

LNMS Evaluation Report

A46/A607 Junction Improvement Scheme



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LNMS Evaluation Report

A46/A607 Junction Improvement Scheme

July 2008

JOB NUMBER: 5048001.1525.805			DOCUMENT REF: POPE of LNMS - A46-A607 Hobby Horse_FINAL.doc			
Revision	Purpose / Description	Originated	Checked	Reviewed	Authorised	Date
A	Draft Report	LS	PB	NDM	NDM	Jan 08
B	Revised Draft	LS	PB	NDM	NDM	May 08
C	Final Draft	LS	PB	NDM	NDM	14/5/2008
D	FINAL	LS	LT	NDM	NDM	22/07/08
		Originated	Checked	Reviewed	Authorised	Date
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1. Introduction

PURPOSE OF THIS REPORT

- 1.1 As part of an ongoing requirement of the Highways Agency to evaluate the impacts of trunk road schemes, Atkins has been commissioned by the Highways Agency to undertake post-opening evaluations of Local Network Management Schemes (LNMS) with an implementation cost of between £1m and £5m. The aim of this process is to assist the Highways Agency (HA) and their Managing Agents to:
- ◆ Quantify the outturn benefits and dis-benefits accruing from new schemes and to ascertain which schemes offer the greatest value for money;
 - ◆ Develop the pre-scheme appraisal processes (PAR Guidance) 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
 - ◆ Ensure that the HA continues to deliver schemes that offer the greatest value for money and that are most effective solutions to problems on the core network.
- 1.2 This document specifically sets out the results of the Post-opening Project Evaluation (POPE) of the A46/A607 Junction Improvement Scheme as implemented in May 2006. More specifically, the report examines the economic and safety impacts resulting from the improvements, with consideration also given to the main environmental, accessibility and integration impacts.

BACKGROUND

- 1.3 The A46/A607 Hobby Horse Roundabout is located approximately 5 miles north of Leicester (**Figure 1.1**) and immediately to the west of Syston. The junction was originally constructed as part of the A46 Leicester western bypass in November 1995 and is on a key commuter route in and out of Leicester. Prior to scheme opening, the A46 north of the junction carried an average of 38,550 vehicles (2-way).
- 1.4 The A46/A607 Junction Improvement Scheme (a Highways Agency Priority Action Site) opened on 12 May 2006 and was designed as an interim measure for longer term plans to grade separate the junction. The recent junction improvements were intended to extend the design life of the junction up to 2016 and address the excessive queuing of traffic at the junction during peak hours. Furthermore it was designed to minimise the number drivers diverting onto routes through the nearby town of Syston in order to avoid delays on the trunk road.

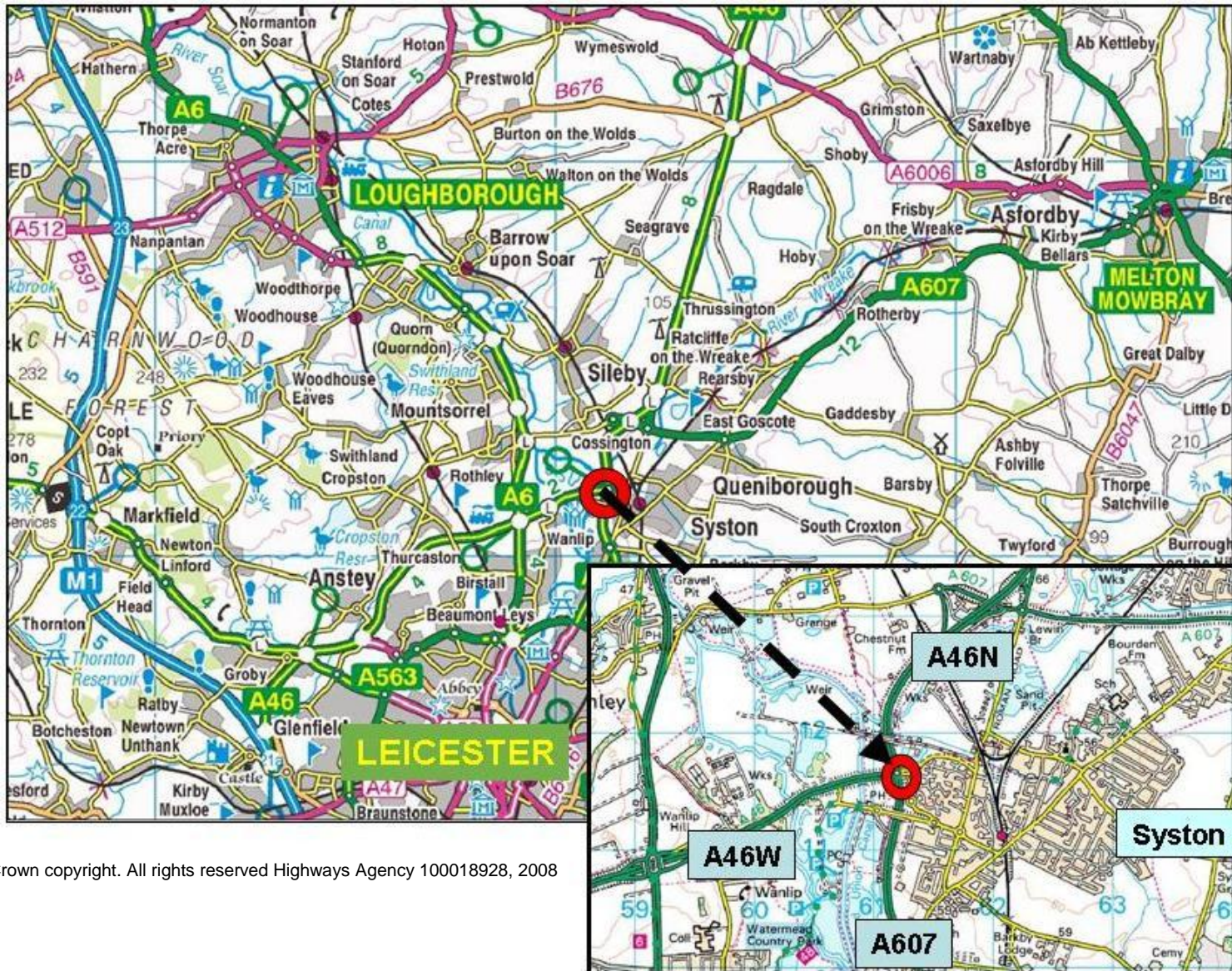
SCHEME DESCRIPTION

- 1.5 The A46/A607 completed scheme comprises of the following improvement measures (**Figure 1.2**):
- ◆ Enlarging the inscribed circle diameter of the roundabout from 65m to approximately 80m and increasing the number of lanes on the circulatory carriageway, with a minimum of 3 lanes all the way around to help increase capacity of the junction;
 - ◆ Installing full time traffic signal control to the three main A road approaches to the roundabout (using MOVA control) which allows the HA to optimise the allocation of green time for key movements at the junction;
 - ◆ Increasing the number of lanes entering the roundabout on the A46 West approach from 3 lanes to 4 lanes, plus an additional lane of free flowing traffic on the A46 towards Newark to increase the junction capacity;
 - ◆ Increasing the number of lanes entering the on the A46 approach from Newark (north of the scheme) from 3 lanes to 5 lanes, and increasing the number of lanes entering the roundabout on the A607 approach from 3 to 4 lanes to increase the junction capacity;
 - ◆ Increasing the number of lanes on the A46 exit towards the M1 and A607 exit from 2 to 3 lanes to increase the junction capacity;
 - ◆ Some modest realignment of the minor Glebe Way (east) arm of the roundabout which will continue to operate on a give way basis; and
 - ◆ Lane markings on the circulatory carriageway to help improve safety by improving lane discipline.
- 1.6 Following the Stage 3 Safety Audit, carried out after the opening of the scheme, several minor changes were made to signing and lining, and these were completed by the end of September 2006. Details of these changes can be found in **Section 2**.

SCHEME CATEGORISATION AND OBJECTIVES

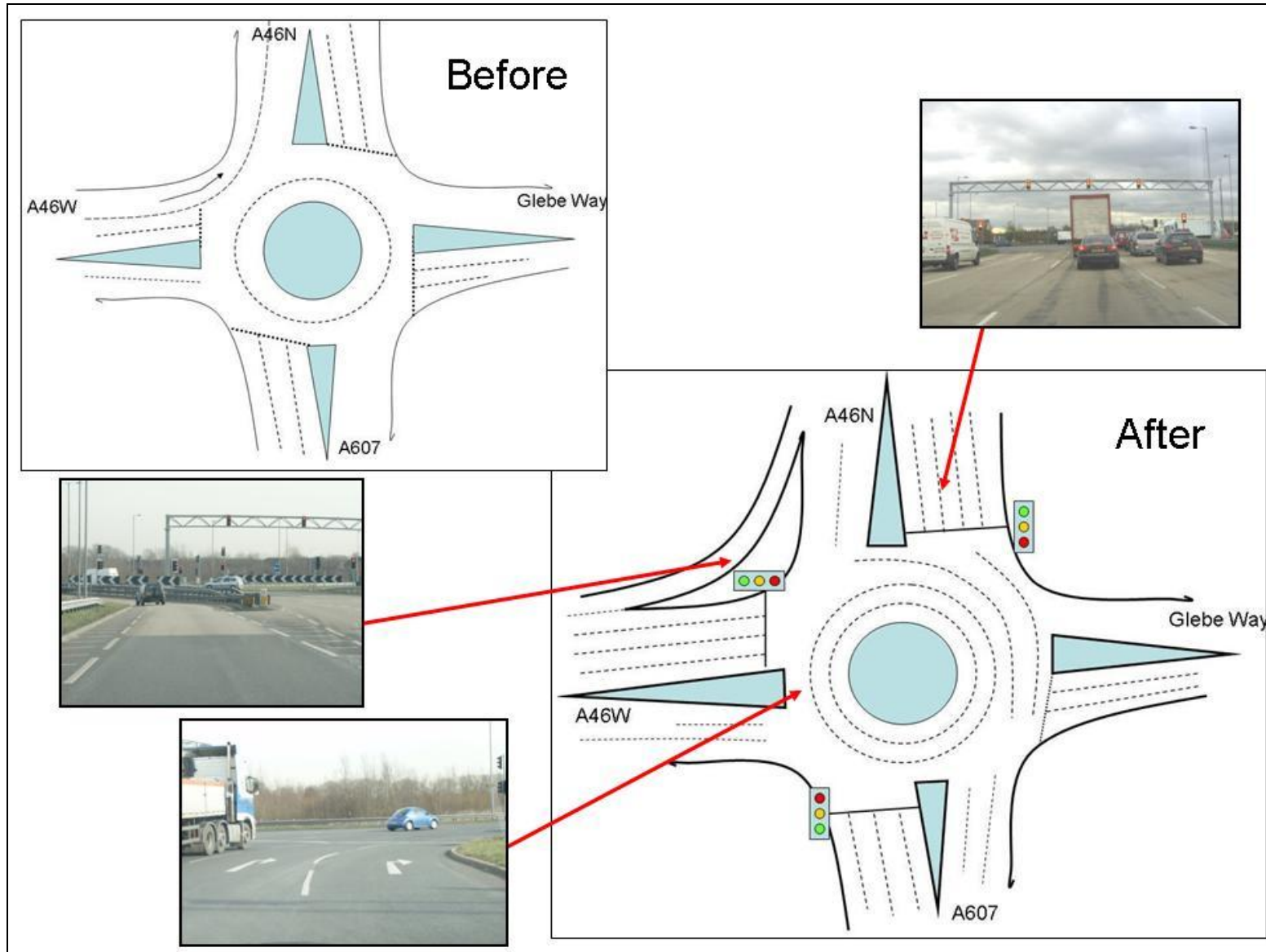
- 1.7 Local Network Management Schemes (LNMS) are categorised according to which of the five assessment objectives of safety, economy, environment, accessibility and integration are primarily addressed by the scheme. As detailed in the PAR document, the scheme has been categorised as an **economy scheme**. The scheme was expected to achieve the following outcomes:
- ◆ Increase capacity at the junction by increasing the number of lanes entering and leaving the junction and by introducing traffic signal control;
 - ◆ Decrease journey times and encourage traffic back to the junction and thus reducing rat-running through Syston town centre;
 - ◆ Reduce in accident severity at the junction; and
 - ◆ Reduce accidents in Syston as a result of less rat-running (not quantified in the original PAR assessment).

Figure 1.1 – Location of A46/A607 Junction Improvement



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Figure 1.2 - Before and After Junction Layout



POPE METHODOLOGY OVERVIEW

1.8 This report provides an overview of the forecast and outturn impacts of the A46/A607 in accordance with the POPE methodology. POPE is based on an evaluation of the scheme's out-turn impacts against the five core 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 the ability with which people can reach different locations and facilities by different modes; and
- ◆ **Integration** - aims to ensure that all decisions are taken in the context of the Government's integrated transport policy.

1.9 More specifically the report presents the following:

- ◆ A comparison of the 'before' and 'after' traffic volumes and journey times at the junction to illustrate how overall traffic conditions have changed following scheme opening;
- ◆ An outline of changes in accident rates at the junction following scheme opening.
- ◆ A comparison of predicted and out-turn environment, accessibility and integration impacts;
- ◆ A summary of scheme performance from the perspective of key stakeholders engaged in the original scheme development including the MAC and project sponsor;
- ◆ The original PAR assessment which forecast the benefits of the scheme. Where required values are converted to 2002 prices and discounted to 2002; and
- ◆ An Evaluation Summary Table based on the outturn effects of the scheme using a methodology consistent with the original PAR assessment undertaken prior to scheme opening.

REPORT STRUCTURE

1.10 The remainder of this report has been divided into 6 further sections as follows:

- ◆ **Section 2 - Data Collection and Stakeholder Feedback:** Contains an outline of the data used to evaluate the scheme, and the responses from key stakeholders regarding the scheme;
- ◆ **Section 3 - Traffic and Economic Impacts:** Outlines the traffic changes in the study area, as well as the economic impacts of the scheme in respect to predicted and outturn works costs, traffic volume changes and journey delay analysis;

- ◆ **Section 4 - Safety Impacts:** Outlines the safety impacts of the scheme through analysis of personal injury accidents;
- ◆ **Section 5 - Environmental, Accessibility and Integration issues:** Summarises the scheme impacts on these issues; and
- ◆ **Section 6 - Summary of Findings and Recommendations:** Summarises the impact of the scheme based on the data available to evaluate the scheme.

1.11 It is intended that the findings from this report will feed into a wider summary of the outcomes of the POPE process as reported in the LNMS annual report.

2. Data Collection and Stakeholder Feedback

INTRODUCTION

- 2.1 This chapter sets out the data collection process used to support this scheme evaluation. More specifically this chapter:
- ◆ Lists the datasets used to undertake the scheme POPE assessment;
 - ◆ Summarises the outcomes of a site visit undertaken by Atkins in February 2008; and
 - ◆ Provides a summary of the feedback from the MAC and Project Sponsor, and any other interested parties regarding the overall effectiveness of the scheme in achieving the intended objectives.

DATASETS USED TO SUPPORT THE POPE EVALUATION

- 2.2 A number of datasets were used to inform the 'before' and 'after' comparisons made in this POPE study, as follows:

Pre-Scheme Opening Data

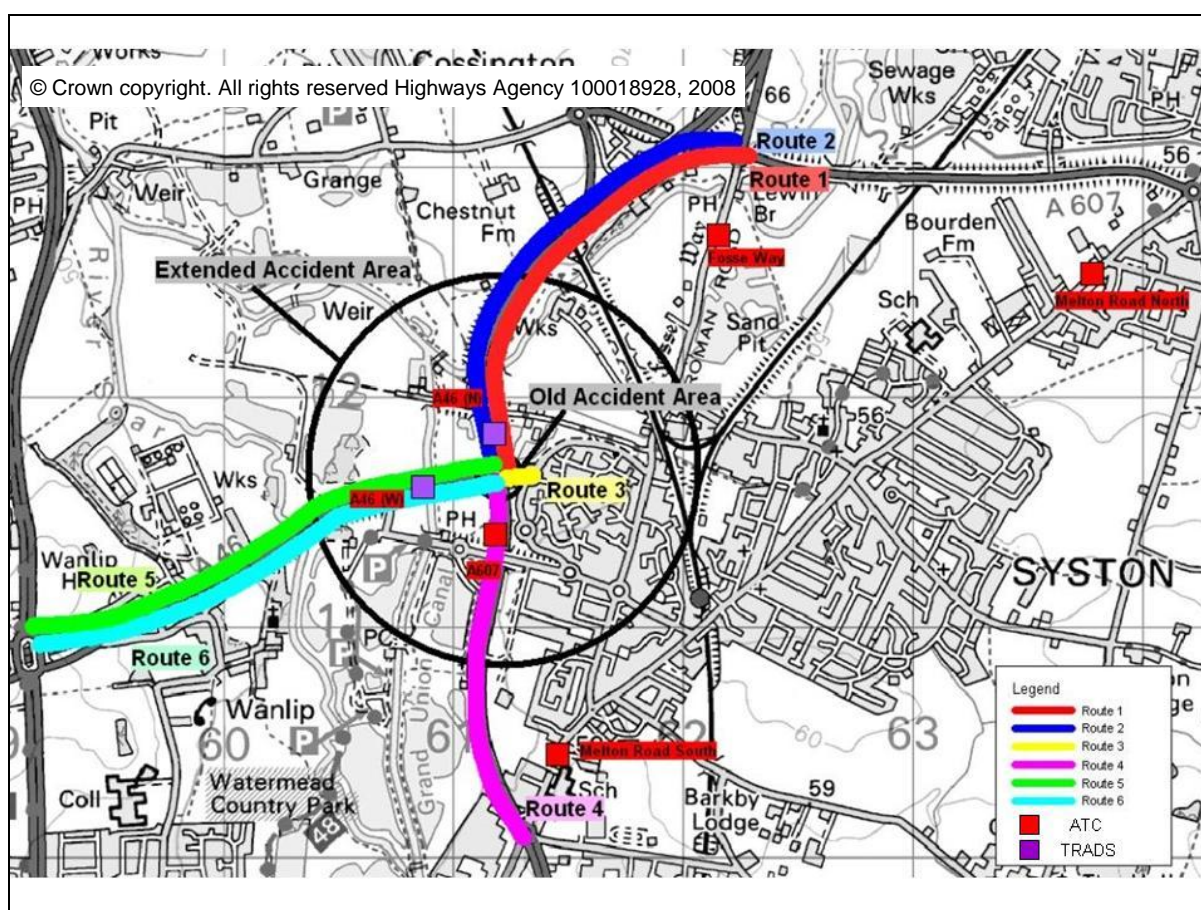
- ◆ Full turning count survey (12hr) for A46/A607 junction undertaken on 11 March 2003 (White Young Green (WYG) Data Collection Report 2004);
- ◆ Highways Agency TRADS 2 Database ATC data for A46 northern arm between August 2002 and February 2003 (details from WYG report);
- ◆ ATC counts at four sites in March 2003, on the junction and in Syston (WYG Report)
 - A46(N)
 - A46(W)
 - A607
 - Melton Road, Syston;
- ◆ Journey time surveys on seven routes in March and April 2003 for AM, Inter and PM Peak times (**Figure 2.1**) (WYG Report);
- ◆ Updated Personal Injury Accident (PIA) data for the five year period September 2000 - August 2005; and
- ◆ Appendix E (WYG, Economic Assessment Report June 2003).

Post-Scheme Evaluation Data

- ◆ Post opening PIA data (June 2006 - November 2007);
- ◆ TRADS ATC site on A46 (West and North from April 2005 - February 2008);
- ◆ 12 hour turning count at junction (March 2008, 7am-7pm, classified HGV/Car);
- ◆ 1 week ATC on A607, and routes through Syston (Melton Road, and Fosse Way) in March 2008 (**Figure 2.1**);

- ◆ Journey times AM Peak, Inter Peak and PM Peak through the junction as detailed below (and **Figure 2.1**);
 - **Route 1:** A46 from Fosse Way Junction, straight ahead at Hobby Horse Junction;
 - **Route 2:** A46 from Fosse Way junction, right turn at Hobby Horse junction;
 - **Route 3:** Glebe Way junction, ahead at Hobby Horse junction,
 - **Route 4:** A607 from Melton Road junction, ahead at Hobby Horse junction;
 - **Route 5:** A46/A6 junction left turn at Hobby Horse junction to A46(N);
 - **Route 6:** A46/A6 junction right turn at Hobby Horse junction;
- ◆ A46/A607 Hobby Horse Junction Improvement Road Safety Audit Stage 3 Report.(WYG)

Figure 2.1 – Count and Journey Time Locations



Note: Old accident area refers to the accident analysis area assumed in the original par assessment.

Other Data

- ◆ Consultation with the MAC, Project Sponsor and Syston town councillors.

SUMMARY OF SITE OBSERVATIONS

2.3 A site visit was conducted on the morning of 28 February 2008 in order to observe post opening traffic conditions at the junction during the AM peak period. The aims of the site visit were as follows:

- ◆ To ensure that the scheme was implemented as per the original PAR and scheme drawings supplied by the MAC;
- ◆ To observe the post opening junction operating conditions during the AM Peak period with regard to traffic flow and safety; and
- ◆ To observe the effects of through traffic in Syston.

2.4 The following observations were made during the site visit:

A46/A607 Junction

- ◆ All lane and lining was observed as described in the PAR, including the minor additions/alterations made as recommended by the Safety Audit;
- ◆ Short queues were observed on the A46(N) arm in the southbound direction (AM peak), although the majority of the queue was cleared within a maximum of two green phases. All other arms were cleared within a single green phase;
- ◆ No near misses or dangerous driving patterns were observed. General lane discipline appeared to be good throughout the junction; and
- ◆ An additional lane right turn arrow on A46(W) approach had been added as a result of the Stage 3 Safety Audit in summer 2006.

Syston

- ◆ High levels of on street parking and congestion in Syston meant that average vehicle speeds through the town were less than 30mph for the majority of the time (**Figure 2.2**); and
- ◆ It was not possible from the site visit to ascertain how much of the traffic in Syston was through traffic. Much of the traffic appeared to be associated with shopping activity along the route.

Figure 2.2 – Melton Road through Syston



STAKEHOLDER FEEDBACK

Project Sponsor

- 2.5 The Project Sponsor stated that on a day to day basis the junction appears to have been enhanced in the peak periods following scheme opening and thus had achieved its intended objectives.

Managing Agent

- 2.6 The following public feedback was received by the MAC in the first few months after opening, before remedial measures were made:

- ◆ Lane markings on the approach to the roundabout from the A46(W) arm are confusing. Initially all lanes are highlighted as straight ahead and subsequently change closer to the junction thus not allowing enough time for users to change lanes safely.
- ◆ Lane markings and signing is confusing when exiting roundabout to the A46(N) and A46(W) as 2 lanes are indicated, which then merge into 1 without sufficient warning.

- 2.7 At the end of May 2006 a safety audit was undertaken for this scheme, entitled A46/A607 Hobby Horse Junction Improvement Road Safety Audit Stage 3. This identified a number of safety issues and made the following recommendations;

- ◆ General clearance of vegetation to ensure that all signs are fully visible;
- ◆ Add reflective marker posts on the dedicated left hand lane before it merges with the main carriageway (**Figure 2.3**);
- ◆ Apply right turn arrows on approach carriageway (A46 arms);
- ◆ Increase the width of stop lines from 200mm to 300mm;
- ◆ Increase the height of a sign on the Glebe Way approach to improve forward visibility;
- ◆ Replace raised glass road studs as these are considered dangerous to motorcyclists;
- ◆ Add larger illuminated signs on A46(W), A46(N) and A607 exits warning of merging lanes (**Figure 2.4**);
- ◆ Illuminate the speed warning sign on the dedicated left hand turn lane (**Figure 2.5**);
- ◆ Reposition some secondary signals to reduce confusion; and
- ◆ Some missing kerb edge lining.

Figure 2.3 – Reflective Marker Posts on A46 (N) Arm



Figure 2.4 – Illuminated Merge Sign



Figure 2.5 – Illuminated Speed Warning Sign



2.8 All recommendations above were actioned by September 2006.

Syston Town Council

2.9 Comments received from Syston Town Council are summarised as follows:

- ◆ The impact of the scheme has largely been positive;
- ◆ Safety at the junction has much improved;
- ◆ Lengthy queues on the A46(W) arm from the M1 appear to remain in the evening peak period; and
- ◆ The scheme appears to have done little to divert through traffic between Melton Mowbray and Leicester on to the A46.

Summary of Costs

2.10 **Table 2.1** illustrates the predicted and outturn costs for the scheme. The PAR prediction was inclusive of 5% optimum bias.

Table 2.1 – The Predicted and Outturn Costs for the Scheme

Costs	PAR Predicted (in 2002 prices)	Outturn (in 2002 prices)
Total Works cost	£2,479,597	£3,295,201
Total Land costs	£20,265	£19,450
Site preparation costs	£149,992	£153,841
Site supervision costs	£124,993	£126,397
Sub Total	£2,774,846	£3,594,889
Risk allowance	£491,369	N/A
Optimism bias	£163,311	N/A
Undiscounted Works, Land and other costs	£3,429,526	£3,594,889
Discounted (to 2002) Works, Land and other PVC	£2,982,196	£3,125,990
Discounted (to 2002) Works, Land and other PVC in Market Prices(*)	£3,605,475	£3,125,990
Annual Maintenance costs	N/A	N/A
Maintenance PVC	N/A	N/A
Total PVC	£3,605,475*	£3,125,990

Note: *Converted to Market Prices as per PAR guidance using a factor of 1.209

- 2.11 If the sub-total figures in **Table 2.1** are compared it is noticeable that the outturn works costs were approximately £800,000 more than predicted. However the inclusion of optimism bias, the risk allowance and the conversion to market prices within the predicted costs distorts this picture and provides the appearance that the scheme was delivered for a lower cost than predicted.
- 2.12 For the predicted costs, PAR guidance requires that the discounted costs are multiplied by the indirect tax correction factor (the average rate of tax in the economy) used in COBA, currently 1.209.

2.13 Key points to note from **Table 2.1** include:

- ◆ The scheme was delivered at an out-turn cost of £3.126m compared to a predicted cost of £3.605m;
- ◆ When the effects of indirect taxation and optimism bias are excluded from the prediction, the out-turn scheme costs are higher than expected due to overrunning works costs; and
- ◆ In the case of this scheme, if the optimism bias and risk allowance were not included within the predicted scheme costs the outturn costs would have been higher than the predicted.

Summary – Section 2:

- ◆ The scheme appears to have been implemented as per the proposals set out in PAR, although some changes were made following scheme opening;
- ◆ The scheme appears to have been generally well received by local stakeholders although it was acknowledged that there were some minor out-standing issues with lane markings and continued queuing on the A46(W) arm in the PM peak hours;
- ◆ Comments received from the public state that there was concern with some of the signing and lining on some of the approaches (received via MAC) however these have been addressed through the Stage 3 Safety Audit;
- ◆ The site visit indicated that whilst queuing still exists at the junction, queues were generally dispersed within a maximum of two green phases;
- ◆ There are still some concerns that rat-running through Syston in the southbound direction still exist. Information on the extent of rat-running was not collected on the site visit undertaken by Atkins;
- ◆ The scheme was delivered at an out-turn cost of £3.126m compared to a predicted cost of £3.605m; and
- ◆ Optimism Bias has been included within the predicted scheme costs. The outturn scheme costs would have been higher than the predicted if it was not for the inclusion of the optimism bias and risk in the original appraisal.

3. Traffic and Economic Impacts

INTRODUCTION

- 3.1 The primary objective of the scheme was to improve the overall efficiency of the junction by reducing congestion. Prior to scheme opening, congestion at the junction was resulting in queues and delays on all approaches, particularly during the AM and PM peak periods. This section sets out the evaluation of the economic impacts derived from the scheme. More specifically this chapter will:
- ◆ Provide an appreciation of the impact of current and future development around the junction;
 - ◆ Provide an appreciation of recent changes in traffic volume at the junction and through the adjacent town of Syston; and
 - ◆ Quantify the outturn impacts of the scheme upon journey times in order to provide an assessment of the economic benefit of the scheme.

DEVELOPMENT IMPACTS

- 3.2 There have been several developments south of this junction which may have an effect on traffic using the junction. The WYG traffic report in 2002 highlights several committed developments in both Syston and in the wider area, and estimated that these developments would lead to:
- ◆ An extra 662 vehicles travelling through the junction in the AM peak (7.45-8.45); and
 - ◆ An extra 672 vehicles travelling through the junction in the PM peak (17.00-18.00).
- 3.3 The committed development traffic was taken into account when preparing design year traffic flows for 2011 and other future years.

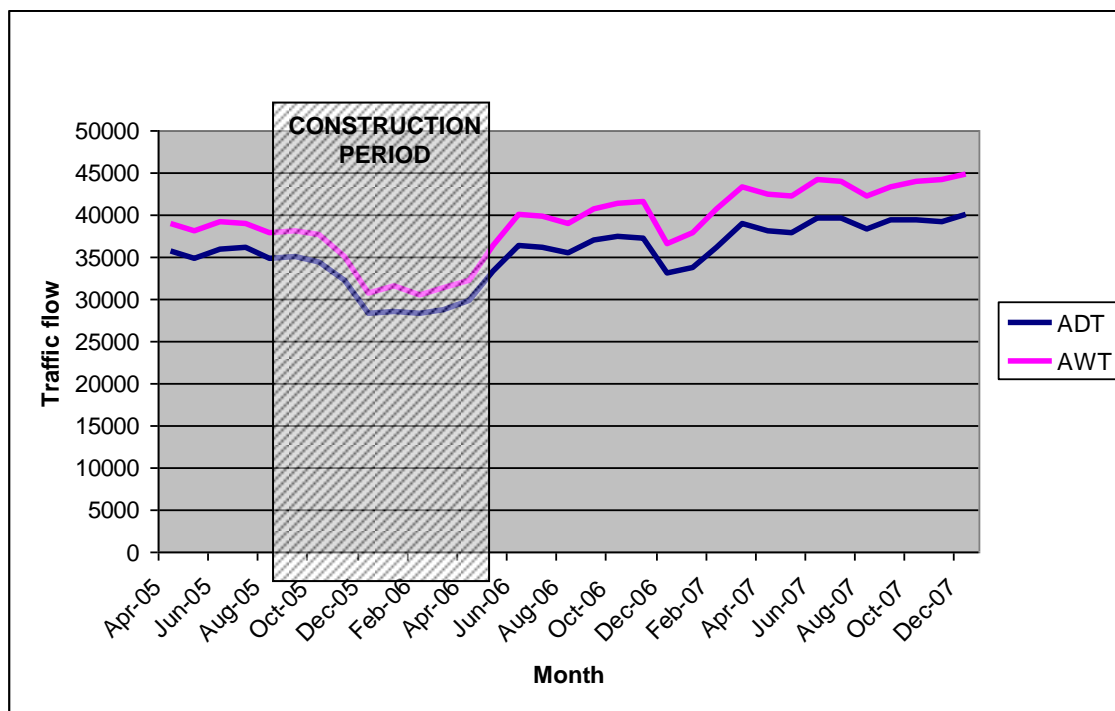
TRAFFIC TRENDS

- 3.4 It is important to consider the extent to which traffic volumes have changed at the junction before and after the A46/A607 Junction Improvement Scheme. Such an analysis serves two main purposes:
- ◆ To ascertain whether any additional traffic (induced traffic) has been attracted to the junction as a result of the scheme; and
 - ◆ To ensure that the benefits for additional/new users of the junction are considered in the estimation of outturn economic benefits.

Traffic Count Comparisons

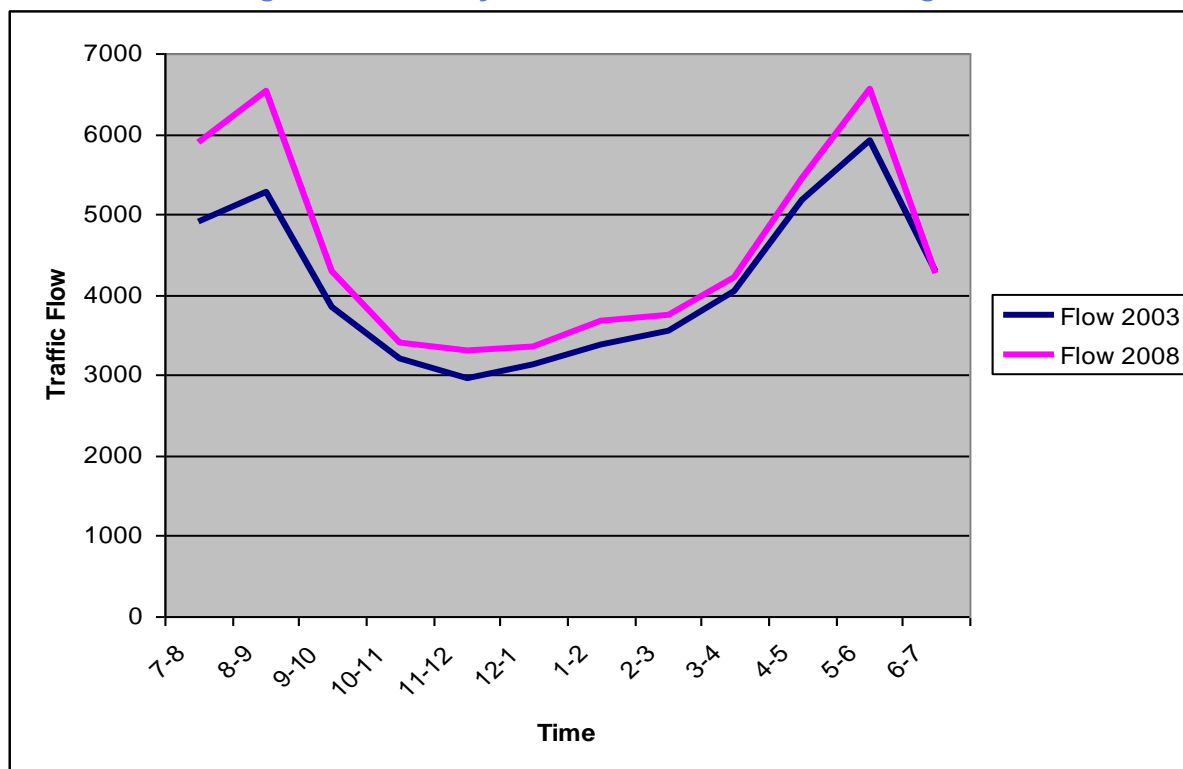
- 3.5 The Highways Agency's TRADS2 Database holds limited data in relation to this junction, as it only has data on the A46 arms (**Figure 3.1**), since 2005.

Figure 3.1 – 2-Way Traffic Flow on A46 Northern Arm 2005 - 2007



- 3.6 Traffic data clearly illustrates the impact of construction between September 2005 and April 2006 as the traffic flow is reduced due to the disruption. However, it also illustrates the immediate increase in traffic once the new junction arrangement was fully opened to traffic.
- 3.7 The average 2-way weekday traffic (AWT) flow on the A46(N) before opening was 38,500 vpd (April - September 2005), and the average 2-way weekday traffic flow on the A46(N) after opening was 41,700 vpd (May 2006 - December 2007). This illustrates an 8% increase in traffic flow.
- 3.8 **Figure 3.1** also shows that the average weekday traffic (AWT) is higher than the average daily traffic (ADT) flow at all times.

Figure 3.2 – Hobby Horse 12 hr Traffic Flow Changes

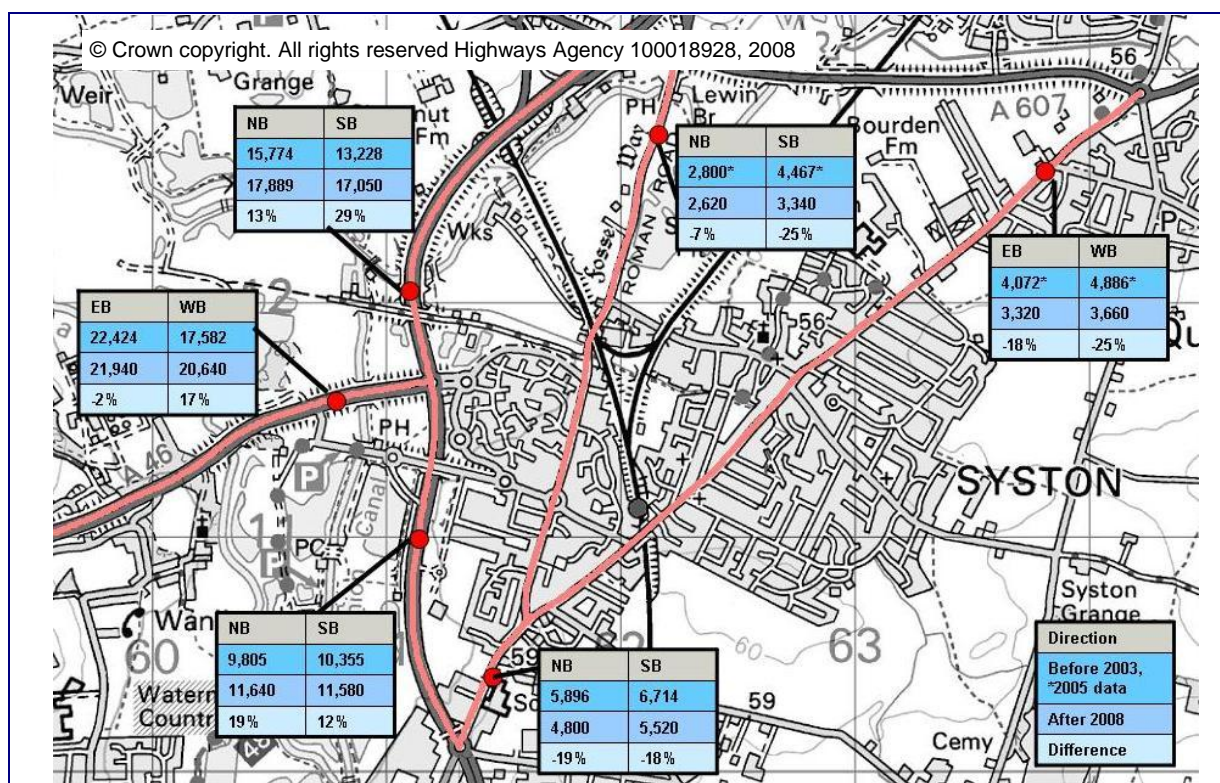


- 3.9 Comparing the 12 hour turning counts undertaken in 2003 (WYG) and 2008 (Atkins), **Figure 3.2** shows that traffic growth appears to have largely taken place during the AM peak and the PM peak. Traffic flow outside of these peak periods remains relatively unchanged. This indicates that routes using this junction have become more attractive to users following the completion of the improvements, and that the junction is working more efficiently.
- 3.10 The total observed amount of traffic using the junction has increased by 9.95% between 2003 and 2008. This is only marginally higher than that predicted by the NRTF (locally adjusted by TEMPRO) prediction of 9.0%. Such trends suggest that overall the scheme has not introduced any induced traffic to the junction.
- 3.11 However, there have been different levels of traffic growth on each of the junction arms, some higher and some lower than the overall junction average suggesting that there have been some re-routing. Graphs illustrating these points can be found in **Appendix C**.

Overall Traffic Change

3.12 **Figure 3.3** below shows the overall change in 12 hour AWT in the area:

Figure 3.3 – 12 hr AWT Traffic Flow Comparison



3.13 The key changes to note from above are outlined below:

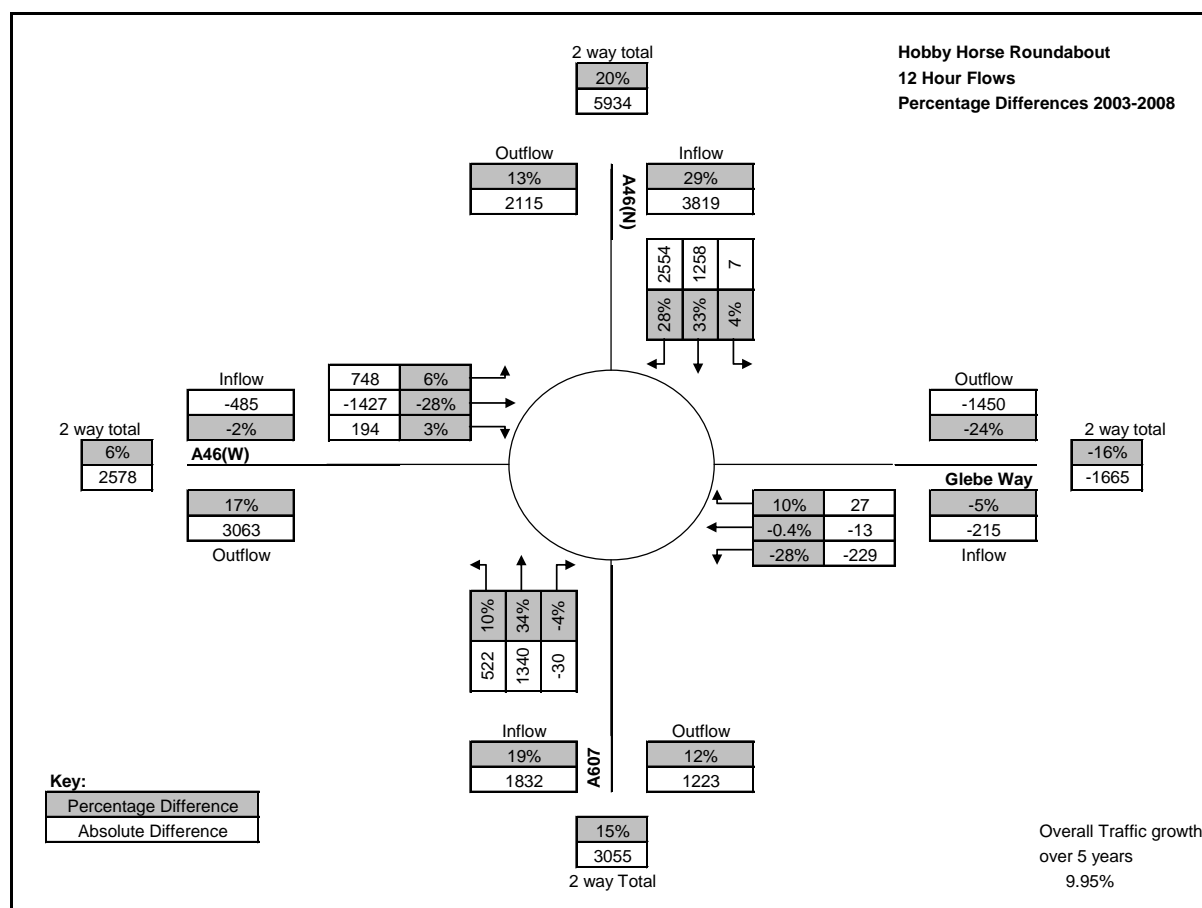
- ◆ Count sites north of the town centre suggest there has been a decrease in traffic travelling southbound through Syston (average of 25% between 2005 and 2008), this corresponds to an increase in traffic travelling southbound on the A46 towards the Hobbyhorse roundabout;
- ◆ Traffic flow reductions north of the town in the northbound direction have been in the region of 14% this correlates with an observed increase in journey times for straight ahead movements through the Hobbyhorse junction between 2003 and 2008 (**Table 3.2**);
- ◆ There has been a marginal decrease in eastbound A46 traffic into the junction (2%);
- ◆ The total 12 hour AWT into the junction has increased from 45,457 to 50,638 (11.3%) between 2005 and 2008; and
- ◆ Two directional flows on the A46(N) arm have increased by almost 6,000 vehicles (20% increase on before flows).

3.14 A key finding to note is that there has been a significant reduction in traffic travelling through Syston on the main rat-running routes to avoid the A46/A607 junction following the completion of this scheme. This reduction in traffic through Syston is coupled with an increase in traffic travelling on the A46(N) and A607 arms of the junction.

TURNING COUNT ANALYSIS

- 3.15 Full turning count data for the junction was collected in March 2003 and March 2008 for a 12 hour period between 7am and 7pm. The results have been summarised in **Figure 3.4** below:

Figure 3.4 – Turning Count Changes



- 3.16 **Figure 3.4** illustrates the changes in turning movements following the completion of this scheme, with the north - south movement experiencing the highest growth (increases of approximately 1/3). NRTF traffic growth forecasts (locally adjusted by TEMPRO) predict that traffic should have grown by 9% between 2003 and 2008 (the years of the traffic observations). Other key changes in traffic are outlined below

- ◆ There has been an increase of 28% (2,554 vehicles) in traffic making the right turn from the A46 (N) to the A46 (W);
- ◆ There has only been a 6% (748 vehicles) increase in traffic making the return movement from the A46 (W) to the A46 (N);
- ◆ There has been a 34% (1,340 vehicles) increase in traffic going north from the A607;
- ◆ There has been a corresponding 33% (1,258 vehicles) growth in traffic going south from the A46 (N).

- 3.17 Overall, it is apparent from viewing **Figure 3.4** that there has not been a uniform traffic change across the junction. Some arms have had traffic growth levels more than 3 times the NRTF forecast, whilst other arms have had lower levels of growth, or in the instance of Glebe Way, an overall reduction in traffic levels.
- 3.18 **Table 3.1** shows that overall there is a reasonable correlation between the observed and predicted traffic flows (both factored to 2008), particularly on the trunk road arms, where the majority of predictions were within 10% of the observed flow.

Table 3.1 – Comparison of Predicted and Observed Traffic Flows

		2-Way Traffic Flows			
		A46(N)	Glebe Way	A607	A46(W)
AM Peak Period	Predicted	8276	2540	5834	10854
	Observed	8164	1745	4959	9548
	Difference	112	795	875	1306
	% Difference	1%	46%	18%	14%
Inter Peak Period	Predicted	18691	6213	12845	24859
	Observed	19146	4839	13203	23720
	Difference	-455	1374	-358	1139
	% Difference	-2%	28%	-3%	5%
PM Peak Period	Predicted	7629	2713	5084	10344
	Observed	7607	2063	5083	9267
	Difference	22	650	1	1077
	% Difference	0%	31%	0%	12%

- 3.19 The predictions for Glebe Way are significantly different to the observed flows for all time periods; whilst the predictions for the A607 were very close to the observed for the inter peak and PM peak periods.
- 3.20 The predicted traffic levels for the A46(W) appear to have been over-estimated for the AM and PM Peak periods (between 12-14%).

JOURNEY TIME SAVINGS

PAR Predictions and Assumptions

- 3.21 The PAR predicted that there would be significant economic efficiency benefits resulting from this scheme. It stated that due to the improvements to the junction, capacity would increase and therefore journey times would improve due to a decrease in queuing. The PAR used COBA to generate these monetary benefits calibrated using observed journey times.

Outturn

- 3.22 The Highways Agency's Journey Time Database holds various data for the A46 through this junction, however the original PAR used observed journey times collected in 2003 across 7 routes through the junction. These surveys were

repeated in March 2008 and compared to provide an estimate of outturn journey time savings.

Journey Time Comparison

3.23 A moving observer technique was used to collect journey times for the following routes (see **Figure 2.1**)

- ◆ **Route 1:** A46 N from Fosse Way Junction, to crossing of give way line (in straight ahead lane);
- ◆ **Route 2:** A46 N from Fosse Way junction, to crossing of give way line (in right turn lane);
- ◆ **Route 3:** Glebe Way junction, to crossing of give way line;
- ◆ **Route 4:** A607 from Melton Road junction, to crossing of give way line (in straight ahead lane);
- ◆ **Route 5:** A46/A6 junction to rejoin the main A46 (in dedicated left hand turn lane); and
- ◆ **Route 6:** A46/A6 junction to crossing of give way line (in right turn lane).

3.24 In total 6 runs were taken for each route within the following time periods:

- AM Peak (7.30-9.30);
- Inter Peak (10.00-15.00); and
- PM Peak (16.00 -18.00).

3.25 **Table 3.2** shows a comparison of the observed journey time surveys for before and after scheme opening. Decreases in journey time are highlighted in green whilst journey time increases are shown in red.

Table 3.2 - Average Journey Times

From	Route	Time period	Before (2003) seconds	After (2008) seconds	Difference seconds	% difference
A46 (N)	Route 1: straight ahead	AM Peak	222	100	-122	-55%
		Inter Peak	55	60	5	9%
		PM Peak	80	112	32	40%
	Route 2: right turn	AM Peak	231	92	-139	-60%
		Inter Peak	65	69	4	6%
		PM Peak	86	58	-28	-33%
Glebe Way	Route 3: straight ahead	AM Peak	67	12	-55	-82%
		Inter Peak	19	12	-7	-37%
		PM Peak	39	11	-28	-72%
A607	Route 4: straight ahead	AM Peak	81	110	29	36%
		Inter Peak	72	68	-4	-5%
		PM Peak	162	86	-73	-45%
A46 (W)	Route 5: left turn	AM Peak	93	80	-13	-14%
		Inter Peak	75	72	-3	-4%
		PM Peak	91	77	-14	-15%
	Route 6: right turn	AM Peak	136	112	-24	-18%
		Inter Peak	73	75	2	3%
		PM Peak	91	95	4	4%

3.26 Key trends to note include from **Table 3.2** include the following:

- ◆ Across all routes there was an average journey time reduction of 25 seconds per vehicle;
- ◆ On average, journey times decreased by 54 seconds and 18 seconds in the AM and PM peak periods respectively;
- ◆ Journey time impacts were not uniform in scale across the junction. The largest reduction in AM Peak journey times were experienced on the A46 southbound into the junction (-122 seconds and -139 seconds for straight ahead and right turners respectively);
- ◆ Average journey times through the junction in the interpeak have remained relatively unchanged;

- ◆ Observed increases in right turners from the A46N to A46W (28%) may have contributed towards an increase in journey times on route 4;
- ◆ The observed reduction in flows from Glebe Way may have facilitated a reduction in journey times from this direction; and
- ◆ With the exception of route 4, journey time savings of between 13 seconds and 139 seconds were experienced in the AM peak.

3.27 In summary the increases in junction throughput and reduced journey times (in most instances) indicates there has been some improvement to the operational efficiency of the junction.

Table 3.3 - Comparison of Predicted and Observed Journey Time Savings

		Journey Time Savings per Vehicle (Minutes)			
		A46(N)	Glebe Way	A607	A46(W)
AM Peak Period	Predicted	4.25	2.63	-1.03	2.44
	Observed	2.18	0.92	0.22	0.31
	Difference	2.07	1.71	-1.24	2.13
Inter-Peak Period	Predicted	1.35	-0.25	-0.47	-0.44
	Observed	-0.08	0.12	0.07	0.01
	Difference	1.43	-0.36	-0.53	-0.45
PM Peak Period	Predicted	2.47	3.16	2.78	2.52
	Observed	-0.03	0.47	1.22	0.08
	Difference	2.50	2.70	1.56	2.44

Note: In the above table a minus number in the predicted or observed rows represents a journey time increase.

3.28 A comparison of predicted and observed journey times for 2008 are summarised in **Table 3.3** above. The predicted journey time savings were obtained from the WYG 'Economic Assessment Report' dated June 2003. The predicted journey time savings are the differences between the delay times predicted for the junction using ARCADY and TRANSYT for the before and after situation and were obtained from **Appendix E** of the report.

3.29 It is apparent that the predicted journey time savings differ to those which have been observed. This is particularly apparent for the A46(N) arm for which the observations show that a journey time saving of approximately 2 minutes per vehicle has been achieved during the morning peak period, against a predicted saving of over 4 minutes

3.30 The significance of this is that the COBA model uses simplified versions of the junction models used for ARCADY and TRANSYT within its program run. This means that the COBA assessment for this scheme is also likely to have over estimated the journey time benefits of this scheme.

PAR APPRAISAL

- 3.31 The original PAR assessment for A46/A607 Junction improvements used COBA to calculate the Transport Economic Efficiency for the scheme. As the original PAR reported these values in 1998 prices they have been converted to 2002 prices to enable comparison with other schemes. The PAR predicted benefits 2002 prices are shown below in **Table 3.4**.

Table 3.4 - PAR predicted benefits 2002 prices

	1998 Prices Discounted to 1998	2002 Prices Discounted to 2002
High Growth PVB	£15,209,000	£18,883,797
Low Growth PVB	£9,077,000	£11,271,053
First Year PVB	£713,000	£885,275

- 3.32 The COBA model used to produce these estimates was not available to inform our evaluation. It is assumed that the original PAR assessment was made using a fully calibrated and validated COBA model.

PREDICTED CORRECTED APPRAISAL

- 3.33 In order to ensure that a like for like comparison of the predicted and outturn economic scheme impacts can be made, a PAR predicted corrected appraisal of the scheme's economic benefits has been undertaken. The purpose of the predicted corrected appraisal is to:
- ◆ Ensure that the predicted corrected and outturn scheme impacts are considered using a like for like approach; and
 - ◆ To allow for any inaccuracies identified in the PAR.
- 3.34 In summary, the predicted corrected assessment of economic benefits for this scheme assumes the following:
- ◆ The predicted corrected benefits are derived for a 24 hour period based upon travel time savings for consumer and business users only. This ensures consistency between the predicted and out-turn appraisals (the latter excludes vehicle operating costs);
 - ◆ The dis-benefits occurring during construction and maintenance have not been included in the predicted corrected calculation as they cannot be replicated in the outturn assessment;
 - ◆ The predicted benefits have been converted to 2002 prices (and discounted to 2002) from a discounted 1998 price base; and
 - ◆ The PAR COBA assessment used a High and Low Growth scenario to calculate the scheme benefits. For the predicted corrected, benefits will be taken as an average of the High and Low Growth.
- 3.35 **Table 3.5** shows the results of the predicted corrected appraisal based upon the above assumptions.

Table 3.5 - Predicted Corrected Economic Benefits

	High Growth	Low Growth
Consumer Travel Time Benefits	£11,108,226	£7,343,799
Business Travel Time Benefits	£10,753,021	£6,899,172
TOTAL PVB	£21,861,246	£14,242,971
Average PVB (for 11 years)	£18,052,108	
Estimated First Year PVB	£1,719,608	

Note: All in 2002 Prices, Discounted to 2002

OUTTURN APPRAISAL

3.36 The outturn economic appraisal of this scheme is based upon the observed journey time benefits resulting from this scheme. The following assumptions were made to calculate the outturn economic benefits of this scheme:

- ◆ The journey time savings are based upon the observed differences in time taken to travel through the junction taken from a series of moving observer journey time surveys undertaken in March 2003 (pre-opening) and March 2008 (post-opening);
- ◆ The average journey time change per junction arm has been assumed to apply to all traffic and all movements on that arm;
- ◆ Off peak (19:00-07:00) journey times were not surveyed. However the off peak time savings are assumed to be equal to those in the inter-peak period;
- ◆ The basic form of the calculation used to calculate journey time benefits is (Journey Time Saving) x (Corresponding Traffic Flow) x (Value of Time);
- ◆ As traffic on the A46(N) arm has increased by more than 10% (once background growth has been taken into account) the 'Rule of Half' has been applied. The POPE methodology assumes that where opening year traffic volume increases by more than 10%, additional traffic has been attracted to the junction. In such circumstances the rule of half is applied and hence it is assumed that each vehicle representing the additional 10% (or more) of traffic only receives 50% of any journey time saving emerging as a result of the scheme. It means that approximately 18% of the traffic on the A46(N) arm (post opening) has only received half of the journey time benefit of the remaining traffic;
- ◆ The value of time used is 1,149 pence per minute per vehicle, this value is the value of time for 2006 in 2002 prices; and
- ◆ A capitalisation factor of 10.498 (derived from Table C.8 of PAR Guidance v3.2) has been used to calculate the benefits of this scheme over its eleven year evaluation period.

3.37 **Table 3.6** and **Table 3.7** illustrate the results of the outturn appraisal of the schemes journey time benefits.

Table 3.6 - Outturn Travel Time Benefits

Time Period	Junction Arm				TOTAL
	A46 (N)	Glebe Way	A607	A46(W)	
AM Peak	£671,772	£61,188	-£64,035	£104,319	£773,246
Inter Peak	-£38,941	£18,736	£32,947	£7,435	£20,177
PM Peak	-£6,882	£31,794	£265,913	£30,246	£321,071
Off Peak	-£54,805	£7,239	£11,833	£2,523	-£33,210
TOTAL	£571,142	£118,959	£246,658	£144,524	-
First Year Benefits 2002 Prices					£1,081,285
First Year Benefits 2002 Prices, Discounted to 2002					£942,278
Total Outturn PVB for eleven year assessment period 2002 Prices, Discounted to 2002					£9,891,844

- 3.38 **Table 3.7** below shows a comparison of the predicted corrected and outturn economic benefits for the Hobby Horse scheme. The results demonstrate that the outturn journey time benefits are £8m less than the predicted corrected estimate. The total outturn benefits of this scheme are only 55% of the original predicted values.

Table 3.7 - Comparison of Predicted Corrected and Outturn Economic Benefits (2002 Prices, Discounted 2002)

Economic Benefits	Predicted Corrected PVB	Outturn PVB	Difference
First Year	£1,719,608	£942,278	-£777,330
Over first 11 years	£18,052,108	£9,891,844	-£8,160,264

- 3.39 Overall it would appear that the expected level of travel time benefits have not been realised either in the first year after opening or in the 11 year design life of the scheme. This is likely to be due to an over optimistic expectation about how much time could be saved by improving this junction (see **Table 3.2**), coupled with forecast traffic flows for which the observations were significantly different from the predictions for several major movements (see **Table 3.1**).
- 3.40 It is still worth noting however, that the scheme has had a positive economic benefit (£942k in opening year equating to a £9.89m benefit over 11 years), albeit lower than expected. It is also worth noting that this assessment fails to take into account the wider impact of this scheme on traffic levels through Syston. This scheme has led to significant traffic reductions through Syston, although these benefits were not calculated, either within the PAR or in this assessment

CONCLUDING REMARKS

- 3.41 It is considered that the quantified assessment of economic benefits for this scheme has been too narrow focussing purely on the effects at the junction. This is despite the wider traffic benefits clearly being identified in the WYG study reports and the forecast traffic flows used in the COBA assessment, that the scheme was expected to have an effect on traffic levels through Syston.
- 3.42 Surveys have shown that the introduction of this scheme has had a beneficial impact upon traffic flows within Syston. These effects were estimated by WYG as part of the scheme development process but were not included within the final PAR appraisal. Including the wider consideration of Syston within the economic appraisal is likely to show that the scheme has produced significantly more economic benefits than those forecast within the PAR.
- 3.43 Due to this we recommend that future PAR guidance is clarified so that for similar future schemes an economic appraisal for a wider area is considered to fully capture the benefits of a scheme. This approach is likely to be compatible with the refreshed NATA guidance which is likely to have a focus on ensuring that the wider economic benefits of a scheme are captured within its appraisal.

Summary – Section 3:

- ◆ Turning count data shows that overall traffic growth through the junction 9.95% was close to the NRTF predictions 9%;
- ◆ However, this masked some arm or turn specific increases which are significantly in excess of NRTF for the period;
- ◆ Comparison of before and after traffic flow data shows that the major growth in traffic has been in the peak hours on the North-South axis, in and out of Leicester;
- ◆ There has been an observed reduction in traffic travelling through Syston between 2003 and 2008 and this contrasts to an increase in trunk road traffic;
- ◆ Comparison of before and after journey time data shows that there has been observed journey time savings on most junction arms in all time periods, including up to up to 2 minutes 20 seconds on the A46N in the AM peak;
- ◆ Journey time savings have been greatest in the AM peak (average of 54 seconds);
- ◆ The impact of the scheme has been marginal in the inter peak periods;
- ◆ The scheme has had a positive economic benefit albeit much less than predicted;
- ◆ Comparison of PAR predicted corrected (£18,052,108) and outturn (£9,891,844) 11 year journey time benefits show that the actual benefits are significantly less than predicted.
- ◆ Comparison of predicted and observed traffic (factored to 2008 flows) show that overall the predicted flows were higher than the observed;
- ◆ The PAR appraisal did not consider the wider economic benefits of this scheme, particularly in Syston. If these were included the overall outturn scheme benefits are likely to have been significantly higher than at present; and
- ◆ Observed increases in the junction throughput and enhanced journey times suggest that the scheme has had positive implications for the operational efficiency of the junction.

4. Safety Impacts

INTRODUCTION

- 4.1 A key objective of this scheme was to reduce the severity of accidents at the junction by introducing full time traffic signal control.
- 4.2 This section examines the changes in 'before' and 'after' accident trends to quantify the scheme safety benefit. The objectives of this section are to:
- ◆ Provide an appreciation of the changes in the number, distribution, severity and causation of accidents as a result of this scheme; and
 - ◆ Ascertain the overall monetary safety benefit derived from improvements at the A46/A607 Hobby Horse Junction.
- 4.3 The scheme took approximately 8 months to construct (September 2005 - May 2006). Accidents within this construction period have been excluded from the accident analysis.
- 4.4 Although the scheme opened in May 2006, there were several alterations made to the junction in the first few months of opening as stated in the A46/A607 Hobby Horse Junction Improvement Road Safety Audit Stage 3 Report. It was considered that some of these changes may have had an effect on the accident data from this period, so the accident data has been analysed for the period between September 2006 and November 2007.
- 4.5 In a separate assessment, accident numbers were evaluated within the town of Syston to the east of the junction as it was anticipated that the junction improvements would lead to a reduction in traffic rat-running through the town to avoid congestion at the Hobby Horse junction.
- 4.6 **Figure 3.3** shows that there has been a significant reduction in traffic through Syston since the opening of the scheme.

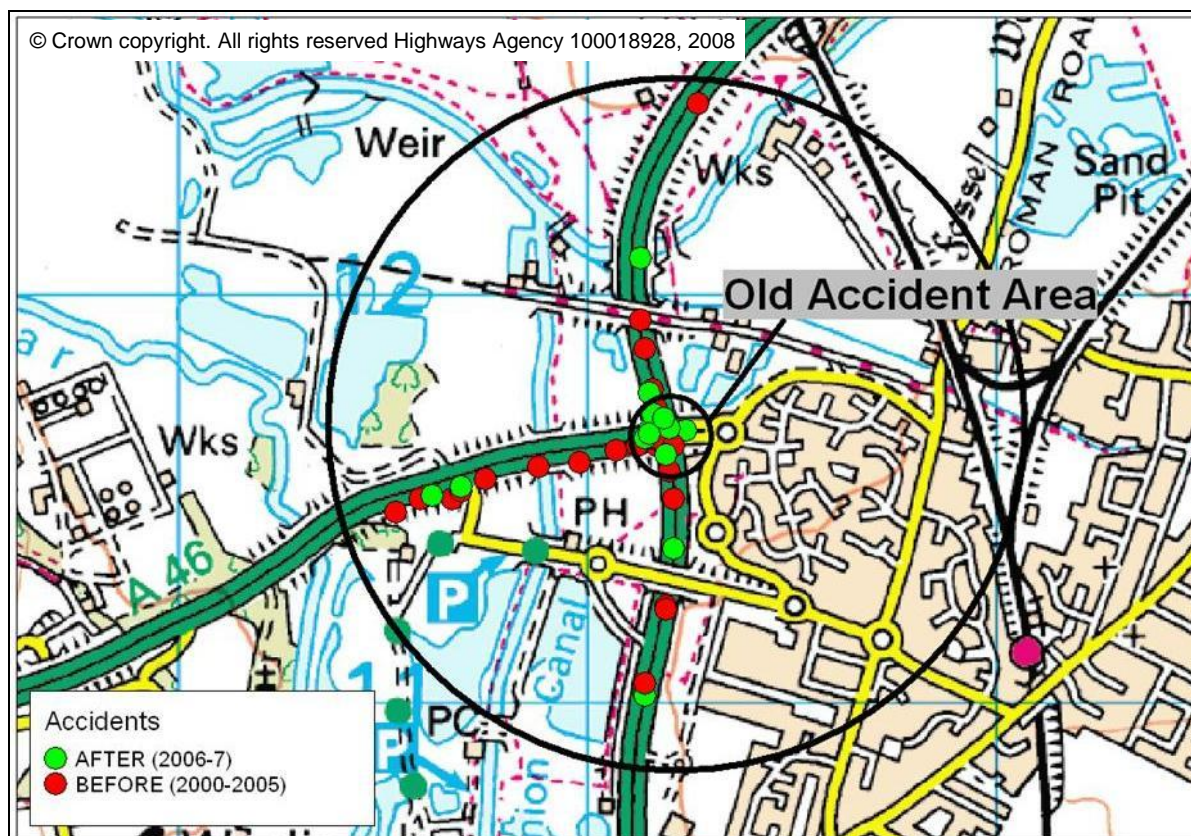
PAR ASSESSMENT

- 4.7 Accidents saving calculations in the original PAR appraisal were based on data for the period January 1999 – December 2001. Key pre-scheme accident trends that can be identified from the PAR include:
- ◆ There was an average of 5.75 accidents per year before the scheme opened;
 - ◆ The accident severity was 13%; and
 - ◆ The observed accident rate before opening was below the average specified in DMRB (6.06) for this type of junction.
- 4.8 The PAR predicted that the scheme would result in an opening year accident saving of 0.9 (approx 10% accident saving). This is equivalent to a monetised opening year benefit of £68,171 (2002 prices, discounted to 2002) and an 11 year saving of £677,766.

PAR PREDICTED CORRECTED ASSESSMENT

- 4.9 The accident data in the PAR covered the period 1999 - 2001 and consequently the PAR predictions did not take into account the number of accidents between 2002 and the start of construction in 2005.
- 4.10 Secondly, the PAR only considered accidents within approximately 50m of the junction. Previous surveys indicated that queues could extend a significant distance back from the junction and accidents within these queues are attributable to the junction.
- 4.11 Finally, the PAR has based its accident predictions on an AADT of 48,500. However, we have been unable to replicate this figure using the information available to us. We have therefore recalculated the 12 hr AADT through this junction to be 49,740 based upon the 2003 turning count of this junction.
- 4.12 Due to these issues, we have produced a PAR Predicted Corrected assessment of accidents at the A46/A607 Hobby Horse Junction. This considers all accidents within a 900m radius of the junction for the period 2000-2005, the area within which the accidents were analysed is shown in **Figure 4.1**. A 900m radius was selected as analysis of the pre scheme journey time and queue length surveys indicated that this would be sufficient to capture any accidents which occurred in the queues on the approach to the junction.

Figure 4.1 – A46/A607 Junction Accident Area (before and after)



- 4.13 Key accident trends from the predicted corrected appraisal include:
- ◆ In the 5 year pre-scheme period (September 2000 to August 2005) there was a total of 40 accidents (an average of 8 per year);
 - ◆ The accident severity for this period was 7.5%;
 - ◆ The observed accident rate before opening was above the average specified in DMRB (6.32) for this type and size of junction; and
 - ◆ There were no recorded fatal accidents at the junction prior to scheme opening.
- 4.14 The PAR predicted safety benefit was recalculated using the updated accident dataset. Based upon this, the first year accident saving was predicted to be 1.26 with the revised opening year benefits calculated to be £94,913.

OUTTURN IMPACTS

Overview of Impacts

- 4.15 Although only 14 months of accident data was available for use in the analysis, this still provides an indication of the relative safety improvements as a result of this scheme. In the 14 months following scheme opening (September 2006 to November 2007) there was a total of 12 accidents at the junction and approaching arms.
- 4.16 A summary of PIAs occurring 'before' and 'after' scheme opening is provided in **Table 4.1** below.

Table 4.1 - Summary of Pre and Post-opening Accident Locations

Accident Location	Number of Accidents	
	Average per year (Before)	Average per year (After)
Approaching Junction	5.4	4.8
Exiting Junction	0	1.6
Circulatory Carriageway	0.6	1.6
Other (not junction related)	2	1.6

- 4.17 Key trends emerging from the post-opening accident analysis include:
- ◆ The overall annual accident rate has risen from an average of 8.0 to 10.3 following scheme opening, representing an increase in the first year accident rate of 2.3;
 - ◆ There has been one serious accident following scheme opening. This involved a HGV which overturned after losing control whilst on the circulatory carriageway;
 - ◆ The accident severity has increased marginally from 7.5% to 8.3%;
 - ◆ There has been a reduction in the number of accidents approaching the junction (not including the circulatory carriageway) from 5.4 per year to 4.8 per year. Most of this reduction is due to a reduction in the number of accidents involving rear end shunts on the approach to the junction;

- ◆ There has been an increase in the number of accidents exiting the junction from 0 before opening, to 1.6 per year after opening;
- ◆ There has been an increase in the annual average number of accidents on the circulatory carriageway, from 0.6 before opening, to 1.6 after opening; and
- ◆ The slight increase in accidents on the revised circulatory carriageway (described above) may be indicative of driver confusion, particularly if they are unfamiliar with the junction as in some locations there are five traffic lanes on the circulatory carriageway. However, this should be monitored as if this rise continues then lane markings may need to be reviewed or reapplied.

ACCIDENT SIGNIFICANCE TEST

- 4.18 A Chi-squared test has been undertaken to determine whether the outturn savings between the Par Predicted Corrected and Outturn analysis occurred by chance or is a direct impact of the scheme. From this test **we can be 95% confident that the change in accident rate could have occurred by chance alone and therefore the change in accident rates is not necessarily a direct impact of the scheme.** A further review of accident trends three years after scheme opening may provide a more accurate reflection of changes in accident trends.

MONETISED ACCIDENT SAVINGS

- 4.19 **Table 4.2** provides a summary of the predicted, predicted corrected and outturn safety impacts.

Table 4.2 – Predicted and Outturn Monetary Safety Benefits

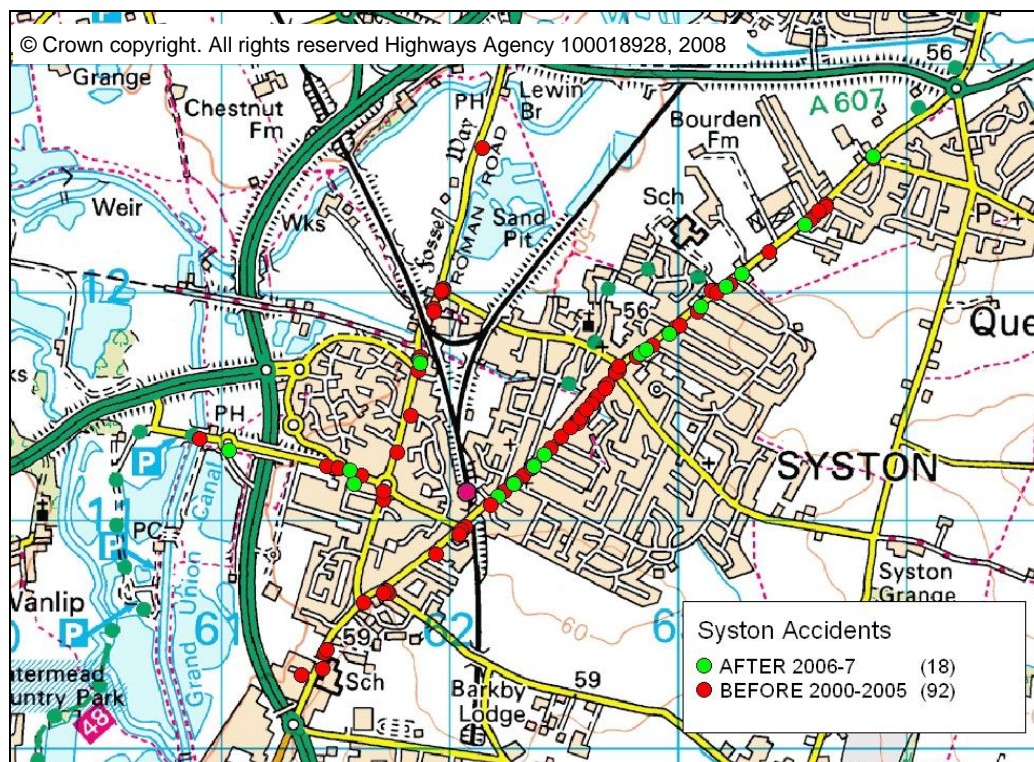
	PAR Predicted	PAR Predicted-Corrected	Outturn
Number of Personal Injury Accidents saved in opening year	0.91	1.26	-2.3
Accident Severity Index	13%	7.5%	8.3%
Average cost of accident in the opening year	£78,358	£78,358	£78,358
Accident value in opening year (2002 prices)	£78,358	£109,095	-£197,905
Annual accident benefit in opening year discounted to 2002	£68,172	£94,913	-£172,178
Accident benefit over 11 year scheme life (factor of 9.942)	£677,766	£943,625	-£1,711,793

- 4.20 The PAR predicted that 0.9 accidents would be saved in the opening year. The outturn opening year accident rate has shown that the number of accidents has increased by 2.3 per year, with the revised accident severity increasing from 7.5% to 8.3%. The increase in accidents could be attributed to an increase in lane changing either entering or exiting the junction. The increase in accidents at Glebe Way also needs to be monitored. This may be due to the significant change in the size of this junction at this location, leading to driver confusion. This may be a short term issue whilst drivers get used to the new layout and therefore should be monitored further in the future, although may just be due to chance.
- 4.21 The accident rate has increased by approximately 28% post opening; however, 14.6% of this increase would be expected due to the increase in traffic at this junction. The DMRB (Design Manual for Roads and Bridges) sets out the accident rate to be expected at this type of junction with different levels of traffic. The additional accidents over and above this are likely to be random events or linked with driver unfamiliarity with the new junction. No clear accident trends are evident from analysing the post-opening data.

ACCIDENT CHANGES IN SYSTON AREA

- 4.22 Prior to improving the A46/A607 Hobby Horse junction, the HA/MAC had received numerous complaints from residents of Syston and members of the local councils regarding the issue of traffic rat-running through Syston to avoid the congestion at the Hobby Horse junction.
- 4.23 One of the un-quantified aims of the improvement scheme was to reduce the amount of traffic rat-running through Syston. Any change in traffic volumes travelling through Syston is also likely to be accompanied by a change in accident numbers or type.
- 4.24 For this POPE assessment, accident trends on the three main routes through Syston (which are the logical rat-running routes) have been reviewed. These roads are Fosse Way, Melton Road and Wanlip Road.
- 4.25 In the before period (2000-2005) there was an average of 18.4 accidents per year, and in the after period (2006/7) there were an average of 12 accidents per year, resulting in a saving of 6.4 accidents in the opening year. Accident severity increased from 8.7% to 11% following scheme opening. **Figure 4.2** shows the locations of the accidents before and after opening.

Figure 4.2 – Accidents in the Syston Area



4.26 Table 4.3 shows a breakdown of accident severity through the town, both before and after opening. The traffic flow changes on these roads are shown in Table 4.4.

Table 4.3 – Accident Severity in Syston

Accident Severity	Before (2000-2005) Annual Average			After (2006-2007) Annual Average		
	Fosse Way	Melton Road	Wanlip Road	Fosse Way	Melton Road	Wanlip Road
Slight	3.4	12.6	0.8	2	7.3	2
Serious	0.2	1.2	0	0	1.3	0
Fatal	0	0.2	0	0	0	0
TOTAL	3.6	14	0.8	2	8.6	2

Table 4.4 – 12 hr Traffic Flow Differences Through Syston

Traffic Site	Before	After	Difference	% Difference
Fosse Way	7270	5950	-1320	-18%
Melton Road N	8960	6970	-1990	-22%
Melton Road S	12600	10300	-2300	-18%

- 4.27 The PAR states that that an expected reduction in traffic levels through Syston should increase safety in the town. Analysis of pre and post opening traffic data has shown that traffic on Fosse Way has decreased by 18% and on Melton Road between 18-22%. In conjunction with this, the accident rate on Fosse Way has decreased from 3.4 to 2 and on Melton Road from 14 to 8.6. The overall accident benefit within Syston is £479,117 and hence offsets some of the accident costs at the Hobby Horse junction. The derivation of this value is shown in **Table 4.5**.

Table 4.5 – Monetary Safety Benefits in Syston in Opening Year

Accident costs before scheme opening	Accident costs after scheme opening	Accident benefits
£1,200,070	£720,953	£479,117

OVERALL SAFETY BENEFIT

- 4.28 During the analysis of the safety benefits of this scheme, it became clear that the original PAR assessment covered a very narrow area, and it was considered that there would be wider benefits of the scheme, particularly through Syston.
- 4.29 If the safety benefits through Syston are taken into account, the accident dis-benefit through the Hobby Horse junction is offset, as detailed in **Table 4.6**.

Table 4.6 – Overall Safety Benefits

	Accident Benefits in Opening Year	Accident Benefits Over 11 Year Appraisal Period
A46/A607 Junction	-£172,178	-£1,711,793
Syston	£479,117	£4,763,381
Combined benefits	£306,939	£3,051,588

- 4.30 As shown in **Table 4.6** above, the wider accident benefits through Syston are significant and also offset the accident dis-benefits from the Hobby Horse junction. Therefore, as with the economic benefits, it is apparent that the narrow appraisal for

this scheme contained within the PAR failed to assess or capture any of the likely wider benefits of this scheme.

- 4.31 Due to this we recommend that future PAR guidance is clarified so that for similar future schemes a safety appraisal for a wider area can be considered to fully capture the benefits of a scheme. This approach is likely to be compatible with the refreshed NATA guidance which is expected to have a focus on ensuring that the wider benefits of a scheme are captured within its appraisal.

Summary – Section 4:

- ◆ The original PAR assessment has been updated to include the most recent 5 years of before opening accidents;
- ◆ The annual number of accidents at the Hobby Horse junction appears to have increased from 8.0 to 10.3 and hence the scheme has resulted in a first year accident disbenefit of -2.3 compared to a predicted corrected saving of 1.26;
- ◆ The accident severity index has increased from 7.5% to 8.3% after opening, due to a higher percentage of serious accidents;
- ◆ The first year outturn safety benefit is equivalent to **-£172,178** compared to a predicted corrected estimate of **£94,912.94**;
- ◆ The average annual accident rate has decreased in Syston, which has coincided with a reduction in traffic flows. The monetary benefit of this is **£479,117** which partly offsets the dis-benefit at the junction;
- ◆ A Chi squared test has revealed that we can be 95% confident that the change in accident rate could have occurred by chance alone and therefore the change in accident rate at the junction is not necessarily a direct impact of the scheme; and
- ◆ If the benefits in Syston are taken into account, the overall safety benefit that may be attributed to this scheme is **£306,939** in the opening year; or **£3,051,588** over the full 11 year appraisal period.

5. Environmental, Accessibility and Integration Impacts

INTRODUCTION

- 5.1 This chapter examines the environment, accessibility and integration objectives of the scheme by presenting a comparison of the predicted and outturn impacts of the scheme.
- 5.2 The forecast impacts of the scheme have been derived from the PAR document. The main source of information for the outturn assessment was a site visit that was undertaken by Atkins in February 2008 using an environmental site visit questionnaire form as prepared by an Atkins Landscape Architect.

IMPACTS ON THE ENVIRONMENT

- 5.3 A Stage 2 Environmental Appraisal Report was produced in 2002 which showed that the proposed junction improvement would not have a significant effect on the environment. A Stage 3 Environmental Appraisal Report was later produced and summarised in the PAR AST.

Noise

PAR/AST

- 5.4 The PAR forecast stated that calculations had shown that due to only a marginal additional traffic volume being predicted as a result of the junction improvements, this does not increase the expected traffic noise by more than 0.1dB, and such an increase is unperceivable by the human ear. It therefore concluded that the assessment was **no impact**.

Outturn Assessment

- 5.5 Total average weekday traffic (between 7am and 7pm) travelling through the junction has increased by approximately 10%. Therefore, it can be considered that the assessment is **no impact**. (No impact = change in traffic flow less than 25%, change in HGV less than 20% and change in speed is less than 5mph).

Local Air Quality

PAR/AST

- 5.6 The AST forecast that the proposal would lead to a minimal decrease in roadside pollutant levels due to the realignment and widening of the roundabout transferring traffic away from receptors. Therefore the scheme was predicted to result in a **slight beneficial** effect.

Outturn Assessment

- 5.7 PAR guidance states that if the change in AADT is more than 700 vehicles then it is considered as adverse. Therefore this scheme has been assessed as having a **slight adverse** effect.

Greenhouse Gases

PAR/AST

- 5.8 The AST predicted that the total CO2 emissions from the study area will increase in the future year with the scheme due to the widening of the junction and the minor increase in traffic flow. This was therefore predicted to have a **slight adverse** effect.

Outturn Assessment

- 5.9 PAR guidance states that if the change in the total distance travelled on roads affected by the project is less than 10%, then the scheme can be regarded as having a neutral impact. However, as the overall traffic volume has not increased by 10%, this has been considered to have had a **neutral** impact.

Landscape

PAR/AST

- 5.10 The AST states that there would be a minor impact on the water margin in the north east corner of the scheme, with a loss of a small number of trees and hedges. It states that mitigation will recreate water margin and increase characteristic tree cover. Even with mitigation, this was regarded as having a **slight adverse** effect.

Outturn Assessment

- 5.11 Although mitigation measures were implemented, it will take some time for these to grow to the same level as the mature trees and shrubs which were removed. In addition, PAR guidance states that the impacts can be considered neutral if the project does not involve the installation of lighting, signals, large signs, gantries, masts or traffic calming. As the scheme has both traffic signals and large gantries (see **Figure 5.1**), it has been regarded as a **slight adverse** effect.

Figure 5.1 – Traffic Signals and Gantries



Townscape

PAR/AST

- 5.12 The AST states that the existing townscape of the edge of Syston would be slightly improved due to the reduction of traffic through the town. Therefore this was assessed as being a **slight beneficial**.

Outturn Assessment

- 5.13 PAR guidance states that townscape impacts will only apply to projects in built up areas or where a project will serve to reduce traffic flows in a built up area. The traffic through Syston has decreased by up to 25% on some routes since the opening of the scheme, so this has been regarded as **slightly beneficial**.

Heritage of Historic Resources

PAR/AST

- 5.14 The AST states that there are no known archaeological sites that would be affected, and that the presence of unknown sites would be unlikely, it therefore states that there would be a **neutral** impact.

Outturn Assessment

- 5.15 PAR guidance states that the impact on Heritage of Historic Resources can be regarded as neutral if the project is wholly within the highway boundary and there is no impact on archaeological or noteworthy built heritage sites. Although there has been some extension of the highway boundary, there has been no major work in

these areas (and past improvements are likely to have discovered something if it existed), so this has therefore been assessed as **neutral** due to the lack of archaeological sites found.

Biodiversity

PAR/AST

- 5.16 The AST states that the land take of the road verges and roundabout is considered of neutral overall significance for nature conservation, and the limited land take of areas surrounding the roundabout is considered a minor impact to the low to medium ecological features and as such constitutes an assessment score of **slight adverse/neutral**.

Outturn Assessment

- 5.17 Although the scheme is not wholly within the highway boundary, there is likely to have been little additional effects on biodiversity. PAR guidance states that if there are no protected species or breeding birds and there is no habitat of local of greater value existing prior to the scheme that may be impacted by the scheme, then the assessment may be given as neutral. Therefore, the overall assessment has been given as **neutral**.

Water Environment

PAR/AST

- 5.18 The AST states that there is likely to be insignificant impacts to a minor aquifer assuming that appropriate mitigation measures such as a pond are implemented. There was also unlikely to be any significant impacts to river floodplains, and no impact to surface water. This was assessed as **neutral**.

Outturn Assessment

- 5.19 The scheme extended the current capacity of the drainage by adding a pond and other minor mitigation measures, which meant that there would have been no significant impact on the aquifer. Therefore this has been assessed as **neutral**.

Physical Fitness

PAR/AST

- 5.20 The PAR predicted that the improvement to the junction was unlikely to affect existing levels of walking or cycling, and therefore was assessed as **no change**.

Outturn Assessment

- 5.21 The scheme did not include any measures specifically aimed to increase or improve levels of walking and cycling, therefore it is considered that this would not have changed, and has been assessed as **no change**.

Journey Ambience

PAR/AST

- 5.22 The PAR states that there was likely to be a **large beneficial** impact due to the high number of daily travellers, and that route uncertainty and levels of frustration would be improved, and the fear of potential accidents would be reduced.

Outturn Assessment

- 5.23 Although the number of accidents has increased at the junction, there has been a decrease in accidents through Syston, and therefore should be considered beneficial overall. In addition, the improved journey times may have reduced the levels of frustration of drivers sitting in queues, therefore outweighing the dis-benefit (at the junction), so it has been assessed as a **slight beneficial** impact. Journey ambience in Syston is also considered to have improved.

ACCESSIBILITY AND INTEGRATION IMPACTS

Option Values

PAR

- 5.24 The PAR stated that this was **not applicable** for this scheme.

Outturn Assessment

- 5.25 This scheme has not had any effect on public transport therefore has been assessed as **neutral**.

Severance

PAR

- 5.26 The PAR forecast that the scheme would have a **neutral impact** on severance as there are no facilities present.

Outturn Assessment

- 5.27 The scheme (at the junction) has had no impact upon severance (at the junction) as there have been no changes to the routes used by pedestrians, equestrians or cyclists, or to the standard of the route that might result in a change of patronage. However it is considered that the resulting traffic reduction in Syston is likely to have made the main shopping area more pleasant which could lead to increased usage by pedestrians leading to a **slight beneficial** impact.

Access to the Transport System

PAR

- 5.28 The PAR forecast that the scheme would have **no impact** on access to the transport system.

Outturn Assessment

- 5.29 Access to the transport system is strongly influenced by two key variables, access to a private car, and proximity to a public transport service. As this scheme has had no impact on these variables, the impact of the scheme has had **no impact** on access to the transport system.

INTEGRATION

Transport Interchange

PAR

- 5.30 The PAR forecast that no improvements would be made to any transport interchange as part of this scheme. The overall assessment was therefore **no impact**.

Outturn Assessment

- 5.31 The scheme does not affect access to park and ride, bus or rail stations and does not affect interchange facilities. The outturn assessment was in agreement that there would be **no impact** on transport interchange.

Land-Use Policy

PAR & AST

- 5.32 The PAR and AST stated that the local plan and structure plan for the area included the improvements to this junction. The overall assessment was therefore **neutral**.

Outturn Assessment

- 5.33 New development is evident to the south of the scheme, although this was accounted for in the PAR and in the local plan. Therefore, it has been concluded that the scheme is **neutral**.

Other Government Policies

PAR & AST

- 5.34 The PAR and AST forecast that no Government policies would be affected by this scheme. The overall assessment was therefore **no impact**.

Outturn Assessment

- 5.35 The scheme was delivered in accordance with the New Deal for Trunk Roads, and therefore accords with Government policies, and therefore is considered a **slight beneficial**.

OVERALL

- 5.36 This section has shown that the PAR assessment only considered the environmental, accessibility and integration impacts in the immediate vicinity of the A46/A607 Hobby Horse Junction. As has been illustrated in **Section 3** and **Section 4**, it is apparent that the effects of this scheme extend over a wider area, particularly through the town of Syston.
- 5.37 The traffic flow changes associated with this scheme, particularly the traffic reductions through Syston, have potentially led to improvements in the levels of noise, air quality, physical fitness and severance within Syston. These were not quantified within the PAR, and cannot be fully quantified in the outturn assessment, but it is likely that there have been beneficial effects under these headings within Syston.
- 5.38 Therefore, as with the economic and safety benefits, it is apparent that the narrow appraisal for this improvement contained within the PAR, failed to assess or capture any of the likely wider environmental, accessibility and integration benefits of this scheme.
- 5.39 Due to this we recommend that future PAR guidance is clarified so that for similar future schemes an appraisal for a wider area is considered to fully capture the benefits of a scheme. This approach is likely to be compatible with the refreshed NATA guidance which is likely to have a focus on ensuring that the wider benefits of a scheme are captured within its appraisal.

Summary – Section 5:

- ◆ Summary of PAR predicted and outturn environment, accessibility and integration impacts:

	PAR Predicted	Outturn
Noise	No Impact	No Impact
Local Air Quality	Slight Beneficial	Slight Adverse
Landscape	Slight Adverse	Slight Adverse
Greenhouse Gases	Slight Adverse	Neutral
Townscape	Slight Beneficial	Slight Beneficial
Heritage of Historic Resources	Neutral	Neutral
Biodiversity	Slight Adverse	Neutral
Water Environment	Neutral	Neutral
Physical Fitness	No Impact	No Impact
Journey Ambience	Large Beneficial	Slight Beneficial
Accessibility	Neutral	Neutral
Integration	No Impact	No Impact
Severance	No Impact	Slight Beneficial
Other Government Policies	No Impact	Slight Beneficial

6. Summary and Conclusions

INTRODUCTION

6.1 The POPE assessment of the A46/A607 Junction Improvements has utilised the data available to examine the outturn impacts of the scheme compared to those forecast in the original PAR. The purpose of this section is to

- ◆ Draw together the key impacts emerging from the POPE evaluation;
- ◆ Summarise the key lessons emerging from this evaluation; and
- ◆ Suggest recommendations that will facilitate and increase the accuracy of future PAR appraisals for schemes similar to that implemented at the A46/A607 Junction Improvements.

SUMMARY OF KEY IMPACTS

6.2 **Table 6.1** below provides a summary of the monetised benefits of the A46/A607 scheme. The Appraisal Summary Table (AST) and the Evaluation Summary Table (EST) are included in **Appendices A** and **B**.

Table 6.1 – Summary of Scheme Benefits (Predicted, Predicted Corrected and Outturn)

	PAR Predicted	Predicted Corrected	Outturn
First Year Safety Junction Benefits	£68,172	£94,913	-£172,178
First Year Safety Syston Benefits	-	-	£479,117
Combined First Year Safety Benefits	£68,172	£94,913	£306,939
First Year Economy Benefits	£885,275	£1,719,608	£942,278
Total First Year Benefits	£953,447	£1,814,521	£1,249,217
Total 11 year Benefits	£15,684,577	£18,995,725	£12,943,432
First Year costs	£3,605,475	£3,605,475	£3,125,990
Total 11 year costs	£3,605,475	£3,605,475	£3,125,990
Benefit Cost Ratio (BCR)	4.4	5.3	4.1
First Year Rate of Return (FYRR)	26%	50%	40%

Note: all costs are in 2002 prices and discounted to 2002.

6.3 Key points to note from the above include:

- ◆ The outturn first year benefits are less than the predicted corrected benefits, even though the outturn includes the accident benefits from the town of Syston;
- ◆ The outturn costs are lower than the PAR predicted, however this is mainly due to the inclusion of the risk allowance and optimism bias within the scheme costs;
- ◆ The BCR of the scheme is less than the predicted corrected value;
- ◆ The first year rate of return is lower than the predicted corrected value; and
- ◆ The out-turn BCR of this scheme (4.1) was broadly in line with the original PAR prediction (4.4).

6.4 However, the scheme has still performed well as the BCR of 40% means that it will pay for itself in less than 3 years, and the junction performs more efficiently (as shown by increased throughput and enhanced journey times on a majority of approaches).

6.5 The main economy, safety, environment, accessibility and integration impacts of the scheme are listed below:

ECONOMY

- ◆ Turning count data shows that overall traffic growth through the junction (9.95%) was close to the NRTF predictions (9%);
- ◆ However, this masked some arm or turn specific increases which are significantly in excess of NRTF for the period;
- ◆ Comparison of before and after traffic flow data shows that the major growth in traffic has been in the peak hours on the North-South axis, in and out of Leicester;
- ◆ Comparison of before and after journey time data shows that there has been variable out-turn journey time savings on most junction arms across all time periods, including up to up to 2 minutes 20 seconds on the A46N in the AM peak;
- ◆ Opening year journey time savings were equivalent to £0.942m;
- ◆ Comparison of PAR predicted corrected (**£18,052,108**) and outturn (**£9,891,844**) 11 year journey time benefits show that the actual benefits are significantly less than predicted.
- ◆ Comparison of predicted and observed traffic (factored to 2008 flows) show that overall the predicted flows were higher than the observed (on average 12.5% observed flows were 12.5% over predicted) The largest inaccuracies were evident on the Glebe Way approach (28%-46% over predictions);
- ◆ Initial indications show that traffic has decreased in Syston following the opening of the scheme; and
- ◆ The PAR appraisal did not consider the wider economic benefits of this scheme, particularly in Syston. If these were included the overall outturn scheme benefits are likely to have been significantly higher than at present.

SAFETY

- ◆ The original PAR assessment has been updated to include the most recent 5 years of before opening accidents;
- ◆ The annual number of accidents at the Hobby Horse junction appears to have increased from 8.0 to 10.3 and hence the scheme has resulted in a first year accident dis-benefit of -2.3 compared to a predicted corrected saving of 1.26;
- ◆ The accident severity index has increased from 7.5% to 8.3% as there have been no fatal accidents following scheme opening;
- ◆ The first year outturn safety benefit is equivalent to **-£172,178** compared to a predicted corrected estimate of **£94,912.94**;
- ◆ The average annual accident rate has decreased in Syston, which has coincided with a reduction in traffic flows. The monetary benefit of this is **£479,117** which partly offsets the dis-benefit at the junction;
- ◆ A Chi squared test has revealed that we can be 95% confident that the change in accident rate could have occurred by chance alone and therefore the change in accident rate at the junction is not necessarily a direct impact of the scheme; and
- ◆ If the benefits in Syston are taken into account, the overall safety benefit that may be attributed to this scheme is **£306,939** in the opening year; or **£3,051,588** over the full 11 year appraisal period.

ENVIRONMENT

- ◆ The scheme produced slight benefits for journey ambience and townscape through improvements to journey times and reduction of traffic through a built up area;
- ◆ The scheme delivered some slight dis-benefits for air quality, landscape and greenhouse gases due to the uneven traffic growth in through the junction; and
- ◆ Mitigation measures suitable for a scheme of this type had been implemented as stated in pre opening documentation.

ACCESSIBILITY

- ◆ The objectives of the scheme were in alignment with the local plan and structure plan for the area.

INTEGRATION

- ◆ The scheme had no measurable impacts on public transport interchange or cycling/walking accessibility.

KEY LESSONS LEARNT

- ◆ The economic benefits were substantially over predicted and therefore the outturn BCR is lower than expected. This may be due to a significant overestimate of the Journey Time Savings predicted to be delivered by this scheme. This directly relates to the models used to calculate the journey time savings and how closely they replicated the situation on the ground.

- ◆ The collection of observed journey time data prior to scheme opening has helped to facilitate this appraisal, particularly given the absence of PAR modelling data;
- ◆ Safety benefits were significantly over estimated, however the safety benefits were originally only looked at for the immediate vicinity of the junction and it was considered that this did not take into account any queuing relating to the junction; and
- ◆ The PAR for this scheme was updated several times between 2003 and 2004 to take into account different appraisal periods and different design years. Although the MAC was able to provide a significant quantity of background information and technical reports they were unable to locate or provide the information which was used to complete the final PAR. This missing data included the COBA and junction models used to assess the scheme. This meant that we were unable to directly replicate any of the economic information contained within the PAR.

SUMMARY OF RECOMMENDATIONS

- ◆ When considering the traffic and economic effects of a scheme consideration should be given to the wider area over which these changes occur, particularly if there are likely to be significant benefits or dis-benefits over this area;
- ◆ All accidents of relevance to the scheme should be included in the PAR, along with details of how these were considered;
- ◆ All models used for the evaluation of schemes should be suitably calibrated and validated prior to use;
- ◆ Efforts should be made to ensure that all supporting documentation used to support a project PAR is retained and made available for use in post opening evaluations; and
- ◆ Accidents at this site should be monitored closely, to ascertain if there are any trends emerging in accident types or locations within the junction.

CONCLUDING REMARKS

- 6.6 In summary, this POPE evaluation has shown that the benefits derived from the journey times and accidents were significantly over predicted, therefore raising questions over the robustness of the inputs into this scheme's PAR assessment. The PAR identified that the scheme could have benefits for the town of Syston, yet these were not quantified. The out-turn assessment has however determined that the scheme has delivered positive impacts in terms of safety and economy savings. Furthermore the scheme has delivered a healthy FYRR and BCR and thus still demonstrates good value for money.
- 6.7 As in most Large LNMS schemes, the accident analysis has been based on a short time period (in this case 14 months) and as such the small accident benefits should only be used as an indication of overall scheme impacts.

APPENDIX A – Appraisal Summary Table (AST)

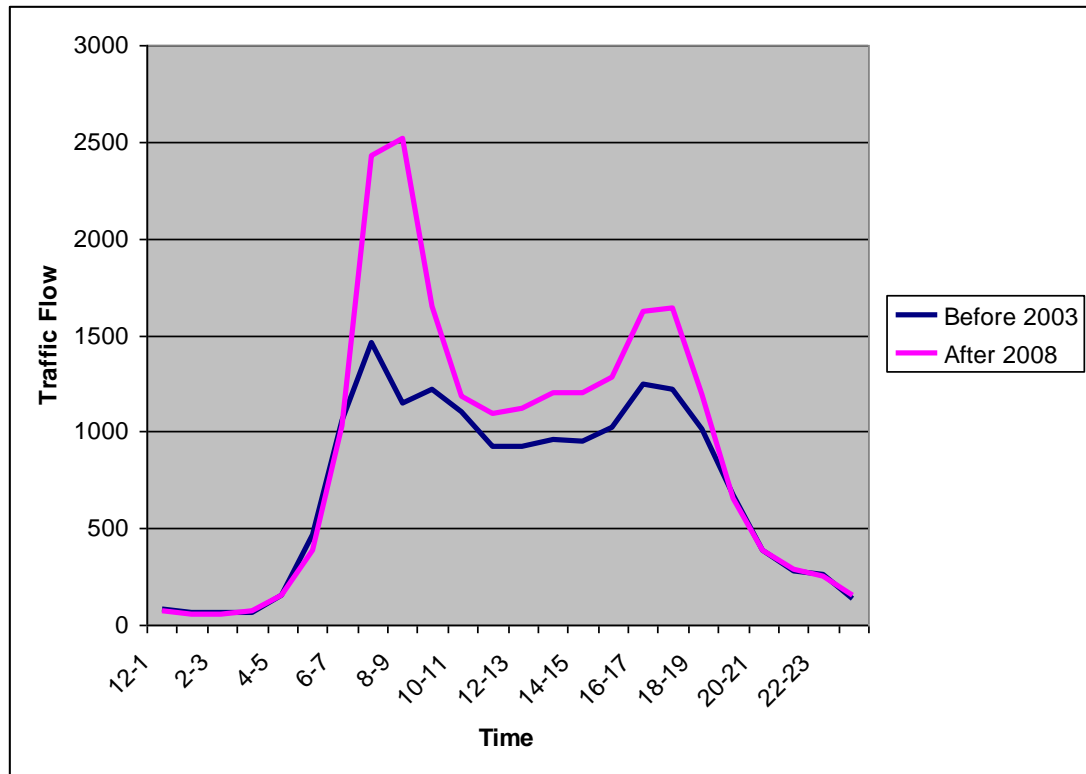
Appraisal Summary Table (AST)		A46/A607 Junction Improvement Scheme		
Objective	Sub-Objective	Qualitative Impacts	Quantitative Measures	Assessment
ENVIRONMENT	Noise	Calculations demonstrate that due to only a marginal additional traffic volume being predicted as a result of the junction improvements, this does not increase the traffic noise level by any more than 0.1 dB. Such a noise level increase is unperceivable by the human ear.	No. of people annoyed do-min: 193 No. of people annoyed with scheme: 193	No impact
	Local Air Quality	The proposal will lead to a minimal decrease in roadside pollutant levels due to the realignment and widening of the roundabout transferring traffic away from receptors.	No. of properties experiencing: -better air quality : 123 -worse air quality: 20	PM ₁₀ change: -13.5 NOx change: -22.1
	Greenhouse Gases	Total CO2 emissions from the study area will increase in the future year with the scheme due to the widening of the junction and the minor increase in traffic flow.	N/A	Added 201 tonnes of CO ₂
	Landscape	Minor impact on water margin in north east corner, loss of small number of trees and hedges. Mitigation will recreate water margin and increase characteristic tree cover.	N/A	Slight Adverse
	Townscape	Existing townscape character of edge of Syston slightly improved by reducing traffic.	N/A	Slight Beneficial
	Heritage of Historic Resources	No known archaeological sites affected. Potential for archaeological remains, but unlikely.	N/A	Neutral
	Biodiversity	The land take of the road verges and roundabout is considered of neutral overall significance for nature conservation, The limited land take of areas surrounding the roundabout is considered a minor impact to the low to medium ecological features and as such constitutes an assessment score of minor adverse	N/A	Minor Adverse to Neutral
	Water Environment	Insignificant impact to minor aquifer assuming used of appropriate mitigation measures such as a vegetative treatment system, Insignificant impacts to river flood plans with implementation of floodplain compensation areas, No impacts to surface waters or fisheries.	N/A	Neutral
	Physical Fitness	Improvement to the junction unlikely to affect existing levels of walking or cycling.	Not assessed	No change
	Journey Ambience	Large beneficial impact of junction improvements will be largely due to high number of total daily travellers	N/A	Large Beneficial
SAFETY	Accidents		Accidents Deaths Serious Slight HG -10.1 0.5 3.0 -12.2 LG -9.8 0.5 2.8 -11.9	PVB HG +£0.512m LG +£0.466m
	Security	There are no existing pedestrian or cycle facilities and none are proposed as part of this scheme	N/A	Neutral
ECONOMY	Public Accounts		Central Govnt PVC £3.303	PVC £3.303m
	Business Users and Providers		Users: HG 7.458 LG 4.355	PVB HG £7.458m LG £4.355m
	Consumer Users		N/A	PVB HG £7.751m LG £4.722m
	Reliability	Reduce conflict for through traffic		Moderate Beneficial
	Wider Economic Impacts	Development is not dependent on the scheme, However the junction improvements will open the area up by allowing better traffic movements and increasing the capacity of the junction.		No
ACCESSIBILITY	Option Values	Not applicable	N/A	N/A
	Severance	There are no facilities at present		Neutral
	Access to Trans System	Not applicable	N/A	N/A
INTEGRATION	Transport Interchange	Not applicable	N/A	No impact
	Land Use Policy	The local plan and structure plan for the area include improvements to the junction		PM ₁₀ change: -13.5 NOx change: -22.1
	Other Government Policies			Added 201 tonnes of CO ₂

APPENDIX B – Evaluation Summary Table (EST)

Evaluation Summary Table (EST)		A46/A607 Junction Improvement Scheme					
Objective	Sub-Objective	Qualitative Impacts	Quantitative Measures				Assessment
ENVIRONMENT	Noise	Traffic has not increased by more than 10%					No impact
	Local Air Quality		AADT has increased by more than 700vpd				Slight Adverse
	Greenhouse Gases	Traffic has increased by more than 10% on some arms	Increase in traffic				Slight Adverse
	Landscape	Implementation of signals and gantries	N/A				Slight Adverse
	Townscape	Traffic decreased through Syston	N/A				Slight Beneficial
	Heritage of Historic Resources	No significant archaeological sites found	N/A				Neutral
	Biodiversity	Little impact on surrounding area	N/A				Minor Adverse to Neutral
	Water Environment	Any impact has been appropriately mitigated	N/A				Neutral
	Physical Fitness		Not assessed				No change
	Journey Ambience	Journey times improved, but accidents increased	N/A				Slight beneficial
SAFETY	Accidents		Accidents 12	Deaths 0	Serious 1	Slight 11	PVB £3,051,588
	Security		N/A				Neutral
ECONOMY	Public Accounts		Central Govnt PVC				PVC £3,125,990
	Business Users and Providers		Users:				PVB £9,891,844
	Consumer Users		NA				
	Reliability						
	Wider Economic Impacts						No
ACCESSIBILITY	Option Values		N/A				N/A
	Severance	No impact on non motorised users					Slight Beneficial
	Access to Trans System	No impact	N/A				N/A
INTEGRATION	Transport Interchange	No impact	N/A				N/A
	Land Use Policy	Development not dependant on scheme, and has been included in local plan					Slight Beneficial
	Other Government Policies	No impact on government policies					Neutral

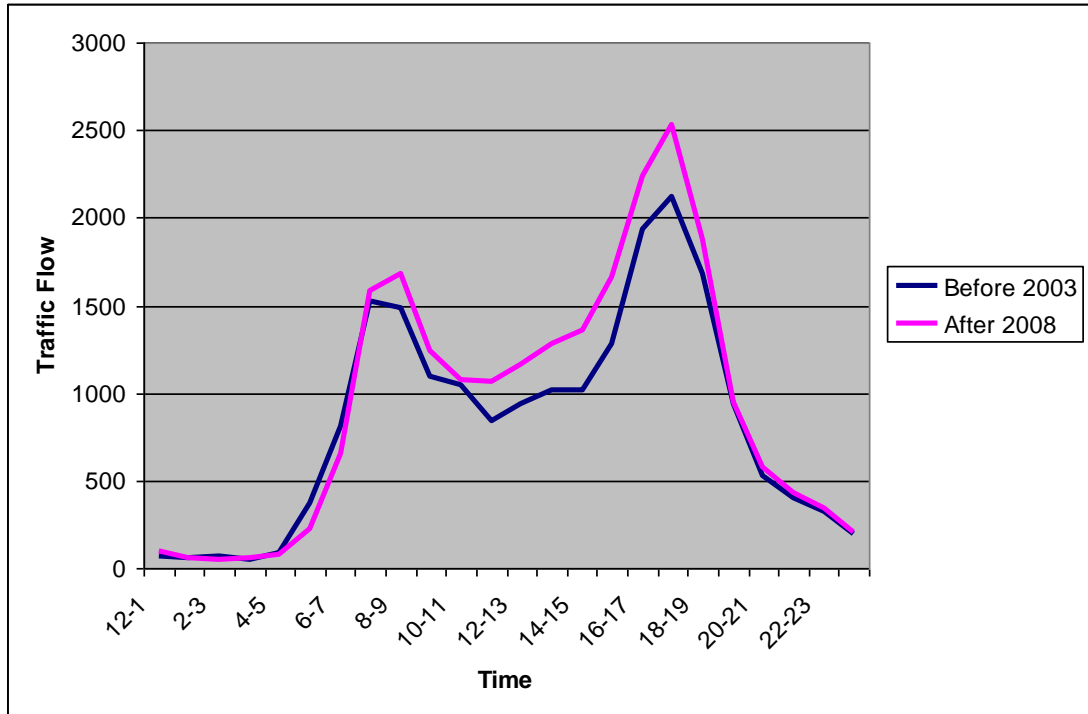
APPENDIX C – Traffic Flow Change

Figure C.1 – Traffic Flow Change (AWT) on A46(N) Southbound Carriageway



- ◆ **Figure C.1** indicates that traffic entering the junction from the northern A46 arm has increased considerably. There has been a general increase between the hours of 7am and 7pm; however there has been a much bigger increase at the AM and PM peak times. This illustrates that the capacity improvement has released some significantly suppressed demand for travel through the junction on this arm; and
- ◆ **Figure C.2** illustrates the increase in traffic on the A46 northern arm leaving the junction (NB) in the PM peak, which is likely to be traffic returning from Leicester, and the traffic using the dedicated left hand lane from the A46(W) which is now free flowing allowing more traffic to use the turn.

Figure C.2 – Traffic Flow Change (AWT) on A46(N) Northbound Carriageway



- ◆ Generally, traffic flows have increased on the main north – south routes through the junction, as this provides a direct route to and from the city of Leicester. **Figure C.3** illustrates the much lower traffic flow changes on the A46(W) entry to the junction;
- ◆ Traffic on the A46(W) eastbound arm (**Figure C.3**) has not increased very much compared to the changes observed on the A46(N) arm, this confirms the analysis in the WYG ‘Traffic Study Report’ which indicated that there would only be a very small amount of traffic (18 vehicles) reassigning to this arm following the completion of the junction improvements;
- ◆ **Figure C.4** shows the increase on the A46(W) westbound arm which is mainly due to the increased junction capacity on the northern arm which has enabled more traffic to move through the junction in the peak hours;
- ◆ **Figure C.5** shows that traffic on the A607 arm on the northbound carriageway has had an increase in traffic over most of the 7am to 7pm period, but also shows the large increase in the PM peak, which corresponds to the traffic going north from Leicester in the PM peak time; and
- ◆ **Figures C.5** and **C.6** illustrate the flows on the A607 arm of the junction, and shows that traffic going south in the AM peak, and north in the PM peak has increased the most, and further supports the indications from the A46 northern arm that the general increase in traffic at the junction is the north/south route through the junction.

Figure C.3 – Traffic Flow Change (AWT) on A46(W) Eastbound Carriageway

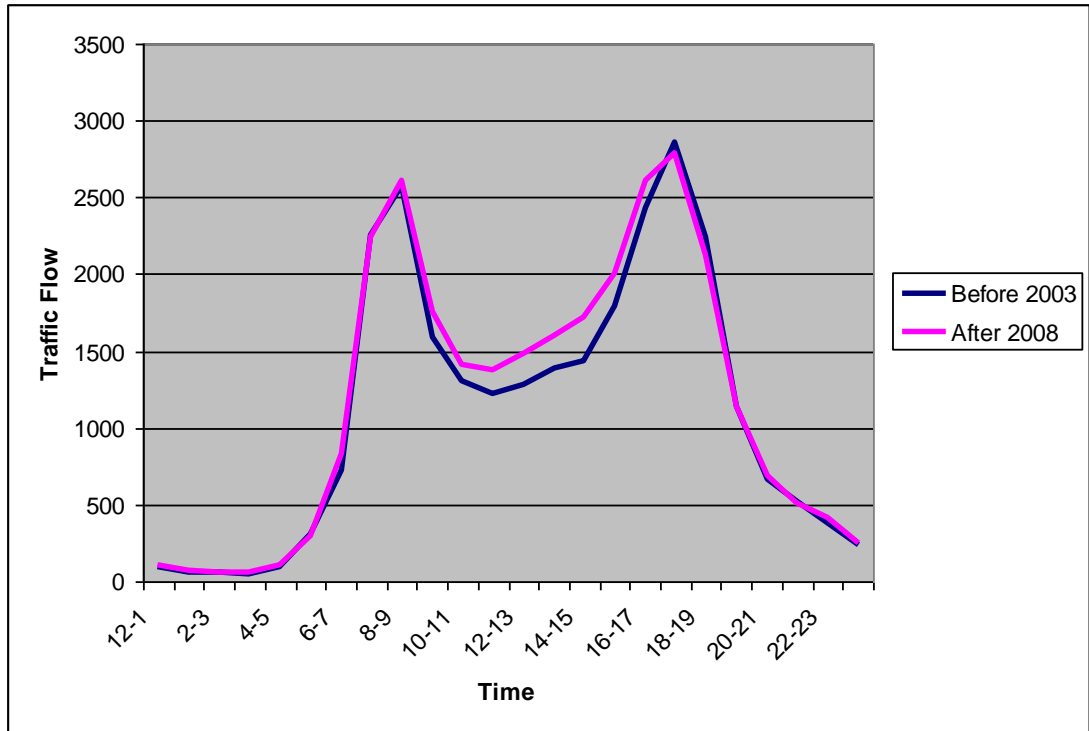


Figure C.4 – Traffic Flow Change (AWT) on A46(W) Westbound Carriageway

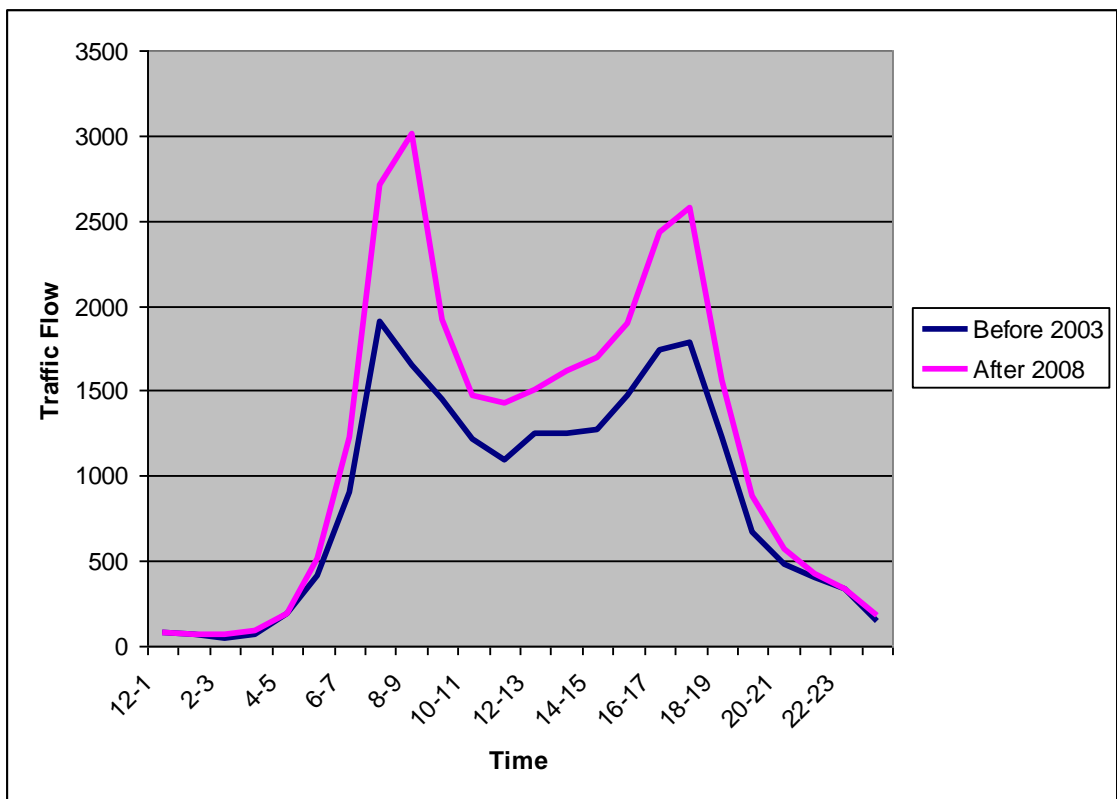


Figure C.5 – Traffic Flow Change (AWT) on A607 Northbound Carriageway

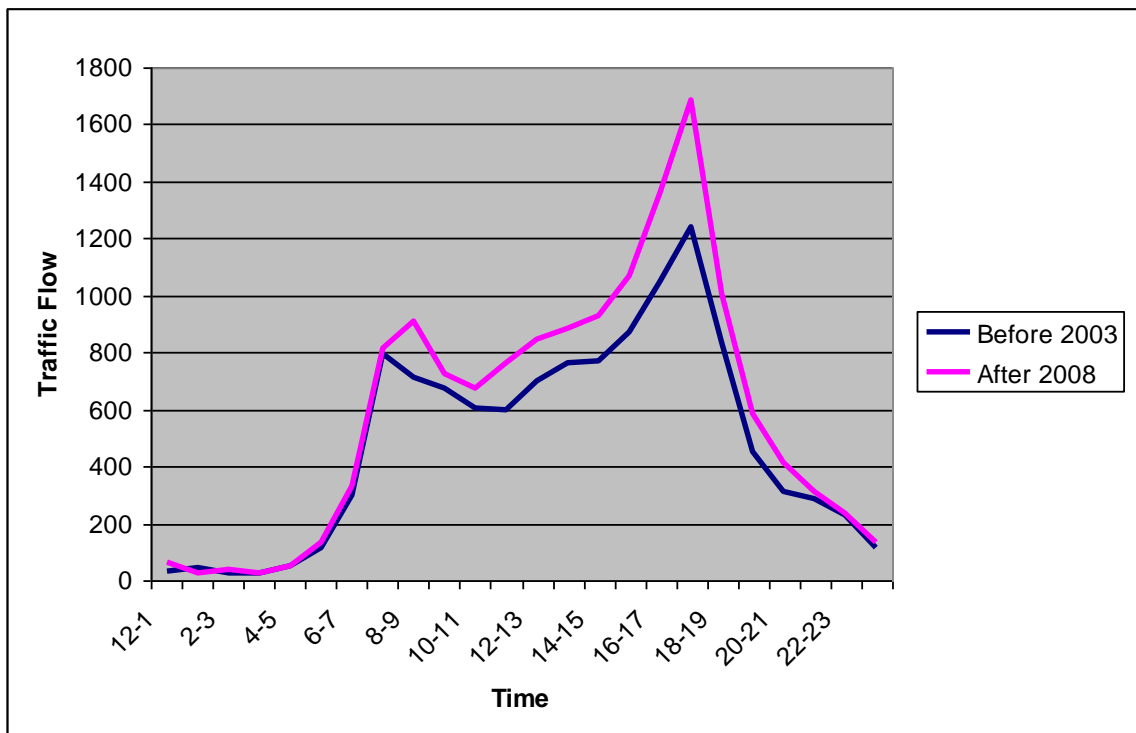
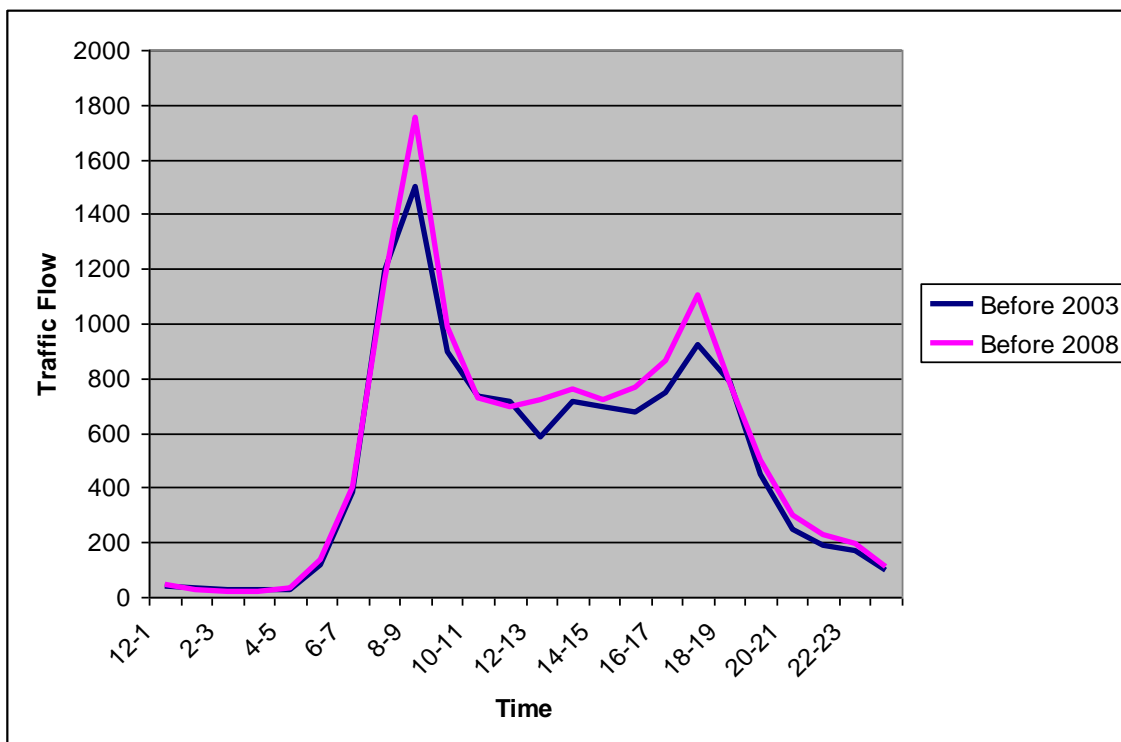


Figure C.6 – Traffic Flow Change (AWT) on A607 Southbound Carriageway



APPENDIX D – Glossary

The following table details the acronyms and specialist terms used within the context of this report.

Term	Definition
AADT	Annual Average Daily Traffic. Average of 24 hour flows, seven days a week, for all days within the year.
ADT	Average Daily Traffic
AWT	Average Weekly Traffic
AST	Appraisal Summary Table. This records the impacts of the scheme according to the Government's five key objectives for transport, as defined in DfT guidance contained on its Transport Analysis Guidance web pages, WebTAG
ATC	Automatic Traffic Count
BCR	Benefit Cost Ratio A ratio identifying the relationship between cost and benefits of a proposed project.
COBA	Cost Benefit Analysis – a computer program which compares the costs of providing road schemes with the benefits derived by road users (in terms of time, vehicle operating costs and accidents), and expresses the results in terms of a monetary valuation. The COBA model uses the fixed trip matrix.
DMRB	Design Manual for Roads and Bridges
EST	Evaluation Summary Table. In POPE studies, this is a summary of the evaluations of the TAG objectives using a similar format to the forecasts in the AST.
FYRR	First Year Rate of Return
HA	Highways Agency. An Executive Agency of the Department for Transport, responsible for operating, maintaining and improving the strategic road network in England.
HGV	Heavy Goods Vehicle
LNMS	Local Network Management Scheme A contribution to bringing about the changes required by the integrated transport white paper and 10 year plan.
MAC	A Managing Agent Contractor is responsible for the operation, maintenance, and improvement of the motorway and trunk road network of a Highways Agency area.
NATA	New Approach to Appraisal
NRTF	National Road Traffic Forecast. This document defines the latest forecasts produced by the Department of the

	Environment, Transport and the Regions of the growth in the volume of motor traffic. The most recent one is NRTF97 and the one previous was NRTF89.
PAR	Project Appraisal Report
PIA	Personal Injury Accident
POPE	Post Opening Project Evaluation , before & after monitoring of all major highway schemes in England.
PVC	Present Value of Costs
VOT	Value of Time
VPD	Vehicles per Day
WYG	White Young Green Consultants