakeholders, i.e. the Managing Agent Contractor (MAC), the scheme designers and appraisers (AECOM) the HA Project Manager and City of York Council.

Data sources

3.2. In order to complete the evaluation, both pre-scheme and post-scheme data is required. The pre-scheme data is used to confirm the data quoted in the appraisal and to baseline the outturn findings. The post-scheme data is used to compare to the pre-scheme to determine the scheme's impacts.

Pre-scheme data

3.3. The following sources of pre-scheme data were collected:

- A64 Roundabouts Traffic and Economics Report (Draft) Faber Maunsell/AECOM, July 2008;
- Accident data provided by York City Council for the period between January 2004 and December 2008;
- Journey time data obtained via sat nav surveys for the pre-scheme period 1st January 2008 to 31st November 2008;
- Scheme drawings, AECOM, July 2006;
- Hopgrove Roundabout Improvements Ecological Assessment, AECOM, September 2008;
- PARAMICS junction models, AECOM, 2008; and
- Pre-scheme link count, turning count and journey time data available on the A64 and the Hopgrove Roundabouts from the HA's HATRIS database and the appraisal documents.

Post-scheme data

3.4. The following sources of post-scheme data were collected:

- Journey time data obtained from sat nav surveys for the post-scheme period 1st January 2010 to 31st November 2010;

- Post-scheme link count, turning count and journey time data available on the A64 and the Hopgrove Roundabouts from the HA's TRADS database and commissioned surveys;

- Stage 3 Road Safety Audits, AECOM, July 2010;

- As-built scheme drawings, AECOM, September 2009;

- A site visit conducted on Friday 23rd March 2012 to assess the implementation of the scheme on site; and

- Accident data provided by York City Council for the period between 1st October 2009 and 31st December 2011.

Stakeholder feedback

3.5. To help understand the impact of the scheme from the opinion of those who planned and implemented it, consultation has been undertaken. Specifically, feedback was requested from:

- The designers and appraisers of the scheme (AECOM);

- The current Managing Agent Contractor at Area 12 (A-One+);

- City of York Council; and

- The HA Project Manager.

3.6. From this consultation exercise the following responses have been obtained:

- The HA Project Manager acknowledged that the priority for the scheme was to tackle peak period traffic delay and congestion, and he was not surprised that our initial findings (detailed in Chapter 4 of this report) showed that the scheme had achieved this aim, but that delays had got slightly worse in the inter peak period;

- The scheme designers and appraisers (AECOM) responded to say that the main aims of the scheme were to reduce peak period congestion and that the scheme has been successful in achieving this aim. It was accepted that the signals would add extra delays at non-peak times of day;

- The MAC at the time of construction was WSP/Carillion but they have since been replaced by the current MAC (A-One+). They have been consulted but no response has been received to date; and

- City of York has also been consulted but no response has been received to date.

Summary

The key findings following stakeholder feedback are:

- The HA Project Manager and design consultant broadly agreed with the findings that the scheme has improved peak period delay and congestion but had a negative effect in non-peak periods; and
- No other stakeholders have responded to the request for feedback at

4. Traffic impacts

4.1. This section of the report is concerned with the impacts on traffic as a result of the A64 Hopgrove Roundabouts improvement. There are two key areas of traffic that will be considered:

- The impact on traffic volume (flow); and
- The impact on key journey times.

Traffic volume

4.2. The traffic volume before and after the scheme provides the context to any changes observed following the scheme. There are a number of sources of traffic volume data that indicate change over the long and short term:

- The Highways Agency's Traffic Flow Data System (TRADS) contains continuous count data at various points on the Trunk Road Network: and
- Turning counts provide data on vehicle turning movements at junctions. Before and after turning counts have been carried out at this junction specifically for the scheme appraisal and this evaluation.

Flow over time

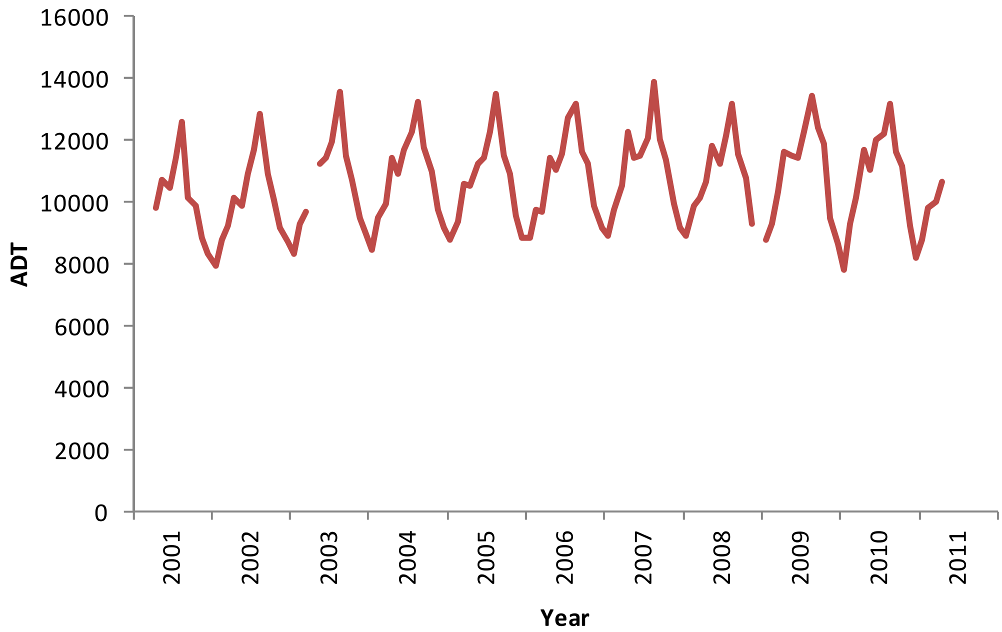
4.3. The traffic analysis has utilised information from TRADS. A TRADS Automatic Traffic Count (ATC) site was available on the A64 south of the Hopgrove roundabout that has collected data from 2001 to the present day. The northbound flows towards the junction provide the most consistent information over a long period. This allows a direct comparison of before scheme opening and after scheme opening flows along this link road for a continuous ten year period.

4.4.

4.5. Figure 4.1 shows this data and demonstrates that the range traffic volumes on the A64 have been relatively consistent over time. There was steady traffic growth from 2001 to 2007 of approximately 2% per year and then a steady reduction in traffic volume from 2007 to 2010 of 1% per year. This follows the national trend in traffic volume as a result of the economic downturn.

4.6. The data also shows how the pattern of peaks and troughs in traffic volume have been relatively consistent over a long time period, with large peaks in the summer months and less traffic in January and December.

Figure 4.1 – Long term average daily traffic (ADT) on A64 south of Hopgrove roundabouts (northbound)

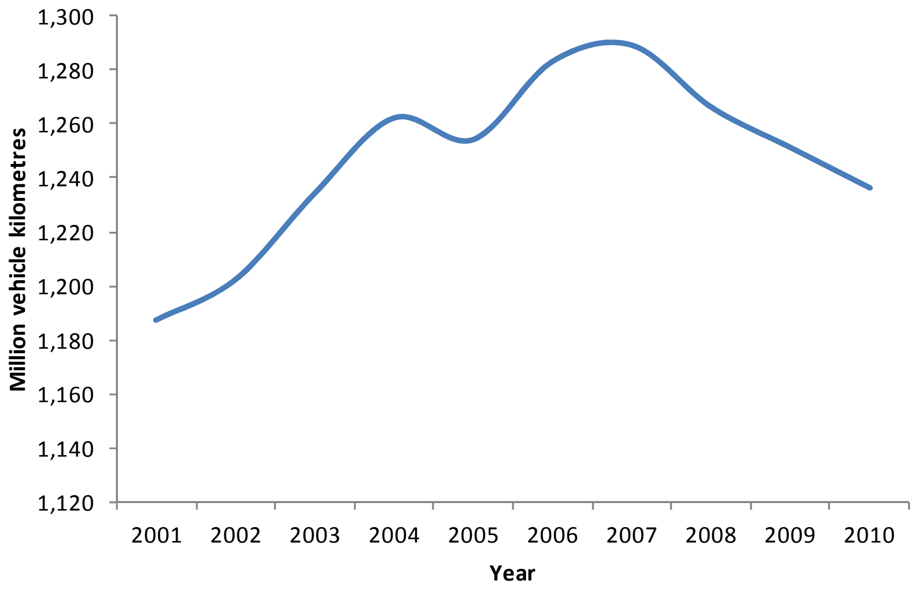


4.7. National traffic statistics have been retrieved from the Department for Transport (DfT). These provide details on how traffic levels have changed nationally and by region. Figure 4.2 demonstrates how traffic volume has changed in the City of York local authority area over a similar time period to TRADS (all road types). It also shows that traffic volumes peaked in 2007 and have since declined by approximately 4%.

4.8. We can therefore be confident that the pattern observed at Hopgrove roundabouts is consistent with national and regional changes, not due to the scheme influencing traffic volume.

Figure 4.2 – Traffic volume change in the City of York[1]

[1] DfT National Road Traffic Survey, June 2011

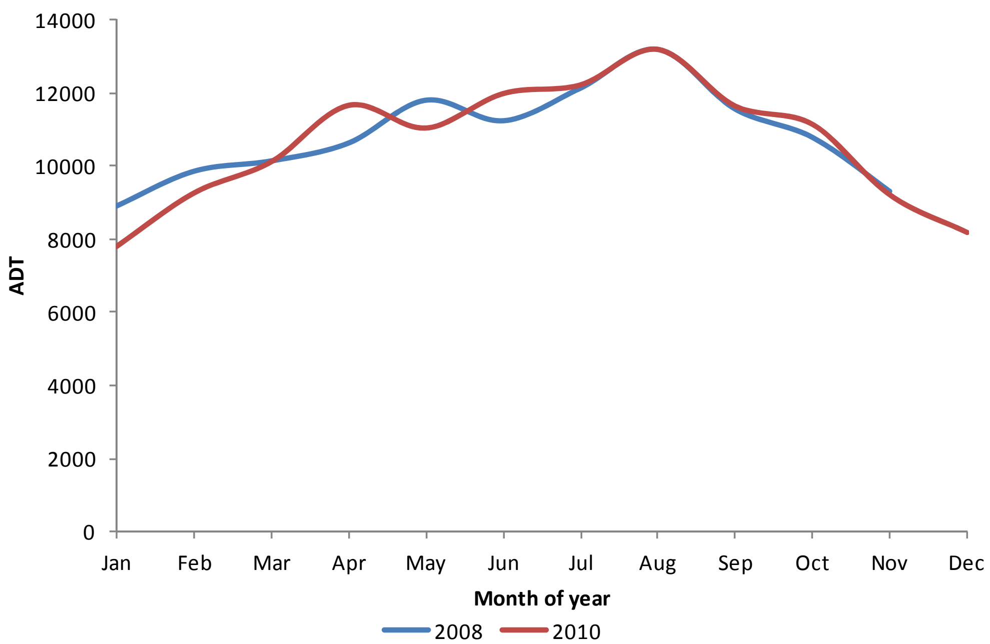


Daily traffic profile

4.9. Returning to the TRADS data, it is possible to compare the profile of traffic from a year prior to the scheme construction and a calendar year after the scheme opened.

4.10. Figure 4.3 shows the profile of daily traffic throughout the pre-scheme and post-scheme years (2008 and 2010, note December 2010 data is missing from TRADS).

Figure 4.3 – Average daily traffic volume on A64 south of Hopgrove roundabout (westbound)



4.11. Figure 4.3 demonstrates that traffic volumes have not changed significantly on the A64 at this location between the pre-scheme (2008) and post-scheme (2010) stages. The profile of average daily traffic during the two years is very similar and we can conclude that the scheme has not caused a noticeable change in traffic volume patterns.

4.12. The profile also demonstrates the seasonality of the site. With traffic levels rising into the summer holiday period (see August) and then declining towards the end of the year. This fits in with our understanding of this route being used to access Scarborough, Whitby and the North Yorkshire Moors National Park during the summer months.

Junction traffic data

4.13. A turning count was carried out for one day in February 2002 (pre-scheme) and also on one day in March 2012 (post-scheme). Although the pre-scheme count is relatively old it is the only pre-scheme turning count that is available and the previous analyses have shown that traffic flow on the A64 as a whole are not significantly different between 2002 and 2012 (see

4.14. Figure 4.1).

Table 4.1 – Combined Hopgrove roundabouts traffic volume – pre- and post-scheme

	Total Junction Flow (vehs)		
Time Period	**2002**	**2012**	**Change**
AM peak Hour	3,706	3,775	+2%
Average Interpeak Hour	2,890	2,570	-11%
PM peak Hour	3,797	3,461	-9%
Total	**10,393**	**9,806**	**-6%**

4.15. The information in

4.16. Table 4.1 shows that there has been a small reduction in total junction flows over a ten year period that includes the construction of the scheme. It shows differing changes in each period of the day with an average traffic reduction of 6%. This is a different result than shown in

4.17. Figure 4.1 that shows that post-scheme traffic volumes are similar to those surveyed in 2002.

4.18. It should be borne in mind that the two turning counts are not directly comparable because the 2002 survey was made up of two separate junction turning counts at the two roundabouts, while the 2012 survey provided origin-destination volumes through the junction. However, we are able to use these two counts to demonstrate how traffic turning volumes have changed.

4.19. This data is not sufficient to provide a continuous comparison of turning flows throughout the before scheme year and after scheme year. However, it does allow for a snapshot of before turning flow data to be compared with a snapshot of after turning flow data.

4.20. Figure 4.4 is a schematic diagram of the junction that shows the labelling of the approach roads used in the turning counts.

Figure 4.4 – Diagram of turning count labelling

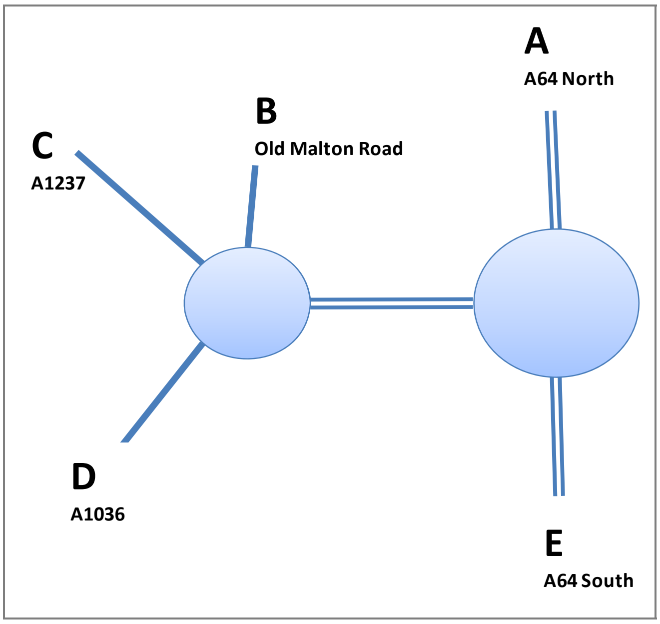


Table 4.2 – Summary of 2012 daily traffic flows (7:00-19:00)

To / From	A	B	C	D	E	Total
A	14	2	346	1,830	5,442	**7,634**
B	20	0	20	48	21	**109**
C	559	24	5	805	5,559	**6,952**
D	1,410	58	904	0	3,603	**5,975**
E	5,672	0	6,004	3,287	0	**14,963**
Total	**7,675**	**84**	**7,279**	**5,970**	**14,625**	**35,633**

4.21. Table 4.2 shows the daily turning flows at the Hopgrove roundabouts in the post-scheme period (based on the turning count carried out in March 2012). The main findings of the survey are:

- The A64 south of the junction carries the largest volumes of traffic (almost 30,000 vehicles per day over both directions);
- The three other main roads into the junction (A64 north, A1036 and A1237) carry similar volumes of traffic to one another (between 12,000 and 15,000 vpd over both directions);
- The vehicles to and from each arm are evenly matched across the twelve hours;
- This makes the turning movements quite complicated and the relative importance of the local authority roads is quite high;
- The two heaviest movements are North-South along the Trunk Road (A-E and E-A) and that between the A64 South and the A1237 around the north side of York (C-E and E-C);
- The less substantial traffic movements are along the A1036 into York city centre that carries heavy flows to and from the A64; and
- The number of vehicles travelling from the A64 North on to the A1237 (A-C) appears to be surprisingly low, given the link flows on each of those roads. However, there is a road that branches these two roads prior to the Hopgrove junction (called North Lane, north of this junction) that provides a shorter route and has a right turn ghost island off the A64. This may provide a convenient alternative to the Hopgrove junction.

Table 4.3 – Summary of 2012 AM peak hour traffic flows (8:00-9:00)

To From	A	B	C	D	E	Total
A	2	0	12	241	534	**789**
B	2	0	2	2	0	**6**
C	61	2	0	86	594	**743**
D	142	2	85	0	223	**452**
E	641	0	717	427	0	**1,785**
Total	**848**	**4**	**816**	**756**	**1,351**	**3,775**

4.22. Table 4.3 shows this information for the AM peak hour only. The main findings of the survey are:

- All of the heaviest flows are either to or from the A64 South of the junction (83% of the total flow through the junction);
- Flows between the other roads into the junction are relatively low (17% of the total flow); and

- The heaviest movement is from the A64 South to the A1237 (E-C), closely followed by the North-South movement along the A64 (E-A).

Table 4.4 – Summary of 2012 PM peak hour traffic flows (17:00-18:00)

To / From	A	B	C	D	E	Total
A	0	0	31	146	592	**769**
B	0	0	0	3	0	**3**
C	26	2	0	69	591	**688**
D	186	9	58	0	601	**854**
E	487	0	734	318	0	**1,539**
Total	**699**	**11**	**823**	**536**	**1,784**	**3,853**

4.23. Table 4.4 shows this information for the PM peak hour only. The main findings of the survey are:

- Again, the heaviest flows are either to or from the A64 South of the junction; and
- There is some evidence of tidal flows, particularly on the A1036 into York city centre which had a 61%:39% split between outbound and inbound traffic in the PM peak. This causes traffic volume from the A1036 to become the largest flow towards the A64, in contrast to the AM peak when it carried less than half the volume of the other roads.

4.24. These surveys show some difference between the pattern of flows in the AM and PM peak hours. The A64 South shows some tidal behaviour with a larger movement northbound in the AM peak and southbound in the PM peak and there is a similar pattern on the A1036 into York city centre.Figure 4.5 and Figure 4.6 show how the turning flows have changed at the junction in the 10 years between the Before and After surveys.

Figure 4.5 – Comparison of turning counts at Hopgrove roundabouts (AM peak)

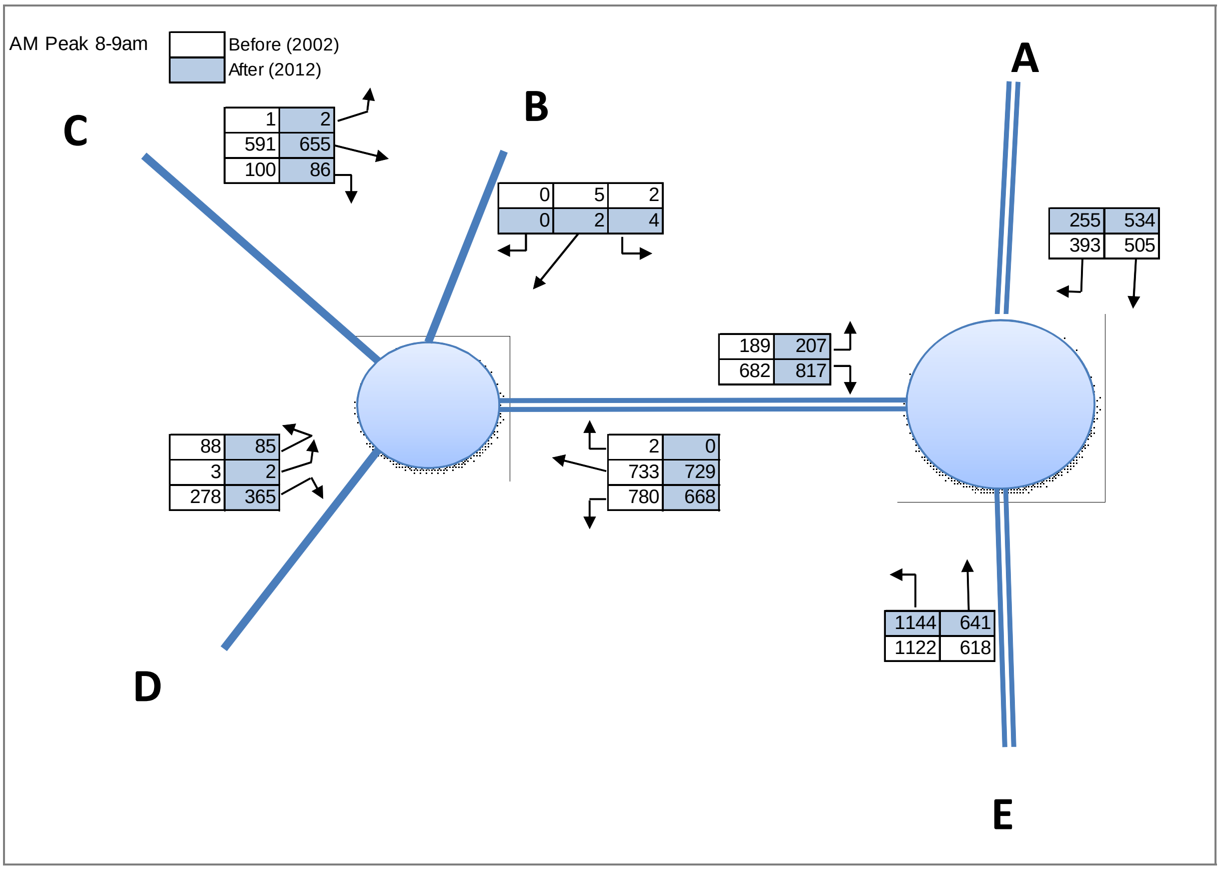
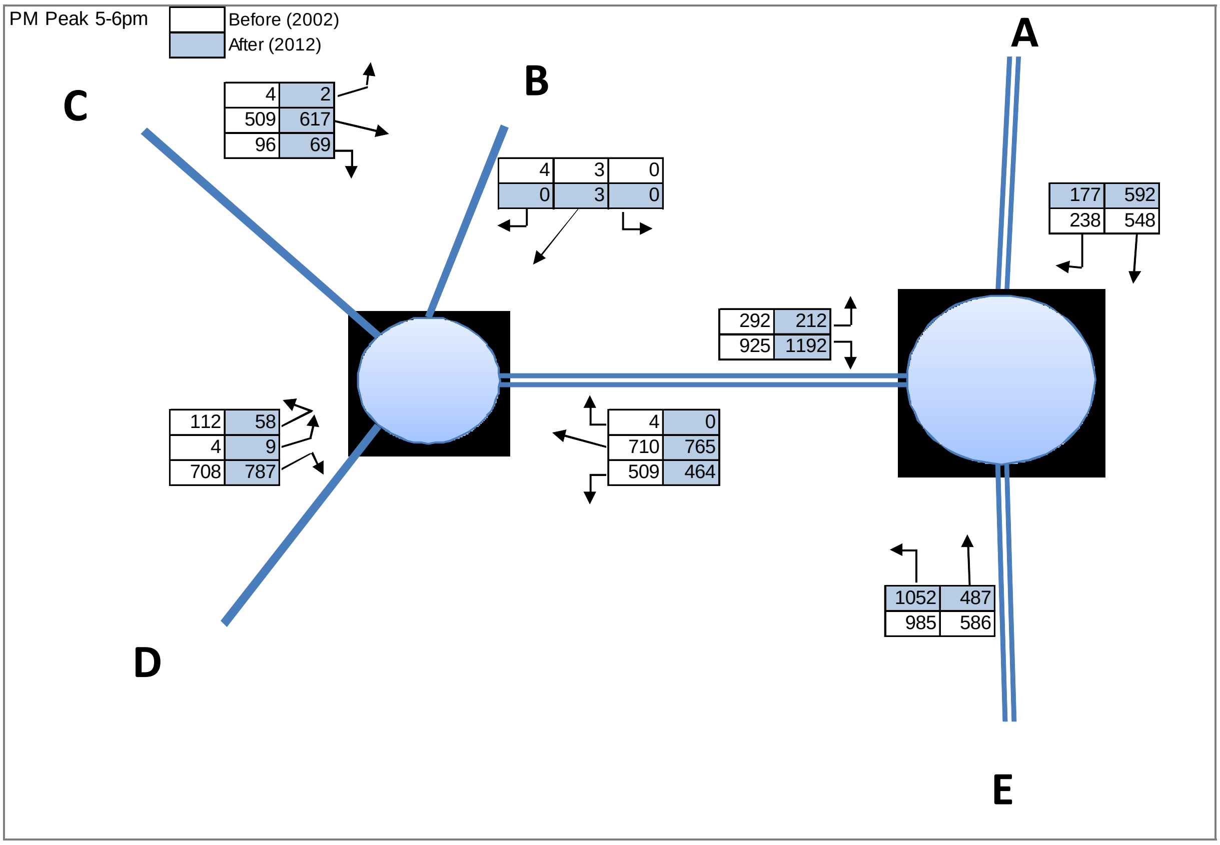


Figure 4.6 – Comparison of turning counts at Hopgrove roundabouts (PM peak)



4.25. Figure 4.5 and Figure 4.6 show the Peak Hour turning flows at the Hopgrove junction before and after the scheme. The main findings of the surveys are:

- The changes between the Before and After traffic volumes are relatively small on most links, especially given the length of time between the two surveys;

- The largest change is on the right turn from the A64 North towards the Malton Road roundabout, which has reduced by over 30%, possibly due to some re-routing by traffic to avoid the roundabout. The ahead movement from A64 North to South has increased so it is possible that there has been some diversion of traffic;

- There are significant differences between the AM and PM peak volumes on certain movements:

    Flows to and from the A1036 show a large flow inbound to York in the AM and outbound in the PM;

    This tidal flow continues on the A64 turning movements towards the city centre as well;

- The link count between the two roundabouts has changed very little in both peak periods.

Forecast traffic volume

4.26. A key reason for the scheme was to improve the junction capacity in advance of an increase in traffic levels. There is anticipated growth in traffic levels caused by both background traffic growth and new developments in the vicinity that are expected to generate additional traffic through the junction.

4.27. The pre-scheme appraisal used the 2002 turning count and factored it using the National Road Traffic Forecasts (NRTF) High Growth factors to give 2005 and 2015 base flows (original forecast scheme opening dates). A check was done against actual data in 2008 which showed that the baseline figures were approximately 5% more than the actual 2008 traffic flows, but the appraisal considered this to compare well enough to continue using the forecasts.

4.28. The Trip End Model Presentation Programme (TEMPRO) traffic growth factors were used to factor the base flows to 2008 and 2018 modelled years and then development traffic from the nearby Monks Cross site was also added to the 2018 flows because it was anticipated that this development would be in place by that year. The flows were constrained to the TEMPRO forecasts where necessary.

4.29. **Table** 4.5 shows how the forecast Do Something traffic volumes compare with the observed traffic. There is a difference between the years used in the forecast (2008) and the observed flows (2012) but we have shown that actual traffic growth has been very small in that time period.

Table 4.5 – Summary of traffic volume forecasts and observed

	Do Something Forecast (2008) AM peak	Observed (2012) AM peak	Do Something Forecast (2008) Inter Peak	Observed (2012) Inter Peak	Do Something Forecast (2008) PM peak	Observed (2012) PM peak
A64 South	1,925	1,785	1,637	1,102	1,724	1,539
A64 North	994	789	829	586	861	769
A1237	767	743	647	516	671	688
A1036	351	452	392	420	697	854
Total	**4,037**	**3,769**	**3,505**	**2,624**	**3,953**	**3,850**

4.30. This table shows that the 2008 forecasts of traffic expected to use the junction were higher than the volumes of traffic that were observed in 2012, especially in the AM peak hour and the average inter peak hour. The appraisal journey time benefits were therefore calculated using larger traffic volumes than have actually occurred.

4.31. This is also important because the analysis later in this report shows that the scheme delivers more benefits, compared to the previous priority controlled layout, when traffic volumes are higher. So if observed volumes are lower than expected then the journey time benefits will also be lower.

Traffic volume summary

4.32. In summary, seasonality and daily traffic volume profiles have changed only slightly over the long term (10 years) and in the short term (pre-scheme, 2008) since the scheme was implemented (2010).

4.33. In terms of turning flows at the junction, overall traffic flows have decreased (as shown in Table 4.1) but individual movements have increased or decreased within that overall figure. Some turning movements have increased in volume by up to 28%. Overall traffic flows at the junction have decreased by 6% between 2002 and 2012.

4.34. Typically, we require overall traffic changes of greater than 10% to be confident that the numbers represent a true change in traffic flow (due to DMRB guidance that counts are accurate to within 10%). As such, the scheme as a whole can be treated as having had no impact on traffic volume. However, traffic volumes have increased by more than 10% on some turning movements.

4.35. On balance, it therefore appears traffic flows have not changed due to the scheme, and so the post-scheme turning count will be used to calculate vehicle hours saved later in this section.

4.36. The forecasts of traffic volume for the junction were higher for 2008 than the observed traffic volumes in 2012 because of the growth assumptions that were used. The implication of this is that the benefits of the scheme will be lower than forecast because the benefits of the scheme, in comparison to the previous layout, increase as it gets busier.

Journey times

4.37. Other than traffic volume, the other traffic impact that needs to be considered is journey times through the junction. Journey times are integral to this scheme as one of the main objectives of the scheme was to improve traffic congestion at the junction.

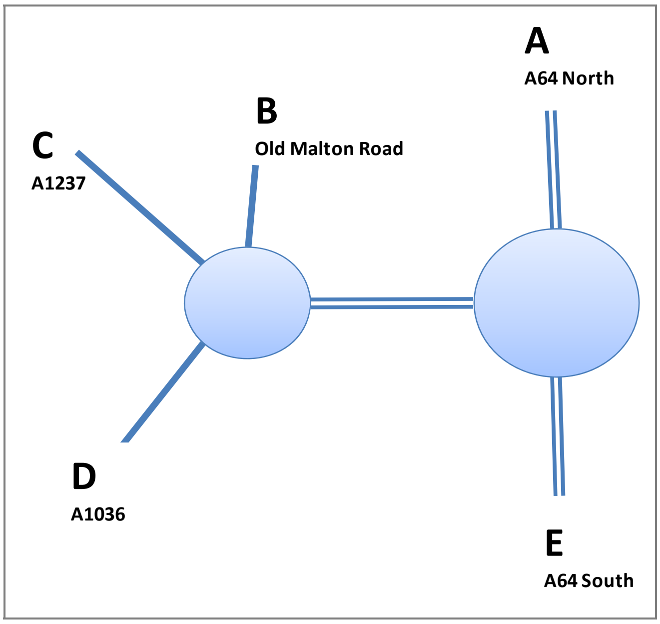
4.38. For this scheme, journey time data from sat nav systems has been used to inform both the pre-scheme and post-scheme evaluation.

4.39. The analysis used neutral pre-scheme and post-scheme periods based on the same 11 month period in 2008 and 2010 (January to November). School holidays and Bank Holidays have been included in the output data because of the importance of tourist related traffic at the junction.

4.40. The journey times have been extracted for the main turning movements at Hopgrove roundabouts in both directions. Journey times for vehicles travelling to and from Old Malton Road were not extracted because the volume of traffic is so small.

4.41. This results in a total of 12 different journey time routes between every possible combination of arms A, C, D and E, as shown in the diagram in Figure 4.7.

Figure 4.7 – Diagram of journey time route labelling



4.42. The journey time routes extracted were:

- Southbound A64 right turn to A1237 (A - C)
- Southbound A64 right turn to A1036 (A - D)
- Southbound A64 straight ahead to A64 South (A - E)
- Eastbound A1237 to A64 North (C – A)
- Eastbound A1237 to A64 South (C – E)
- Eastbound A1237 right turn to A1036 (C – D)

- Northbound A1036 left turn to A1237 (D – C)
- Northbound A1036 to A64 North (D – A)
- Northbound A1036 to A64 South (D – E)
- Northbound A64 to A1037 (E – D)
- Northbound A64 to A1237 (E – C)
- Northbound A64 straight ahead to A64 North (E - A)

4.43. For each of these routes, the following time periods have been extracted:

- AM peak Hour 07:00-08:00
- AM peak Hour 08:00-09:00
- Inter Peak 09:00-16:00
- PM peak Hour 16:00-17:00
- PM peak Hour 17:00-18:00
- Shoulder Peak 18:00-19:00

4.44. These time periods are in line with the flow information presented earlier in this section and the hours used in the pre-scheme appraisal which outlined that the peak periods are 07:00 - 09:00 and 16:00 – 18:00. Therefore, these two periods have been assessed as individual hours so we can understand them in detail.

4.45. The inter peak hours are provided in less detail and are aggregated into a seven hour time period. This is sufficient because we are not expecting to find significant journey time change during these off peak periods, as traffic flows are lower.

Sat nav data validation

4.46. In order to check the accuracy of the sat nav data that we have used, a validation exercise was carried out.

4.47. Journey time data was extracted from the HA's JTDB along the A64 for the same 11 month period as the sat nav data extracted. The data is not directly comparable because JTDB uses long sections of road and fixed timing points that do not necessarily correspond with the preferred timing points at this junction.

4.48. However, the validation exercise showed that the trend in journey times on the A64 was similar in the JTDB data as the trend observed in the sat nav data. The large size of the sample, spread across an 11 month study period also provides added confidence in the results produced from the JTDB and sat nav data analysis. Using the same source of sat nav data to inform the pre- and post-scheme should also guarantee a more robust and fair evaluation. We can therefore be confident in the validity of the sat nav data and hence this is what we have used to calculate the changes in journey time caused by the scheme.

Comparison of before and after journey times

4.49. Table 4.6 provides a summary of the peak hour journey time data results;

Table 4.6 – Average journey times, peak hour (secs)

			08:00-09:00			17:00-18:00		
	Junction Movement		**Before**	**After**	**Change**	**Before**	**After**	**Change**
A64 North	A-C	A64N-A1237	236	243	*+7*	236	251	+15
	A-D	A64N-A1036	226	236	*+10*	232	245	+13
	A-E	A64N-A64S	211	208	*-3*	216	213	-3
A1237	C-A	A1237-A64N	152	96	*-56*	308	107	-201
	C-D	A1237-A1036	162	120	*-42*	313	120	-193
	C-E	A1237-A64S	227	171	*-56*	384	181	-203
A1036	D-A	A1036-A64N	103	106	*+3*	182	119	-63
	D-C	A1036-A1237	102	118	*+16*	168	128	-40
	D-E	A1036-A64S	177	182	*+5*	258	201	-57
A64 South	E-A	A64S-A64N	92	76	*-16*	95	129	+34
	E-C	A64S-A1237	163	151	*-12*	155	201	+46
	E-D	A64S-A1036	153	145	*-8*	151	195	+44
	Flow weighted average				***-16***			**-32**

4.50. Table 4.6 shows that there were large journey time savings on many of the routes surveyed after the construction of the scheme, particularly in the PM peak hour. The key findings are:

- Morning peak hour change was modest, with the largest savings being for vehicles emerging from the A1237 (Arm C) to all the other directions;
- Movements from Northbound A64 (Arm E) also produced savings across all movements in the AM peak, though to a very small magnitude. The flow weighted average saving across all junction movements in AM peak hour journey time was 16 seconds;
- Much larger time savings were observed in the PM peak, both on average across the junction and individually. Time savings of over three minutes per vehicle were observed for A1237 traffic again. Also, the A1036 (Arm D) traffic travelling out of York received time savings of up to one minute per vehicle. This is likely to be because the signals have given these traffic movements a greater ability to make the traffic movement than they had under the previous priority control;
- Some routes experienced increases in journey time, particularly for northbound traffic on the A64 South (Arm E) heading towards the A1237 and A1036. This is likely to be because this traffic is now under signal control

where previously it had to give way to a relatively low volume of circulating traffic;

- The flow weighted average saving in the AM and PM peak hour journey times across all movements is 16 and 32 seconds respectively; and
- These figures demonstrate that the scheme has achieved one of its objectives to reduce peak time congestion and delay.

Table 4.7 – Average journey times, average inter peak hour (secs)

	Junction Movement	Before Inter- Peak	After Inter- Peak	Change
A64 North	A-C A64N-A1237	230	246	*+16*
	A-D A64N-A1036	224	240	*+16*
	A-E A64N-A64S	211	213	*+2*
A1237	C-A A1237-A64N	108	96	*-12*
	C-D A1237-A1036	129	126	*-3*
	C-E A1237-A64S	186	176	*-10*
A1036	D-A A1036-A64N	97	105	*+8*
	D-C A1036-A1237	104	115	*+11*
	D-E A1036-A64S	174	184	*+10*
A64 South	E-A A64S-A64N	95	131	*+36*
	E-C A64S-A1237	158	200	*+42*
	E-D A64S-A1036	152	194	*+42*
Flow weighted average				***+18***

4.51. Table 4.7 shows the impacts of the scheme on inter peak journey times (those between 09:00 and 16:00);

- In contrast to the peak hour impacts of the scheme, there have been more journey time disbenefits during the inter peak period on many of the routes surveyed. The flow weighted average of this change is a small increase in journey times of 18 seconds per vehicle during the inter peak following the construction of the scheme;
- Similarly to the PM peak hour, the A64 South (Arm E) has experienced significant increases in journey time for traffic heading to all the other roads, while the other approaches experienced relatively small changes;
- The impact of these inter peak changes is significant, because this period of the day covers seven hours, so it has a larger impact on the total journey time benefits of the scheme than the peak hour journey time savings, even though traffic flows are lower per hour; and

- These findings are not unusual for schemes that include the signalisation of junctions. Congestion is, typically, a peak hour problem and many junctions that are congested in peak hours operate satisfactorily for the rest of the day. The installation of traffic signal control often delivers peak hour benefits but it also applies a time penalty to traffic for the remainder of the day (assuming the signals are in full-time operation).

4.52. This sat nav journey time data includes percentile statistics, and as such, it is possible to consider journey time reliability for each of these routes and time periods. Detailed data to inform journey time reliability is presented alongside the change in average journey times for all study time periods in Appendix A. This information provides a good understanding of journey time reliability and journey time changes in all the scenarios tested.

4.53. The general finding when considering journey time reliability is that the movements and time periods that benefit from improved reliability are consistent with those which have journey time savings and vice versa. The key findings are:

- On movements where journey time reliability has improved, the improvement is most prominent in the peak periods of 8-9am and 5-6pm;

- Movements from the A46 south arm (arm E) have the largest worsening of journey time reliability, just as they had the worse journey time disbenefit; and

- The most significant improvements to journey time reliability are seen at the movements A1035 to A64 south (D-E), A1237 to A64 south (C-D) and A1237 to A1035 (C-E).

4.54. The key journey time benefits are as follows in Table 4.8:

Table 4.8 – Summary of key journey time savings

			Journey time change per vehicle (seconds) (negative is a JT saving)					
From	**To**	**Turn**	**7:00-8:00**	**8:00-9:00**	**Inter-Peak**	**16:00-17:00**	**17:00-18:00**	**18:00-19:00**
A64 South	A1237	A-C	7	7	16	14	15	13
	A1036	A-D	7	10	16	14	13	11
	A64S	A-E	-3	-3	2	-4	-3	0
A1237	A64N	C-A	-15	-56	-12	-120	-201	-6
	A1036	C-D	-6	-42	-9	-113	-193	-61
	A64S	C-E	-12	-56	-10	-117	-203	19
A1036	A64N	D-A	13	3	8	-19	-63	-1
	A1237	D-C	19	16	11	-5	-40	-4
	A64S	D-E	14	5	10	-17	-57	2
A64 North	A64N	E-A	0	-16	36	31	34	22
	A1237	E-C	5	-12	42	5	46	28

A1036	E-D	4	-8	42	40	44	26
Flow weighted average		**1**	**-16**	**18**	**-18**	**-32**	**13**

4.55. In order to simplify a complex pattern of delay and change we have broken the analysis down by approach road to the junction.

A64 Northbound

4.56. For the traffic that turns left there was little change in delay in the AM peak but the level of delay got slightly worse in the inter peak and PM peak, probably because the traffic is forced to stop now rather than taking advantage of gaps in the circulating traffic when it was priority controlled. Journey time reliability also improved in the AM peak but got worse in the other time periods.

4.57. For the traffic that travels straight on to the A64 North there was little change in AM peak delay but it got worse in the Inter peak and PM peak. Journey time reliability followed the same pattern.

A64 Southbound

4.58. For the traffic that turns right there was a consistent increase in average journey time in all time periods and journey time reliability got worse because traffic is forced to stop rather than accepting gaps in the circulating traffic.

4.59. For the traffic that travels straight on to the A64 South there were small peak time reductions in average journey time and small increases in journey time in the inter peak. Reliability improved in the peak hours.

A1237 Eastbound

4.60. For the traffic that turns towards the A64 there was a low level of delay and small improvements in the AM peak period. Pre-scheme delays were much larger in the PM peak and the scheme has achieved large time savings, probably because the traffic now has a regular opportunity to get on to both of the roundabouts whereas previously it had to give way at both roundabouts. Inter peak delays have also benefited slightly. Journey time reliability improved by large amounts for traffic heading to the A64 in the peak hours.

4.61. For the traffic that turns right towards the A1036 there were small improvements in the AM peak but there were much larger pre-scheme delays in the PM peak and very large time savings were made by the scheme. Again, the installation of signals has aided traffic making this movement. Inter peak delays changed little. Journey time reliability has improved dramatically in both peak periods but changed very little in the inter peak.

A1036 Northbound

4.62. For the traffic that turns towards the A64 there was little change in the AM peak period. Pre-scheme delays were much larger in the PM peak and the scheme has decreased these delays by large amounts by providing regular opportunities to get on to the roundabout. Inter peak delays have increased slightly. Journey time reliability has remained the same in some time periods but improved a lot in the PM peak.

4.63. For the traffic that turns left towards the A1237 there was previously a low level of delay in the AM and inter peak and this is now slightly worse, post-scheme. There were much larger delays in the PM peak and large time savings were made by the scheme. Journey time reliability followed a similar pattern of change.

Journey time summary

4.64. The main conclusions that can be drawn from this analysis of journey times are:

- The scheme has delivered peak hour journey time improvements, particularly in the PM peak on York City Council roads (A1237 and A1036). The trunk road A64 South approach experienced worse journey times in the PM peak hour;
- There has been an increase in journey times during the inter peak time period, particularly on the A64 South approach. These increases were smaller than the peak hour journey time savings, but they apply to more hours of the day, as might be expected from a scheme that has implemented traffic signals; and
- Journey time reliability – Similarly to journey times, there is a variable pattern to changes in journey time reliability. Changes in reliability generally follow the same pattern as changes in average journey time. Some approach roads achieved improvements in reliability in almost every time period (A1237) as they now have a greater and more regular ability to get through the junction than they did under priority control. However, both of the A64 approaches experienced worse reliability in most time periods because the traffic signals have taken away some of the priority that they had previously when travelling through the junction. The A1036 had a mixture of better and worse reliability in different time periods.
- As a result of this analysis, Reliability has been scored as Neutral in the scheme EST because there is not a clear pattern of better or worse journey time reliability.

Quantifying the journey time benefit

4.65. So far, we have identified the traffic flow profile at the scheme and the scale of journey time benefit per vehicle due to the Hopgrove roundabouts scheme. Now we must use this data to quantify the annual benefit to all vehicles.

4.66. The outturn journey time benefits for this scheme have been evaluated using a PAR approach, typically adopted by the HA for the appraisal and evaluation of LNMS schemes.

4.67. The PAR method of calculating the Transport Economic Efficiency (TEE) journey time benefits is based on the vehicle hours saved in the first year, monetised by using a Value of Time (VOT) that converts vehicle hours saved into monetary benefits. This is then converted to a forecast for the whole appraisal period using capitalisation factors, which provide a forecast for scheme life benefits.

4.68. Vehicle hours saved in the opening year were calculated using the observed turning count and sat nav journey times described previously in this section for the AM, Interpeak and PM weekday time periods as used in the appraisal.

4.69. Based on the findings of the previous analysis, the following assumptions will be made to attempt to simplify the process of calculating the annual benefit:

- Benefits have been applied to each turning movement at the junction based on the average post-scheme journey time per vehicle for that movement;

- The turning count survey that was carried out at the pre-scheme stage (2002) did not collect data about complete movements through the junction from entry to exit arm so the post-scheme turning volumes (2012) have been used. The difference between the pre-scheme and post-scheme total traffic volume through the junction is small so we have used the most recent and thorough traffic volumes;

- Benefits have been calculated for the AM peak period (07:00–09:00), inter peak period (09:00–16:00), PM peak period (16:00–18:00) and shoulder-peak period (18:00-19:00); and

- The average benefit has been applied to 260 days as an estimate of the number of weekdays per annum. The impacts at weekends have been excluded from the calculations to reflect the approach used in the appraisal and a lack of weekend data. The weekend impacts are expected to be small compared with the peak and inter-peak periods.

4.70. Using the journey time savings per vehicle quoted in Table 4.8 along with the traffic flows presented in Table 4.9, it is possible to calculate the annual vehicle hour savings as a result of the Hopgrove Roundabouts scheme based on the assumptions stated above.

Table 4.9 – Summary of 2012 traffic flows

	Average Traffic Volume (vehs)					
Turn	**7:00-8:00**	**8:00-9:00**	**Inter-Peak (9:00-16:00)**	**16:00-17:00**	**17:00-18:00**	**18:00-19;00**
A-C	8	12	231	35	31	30
C-A	64	61	350	31	26	30
A-D	180	241	994	134	146	135
D-A	99	142	623	179	186	118
A-E	426	534	2,877	668	592	343
E-A	573	641	3,136	483	487	349
C-D	45	86	469	71	69	68
D-C	80	85	546	76	58	61
C-E	605	594	2,793	583	591	393
E-C	570	717	2,940	584	734	460
D-E	253	223	1,771	471	601	285
E-D	391	427	1,638	263	318	247

Table 4.10 – Vehicle hours saved per year (260 days)

	Vehicle Hours (negative is a saving)						
Turn	**7:00-8:00**	**8:00-9:00**	**Inter-Peak (9:00-16:00)**	**16:00-17:00**	**17:00-18:00**	**18:00-19;00**	**Total**
A-C	4	6	267	35	34	28	**374**
A-D	91	174	1,149	135	137	107	**1,793**
A-E	-92	-116	416	-193	-128	0	**-113**
C-A	-69	-247	-303	-269	-377	-13	**-1,278**
C-D	-20	-261	-305	-579	-962	-300	**-2,427**
C-E	-524	-2,402	-2,017	-4,926	-8,665	539	**-17,995**
D-A	93	31	360	-246	-846	-9	**-617**
D-C	110	98	434	-27	-168	-18	**429**
D-E	256	81	1,279	-578	-2,474	41	**-1,395**
E-A	0	-741	8,154	1,081	1,196	555	**10,245**
E-C	206	-621	8,918	211	2,439	930	**12,083**
E-D	113	-247	4,969	760	1,011	464	**7,070**
Total	**167**	**-4,245**	**23,319**	**-4,596**	**-8,805**	**2,326**	**8,166**

4.71. Table 4.10 shows the annual vehicle hours saved by traffic movement following the construction of the scheme. It demonstrates that when the journey time savings are multiplied by the most recent traffic volumes, the pattern of benefits and disbenefits is influenced by the relative length of the different time periods (for example there are 7 inter peak hours so this period is particularly critical). The main points arising from this table are:

- There have been significant savings in total vehicle hours spent on the network during the peak hours of 08:00-09:00, 16:00-17:00 and 17:00-18:00, indicating that the scheme has effectively reduced congestion and delay during these peak times;

- However, there has been a corresponding increase in delay during the inter peak, shoulder peak and the hour beginning 7am that outweighs the peak time benefits to produce a net increase in total vehicle hours spent at the junction over a year;

- The total inter peak increase in vehicle hours is large (23,319 hours) but this period is made up of seven hours of an hourly journey time change that is smaller than the peak time hourly change, (i.e. 7 x 3,331 inter peak hours). The introduction of permanent traffic signals has applied a time penalty to all traffic in non-peak hours of the day leading to an overall increase in time spent travelling through the junction; and

- Journey time disbenefit is experienced predominantly on the A64 South approach (arm E) to the junction towards the other three main roads, this is unsurprising as this trunk road arm has a high traffic flow, and prior to the scheme, had to give way to very little traffic at the junction. Now, with the signal arrangement, the arm is forced to give way to other, lesser movements.

4.72. Signals are generally the best option when traffic flows are high, to help balance delays between numerous arms. Considering the results presented in Table 4.10, it appears the scheme would benefit from only using part-time signals. This would produce benefits during the peak periods by implementing a controlled junction, and then release traffic in the inter peak periods without introducing delays.

Summary

This traffic analysis section has demonstrated the conditions before and after the scheme. Specifically, the key findings are:

- The long term traffic volume travelling through the junction has not changed significantly over the last 10 years or between the immediate Before and After time periods (2008-2010);
- The A64 South (York southern ring road) carries the largest volumes of traffic into the junction, the A64 is the only trunk road in this scheme;
- Overall, the scheme has delivered
  - Small journey time benefits in the AM peak (8:00-9:00) and early PM peak (16:00-17:00);
  - Large journey time benefits in the PM peak (17:00-18:00);
  - Small journey time disbenefits in each of the inter peak hours (9:00-16:00);
- The largest journey time benefits have been experienced by traffic approaching the junction on the A1237 and A1036, in all time periods but especially in the PM peak, as these roads have been given a level of priority and capacity that they did not have under the previous priority control;
- The largest journey time disbenefit has been for traffic approaching on the A64 South, which also carries, by far, the largest volumes of traffic. This arm would previously have had little delay under the previous junction arrangement;
- The inter peak disbenefits have outweighed the peak hour benefits due to the fact there are seven inter peak hours. As such, overall, there has been an increase in vehicle time spent at the junction (i.e. total delay);
- Vehicle hour disbenefits amass to 8,166 vehicle hours in the opening year based on 260 weekdays in the average year;
- Overall, the reliability of journey times has not improved significantly but individual traffic routes through the junction have experienced better

5. Safety impacts

5.1. This section examines the accidents both before and after scheme opening to establish whether the scheme has resulted in a post opening safety benefit or disbenefit. The aims of this section are:

- To determine whether the scheme has achieved its safety objectives;

- To determine whether there has been any change in the number, location and causation of Personal Injury Accidents (PIAs) following scheme opening; and
- To determine if the scheme has resulted in an overall safety benefit or disbenefit and to quantify this change.

Appraisal forecasts

5.2. The pre-scheme appraisal used accident data for the five year period from 2003 to 2007. This assessment of PIAs on the basis of this selective assessment revealed the following:

- 40 PIAs occurred at the junction over a period of five years, amounting to an observed accident rate of 8 PIA/yr; and
- The Killed and Seriously Injured (KSI) severity index[2] was 5% over the same five year period, with two serious accidents and zero fatal accidents.

5.3. A summary of the accident analysis as detailed in the appraisal is shown in Table 5.1.

Table 5.1 – Summary of pre-scheme accident as documented in the appraisal

Year from	Slight	Serious	Fatal	Total	Severity Index
2003	11	0	0	11	0%
2004	8	0	0	8	0%
2005	9	0	0	9	0%
2006	6	2	0	8	25%
2007	4	0	0	4	0%
Total	**38**	**2**	**0**	**40**	**5%**
Per Annum	**7.6**	**0.4**	**0**	**8**	**5%**

5.4. An analysis of these accidents was carried out for the scheme appraisal. It showed that the majority of these accidents were concentrated on the two A64 approaches to the junction and included a high proportion of rear end shunts, related to the queues of traffic on these approaches.

5.5. As part of the appraisal the pre-scheme accident record at the junction was compared with the national average for this type of junction using guidance from COBA 11, DMRB Vol. 13, part 2. This approach suggested that an 'average' figure for the junction would be 3.75 PIAs in 2007, giving a five year expected total of 20 PIAs. This shows that the actual accident rate at the junction was double the expected figure, based on national average values from COBA.

5.6. It was estimated, using the accident reports and eliminating those accidents that would not occur when the proposed road layout is constructed, that the scheme would save 3.5 PIAs in the opening year and save 31 PIAs over the 10 years to

[2] Fatal accidents and serious accidents as a percentage of all personal injury accidents.

2019. The use of a 10 year forecast is unusual; the standard approach is to use a 60 year timescale for future benefits, and the design consultant has acknowledged that this approach was flawed.

5.7. As no PAR has been produced for this scheme, it is assumed that at the time of appraisal, the forecast accident saving would have been conducted over 60 years to be in line with the journey time saving forecast. As such, for the purpose of this evaluation, the appraisal is updated using PAR methodology to forecast 162 accidents saved over 60 years.

5.8. The reduction in queues and delays was expected to help reduce the accident rate, along with the road safety benefits of introducing traffic signal control. The scheme was expected to remove some of the driver uncertainty that existed previously.

Predicted Corrected

5.9. To ensure a like-for-like comparison of the predicted and outturn safety impacts of the scheme, a predicted corrected appraisal of the scheme has been undertaken. In this instance, this has been done to:

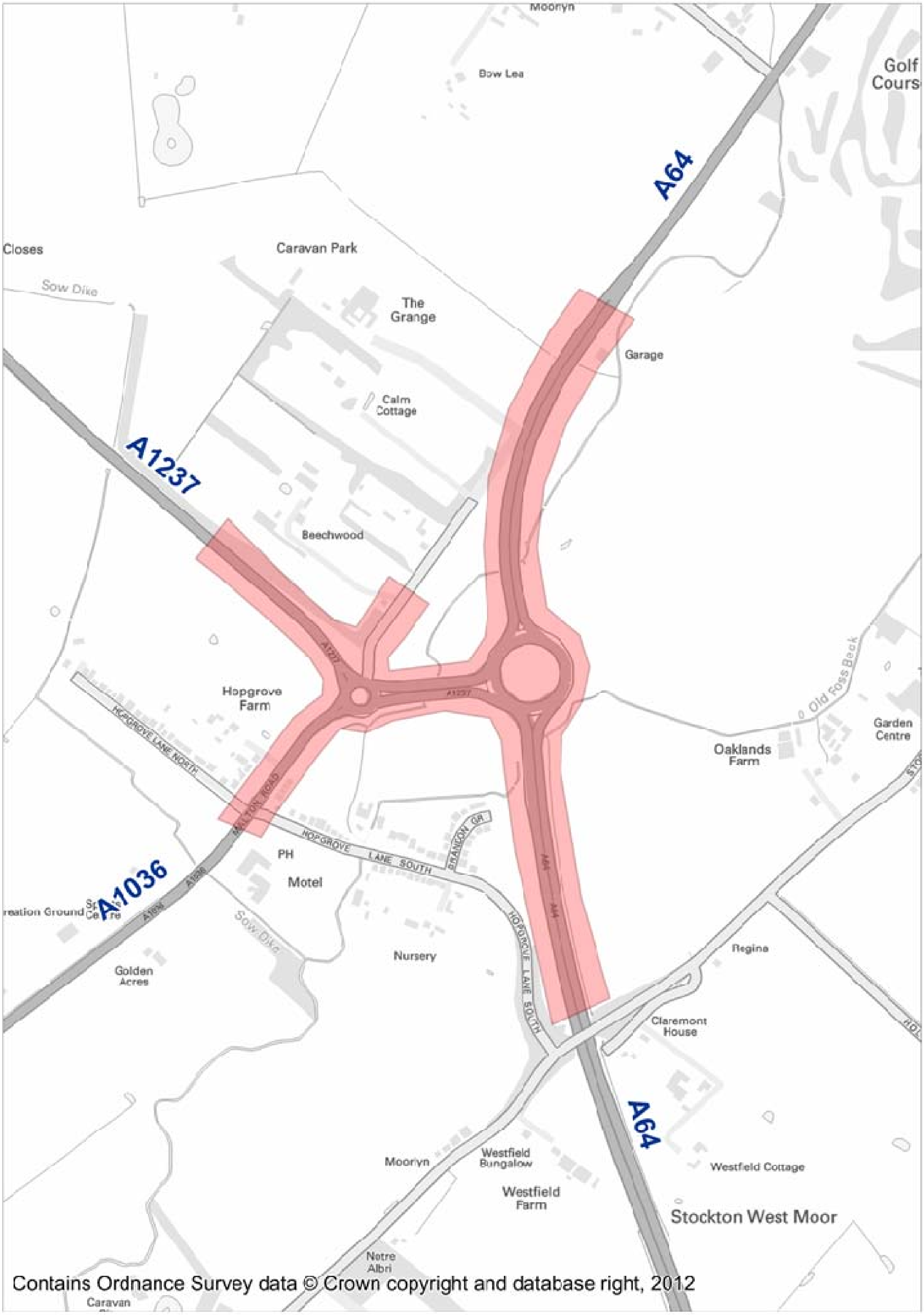
- Ensure that the same geographical area is used for both the before and after periods; and
- Extend the accident appraisal period to 60 years instead of the 10 used in the appraisal.

5.10. We also calculate a predicted corrected based on the five years immediately leading up to the start of scheme construction rather than the five years that was used in the appraisal. This is done to ensure that the most up to date pre-scheme data is used to compare with the post-scheme period, thus isolating the scheme as the only change between pre- and post-scheme.

5.11. It is considered that traffic management during the period of construction for the scheme would have affected driver behaviour; therefore this period has been excluded (December 2008 to October 2009). The predicted corrected analysis takes account of the 59 month period up to the start of construction (1st Jan 2004 to 30th November 2008).

5.12. A comparison of the accidents used in the appraisal and those available now shows that the total number of accidents in the study area is identical so no adjustment of the accident saving was necessary to take account of this. The geographical area used for accident analysis is illustrated in Figure 5.1.

Figure 5.1 – Geographical area for accident analysis



5.13. Table 5.2 provides a summary of the PIA numbers occurring in the defined study area before the scheme opened. Two pre-scheme periods have been presented as follows:

(a) For the years as detailed in the appraisal (60 months from January 2003 to December 2007).

(b) Most recent period prior to the start of construction (59 months January 2004 to November 2008)

Table 5.2 – Summary of accident numbers before scheme opening - Predicted Corrected

Period	Time Period		Slight	Serious	Fatal	Total
Appraisal Period	Jan 2003 to Dec 2007	PIAs	38	2	0	**40**
		Annual Rate	7.6	0.4	0	**8**
Most Recent Pre-construction	Jan 2004 to Nov 2008	PIAs	36	4	0	**40**
		Annual Rate	7.3	0.8	0	**8.1**

5.14. The table shows that there is not a significant difference in the number of accidents or the accident rate in the two time periods. However, there is a small increase in the severity index in the most recent figures because two of the accidents were serious rather than slight, thus increasing the severity index from 5% to 10%.

Outturn

5.15. To calculate the outturn accident rate, safety data was requested for the same geographical area used in the predicted corrected scenario from the date of scheme opening to as recent a date as is available (minimum of one year's post-scheme data).

5.16. For this scheme, post-scheme accident data was available from November 2009 until the end of December 2011, providing 26 months of post-scheme data. The pre and post-scheme accident data and saving compared to Predicted Corrected is shown in Table 5.3.

Table 5.3 – Post-scheme accident comparison

Scenario	Time Period		Slight	Serious	Fatal	Total
Most Recent Pre-construction	Jan 2004 to Nov 2008 (59 months)	PIAs	36	4	0	**40**
		Annual Rate	7.3	0.8	0	**8.1**
Outturn	Nov 2009 to Dec 2011 (26 months)	PIAs	11	4	0	**15**
		Annual Rate	5.1	1.8	0	**6.9**
Annual Accident Change			**-2.2**	**1.0**	**0**	**-1.2**

5.17. There have been 15 PIAs at Hopgrove in the latest 26 month period since the opening of the scheme. Table 5.3 shows that there has been a PIA reduction of

2.2 slight accidents per annum since the scheme was opened (from 7.3 per year pre-scheme to 5.1 per year).

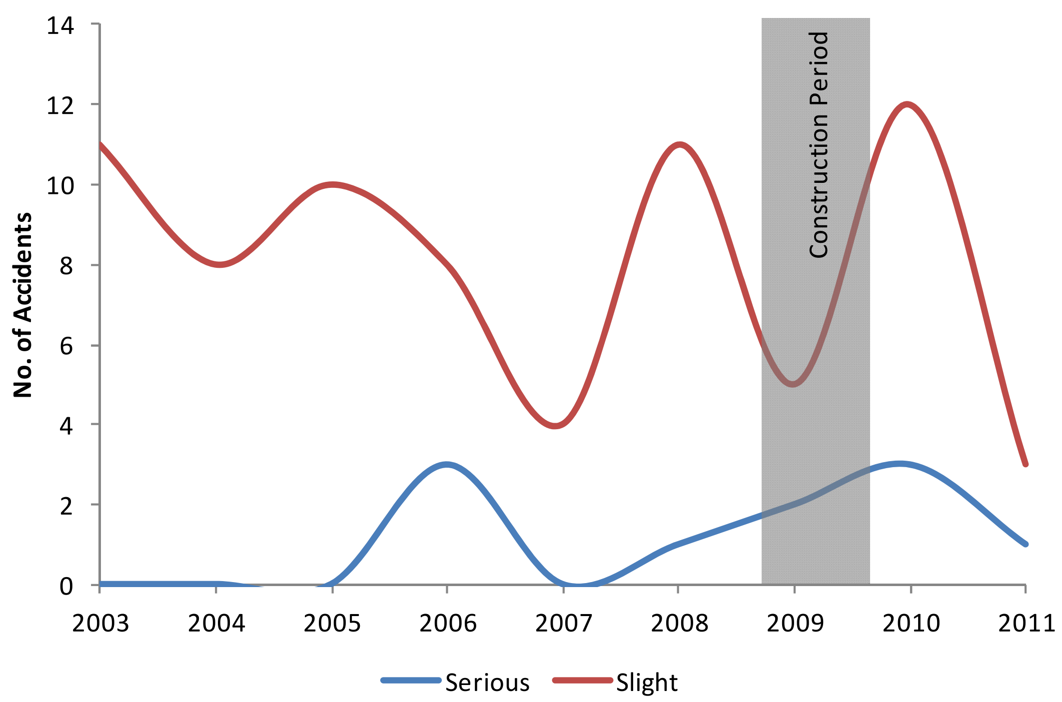
5.18. However, there has been an increase in the rate of serious accidents, from 0.8 per year to 1.8 per year, increasing the post-scheme Severity Index from 10% to 26.7%. This counter-balances some of the savings that have been made in the number of slight accidents to produce a total accident saving of 1.2 PIAs per year.

5.19. Figure 5.2 shows how the number of accidents has varied over the past 9 years, including the pre-scheme period, the construction period and the post-scheme period. It shows that there have been fluctuations in the number of accidents per year but no significant trend of accident reduction or increase.

5.20. It also shows that the immediate post-scheme year 2010 was a bad year for accidents, having the largest number of any year (15 PIAs) but that the following year was the joint best year with only 4 PIAs. This might indicate that the scheme has taken some time to be understood and used safely by drivers but that now the design has become familiar it is possible that the junction will continue to be safer than before the scheme was constructed. It is also possible that the previous fluctuations in accident figures are continuing post-scheme.

5.21. It is acknowledged that a longer period of post-scheme accident study would provide more certainty about the statistical significance of these conclusions.

Figure 5.2 – Observed personal injury accidents in study period



Comparison of predicted and actual savings

5.22. This sub-section considers all safety as a result of the scheme from the forecast accident savings to the observed opening year accident saving to consider whether the scheme has met its objectives in terms of safety.

5.23. An overview of the predicted accident saving at an appraisal, Predicted Corrected and Outturn level is shown in Table 5.4. The outturn saving is calculated in comparison to both the predicted accident rate and the predicted corrected accident rate. The 60 year PIA saving is calculated using the PAR guidance approach to capitalisation. As stated earlier, this approach has also been used to convert the 10 year appraisal forecast into a 60 year one for consistency.

Table 5.4 – Forecast and observed accident savings

Scenario	Time Period	Opening Year PIA Saving	60 Year PIA Saving
Appraisal Prediction	Jan 2003 – Dec 2007	3.50	162*
Predicted Corrected (Latest dates)	Jan 2004 - Nov 2008	3.56	164
Outturn	Nov 2009 - Dec 2011	1.2	56

* As recalculated (described earlier in this section) to be consistent with the 60 year scheme life.

5.24. Table 5.4 demonstrates that an opening year PIA saving of 3.5 was predicted in the appraisal but an outturn PIA saving of only 1.2 PIA was realised.

5.25. As such, the scheme is considered to be successful on accident reduction with a saving of 1.2 PIAs in the opening year and a reforecast 56 PIA saving over the 60 year scheme life. Despite the fact that the scheme has not been as beneficial as hoped for in the pre-scheme appraisal it has still had a positive impact on road safety.

Accident location

5.26. The most recent pre-scheme accidents (predicted corrected) are shown geographically in Figure 5.3. It is clear in the before scenario that accidents were clustered on the two A64 approaches entering the circulating carriageway of the roundabout. Half of all the pre-scheme accidents in the study area occurred in these two areas (11 on the A64 South approach, 9 on the A64 North approach and 20 on the rest of the junction).

5.27. The distribution of post-scheme accidents is shown geographically in Figure 5.4. The main differences between the pre-scheme and post-scheme distribution of accidents are:

- There have been no post-scheme accidents on the Malton Road (A1237/A1036) roundabout or on the central link road between the two roundabouts. Eight (20%) of the 40 pre-scheme accidents were on these links. This suggests that the introduction of signal control has greatly reduced the risk of accidents at the smaller of the two roundabouts;

- The clustering of accidents on the immediate A64 North and South approaches has been reduced, suggesting that drivers are more aware and controlled on the high speed approaches to the larger roundabout;

- Proportionally, there are more accidents on the circulating carriageway of the A64 roundabout. This may be because there are now signals and stoplines on the circulating carriageway and more traffic lanes around the roundabout and this has introduced a new accident risk to this part of the junction; and

- The proportion of serious accidents has increased but there is no clear link between the locations of these accidents.

Figure 5.3 – Location of pre-scheme PIAs (Jan 2004 to Nov 2008)

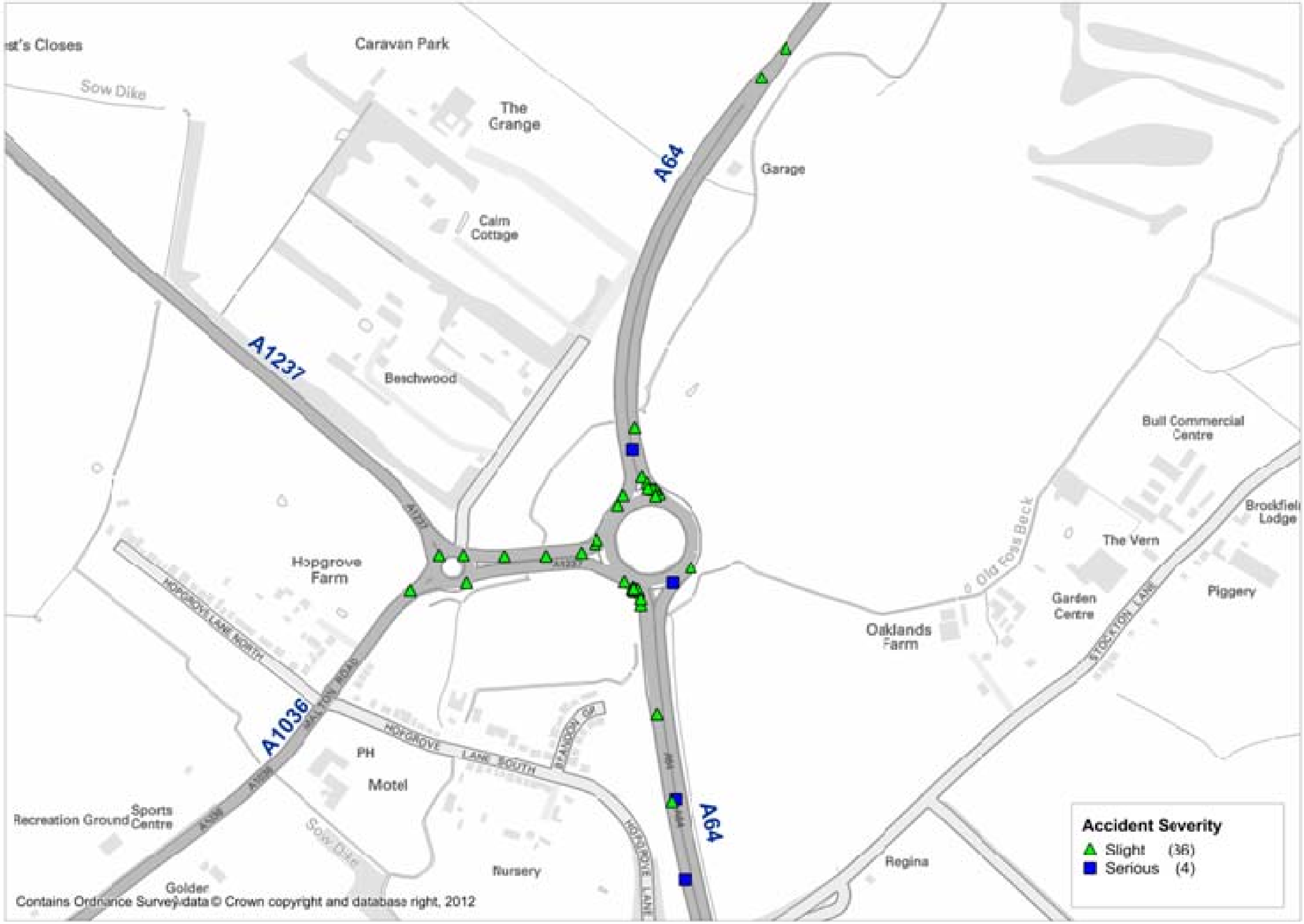
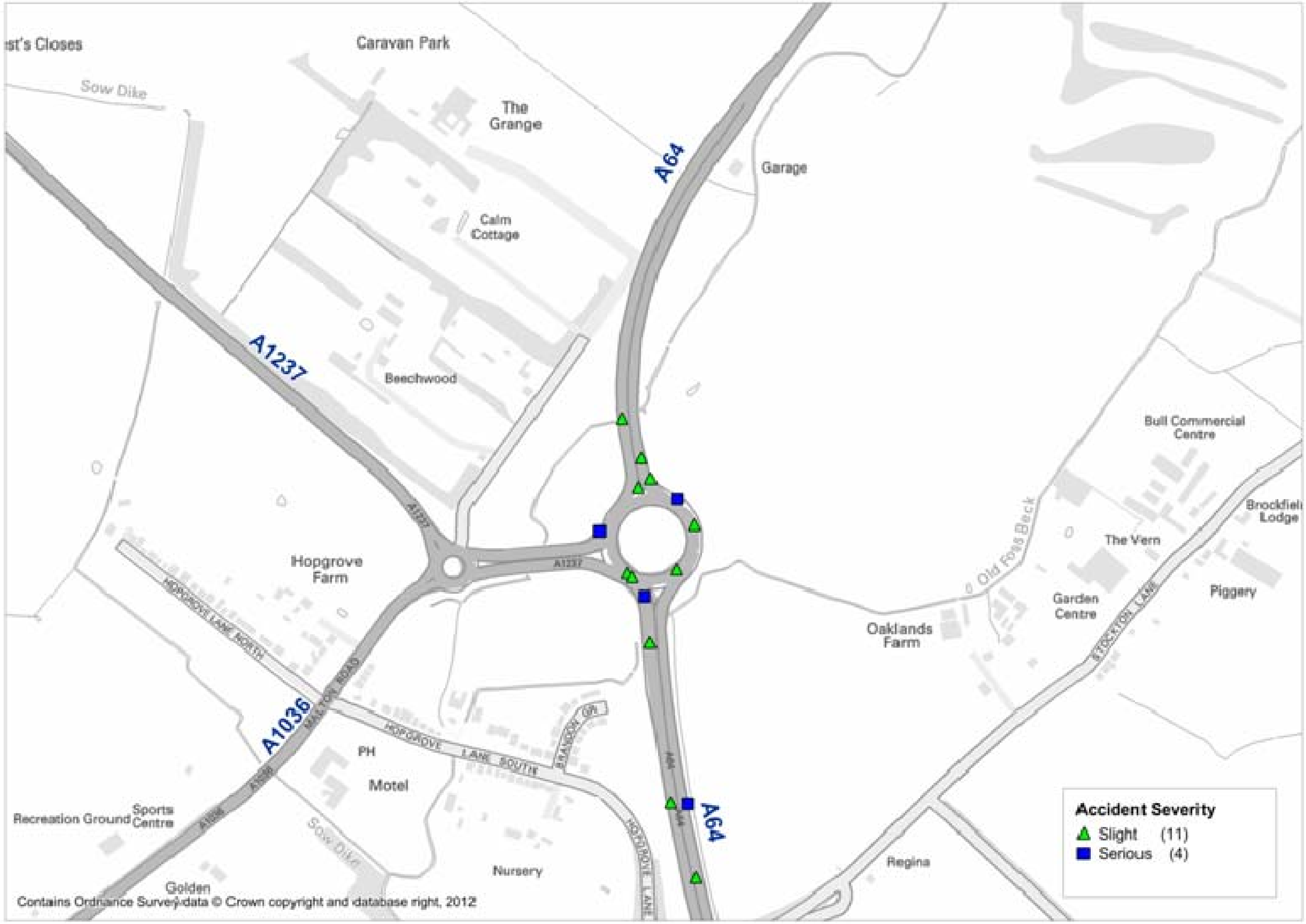


Figure 5.4 – Location of post-scheme PIAs (Nov 2009 to Dec 2011)



Accident causation

5.28. The STATS19 accident data provides a comprehensive dataset regarding the accidents that have occurred. This allows us to go beyond the frequency of accidents and consider why accidents have been occurring and how this may have changed.

5.29. The STATS19 accident descriptions have been analysed and they show that prior to the scheme there has been a large number of ‘rear shunt’ type accidents where one or more vehicles have been hit by another vehicle from the rear. Table 5.5 shows the number of pre-scheme and post-scheme ‘rear-shunt’ accidents and compares this with the rate of other accident types. ‘Other’ accident types contain a mixture of various types of accident that are more infrequent in number and are spread across the junction in a more scattered distribution.

Table 5.5 – Accident type analysis

Time Period			Rear Shunt Accidents	Other Accident Types	Total
Most Recent Pre-construction	Jan 2004 - Nov 2008	PIAs	**28**	**12**	**40**
		Annual Rate	**5.7**	**2.4**	**8.1**
Outturn	Nov 2009 - Dec 2011	PIAs	**5**	**10**	**15**
		Annual Rate	**2.3**	**4.6**	**6.9**
Annual Accident Change			-3.4	+2.2	-1.2

5.30. Table 5.5 demonstrates that there was a large problem with rear-shunt type accidents at the roundabout in the pre-scheme period and that the installation of traffic signal control has reduced this accident type by over half. There has, however, been an increase in other accident types that partly counter-balances the reduction in shunt-type accidents, but there is no obvious trend in the type or location of these other accident types to indicate a particular accident problem or risk.

Casualties

5.31. The STATS19 data also provides some information about the number and category of casualties that have been involved in accidents at the junction. Table 5.6 provides a summary of the casualties at the junction.

Table 5.6 – Accident casualties

Period		Total Casualties	Cyclists	Pedestrians
Pre-Scheme	Number	56	0	0
	Annual Rate	11.4	0	0
Post-Scheme	Number	25	0	0
	Annual Rate	11.5	0	0

5.32. The table shows that, although there has been a reduction in the number of accidents per year (from 8.1 to 6.9) since the scheme was installed; there has been virtually no change in the rate of casualties involved in accidents at the junction. This means that the number of people injured per accident has increased from 1.4 to 1.7. If we assume that there has been no significant increase in vehicle occupancy rates between the pre-scheme and post-scheme periods, a possible cause of an increase in the number of people injured per accident is the increase in the annual rate of serious accidents at the junction. It is possible that more serious accidents may result in a higher number of casualties than slight accidents.

5.33. There have been no accidents involving cyclists or pedestrians at the junction, before or after the scheme was installed. This relates to the lack of pedestrian and cyclist activity at the junction.

Security

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

5.35. The Hopgrove Roundabouts scheme has had a minimal impact on security for road users. The junction is located in a rural location and the number of pedestrians and cyclists that use the junction is very small. None of the measures are likely to impact significantly on actual or perceived levels of security and hence it has been scored as ‘neutral’ in the EST.

Summary

The safety analysis presented in this section has demonstrated that:

- Taking the most recent period prior to scheme construction (59 months between January 2004 and November 2008), there were on average 8.1 PIAs per year at the junction;
- There was a forecast PIA saving of 3.5 per year and 162 PIAs over the 60 year scheme life;
- Observing the 26 months since the scheme opened demonstrates that the rate of PIAs has decreased to 6.9 per year;
- The scheme has actually reduced accidents by 1.2 per year and is forecast to save 56 accidents over the scheme's 60 year life;
- There has been a decrease in the number of slight accidents but a corresponding increase in the number and proportion of serious accidents, which may help explain the increase in the number of casualties per accident;
- The STATS19 data shows that the clusters of accidents on the two A64 approaches to the roundabout have been reduced and that accidents are now more evenly distributed around the junction;
- The proportion of 'rear-shunt' type accidents has been cut from 70% to 33% of all accidents which could indicate that safety has been improved at these locations; and

6. Economy

6.1. This section of the report presents information regarding the forecast and outturn economic impacts of the scheme based on observed data from both before and after the scheme opened. The safety and economy benefits presented in Chapter 4 and 5 have been monetised and a review of the scheme costs against the forecast will also be undertaken, thus allowing the scheme's overall value for money to be assessed.

6.2. These figures will also provide an opportunity to consider the accuracy of the appraisal forecasts of costs and benefits to understand how value for money was appraised and to inform future LNMS appraisal.

6.3. Economic benefits presented in this section are derived from:

- Journey time benefits associated with a reduction in the typical journey time along the route; and
- Safety benefits associated with any reduction in accidents observed at the scheme location.

6.4. All scheme costs and benefits presented in this section are in 2002 prices discounted to the opening year, unless stated otherwise.

Journey time benefits

6.5. The journey time benefits due to the scheme can also be monetised for inclusion in the value for money assessment. This is done by factoring the number of vehicle hours saved by the recognised cost saving per hour for the typical road user called the 'value of time'. This process is outlined within this section.

Forecast journey time benefits

6.6. The forecast journey time benefits for the Hopgrove scheme were derived from a micro-simulation traffic model (PARAMICS modelling suite in this case) that fed a TUBA economic assessment.

6.7. The appraisal does not specify the value of the opening year monetary benefit for journey times but forecasts a 60 year scheme life benefit of £52.4m (due to being a TUBA output this is in 2002 prices, discounted to 2002). The appraisal also included the monetary benefits of the scheme on Vehicle Operating Costs (VOCs) which were estimated to be £4.2m (2002 prices, discounted to 2002) over the scheme life, a small proportion of the overall benefits.

6.8. Therefore, TUBA predicts that the net benefit on journey times as a result of the scheme was forecast to be £56.720m in 2002 prices, discounted to 2002.

6.9. However, the TUBA output file also provides a year-by-year breakdown of the scheme performance. Therefore, an analysis of the TUBA outputs has enabled us to extract the forecast opening year economic benefits of the scheme and to understand how the benefits were expected to accumulate year-on-year over the 60 year scheme life.

6.10. No changes were necessary to the appraisal forecasts and so no Predicted Corrected calculations have been necessary.

6.11. The first year and scheme life results from TUBA are presented in Table 6.1. Note that all TUBA outputs are presented in 2002 prices discounted to 2002; therefore the discounting to opening year value is provided for the total figures only.

Table 6.1 – Forecast journey time benefits

£000s, 2002 prices, discounted to 2002	JT Benefits in opening year	60 Year JT Benefits
AM peak	£698	£70,545
Inter peak	-£1,981	-£31,405
PM peak	-£141	£17,580
Total	**-£1,424**	**£56,720**
Total (discounted to opening yr)	**-£1,750**	**£69,723**

6.12. The table demonstrates that the appraisal forecasts a negative benefit in the opening year, indicating that journey times would get worse overall when the scheme first opened. This is an unusual occurrence for a LNMS scheme and the negative first year impact is not recognised in the appraising documentation, only uncovered by looking at the TUBA output file.

6.13. A further analysis of the TUBA outputs provides more detail about how the benefits were expected to vary by time period and over the scheme life. The scheme was expected to deliver:

- Positive benefits in the AM peak period from the outset and these went on to form the bulk of the benefits over the whole scheme life;
- The inter peak was expected to experience disbenefits in each year of the scheme life, starting with a large £1.9m disbenefit in the opening year; and
- The PM peak had a small negative impact on journey times in the early years but this was expected to become beneficial in the fourth year after opening due to traffic growth. This then continued to be positive over the remainder of the 60 years.

6.14. This indicates that the appraisal recognised that the benefits of the scheme only become positive when traffic levels and congestion reach a certain level. Below this level the benefits of the new scheme are outweighed by the disbenefits associated with applying traffic signals control to traffic that was flowing more freely.

6.15. Traffic levels were expected to increase at the junction, due to background traffic growth and the effects of land use developments nearby, and the signals were expected to become more beneficial than the previous priority control as they are more efficient at controlling flows and balancing delays. The forecast suggested a journey time disbenefit in the opening year but the forecast traffic growth over the scheme life transferred this into a large positive benefit. The level of overall benefit would have been higher if the scheme had not been constructed until traffic had reached a greater level.

6.16. The economic assessment that was included in the Traffic and Economics Report makes no reference to opening year disbenefits, although an analysis of the TUBA outputs that have been made available for this evaluation show that negative benefits were expected in the inter peak period throughout the scheme life. It is therefore unclear whether the scheme was given approval in the full knowledge that the scheme impact would be adverse in the opening years and whether it was commissioned with this knowledge.

6.17. The TUBA results also demonstrate that the scheme was never thought to be positive outside of the peak hours (shown to be true in Section 4 of this report) and that the scheme's success was reliant on its peak time impact (particularly in the AM peak). The differential between different time periods was not made clear in the TEE section of the report, and so it is not clear whether the investment decision was made in full knowledge of the scheme's likely impacts.

6.18. In theory, the appraisal documentation included sufficient information to show that part-time signals at the junction would deliver far more journey time benefits (i.e. fewer inter peak disbenefits), there is no documentation covering whether this was considered.

6.19. It is recognised however that a decision to implement part-time signals would be reliant on non-economic factors relating to design and road safety, and so this may not have been a viable option.

Outturn journey time benefits

6.20. Outturn journey time benefits have been calculated by using sat nav journey time data available on all approaches to the junction for the pre-scheme and post-scheme time periods (see Section 4). The findings can be summarised as:

- There have been significant savings in total vehicle hours spent on the network during the peak hours, indicating that the scheme has effectively met its objective to reduce congestion and delay during peak times;
- There has been an increase in delay during the inter peak hours that outweighs the peak time benefits to produce a net increase in total vehicle hours spent at the junction on an average day;
- The total inter peak increase in vehicle hours is large (23,319 hours) but this is made up of seven hours of a journey time change that is smaller than the peak time change (3,331 hours); and
- Journey time disbenefit is largely derived from the A64 South approach to the junction towards the other three main roads.

6.21. The opening year vehicle hour savings have been converted to monetised benefits using the Value of Time method from PAR guidance.

6.22. For the outturn scheme life benefits, the previously discussed TUBA profile of forecast benefits has been used to produce the reforecast of benefits over the 60 year scheme life.

6.23. The scheme life figures have been calculated by using the observed opening year journey time saving and applying the TUBA profile of benefits to the AM, PM and inter peak periods independently. To be clear, the TUBA profiles show:

- AM peak – positive benefits in every year of the scheme life. The observed opening year benefits were much lower than the forecast opening year benefits which means that the scheme life AM peak benefits are significantly lower also;

- Inter peak – negative benefits were forecast in every year of the scheme life, starting out as high negative benefits and reducing over time. The observed opening year disbenefits were much lower than the forecast disbenefits which means that the scheme life inter peak disbenefits are also significantly lower; and

- PM peak – benefits were expected to be negative in the early years, breaking even in the fourth year and going on to provide positive benefits for the remaining years. The observed PM benefits in the opening year were actually positive and therefore the profile from year 4 onwards has been applied in the outturn resulting in PM scheme life benefit slightly higher than forecast.

6.24. The results of these calculations are shown in Table 6.2. Again note that the TUBA outputs are by default presented in 2002 prices discounted to 2002.

Table 6.2 – Forecast and outturn journey time benefits

£000s, 2002 prices, discounted to 2002	Opening Year		60 Year	
	Forecast	**Outturn**	**Forecast**	**Outturn**
AM peak	£698	£52	£70,545	£4,548
Inter peak	-£1,981	-£300	-£31,405	-£4,842
PM peak	-£141	£172	£17,580	£18,359
Total	**-£1,424**	**-£75**	**£56,720**	**£18,065**
Total (discounted to opening yr)	**-£1,750**	**-£92**	**£69,723**	**£22,207**

6.25. The table demonstrates that the total opening year observed journey time benefits are negative as expected, but the disbenefit is a lot smaller than forecast. However, there are some benefits during both peak hours. The scheme life PM peak time benefits are actually higher than forecast because the opening year journey time saving is positive (i.e. a benefit), unlike the negative (disbenefit) figure that was forecast.

6.26. Our revised scheme life forecast shows that we expect inter peak benefits to be negative for every year of the scheme life, as was forecast in the original appraisal, but the overall scale of this disbenefit is lower, because the opening year figure is less negative than expected.

6.27. The major difference over the scheme life is in the AM peak, and this is the main reason that the appraisal predicted benefits have not occurred. The forecast was for large opening year benefits (£698,000) and scheme life benefits (£70.5m) to be gained in the AM peak but the observed opening year journey times of only

£52,000 suggest that the actual scheme life benefits will fall well short of this figure at only £4.5m.

6.28. The outturn opening year benefit is -£92,000, a disbenefit for road users. However, assuming the TUBA benefits profile is accurate; the reforecast 60 year scheme life benefits are now thought to be £22.2m. This is over £47m less than the predicted scheme life journey time benefits.

6.29. Whilst the scheme appraisal significantly overestimated the scheme benefits in terms of journey time there were opening year benefits during the peak periods and we expect the scheme to continue to deliver significant scheme life benefits during these peaks.

6.30. The forecasts acknowledged that there would be journey time disbenefits when the scheme first opened and it would be a number of years before it started to deliver a positive impact overall. However, in reality benefits in the peak periods were already observed in the opening year, even with the absence of the expected traffic growth.

Safety benefits

6.31. In scheme appraisal, safety benefits are calculated by converting a predicted reduction in accident rate into a monetary benefit based on the figures for the average cost of an accident.

6.32. To evaluate the scheme post-opening, this process has been repeated with the observed change in accident rate to indicate the likely road safety returns of this scheme.

Forecast safety benefits

6.33. Prior to the scheme, the appraisal made a forecast that there would be an opening year accident saving of 3.5 personal injury accidents associated with the scheme that equated to an opening year monetary benefit of £246,000 (2009 prices, discounted to 2002). The appraisal also provided a future year assessment of accident benefits for a 10 year period (2009-2019). This was to save 31 accidents over 10 years, with a monetary value of £2,148,000.

6.34. This approach requires two changes in order for us to follow the standard evaluation methodology, namely:

- Converting the forecast safety benefits to 2002 prices, discounted to opening year, was done to ensure they are consistent with the standard approach to evaluation. This results in a revised forecast figure of £313,495 for the opening year forecast accident saving; and

- Extending the 10 year scheme life accident benefits to a 60 year scheme life, in line with guidance (as discussed in Section 5 of this report). The design consultant has acknowledged that the original approach was flawed and we have assumed that, had a PAR been completed, a 60 year scheme life would have had to be used. As such, the forecast accident monetary benefit has been increased to £13.2m over the 60 year scheme life.

Predicted Corrected

6.35. The analysis of accidents in the previous section showed that we were able to match the accidents from the appraisal with the data provided. Therefore there is no change to the accident rate and forecast savings (3.5 accidents in the opening year) for the appraisal dates.

6.36. For the Predicted Corrected latest dates, there was very little difference in the number of pre-scheme accidents in the original appraisal time period (2003-2007) and in the most recent pre-scheme time period (2004-2008). This means that there is only a very small change to the forecast accidents saving in the Predicted Corrected latest dates from 3.5 to 3.56.

6.37. Table 6.3 shows the calculation of Predicted Corrected opening year and scheme life accident benefits.

Table 6.3 – Calculation of forecast safety benefits (PAR and Predicted Corrected)

	Appraisal (2003-2007)	**Predicted Corrected (latest dates)**
Opening Yr accident saving	3.5	3.56
Accident Capitalisation Factor	46.19	46.19
60 Yr Accident Saving	162	164
Average Cost of Accident in Opening Yr	£89,570	£89,570
Accident Benefit in Opening Yr	**£313,495**	**£318,869**
Capitalisation Factor	42.09	42.09
Accident Benefit over 60 Yrs	**£13.194m**	**£13.420m**

6.38. The table demonstrates the only change from the appraisal safety forecasts is a small change due to the use of the latest dates for the Predicted Corrected stage.

Outturn safety benefits

6.39. Using observed data from the 26 months after opening it has been possible to calculate the first year safety monetary benefit and then estimate the safety benefits of the scheme over 60 years.

6.40. These calculations are shown in Table 6.4, which is based on comparing the outturn accident rate to the most recent and viable period prior to start of scheme construction. Note that the most recent and viable before period is used in this evaluation rather than the appraisal years as this provides the most up to date data and isolates the impact of the scheme. The capitalisation factors and average cost of accidents are derived from current PAR guidance.

Table 6.4 – Calculation of Outturn safety benefits (2002 prices)

	Compared to Predicted Corrected latest dates
Opening Year Accident Saving	1.21
Accident Capitalisation Factor	46.19
60 Year Accident Saving	56
Average Cost of Accident in opening year (dual carriageway)	£89,350
Accident Benefit in opening year	**£108,338**
Capitalisation Factor	42.09
Accident Benefit over 60 Years	**£4,559,946**

6.41. Table 6.4 shows that the opening year and scheme life outturn safety benefits are £108,338 and £4.560m respectively. Comparing these figures to those forecast in **Error! Reference source not found.**, it is clear that the outturn savings are lower than those forecast in the appraisal because there was a lower than expected saving of PIAs.

Total Present Value Benefits (PVB)

6.42. The overall reforecast Present Value Benefits (PVB) for the 60 year assessment period is shown in Table 6.5 (safety and economy benefits combined). The Appraisal Forecast, Predicted Corrected and Outturn figures are all presented in their component safety, journey time and total benefit disaggregates.

Table 6.5 – PVB and component parts

£000s	Appraisal Forecast	Predicted corrected (most recent)	Outturn
		Opening Year	
Accident Benefits	£313	£319	£108
Journey Time Benefits	-£1,750	-£1,750	-£92
Total Benefits	**-£1,437**	**-£1,443**	**£16**
		60 Year Benefits	
Accident Benefits	£13,194	£13,420	£4,560
Journey Time Benefits	£69,723	£69,723	£22,207
PVB	**£82,917**	**£83,143**	**£26,767**

6.43. Table 6.5 demonstrates that the outturn opening year benefits represent a significant improvement when compared to the large journey time disbenefit that was forecast for the opening year. The outturn opening year accident benefits and journey time disbenefits largely cancel each other out to leave a very small net benefit (£16,000). This is in contrast to the first year forecast of a large disbenefit of £1.4m resulting from large journey time disbenefits in the first year.

6.44. The scheme life benefits are lower than expected, largely due to the lower than expected journey time benefits, as explained in the previous sub-section. The lack of significant AM peak journey time savings in the opening year means that the large benefits that were expected to materialise over time in this period are now expected to be much lower. Clearly the scheme has performed better than expected in the opening year because of the substantially smaller than expected inter peak disbenefit. However, this does not translate into a large scheme life benefit because of the lack of AM peak journey time savings that were by far the largest component of the forecast benefits.

6.45. In terms of safety benefits though, the scheme has performed well by achieving an accident reduction, but not as well as expected over the first year or the scheme life. Monetary accident figures for the outturn are approximately a third of what was forecast in the scheme appraisal and the predicted corrected forecast.

Scheme costs

6.46. The predicted, predicted corrected and outturn scheme costs for the A64 Hopgrove Roundabouts scheme are shown in Table 6.6.

Table 6.6 – Summary of predicted and outturn scheme costs

2002 Prices, Discounted to opening year	Appraisal	Predicted Corrected	Outturn
First Year Cost	£9.54m	£8.54m	£7.11m
Total Project PVC	£11.69m	£10.69m	£7.68m

6.47. Maintenance costs were not included in the appraisal for the scheme and no further information is available on maintenance. Maintenance costs have therefore also been excluded from the predicted corrected and outturn costs.

6.48. A predicted corrected cost had to be calculated because of an error that was identified in the calculation of the works cost. The works cost estimate that was calculated at a Risk Management Workshop (April 2008) was found to contain an error relating to the calculation of non-recoverable VAT. The correct figure was used to produce a predicted corrected scheme cost.

6.49. The outturn first year cost is £1.43m lower than predicted and scheme life PVC is £3.01m lower. A breakdown of outturn scheme cost by category (e.g. Preliminary works, structures, etc) has not been provided by the MAC so it is not possible to identify where the scheme cost savings have been made.

6.50. However, other identifiable factors in this difference are;

- The lack of risk allowance or optimism bias in the outturn costs. This had accounted for £1.09m in the predicted appraisal costs but it is not clear what proportion of these risks were realised; and

- A lower than expected value of Indirect Tax (treated as a cost to the scheme because of the reduced income to government). The opening year journey time benefits have been used to produce a reforecast of the change in Indirect Tax. This showed that Indirect Tax was only 26% of the figure that was forecast in the appraisal because of a lack of journey time benefits and traffic growth.

First Year Rate of Return and Benefit Cost Ratio

6.51. The First Year Rate of Return (FYRR) is the ratio of monetised benefits from the first year of a scheme relative to the capital invested in the scheme during construction. Effectively, it informs of how much of the scheme cost is recovered in the first year of the scheme operating. During this one year after evaluation, it is possible to provide an outturn FYRR with some confidence having observed the opening year.

6.52. The Benefit Cost Ratio (BCR) for this scheme is the ratio between the monetised 60 year benefits (PVB) and costs (PVC). It informs of how many times the project is likely to pay for itself over the 60 year assessment period. The outturn BCR provided is simply an improved forecast based on the observations of the opening year. The calculation of FYRR and BCR is shown in Table 6.7.

Table 6.7 – FYRR and BCR Calculations

2002 Prices Discounted to opening year	Appraisal Forecast	Predicted corrected (most recent)	Outturn
	First Year Rate of Return		
Total Benefits in opening year	-£1.44m	-£1.44m	£0.02m
Costs in opening year	£9.54m	£8.54m	£7.11m
FYRR	**-15%**	**-17%**	**0.3%**
	Benefit Cost Ratio		
PVB	**£82.92m**	**£83.14m**	**£26.77m**
PVC	**£11.69m**	**£10.69m**	**£7.68m**
BCR	**7.1**	**7.8**	**3.5**

6.53. The calculation of FYRR and BCR demonstrates that:

- The observed first year rate of return is slightly positive rather than the large negative that was forecast. The pre-scheme forecast suggested a negative FYRR in the order of 17% of the scheme costs but the actual FYRR was 0.3%, because the first year accident and journey time benefits balanced each other out to produce a very small total first year benefit. The outturn journey time benefits were much higher than the negative first year predicted corrected journey time disbenefits;

- The impact of the lower outturn scheme costs is negligible on the FYRR, because the net benefits are of a much smaller magnitude than costs;

- The outturn scheme life benefits are a lot lower than expected, as explained in the previous sub-section. The main cause of this is a lack of AM peak hour journey benefits that were the main component of the scheme life benefits. The lack of opening year journey time savings in the AM peak hour means that the benefits do not accumulate to the same extent that was forecast in the appraisal; and

- Scheme life costs are lower to help produce a BCR (3.5) that is just less than half of the expected BCR (7.8), although a BCR of this level still represents good value for money.

Wider economic benefits

6.54. The provision of additional capacity to facilitate economic growth in the local area was a key driver in the development of the scheme. Land use development was proposed at a site called Monks Cross that is an extension of an existing development approximately 2km to the west of the junction, on the edge of York.

6.55. Forecasts of development traffic and background traffic growth led to the development of the improvement scheme because of concerns about the lack of spare capacity at the junction. There is a phased approach to the expansion of capacity at the Hopgrove roundabouts (the scheme in question in this report is Phase1) that was programmed to correspond with the phasing of development at Monks Cross. The forecast traffic from the site was included in the PARAMICS junction model for the year 2018, when development was expected to be complete.

6.56. The development at Monks Cross has not progressed as expected, presumably because of the impacts of the economic recession since the development and road scheme were proposed. This lack of development has contributed to the lower than expected volumes of traffic using the junction. The appraisal of the junction scheme suggested that the benefits of the scheme will increase as traffic volumes increase, i.e. if the scheme were **not** built the situation would get a lot worse.

6.57. The introduction of the signals and widening has created the capacity to allow future growth to continue. This growth has been delayed because of the recession so the full benefits of the scheme may also have been delayed but the capacity is now in place to facilitate this development when the economy begins to grow.

6.58. On balance, the scheme has been scored as ’Beneficial’ for the Wider Economic Impact objective.

Summary

This section has considered the economy impacts of the A64 Hopgrove Roundabouts improvement. The scheme cost, safety benefit and journey time benefits have all been considered. This has shown that:

- The first year scheme cost was 25% less than predicted in the appraisal and 17% less than the predicted corrected scheme cost. This is mainly due to lower than anticipated works costs in addition to the high optimism bias and risk allowance in the appraisal calculations;
- The accident outturn benefits are lower than those forecast in the appraisal. The first year safety benefit is observed as £108,000 compared with an expected saving of £319,000 and this is now expected to grow to £4.5m over the scheme life compared with a forecast of £13.4m;
- Overall the opening year journey time benefits are slightly worse than before the scheme was constructed, however this result is actually better than was expected. A large disbenefit was forecast in the opening year (-£1.750m) while in reality the disbenefit was more modest (-£0.092m);
- The reforecast total scheme life benefits (£22.2m) are large but are significantly lower than forecast (£69.7m). This is mainly because the expected journey time savings in the AM peak are much smaller than expected;
- The scheme appraisal acknowledged that the scheme would deliver disbenefits in the inter peak period throughout the scheme life but that the peak hour benefits would eventually outweigh this disbenefit. This appears to be true in the opening year, although the scale of the benefits and disbenefits is lower than expected;
- The scheme produces an outturn FYRR of 0.3% as the first year accident benefits and journey time disbenefits cancelled each other out; and
- The scheme is estimated to produce an outturn BCR of 3.5, which is still considered to be a good long term return on investment.

7. Environment, Accessibility and Integration

7.1. This section of the report presents information relating to the NATA objectives of environment, accessibility and integration. This information will be compared to the forecasts made in the scheme appraisal.

7.2. The HA commissioned an Ecological Assessment for the Hopgrove Roundabouts scheme in September 2008, that expanded on previous assessments undertaken in 2004 and 2005. As a result of the Ecological Assessment various measures were incorporated into the scheme to address environmental concerns, including:

- A mammal tunnel underneath the A64 South carriageway to assist Otters and Water Voles, that are protected species; and

- An extension of the culvert adjacent to the mammal tunnel that carries Old Foss Beck underneath the carriageway.

7.3. Other environmental features were also included in the scheme design, including:

- Noise barrier on the Western side of the A64 South approach to the junction, between the widened carriageway and the houses on Brandon Grove; and

- Various areas of planting around the scheme.

7.4. The appraisal and scheme design were particularly concerned with the ecological impacts of the scheme so the evaluation has also focussed on this issue. Reference is made to other, non-ecology, environmental issues later in this section, along with an evaluation of the impacts of the scheme on Accessibility and Integration objectives.

Ecology evaluation process

7.5. A survey was carried out by an Ecologist as part of this evaluation. The survey consisted of one site visit to assess the implemented otter mitigation measures and compare the measures to the Design Manual for Roads and Bridges (DMRB) standards for otter mitigation. The water course and otter tunnel entrances within the survey area were also surveyed for evidence of otter.

7.6. DMRB standards were taken from Design Manual for Roads and Bridges Volume 10, Environmental Design and Management, Section 4 Nature Conservation, Part 4 HA 81/99, Nature Conservation Advice in Relation to Otters.

7.7. Ecological surveys are limited by factors which affect the presence of plants and animals, such as the time/season of year and the migration patterns and behaviour of animals. For example, seasonal foraging and dispersal patterns of otters may mean that otters do not use a particular dispersal route at certain times of the year. This site survey did not constitute a survey for the presence/absence of otters only a spot check to search for otter evidence.

7.8. The initial ecological assessment was carried out by Faber Maunsell on behalf of the HA in 2008, (Hopgrove Roundabout Improvements Ecological Assessment, Faber Maunsell/AECOM September 2008). This identified potential impacts on otters using Old Foss Beck as a result of the scheme and recommended mitigation in order to reduce the severity of adverse impacts and enhancement to fulfil requirements of the Highways Agency Biodiversity Action Plan (HABAP). The relevant mitigation and enhancement measures are:

- The existing cylindrical culvert shall be replaced with a square culvert which is accepted as the preferred option for otters. Cylindrical culverts represent a danger to otters because their design causes problems in times of flood through an increased risk of drowning. One of the main causes for otter road casualties is the need to cross the road because the culvert design does not allow an otter to pass through it. The design of any culvert should allow for plenty of air space above the water during times of flood or if this is not possible an alternative route should be provided (DMRB, 1999). The erection of a square culvert shall address these potential impacts;

- A mammal tunnel following DMRB (1999) specifications shall be constructed to encourage otters and other mammals to cross the A64(T) via the tunnel rather than choosing to cross over the road when the existing culvert is filled to capacity in times of high water. Otter proof fencing shall be erected to a distance of 500m up- and downstream of the watercourse to guide otters to the mammal tunnel rather than crossing the road; and

- Any areas of habitat to be affected by the works (i.e. above the culvert and above the artificial bank supports) shall be replanted with scrub to provide cover for otters whilst foraging and commuting.

7.9. Other mitigation recommendations regarding the construction phase and downstream silt traps are not evaluated here.

Ecology evaluation

7.10. The methodology of evaluation involved a single site visit to carry out a thorough inspection of the installation/mitigation design to highlight any design faults or defects. A search of Old Foss Beck watercourse was undertaken where access was available up and downstream for evidence of current otter activity. The site visit was undertaken on the 23 March 2012.

Inspection of installations

7.11. Inspections checked the installation designs against recommended design specifications, as detailed in the DMRB guidance and against design specifications included in the Faber Maunsell report (2008)[3]. Any defects observed are described below in relation to their potential likelihood to pose a risk to otter populations. The mammal tunnel on the western side of the A64 South is shown in figure 7.1.

7.12. The survey found potential evidence of otters utilising Old Foss Beck. A partial print which was considered highly likely to be an otter print was identified in mud around the eastern entrance to the mammal tunnel, as shown in Figure 7.2. No further evidence of otter such as sprainting or further footprints was found.

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3 Hopgrove Roundabout Improvements Ecological Assessment, Faber Maunsell/AECOM September 2008

Figure 7.1 – Mammal tunnel on western side of A64 South

Figure 7.2 – Suspected otter footprint at entrance to mammal tunnel

Results and analysis

7.13. The presence of a suspected otter footprint at the entrance to the mammal tunnel indicates that otters are likely to be currently using Old Foss Beck for dispersal.

The beck was considered unlikely to provide suitable foraging habitat for otter due to relatively low water levels and limited food supply/resources.

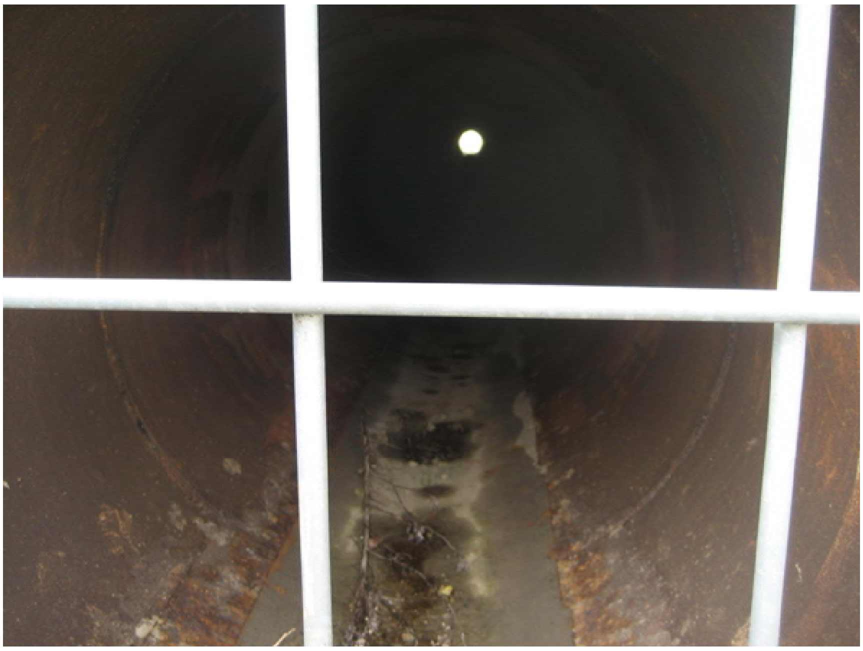
7.14. This dispersal route for otters is unlikely to be compromised during high rainfall and flood events due to the height of the mammal tunnel above the culvert and water level at the time of survey. The mammal tunnel is likely to be passable in all circumstances.

Tunnel specification

7.15. The mammal tunnel has been constructed in accordance with DMRB guidance, running parallel to the existing culvert with the entrance approximately 2m from Old Foss Beck and 1.5m above the water level at the time of survey, as shown in Figure 7.1. No evidence was seen that water levels ever reach the height at which the mammal tunnel is situated. Fencing has also been installed along the road to guide otters to use the tunnel. A grid on the tunnel entrances has openings 330mm by 330mm, large enough to allow an adult otter to pass through.

7.16. The mammal tunnel is a cylindrical pipe 1.2m in diameter and approximately 40m long (DMRB states that in crossings over 20m in length the width should be over 900mm). The entrances to the mammal tunnel have not been softened and are concrete aprons.

Figure 7.3 – Mammal tunnel under the A64 carriageway



Culvert specification

7.17. The mitigation measures in the Faber Maunsell (2008)[4] report include the replacement of the existing cylindrical culvert with a square culvert. The new section of culvert on the western side of the carriageway is appropriate with a large rectangular entrance present, although no ledge was included in the design. The eastern side of the culvert is still the original cylindrical culvert which was partly blocked by debris at the time of survey; the culvert is therefore not considered to be suitable for use by otters.

[4] Hopgrove Roundabout Improvements Ecological Assessment, Faber Maunsell/AECOM September 2008

7.18. The DMRB recognises that cylindrical culverts represent a danger to otters and states that it is not good practice to install cylindrical culverts if other options exist. As the cylindrical culvert has been left in situ and not installed during the works the DMRB has not been contradicted, however, the full recommendations of the Faber Maunsell report have not been carried out. The culvert still therefore represents a danger to otters but no more than was the case prior to works and the mammal tunnel provides an alternative route for otters.

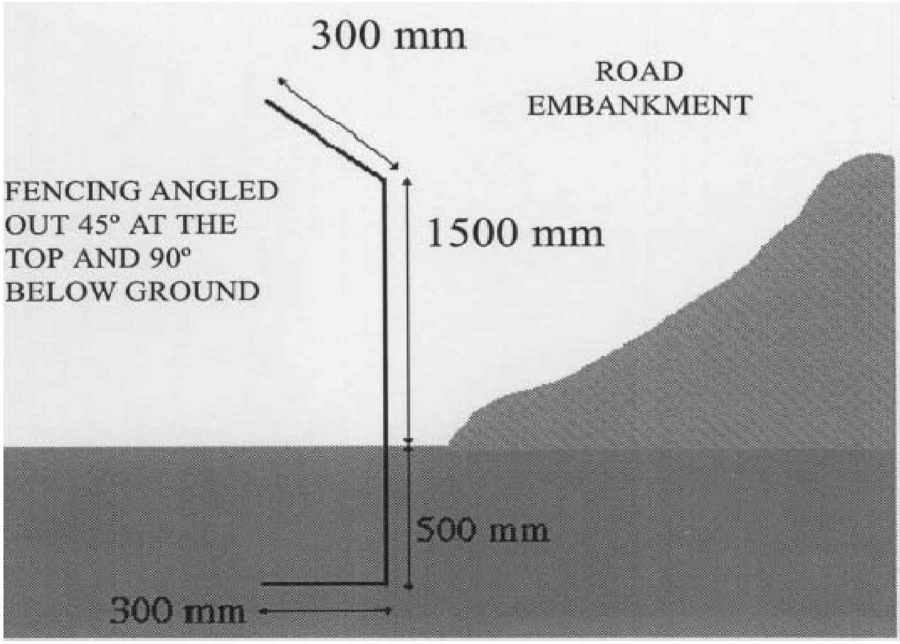
Fencing specifications

7.19. The fencing erected near the culvert and mammal tunnel was of an appropriate height with some sections having an appropriate over-hang and it was buried (the depth to which the fencing was buried could not be ascertained at the time of survey). This is shown in figure 7.4.

Figure 7.4 – Otter fencing

7.20. An appropriate design for otter proof fencing is shown in Figure 7.5, taken from the DMRB Volume 10, Section 4, Nature Conservation, Part 4.

Figure 7.5 – DMRB guidance on otter proof fencing



A design for otter proof fencing.

7.21. On the eastern side of the carriageway no overhang was present, however, this overhang is primarily designed to render the fence deer proof as well as otter proof and the fencing should not be easily scaled by otters even without this over-hang owing to the height of the fence being approximately 1.7m.

7.22. The mitigation measures in the Faber Maunsell report state that otter proof fencing should be erected for 500m up and down stream to prevent otters from crossing the road and guide them into the mammal tunnel. The DMRB states that otter proof fencing should be installed for at least 100m on both sides of the road for the same purpose. The fencing installed on the western side of the carriageway extends 25m north of the mammal tunnel, to the south an impassable concrete and steel wall extends over 100m. On the eastern carriageway the fence extended approximately 40m to the north and 20m to the south of the mammal tunnel. As such the fencing does not meet the requirements of the mitigation measures or the requirement laid out in the DMRB and does not adequately protect otters from attempting to cross the road.

Surrounding habitats

7.23. The area surrounding the eastern entrance to the mammal tunnel is vegetated with bramble and hawthorn scrub which provides good cover for otters leaving the Old Foss Beck and entering the tunnel. The western side of the mammal tunnel has grassy banks. Planting of shrubs to increase cover could encourage otters to use the tunnel or guide the otters to the tunnel and increase usage reducing the risk of road kills.

Planting

7.24. A General Arrangement Landscape Planting Area drawing was produced detailing planting of a native hedgerow for 135m overlapping with the noise barrier and stretching to the south down the west side of the A64.

7.25. The hedgerow was intended to contain native species hawthorn, field maple, bird cherry, hazel, dog rose and holly. No hedgerow was present at the time of survey.

7.26. A woodland block approximately 500 square metres is featured on the General Arrangement Landscape Planting Area Drawing with species to be planted including common holly, holm oak, sessile oak, scots pine, hawthorn, blackthorn, and hazel. The woodland appeared to be located within the correct location at the end of the noise barrier with species actually planted including Norway spruce, holly, hawthorn, *ribes sp.* (currant), cherry, field maple, holm oak, sessile oak, blackthorn field rose and *salix sp.* (willow).

7.27. There was some variation between the recommended species planted in the woodland block however the trees had taken and the woodland was located in the place indicated on the General Arrangement Landscape Planting Area drawing. The planting generally fits with DMRB guidance that it should fit with the landscape character of the area and that adequate topsoil provision appears to be in place.

Other environmental evaluation

7.28. The site visit was also used to assess the implemented mitigation measures and compare the measures to the Design Manual for Roads and Bridges (DMRB) standards[5]' and the proposed General Arrangement Landscape Planting Area drawing number 46528MDRH/3000/001.

Noise

7.29. An environmental barrier was erected on the west side of the A64 to the south of the roundabout in order to shield the nearest properties from any additional noise due to the improvement works. The DMRB states that 'an environmental barrier combines the function of a visual screen and a noise barrier to protect residential, recreational and other vulnerable areas alongside a road[6]'. The barrier in this case sought to attenuate noise by constructing a barrier (acoustic fence) which impedes the transmission of noise.

7.30. A barrier creates a "shadow zone" behind it, reducing the energy of the sound waves. Because of the diffraction of sound by the edge of a barrier, the benefits decrease as the point of reception moves further away from the barrier. A barrier which protects one side of a road can also reflect noise back across the road, as no sensitive receptors are present on the eastern side of the road this is not considered further.

7.31. The erected environmental barrier is less than 3m tall to avoid being visually intrusive as per the DMRB guidance and is therefore rated as a category 0 structure.

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5 DMRB standards were taken from Design Manual for Roads and Bridges Volume 10, Environmental Design and Management, Section 5 Environmental Barriers, Part 1 HA 65/94, Design for Environmental Barriers and Design Manual for Roads and Bridges Volume 10, Environmental Design and Management, Section 5 Environmental Barriers, Part 2 HA 66/95, Environmental Barriers: Technical Requirements.

6 Design Manual for Roads and Bridges Volume 10, Environmental Design and Management, Section 5 Environmental Barriers, Part 1 HA 65/94, Design for Environmental Barriers, paragraph 1.2

7.32. The DMRB guidance states regarding timber barriers that:

'Timber is a common fencing material, but its maximum height is restricted by structural requirements. It is a requirement of the specification that timber screens remain serviceable for 40 years and require no maintenance for 20 years. Factory treatments can provide this life but on site modifications may significantly reduce the durability of timber. Timber panelling is versatile in that it can be readily modelled around existing ground features such as over the root systems of retained trees, thus ensuring the continuity of noise barriers. Noise absorbent timber barriers have been developed incorporating cavities and dispersing elements behind timber battens, which can be arranged in various patterns.'

7.33. The timber environmental barrier appeared to be a standard barrier constructed largely according to the DMRB standards and appears to have been constructed with appropriate regard to sensitive receptors.

7.34. In terms of traffic noise impact, the Traffic Section of this report shows that traffic volumes have decreased since the scheme was implemented, between 2008 and 2012. This is more likely to be caused by changes to background traffic volumes rather than any consequence of the scheme, but it indicated that traffic noise will also have decreased. Although the widening of the carriageway has brought the traffic closer to some residential properties the construction of a noise barrier has provided some mitigation for the noise impact of the scheme on the environment and the overall impact of the scheme on noise has been scored as neutral.

Environmental impacts summary

7.35. The evaluated impacts on the environment have been summarised by each of the sub-objectives in Table 7.1. The sub-objectives have each been scored on a scale from large beneficial to large adverse.

Table 7.1 – Summary of predicted and outturn environmental impacts

Sub-Objective	Outturn Impact (EST)
Noise	**Neutral** Traffic volumes decreased across the whole junction between 2008 and 2012. A 25% change is required for noise to be affected. A noise barrier has been provided to mitigate any future increase in noise at the properties nearby
Local Air Quality	**Neutral** There are no properties within 50m of the edge of the carriageway and the scheme does not involve a significant change in AADT and so air quality impacts are minimal.
Greenhouse Gases	**Neutral** The change in total distance travelled on the network has not increased by more than 10% and the scheme has been successful at keeping traffic moving, especially during the PM peak period. Although there have been some increases in inter peak and Off-peak delays the peak time benefits will outweigh this effect and the total vehicle kilometres have not increased as a result of the improvements. The scheme therefore has a neutral impact on greenhouse gases.
Landscape	**Slight Adverse** Changes to the landscape involved the widening of an existing carriageway and the addition of traffic signals and road signs and gantries. When considered in context with the entirety of the landscape contribution of the A64, A1237 and A1036, this amendment resulted in a slight impact on the appearance of the local landscape. The magnitude of landscape impact is therefore considered to be slight adverse.
Townscape	**Neutral** The scheme is not in a built up environment and thus townscape is scored as neutral.
Heritage of Historical Resources	**Neutral** The scheme is wholly within the highway boundary and there was no impact on archaeological or heritage sites so is scored as neutral
Biodiversity	**Slight Adverse** The scheme is likely to have had an adverse impact on Biodiversity because the carriageway has been widened. Measures have been installed that mitigate much of this impact and some measures may even be an improvement on the previous layout at the junction (such as the mammal tunnel). However, on balance a Slight Adverse score has been given.
Water	**Neutral** There has only been a small change and mitigation measures have been implemented to address highway drainage and so the scheme is scored neutral.
Physical Fitness	**Neutral** There is no change to the length or number of walking and cycling trips that use the junction so this is scored as neutral
Journey Ambience	**Slight Beneficial** There have been peak time reductions in delay but increases in non-peak times. There has been a reduction in the accident rate so, in keeping with current PAR guidance, this represents a beneficial impact on journey ambience due to reduced driver stress and fear of accidents. There has been no change to the roadside facilities. On balance the scheme has had a small

	beneficial impact.

Accessibility impacts

7.36. The scheme's predicted impacts and outturn evaluated impacts on Accessibility have been summarised by sub-objective in Table 7.2.

Table 7.2 – Summary of predicted and outturn accessibility impacts

Sub-Objective	Predicted Impact	Outturn Impact (EST)
Option Values	**N/A**	**Neutral** The project has no impact on the provision of public transport services
Severance	**N/A**	**Neutral** The scheme has minimal impact on the routes used by pedestrians, equestrians or cyclists, although facilities have been incorporated into the scheme that can be used if other cycle and pedestrian links are provided in the future (e.g. a cycleway round the junction and space for Advanced Cycle Stop Lines)
Access to Transport System	**N/A**	**Neutral** The scheme has minimal impact on the public transport system

Integration impacts

7.37. The scheme's predicted impacts and outturn evaluated impacts on Integration have been summarised by sub-objective in Table 7.3 below.

Table 7.3 – Summary of predicted and outturn integration impacts

Sub-Objective	Predicted Impact	Outturn Impact (EST)
Transport Interchange	**N/A**	**Neutral** The scheme has no impact on public interchange facilities
Land Use Policy	**N/A**	**Large Beneficial** The City of York Local Development Framework includes a site called Monks Cross as a potential development opportunity. This site is close to Hopgrove and would generate significant extra traffic through the junction. The origins of the junction scheme are associated with this development. The scheme has provided additional capacity and reduced congestion during peak periods. This means that is has a better ability to deal with additional traffic from the local land use development proposals than the previous junction

		layout. The resilience of the junction to cope with increased traffic flows has been improved.
Other Govt Policies	**N/A**	**Neutral** The appraisal made no reference to Other Government Policies so it has been scored as a neutral impact.

Summary

The scheme has been assessed on its impacts on environment, accessibility and integration. The main findings are that:

- The appraisal did not include a PAR and an AST has not been provided by the MAC or Project Manager so we have not been able to present the predictions that were made and compare them with the outturn impacts. The appraisal did however highlight the importance of the Ecology impact of the scheme and a separate Ecology impact Report was prepared;
- The Ecology evaluation showed that the mitigation measures that have been installed are largely in accordance with DMRB standards but a few improvements have been highlighted and recommendations made for ongoing maintenance and monitoring of the scheme;
- Evidence of use of the mammal tunnel by otters was found and most of the planting has been carried out as expected, with the exception of a proposed hedgerow. The plants were growing successfully and a noise barrier has also been provided; and
- The scheme has no accessibility impacts but is felt to have contributed positively to Land Use policy objectives because of its impact on congestion and the ability to cope with future traffic volumes.

8. Conclusions and recommendations

8.1. This report presents the POPE of the A64 Hopgrove Roundabout improvement, implemented by AECOM Area 12 MAC in 2010.

8.2. The report has made use of the best data currently available to evaluate the impact of the scheme and compare this to the pre-scheme conditions and the forecasts for scheme impact presented in the scheme appraisal.

8.3. A PAR was not provided by the MAC for the final scheme so we have had to use the Traffic and Economics Report and other documents prepared during the scheme appraisal stage. The purpose of this section is to:

- Summarise the key impacts of the scheme and show how these compare to forecasts.

- Consider the lessons learnt and make recommendations to improve future LNMS.

Summary of scheme impacts

Stakeholder feedback

- The HA Project Manager acknowledged that the priority for the scheme was to tackle peak period traffic delay and congestion, and was not surprised that our initial findings showed that this was the case; and

- City of York has also been consulted but had not responded by the time this report was produced.

Traffic

- The long term traffic volume travelling through the junction has not changed significantly over the last 10 years or between the immediate before and after time periods (2008-2010);

- The A64 South (York southern ring road) carries the largest volumes of traffic into the junction;

- Overall, the scheme has delivered:

  Small journey time benefits in the AM peak (8:00-9:00) and early PM peak (16:00-17:00);

  Large journey time benefits in the PM peak (17:00-18:00pm);

  Small journey time disbenefits in the inter peak (9:00-16:00) and early AM peak (7:00-8:00);

- The largest journey time benefits have been experienced by traffic approaching the junction on the A1237 and A1036, in all time periods but especially in the PM peak, as these roads have been given a level of priority and capacity that they did not have under the previous priority control;

- The largest journey time disbenefit has been for traffic approaching on the A64 South, which also carries, by far, the largest volumes of traffic. Prior to the scheme, this arm would have had to give way to few vehicles;

- The inter peak disbenefits have outweighed the Peak hour benefits so that, overall, there has been an increase in vehicle time spent at the junction (i.e. total delay)

- Vehicle hour disbenefits amass to 8,166 vehicle hours in the opening year based on 260 weekdays in the average year;

- Overall, the reliability of journey times has not improved significantly but individual traffic routes through the junction have experienced better, worse and no change in reliability; and

- It can be concluded that the scheme provides more benefits during busy peak periods when the traffic signals control flows more efficiently than the priority control did. As traffic volumes grow (due to background traffic growth and/or local development traffic) the proportion of time that the scheme delivers benefits will expand to deliver greater positive benefits in the medium and long term

Safety

- Taking the most recent period prior to scheme construction (59 months between January 2004 and November 2008), there were on average 8.1 PIAs per year at the junction;

- There was a forecast PIA saving of 3.5 per year, with an expected scheme life saving of 162 PIAs over 60 years;

- The rate of PIAs has decreased to 6.9 per year since the scheme opened;

- Observing the 26 months since the scheme opened demonstrates that the scheme has actually reduced accidents by 1.2 per year and is reforecast to save 56 accidents over the scheme's 60 year life;

- There has been a decrease in the number of slight accidents but a corresponding increase in the number and proportion of serious accidents, which may explain the observed increase in the number of casualties per accident;

- The STATS19 data shows that the clusters of accidents on the two A64 approaches to the roundabout have been reduced and that accidents are now more evenly distributed around the junction. The proportion of 'rear-shunt' type accidents has been cut from 70% to 33% of all accidents which could indicate that safety has been improved at these locations; and

- No post-scheme accidents have occurred on the Malton Road roundabout or on the A1237 and A1036 approaches or on the central link road between the two roundabouts.

Economy

- The first year scheme cost was 25% less than predicted in the appraisal and 17% less than the predicted corrected scheme cost. This is mainly due to lower than anticipated works costs in addition to the high optimism bias and risk allowance in the appraisal calculations;

- The accident outturn benefits are lower than those forecast in the appraisal. The first year safety benefit is observed as £108,000 compared with an expected saving of £319,000 and this is now expected to grow to £4.5m over the scheme life compared with the pre-scheme forecast of £13.4m;

- Overall the opening year journey time benefits are slightly worse than before the scheme was constructed, however this result is actually better than was expected. A large disbenefit was forecast in the opening year (-£1.75m) while in reality the disbenefit was more modest (-£0.092m);

- The reforecast scheme life benefits (£22.2m) are large but are significantly lower than forecast (£69.7m). This is mainly because the observed journey time savings in the AM peak are much smaller than those expected;

- The TUBA conducted prior to the scheme contained the evidence that the scheme journey time benefits would be adverse in the opening year and that the inter-peak would always be adverse for every year of the 60 year scheme life. The peak time benefits were expected to eventually outweigh this disbenefit as traffic levels increased. This appears to be true in the opening year, although the scale of the benefits and disbenefits is lower than expected;

- The scheme produces an outturn FYRR of 0.3% as the first year accident benefits and journey time disbenefits cancelled each other out; and

- The scheme BCR is now calculated as 3.5 (less than half of the forecast 7.8). If achieved, this still represents good value for money.

Environment, Accessibility and Integration

- The appraisal did not include a PAR and an AST has not been provided by the MAC or Project Manager so we have not been able to present the predictions that were made and compare them with the outturn impacts. The appraisal did highlight the importance of the ecology impact of the scheme and a separate Ecology Impact Report was prepared;

- The ecology evaluation showed that the mitigation measures that have been installed are largely in accordance with DMRB standards but a few improvements have been highlighted and recommendations made for ongoing maintenance and monitoring of the scheme;

- Evidence of use of the mammal tunnel by otters was found and most of the planting has been carried out as expected, with the exception of a proposed hedgerow. The plants were growing successfully and a noise barrier has also been provided; and

- The scheme has very little accessibility impact but facilities have been included in the scheme for the future development of pedestrian and cycle links in the future. The scheme is felt to have contributed positively to Land Use Policy objectives because of its relationship to development in the area and its impact on congestion and the ability to cope with future traffic volumes.

•

Scheme specific objectives

8.4. Drawing on information presented in this report, a summary of the scheme's success against the scheme specific objectives listed in the introduction to this report, is provided in Table 8.1.

Table 8.1 – Scheme specific objectives

Objective	Success	
To improve traffic congestion and journey times at the junction	Peak hour congestion has been reduced at the junction, particularly on the A1237 and A1036 as it leaves York during the PM peak period. As traffic growth increases in the future the benefits of the scheme will increase as it will provide journey time benefits for more hours of the day	✓
To increase capacity to cope with forecast increases in traffic volume and nearby land use developments	Forecast development has not progressed as expected because of the economic recession but the junction capacity has now been provided to cater for this development whenever it is constructed	✓
To improve road safety	The annual rate of personal injury accidents has decreased since the scheme was completed and the most recent figures (from 2011) show an even greater decrease than the 2010-2011 average which may indicate that the scheme could be even more successful in the long run. There is some evidence to suggest that there has been an increase in the severity of the accidents.	✓

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

8.5. The Appraisal Summary Table (AST) is a brief summary of the main economic, safety, environmental and social impacts of a highway scheme. This is usually completed within a Project Appraisal Report (PAR) but no such report has been completed for this scheme. Therefore, an AST has not been provided for the Hopgrove scheme.

8.6. The Evaluation Summary Table (EST) was devised for the POPE process. It mirrors the format of the AST, adjusted to score the scheme against the NATA objectives based on first year observed findings. The EST for this scheme is presented in Appendix B.

Recommendations

8.7. During the course of this evaluation, a number of findings have revealed ways in which the LNMS appraisal process could be improved. These are summarised in this sub-section of recommendations:

- The use of part-time traffic signals would have achieved a greater level of journey time benefit by removing the inter-peak and off-peak disbenefits, and maintaining the peak hour benefits. Clearly this would be subject to design and road safety issues, and may have been considered in the appraisal, but there was no evidence that this alternative option had been considered nor that the HA/MAC had understood that the first year impacts of this scheme would be negative;

- The scheme appraisal report did not explicitly state that there would be inter peak journey time disbenefits throughout the scheme life, but an analysis of the economic assessment (TUBA) shows that this was the case. PM peak benefits were not expected to be positive until the fourth year after construction but the combined peak time benefits would not outweigh the inter peak disbenefits until 6 years after opening. If this information was presented in the Traffic and Economics Report it may have been used to give weight to a proposal for part-time signalisation;

- It is preferable that a final PAR is produced and provided if a full evaluation is to be carried out. This would make evaluation more effective and, by filling out a PAR, make the MAC consider the opening year impacts of the scheme;

- It is strongly recommended that the otter fencing is extended to comply with DMRB standards as it is important that it is capable of preventing the animals from reaching the road and encourages them to use other suitable crossing points, if this is not the case the risk of road kills is increased and the mitigation will not be effective;

- It is recommended that should maintenance or improvement works be required on this section of road, replacement of the old cylindrical culvert with a larger rectangular culvert and the installation of an appropriate ledge is considered as recommended in the Ecological Assessment Report and as detailed in DMRB;

- Planting of scrub on the bank on the western side of the carriageway is recommended in order to provide cover for otters;

- It is advised that thorough inspections of the fence and ledge are undertaken by a suitably experienced ecologist or engineer at regular intervals to take account of changing conditions at each site. DMRB guidance recommends that this is completed a minimum of every six months. Particular attention should be paid to the stretches of fencing closest to the watercourses where otters are more likely to encounter and exploit any breaches in the fence; and

- It is recommended that repeat checks for otter activity are undertaken at this location. DMRB guidance recommends that checks for otter use are undertaken six months and twelve months after installation of the structures.

Therefore it is recommended that a second check should be carried out in September 2012 (6 months after the first check).

Appendix A. Journey Time Analysis

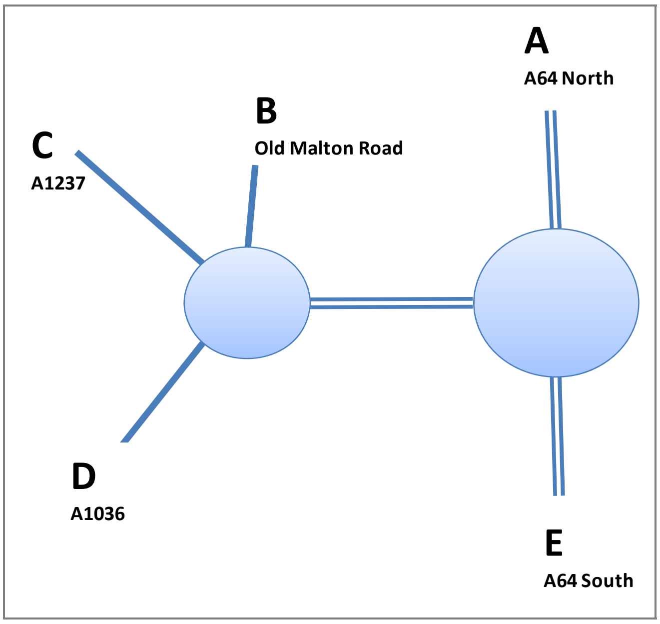
This appendix presents graphs based on the satnav journey time interrogated to inform both the pre- and post- scheme accident savings. Each of the graphs in this appendix show a separate movement around the junction, demonstrating mean, 5th, 95th and inter-quartile range journey times for both pre- and post-scheme.

Each graph shows the results for the following time periods:

- AM peak 07:00-08:00;
- AM peak 08:00-09:00;
- Inter peak 09:00-16:00;
- PM peak 16:00-17:00;
- PM peak 17:00-18:00; and
- Shoulder peak 18:00-19:00.

The figures presented are as follows:

- Figure A.1 - A64 Southbound right turn to A1237 (A – C);
- Figure A.2 - Southbound A64 right turn to A1036 (A - D);
- Figure A.3 - Southbound A64 straight ahead to A64 South (A - E);
- Figure A.4 - Eastbound A1237 to A64 North (C - A);
- Figure A.5 - Eastbound A1237 right turn to A1036 (C - D);
- Figure A.6 - Eastbound A1237 to A64 South (C - E);
- Figure A.7 - Northbound A1036 to A64 North (D - A);
- Figure A.8 - Northbound A1036 left turn to A1237 (D - C);
- Figure A.9 - Northbound A1036 to A64 South (D – E);
- Figure A.10 - Northbound A64 straight ahead to A64 North (E - A);
- Figure A.11 - Northbound A64 left turn to A1037 (E - D); and
- Figure A.12 - Northbound A64 to A1237 (E - C).



The impact on journey time reliability can be ascertained from the graphs by looking at the spread of 5th to 95th percentile and the spread of inter-quartile range. Where these ranges are reduced in the post-scheme, there is an improvement in journey time reliability as the road user has a more consistent idea of what their journey time will be.

During the analysis of the journey time data we found that it was necessary to adjust the length of the journey time routes that ran from all arms towards Arm A (A64 North) in order to ensure that all the data used was relevant to this junction scheme rather than any other non-related issues along the route. This provides us with the most accurate analysis of pre-scheme and post-scheme average journey times that we can achieve. However, the format of the data does not allow us to cut down the journey time reliability data in the same way so the reliability data for these three movements (C-A, D-A and E-A) continues to show reliability for the original, longer journey time run. Thus, the mean journey time data on figures C.4, C.7 and C.10 does not relate to the box and whisker data on reliability, hence the average journey time is outside of the reliability data range, which is clearly impossible. The relative patterns of change are still relevant and we have reported on these accordingly.

The figures presented in this section show that the relationship between movement and journey time reliability is in line with the relationship between movement and journey time saving (as presented in Section 4 of this report). To summarise briefly:

- On movements where journey time reliability has improved, this is most prominent in the peak periods of 8-9am and 5-6pm;
- Movements from the A46 south arm (arm E) have the largest worsening of journey time reliability, just as they had the worse journey time disbenefit also; and
- The most significant improvements to journey time reliability are seen at the movements A1035 to A64 south (D-E), A1237 to A64 south (C-D) and A1237 to A1035 (C-E).

Figure A.1 - A64 Southbound right turn to A1237 (A – C) journey time analysis

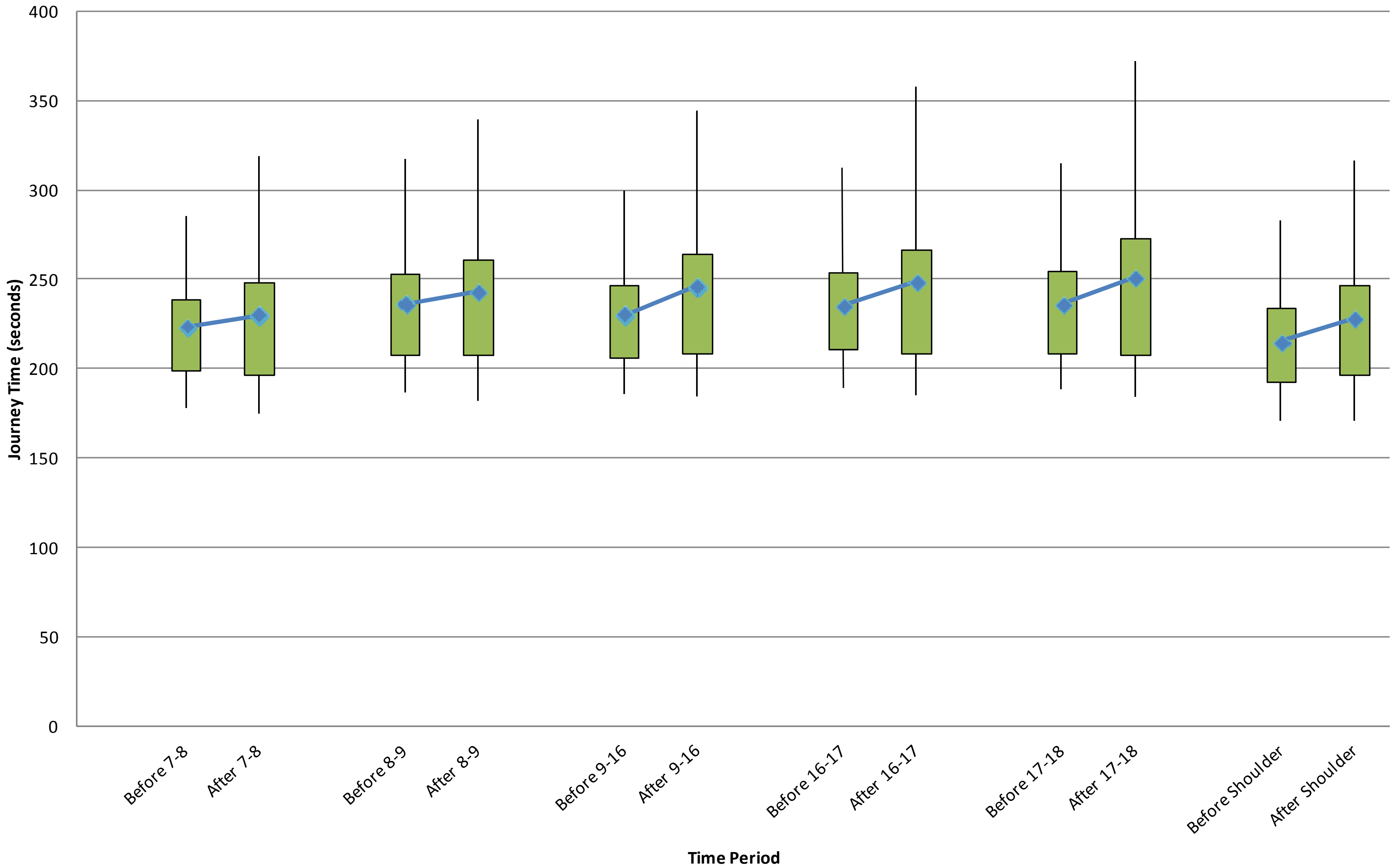


Figure A.2 - Southbound A64 right turn to A1036 (A - D) journey time analysis

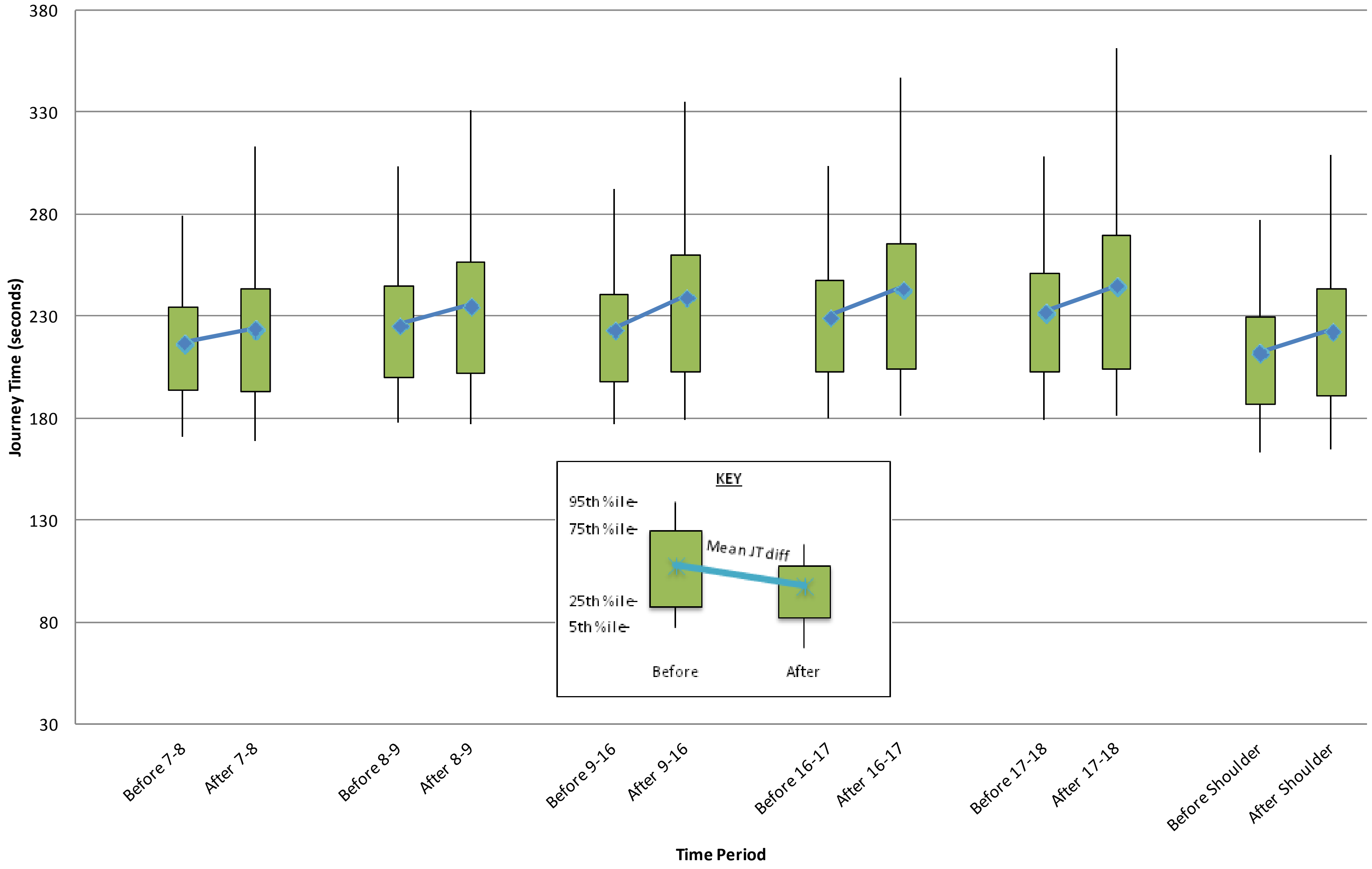


Figure A.3 - Southbound A64 straight ahead to A64 South (A - E) journey time analysis

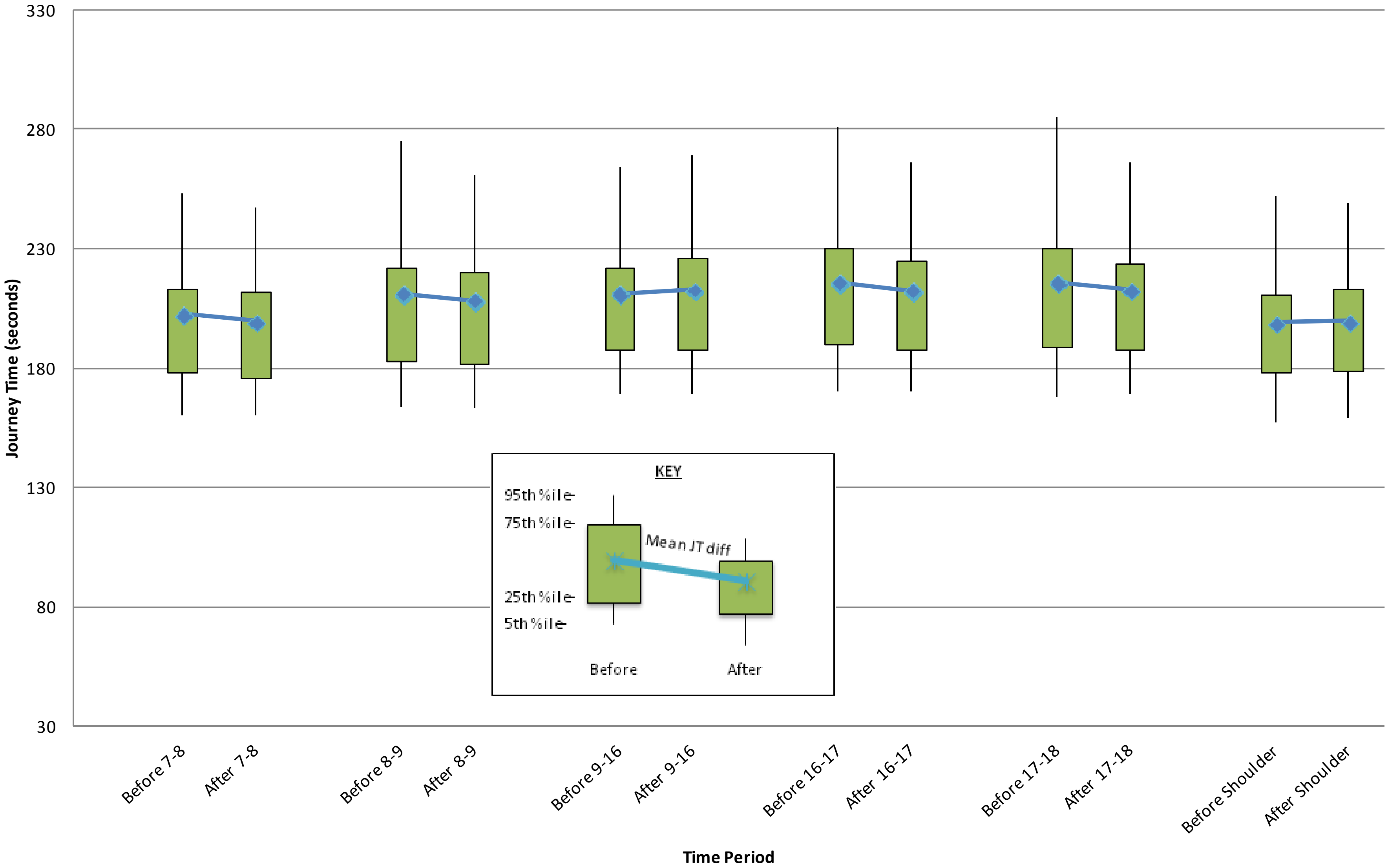


Figure A.4 - Eastbound A1237 to A64 North (C - A) journey time analysis

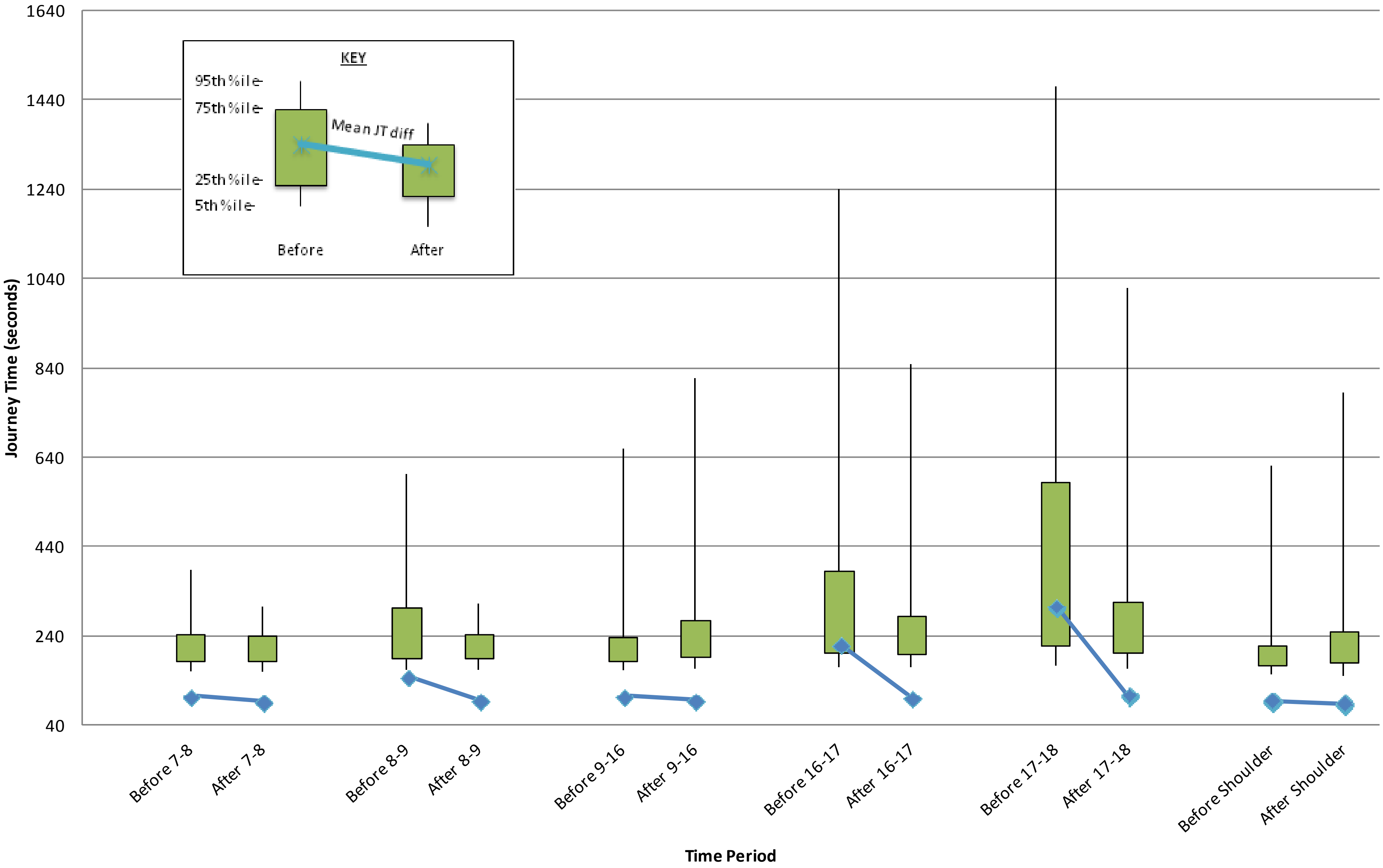
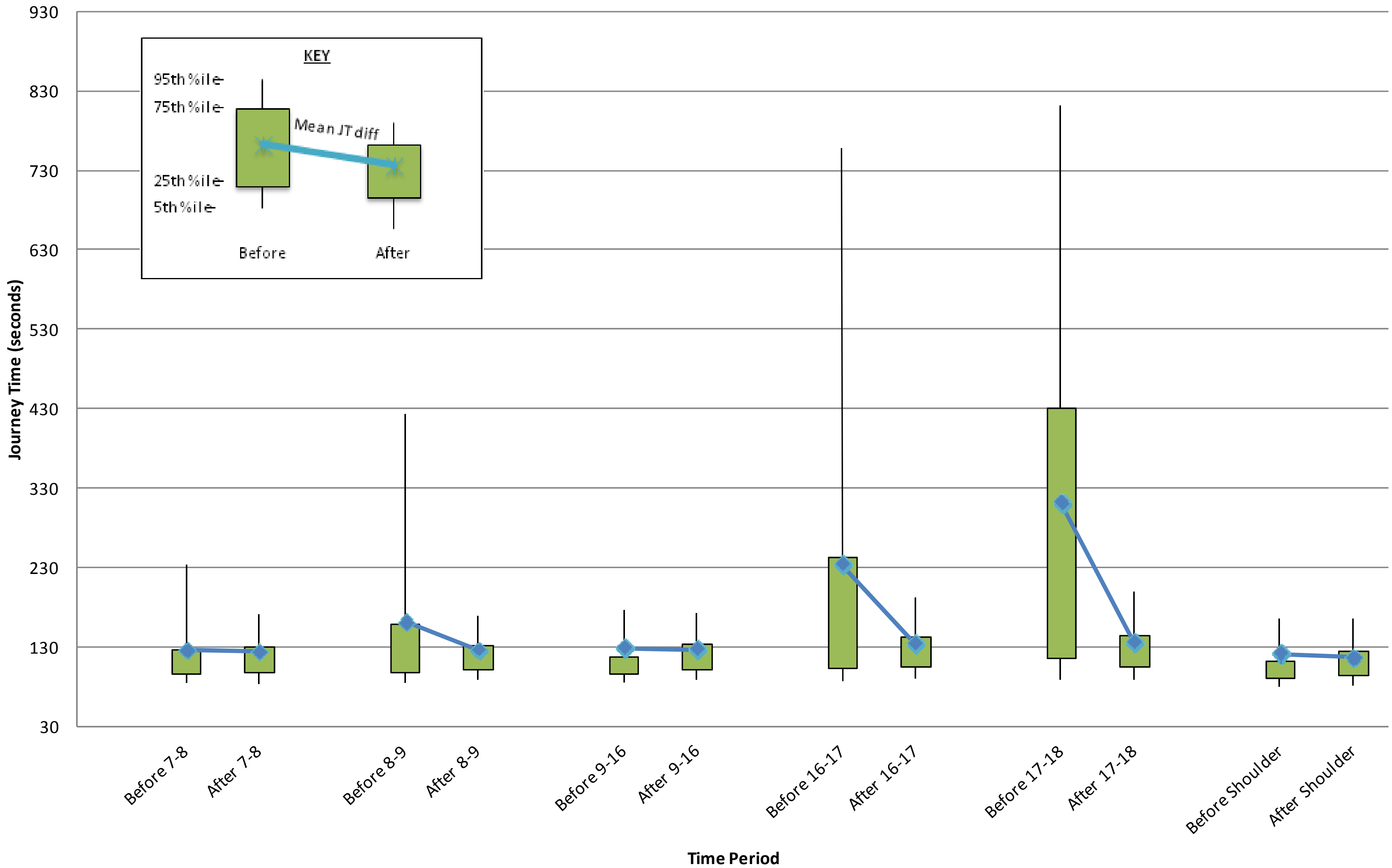

KEY
95th %ile
75th %ile
Mean JT diff
25th %ile
5th %ile
Before
After
1640
1440
1240
1040
840
640
440
240
40
Journey Time (seconds)
Before 7-8
After 7-8
Before 8-9
After 8-9
Before 9-16
After 9-16
Before 16-17
After 16-17
Before 17-18
After 17-18
Before Shoulder
After Shoulder
Time Period

Figure A.5 - Eastbound A1237 right turn to A1036 (C - D) journey time analysis



930
830
730
630
530
430
330
230
130
30
Journey Time (seconds)
KEY
95th %ile
75th %ile
Mean JT diff
25th %ile
5th %ile
Before
After
Before 7-8
After 7-8
Before 8-9
After 8-9
Before 9-16
After 9-16
Before 16-17
After 16-17
Before 17-18
After 17-18
Before Shoulder
After Shoulder
Time Period

Figure A.6 - Eastbound A1237 to A64 South (C - E) journey time analysis

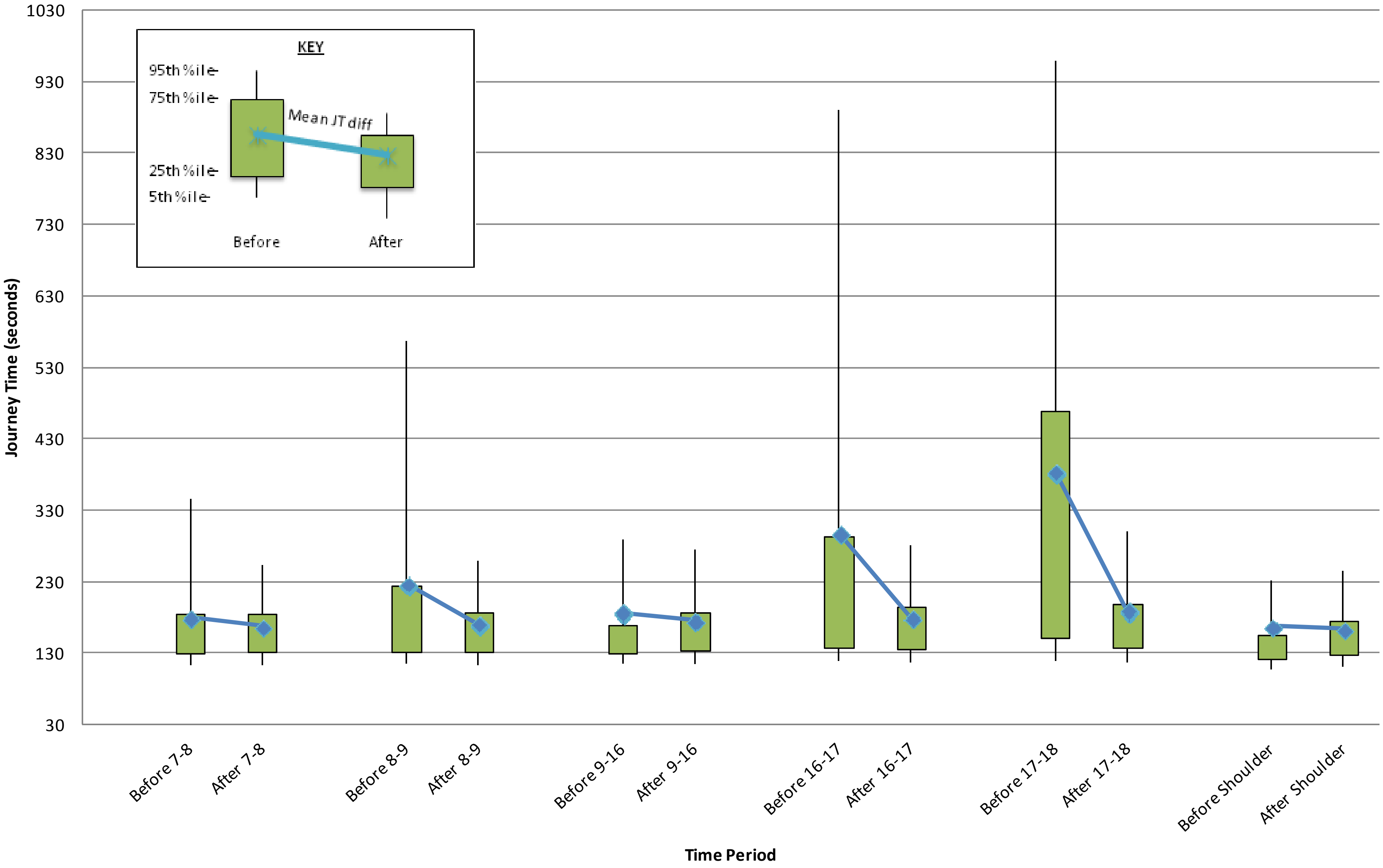
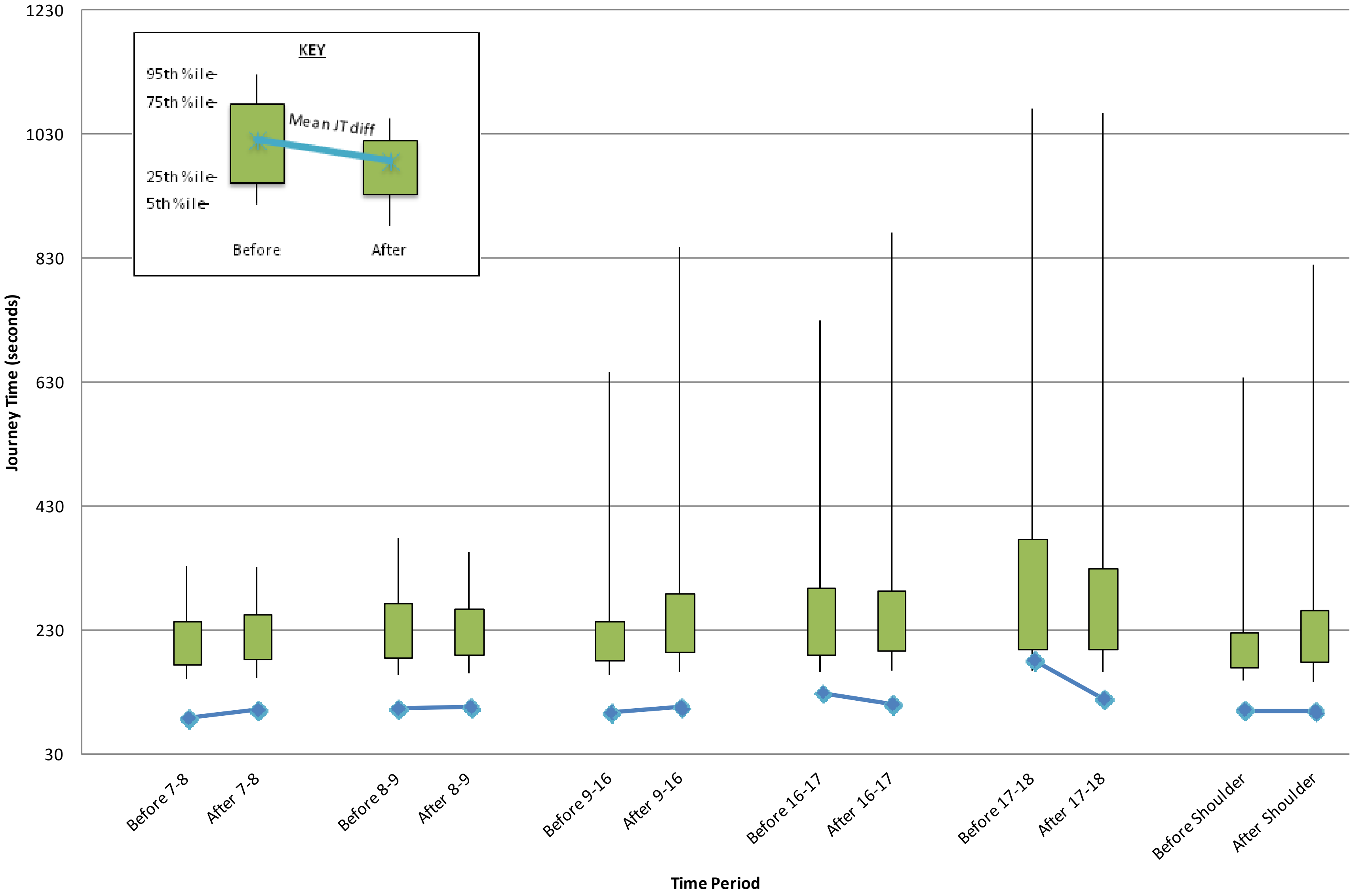


Figure A.7 - Northbound A1036 to A64 North (D - A) journey time analysis



KEY
95th %ile
75th %ile
Mean JT diff
25th %ile
5th %ile
Before
After
1230
1030
830
630
430
230
30
Journey Time (seconds)
Before 7-8
After 7-8
Before 8-9
After 8-9
Before 9-16
After 9-16
Before 16-17
After 16-17
Before 17-18
After 17-18
Before Shoulder
After Shoulder
Time Period

Figure A.8 - Northbound A1036 left turn to A1237 (D - C) journey time analysis

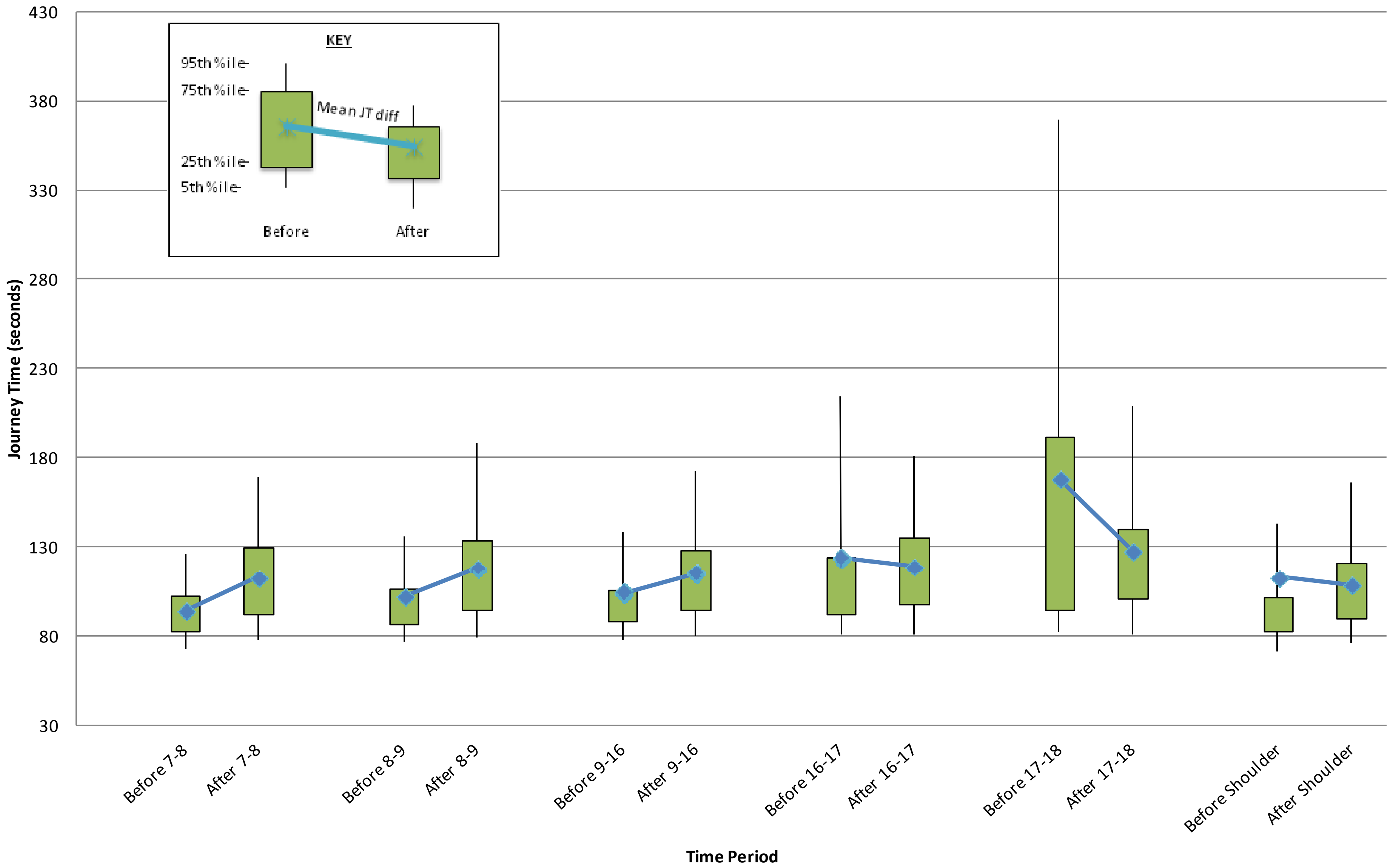

KEY
95th %ile
75th %ile
Mean JT diff
25th %ile
5th %ile
Before
After
430
380
330
280
230
180
130
80
30
Journey Time (seconds)
Before 7-8
After 7-8
Before 8-9
After 8-9
Before 9-16
After 9-16
Before 16-17
After 16-17
Before 17-18
After 17-18
Before Shoulder
After Shoulder
Time Period

Figure A.9 - Northbound A1036 to A64 South (D – E) journey time analysis

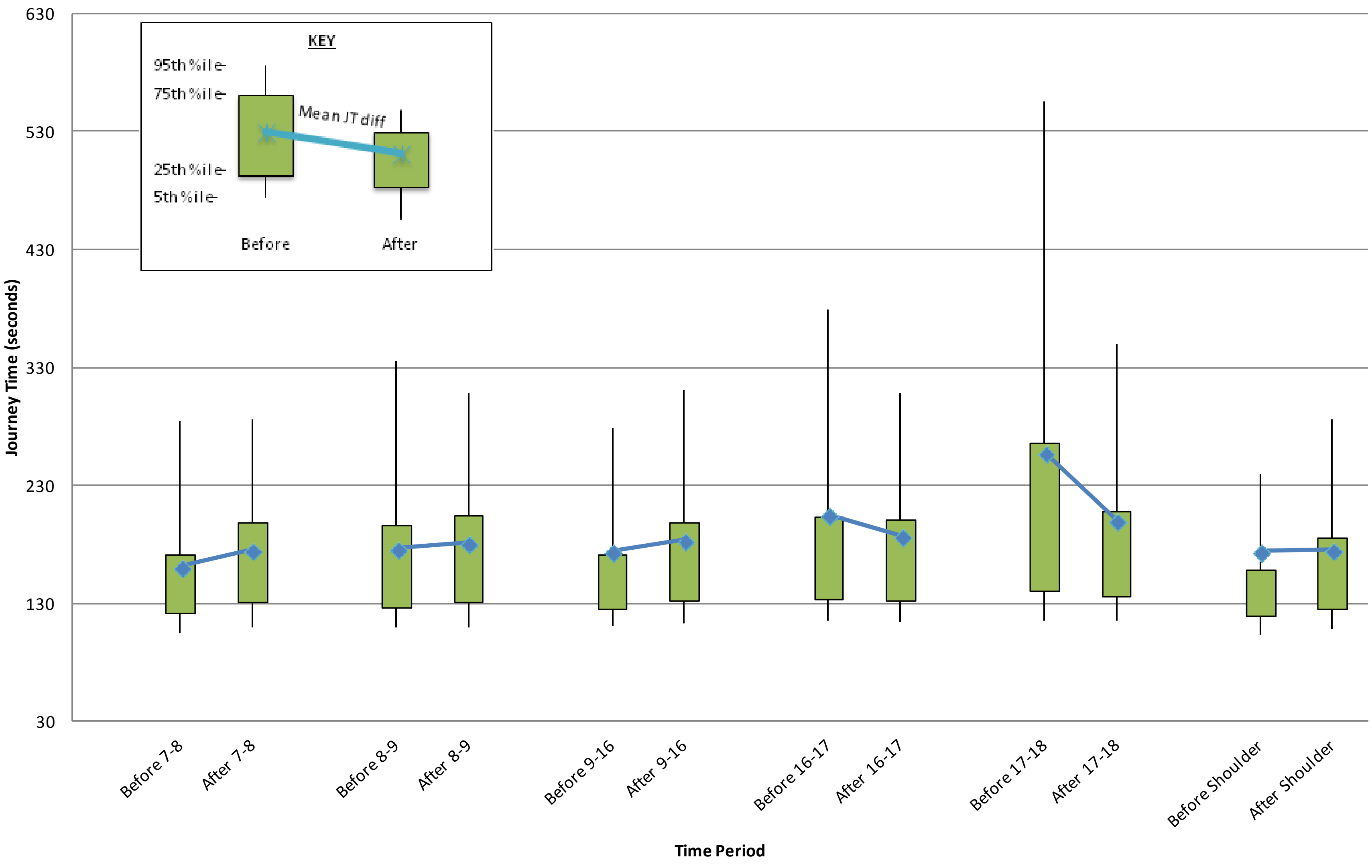


Figure A.10 - Northbound A64 straight ahead to A64 North (E - A) journey time analysis

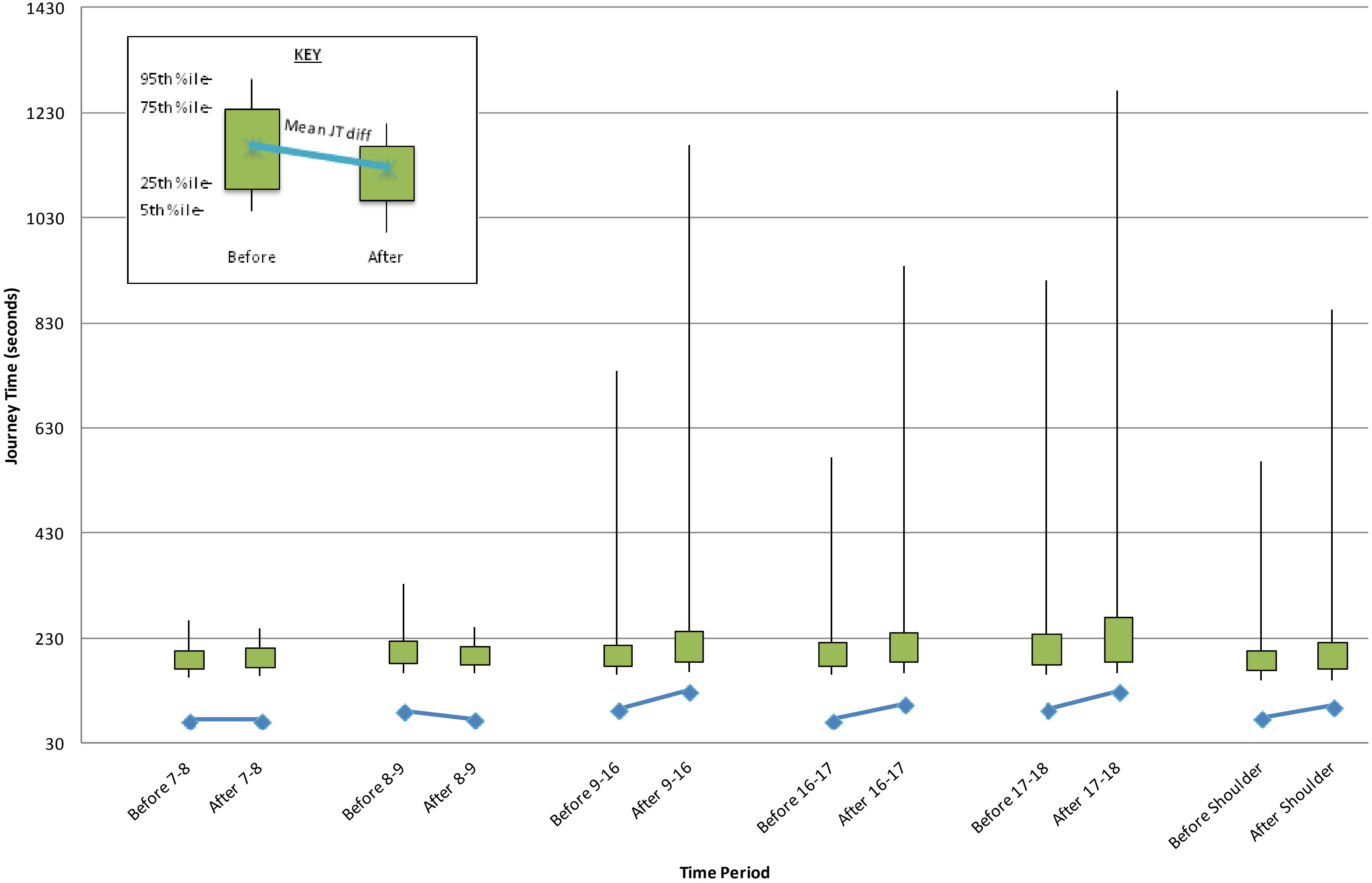


Figure A.11 - Northbound A64 to A1237 (E - C) journey time analysis

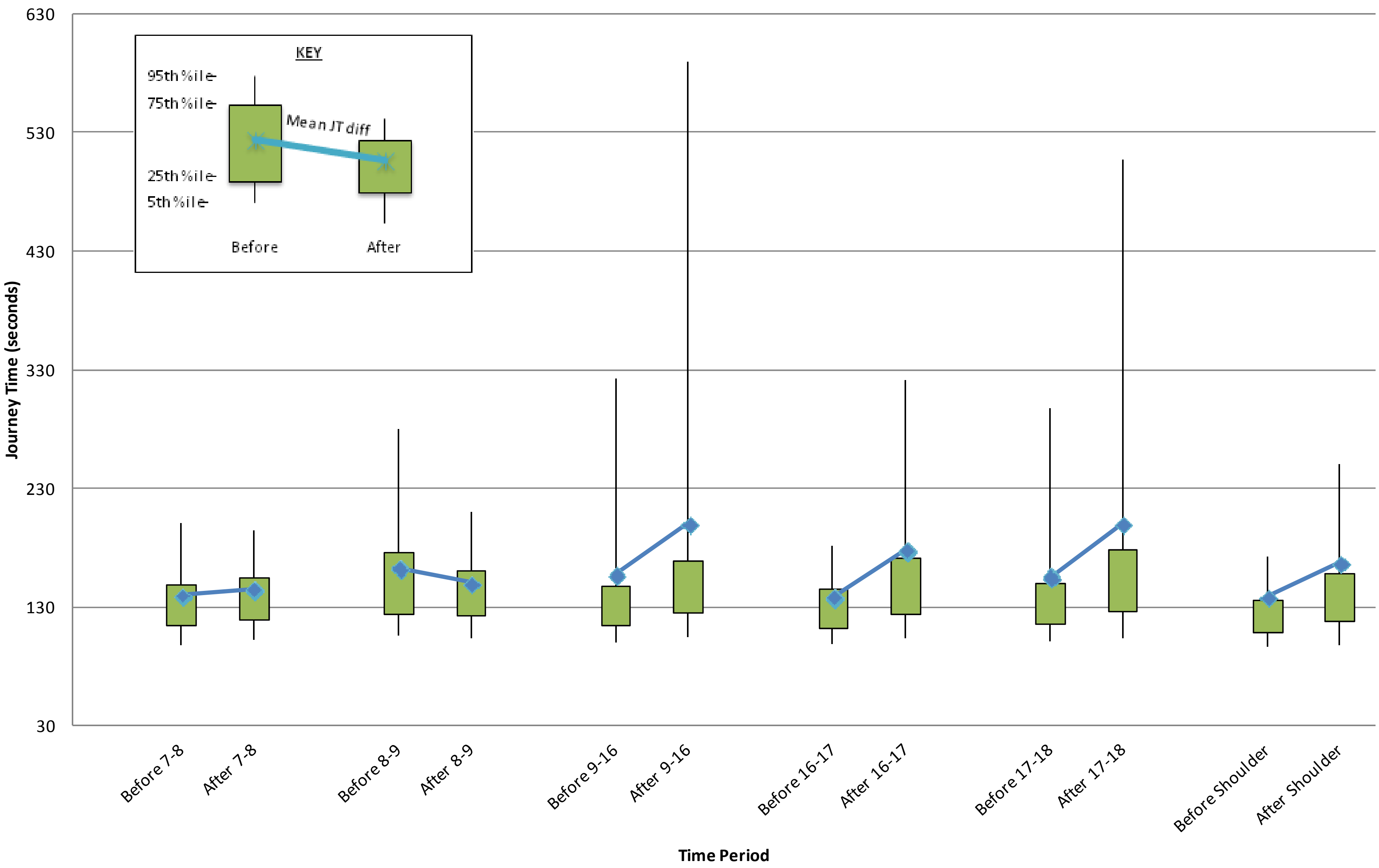
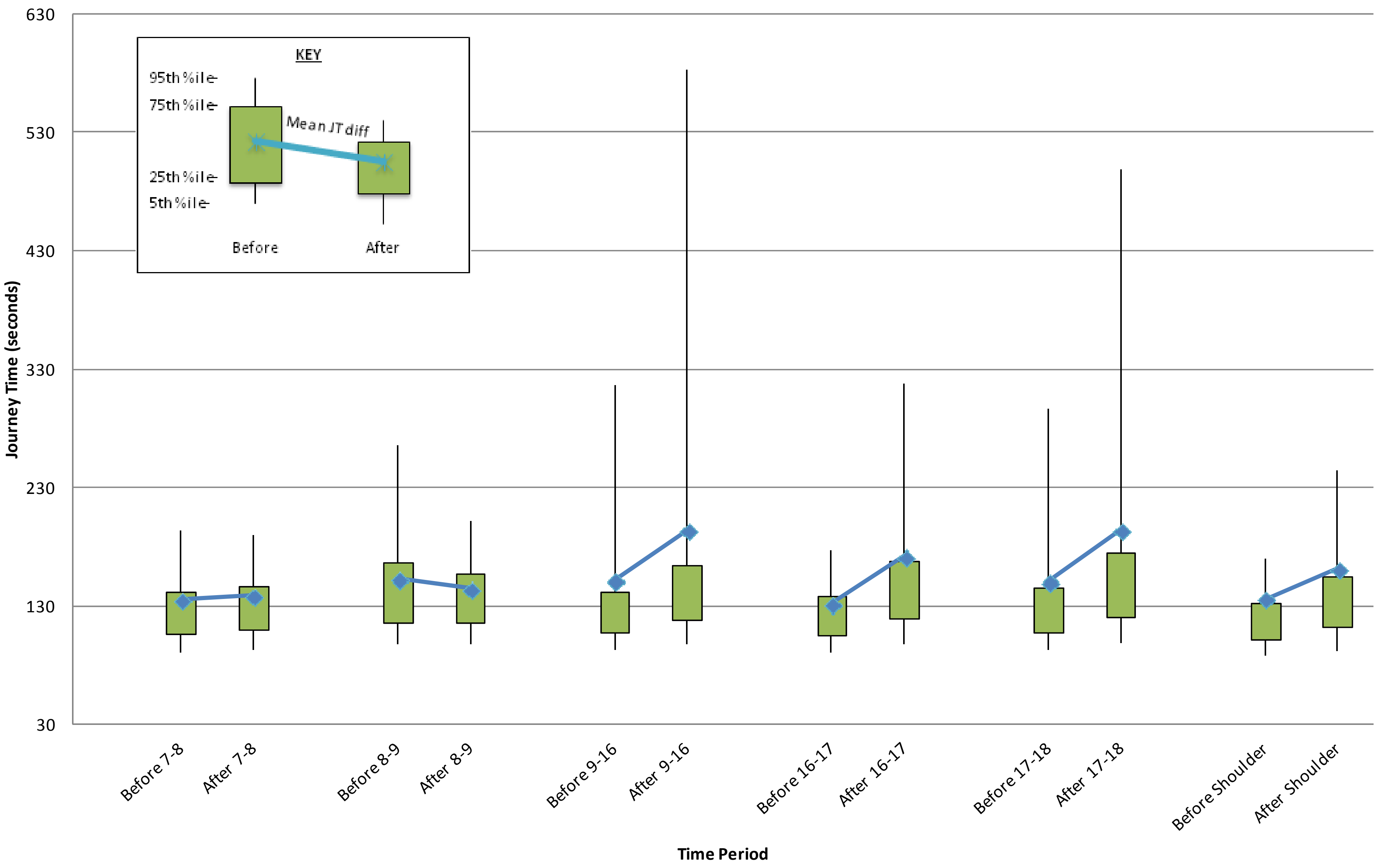


Figure A.12 - Northbound A64 left turn to A1037 (E - D) journey time analysis



Appendix B. EST

This appendix shows the scheme Evaluation Summary Table (EST). This outlines the impact of the scheme on each of the NATA objectives and sub-objectives. Typically a scheme also has an Appraisal Summary Table (AST) within the PAR document, but as no PAR was completed for this scheme this is not available.

Objective	Sub Objective	Qualitative Impacts	Quantitative Measure	Assessment
Environment	Noise	Traffic volumes have not increased across the whole junction since the scheme was installed. A 25% change is required for noise to be affected.	<10% increase in traffic volume	No Impact
	Local Air Quality	The scheme does not involve a significant change in AADT and so air quality impacts are minimal.	<10% increase in traffic volume	No Impact
	Greenhouse Gases	Total distance travelled has not increased and the scheme has been successful at keeping traffic moving reliably, especially during the peak periods. As vehicle kilometres have not changed as a result of the scheme it has had a minimal impact on greenhouse gases.	N/A	No Impact
	Landscape	The existing carriageway has been widened and new signs, signals and gantries have been installed. The junction already had an impact on landscape but this scheme has made that impact slightly worse.	N/A	Slight Adverse
	Townscape	The scheme is not in a built up environment and thus townscape is scored as neutral.	N/A	No Impact
	Heritage of Historical Resources	The scheme is wholly within the highway boundary and there was no impact on archaeological or heritage sites	N/A	No Impact
	Biodiversity	The scheme is likely to have had an adverse impact on biodiversity but measures have been installed that mitigate much of the impact. On balance a slight adverse score has been given that is consistent with the conclusion of the pre-scheme Ecological Assessment	N/A	Slight Adverse
	Water Environment	There has been no change to highway drainage and so the scheme is scored neutral.	N/A	No Impact
	Physical Fitness	There is no change to the length or number of walking and cycling trips that use the junction.	N/A	No Impact
	Journey Ambience	There have been large peak time reductions in delay and congestion but small increases during non-peak times of day. The number of accidents has reduced. On balance the scheme has had a slight beneficial impact	sat nav journey time data showed an average journey time saving of12 seconds in the AM peak and 49 seconds in the PM peak and an increase of 13 seconds in the inter peak.	Slight Beneficial
Safety	Accidents	The scheme has successfully reduced PIAs but not by as many as forecast.	1.21 accidents saved.	Accident PVB £4.56m (lower than expected)
	Security	The scheme has had minimal impact on actual or perceived security	N/A	No Impact

Objective	Sub Objective	Qualitative Impacts	Quantitative Measure	Assessment
Economy	Public Accounts	The outturn costs were lower than pre-scheme forecast (£10.69m, predicted corrected)	PVC £7.68m	Better than expected
	Business Users & providers	Overall, the scheme has provided journey time improvements during the peak traffic flow periods but there have also been journey time disbenefits during the inter peak periods, when the traffic signals impose a time delay to traffic that previously flowed more freely. The monetisation of these impacts has shown that the scheme caused small disbenefits in the opening year, but these disbenefits were not as large as expected. The reforecast scheme life benefits (£22.2m) are lower than expected (£69.7m), mainly due to a lower than expected improvement in the AM peak period.	sat nav journey time data showed an average journey time saving of 12 seconds in the AM peak and 49 seconds in the PM peak and an increase of 13 seconds in the inter peak.	Beneficial (lower than expected) PVB £22.2m)
	Consumer Users			
	Reliability	There has been a varied pattern of change in relation to the reliability of journey times with some roads achieving large benefits (A1237) while reliability got worse on other roads (A64).	N/A.	Neutral Impact
	Wider Economic Impacts	The scheme was required as a result of development in the area. This development has not progressed as expected but the road capacity is now in place to facilitate the development when it does proceed.	N/A	Beneficial
Accessibility	Option values	Not applicable	N/A	No Impact
	Severance	The scheme does impact on severance	N/A	No Impact
	Access to Transport System	There is no change to the public transport system due to the scheme.	N/A	No Impact
Integration	Transport Interchange	The scheme has no impact on interchange facilities.	N/A	No Impact
	Land Use Policy	The scheme has provided additional capacity and it now has an improved ability to cope with additional development traffic generated by land use change	N/A	Large Beneficial
	Other Government Policies	The scheme involved working with the Local Authority and achieved aims set out in the Department for Transport document DfT 'Towards a sustainable transport system' report Oct 2007. Accident rates have been reduced and peak time congestion reduced whilst environmental mitigation has been implemented successfully	N/A	Beneficial