

# **LNMS EVALUATION REPORT**

## **A55/A483 Junction Improvement Scheme-Segregated Left Turn from A483(N) to A55(E)**



**March 2006**

# A55/A483 Junction Improvement Scheme Segregated Left Turn From A483(N) To A55(E)

## LNMS EVALUATION REPORT March 2006

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# 1. Introduction

## BACKGROUND

- 1.1 The A55/A483 interchange is on a main arterial route into Chester city centre and is located southwest of Chester on the A55 Chester southerly by-pass. The improvement scheme originates from a scheme identification study carried out in February 1997. This study recommended various improvements to the A55/A483 junction in order to reduce congestion and hence reduce journey times through the junction. These improvements, as discussed in detail in the paragraphs 1.3 and 1.5, form phase 2 of the scheme and are examined in this report. Phase 1 improvements, which involved the introduction of traffic signals on the A55 approach from the west, were completed in March 1999.

### *Original PAR Document*

- 1.2 The PAR was produced by Atkins, Warrington and was last updated in October 2002.

### *The Scheme*

- 1.3 The scheme provided a segregated left turn lane from the A483 from Chester in the north to the A55 East. Figure 1.1 below illustrates the segregated left turn from the A483 to the A55 East.



**Figure 1.1 – Segregated left turn to the A55 (E)**

- 1.4 Figure 1.2 shows the location of A55/A483 Wrexham Road Interchange.

A55/A483 Junction Improvement Scheme: Segregated left turn from A483(N) to A55(E)

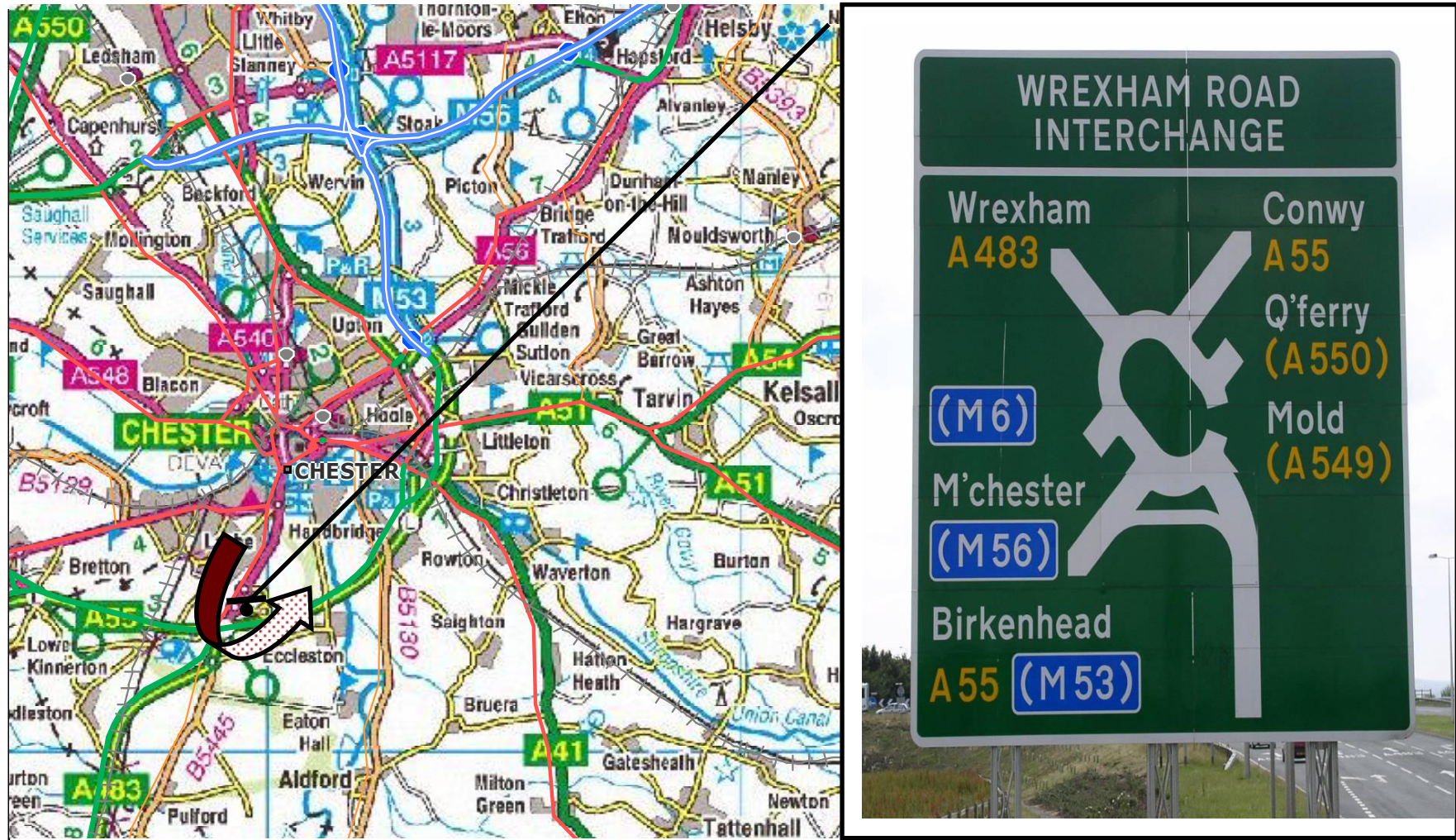


Figure 1.2 – A55/A483 Wrexham Road Interchange

- 1.5 Other elements of the scheme were a new ghost island merge layout as shown in Figure 1.3 that was constructed for an improved merge from the slip road to the A55.



**Figure 1.3 – Ghost Island merge from the A483 (N) slip road to the A55**

- 1.6 The primary problem identified within the PAR was the build-up of substantial queues and the resultant delays in the evening peak for traffic leaving Chester and the Chester Business Park approaching the A55 interchange on the A483. The Business Park which is located half a mile north of the interchange, covered an area of 94,000 m<sup>2</sup> at the time of appraisal and is due to expand 132,000 m<sup>2</sup>. It was anticipated that this proposed expansion of the business park would exacerbate the delays experienced at the junction and would become a significant problem in the future.
- 1.7 Other options considered were:
- ◆ An alternative alignment of the left turn lane and signalisation of the junction between the left turn lane and the A55 slip road; and/or
  - ◆ A major improvement scheme for the long term improvement of the junction, possibly with a dedicated junction from the A55 serving the Chester Business Park as recommended by the identification study.
- 1.8 As reported by the Highways Agency's area team, the scheme was opened to traffic in June 2003.

#### **SCHEME OBJECTIVES**

- 1.9 The scheme objective, as detailed in the PAR, is to reduce delays on the A483 approach to the roundabout from the north (Chester and Chester Business Park). The purpose of this project fits in with the Ten Year Plan in terms of economy, which is "to support sustainable economic activity and obtain good value for money".

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## PURPOSE OF THE REPORT

- 1.10 The Highways Agency has a requirement to carry out re-evaluations of trunk road schemes recently implemented by the Department of Transport. The purpose of these re-evaluations is to provide a back check of the levels of benefit accruing from new schemes and to determine how far the department achieves the objectives and benefits it claims from its road programme.
- 1.11 This report will initially undertake an assessment of the 'physical' impact of the scheme, namely:
- ◆ A comparison of the 'Before' and 'After' traffic volumes and delays on the A483 to illustrate how they have changed, if at all, since the opening of the scheme; and
  - ◆ The report will also outline the changes in accidents on the route since the scheme has been implemented and establish whether they have changed since the opening of the scheme. No predictions with this regard were made during the scheme appraisal.
- 1.12 This in turn is followed by the assessment of the scheme in accordance with the 'POPE methodology', which is being followed for the purpose of this study. This methodology aims to provide a method by which the forecast and outturn effects of a scheme can be evaluated on a common basis. This process ultimately presents two appraisals:
- ◆ Appraisal 1: The Original PAR assessment (including the original AST). This is a forecast of the cost/benefits of the scheme, usually calculated in accordance with PAR3 (1998 prices discounted at 6%).
  - ◆ Appraisal 2: An Evaluation Summary Table (EST) based on outturn effects, but evaluated on precisely the same terms (version of the PAR document, present value year and discount rate) of the original assessment. The calculation is usually a simple pro-rate of the original assessment based on the outturn impact with regard to user benefits and scheme costs. The advantage of this assessment is that it is an outturn assessment that is directly comparable with the original PAR AST.
- 1.13 Following this introduction the report is divided into six further sections as follows:
- ◆ Section 2 outlines existing data collation and new data collection;
  - ◆ Section 3 outlines the scheme's impact and reports on traffic volumes, delays and journey times and accident changes attributable to the scheme;
  - ◆ Section 4 presents an assessment of predicted and outturn economic benefits using the POPE journey time and accident methodology;
  - ◆ Section 5 presents the original Appraisal Summary Table (AST) for the segregated left turn from the A483 to the A55 East scheme, and then re-evaluates these predictions with an Evaluation Summary Table (EST); and
  - ◆ Section 6 and 7 summarises the main conclusions from the evaluations and the limitations to use.
- 1.14 It is intended that the findings of this report will feed into a wider summary of the outcomes of the POPE process.

## 2. Data Collection

### 'BEFORE' SURVEYS

2.1 The PAR document submitted in support of the scheme was based upon the following data:

- ◆ Accident data from September 1995 – August 1999; and
- ◆ An ARCADY model of the proposed scheme, based on turning movement information for 2002 factored from data collected in 2001.

### 'AFTER' SURVEYS

2.2 In the course of undertaking the Local Network Management (LNM) evaluation of the scheme, the following data was utilised.

#### *Classified Turning Movement Counts*

2.3 Turning movement count data was collected for the after evaluation of the scheme. The survey was conducted on Wednesday 22<sup>nd</sup> June 2005 between 0700 and 1900 hours. Count- on- us was commissioned to conduct the surveys.

2.4 Further detail on the survey methodology is provided in Appendix A.

#### *Journey Time Surveys*

2.5 Count- on- us was commissioned to carry out journey time surveys to determine the time taken to access and get through the roundabout along each of the arms. To achieve this journey times were recorded for vehicles travelling between each of the arms with a start and finish point being 200 meters upstream and downstream of the junction respectively.

2.6 The journey time surveys were undertaken simultaneously with the Turning movement surveys on Wednesday 22<sup>nd</sup> June 2005 during:

- ◆ AM peak, 0800 to 0900 hours;
- ◆ PM peak, 1700 to 1800 hours; and
- ◆ Inter peak, 0900 to 1700 hours.

#### *Accident Data*

2.7 Accident data was obtained from the Highways Agency area team for 01/09/1995 to 30/04/2005.

#### *ARCADY*

2.8 The original ARCADY files were obtained from Atkins archive.

### 3. Scheme Impact

#### OVERVIEW

- 3.1 This section provides details of the outturn traffic, journey times and safety impacts of the scheme.

#### TRAFFIC VOLUME CHANGES

- 3.2 Examination of turning movement information for the pre-opening period (2002) and the post opening (2005) from the turning movement counts reveals the following:
- ◆ Traffic approaching the A483 (N) arm of the junction has reduced by 38% (from 680vph to 420vph) in AM peak, 22% (from 1620vph to 1270vph) in PM peak and 25% (from 770vph to 580vph) in the inter-peak between 2002 (pre-opening) and 2005 (Post-opening) scenario. This reduction is attributed to the scheme as the segregated left turn lane enabled the A483 traffic from Chester to A55 eastbound to use this instead of the Wrexham interchange.
  - ◆ However, total traffic approaching all other arms has shown an increase in traffic. The total traffic entering the roundabout from all the arms has increased by 8% (from 5230vph to 5650vph) in AM peak, 5% (from 5410vph to 5690vph) in PM peak and 10% (from 3620vph to 4000vph) in the inter-peak between 2002 (pre-opening) and 2005 (Post-opening) scenario. This growth in traffic can be partly attributed to expected annual growth in traffic and partly to the traffic generated due to the Chester Business Park development in the close proximity to the interchange.
- 3.3 Further detail on the analysis of traffic flow data is provided in Appendix A.

#### DELAYS AND JOURNEY TIMES

##### *ARCADY Modelled Delays*

- 3.4 The scheme being an economy scheme the key element of the original PAR assessment of the scheme was the predicted journey time saving. The estimation of journey time savings was based on the difference in delays as estimated by ARCADY model used during the time of PAR assessment. The PAR had predicted annual saving of 28,728.6 vehicle hours in the opening year.
- 3.5 It was assumed during the PAR assessment that these savings were consequential to the reduction in traffic flows from A483 Chester to A55 east bound, which would take the segregated left turn constructed during the scheme. The impact of the scheme on traffic from all other arms was assumed to be negligible. Therefore for the PAR assessment, the impact on the total roundabout was not considered.
- 3.6 In order to undertake an evaluation of the actual benefits, the ARCADY model for the scheme was revisited. The delay to the traffic approaching the junction from A483 (N) was estimated for the AM, PM and the inter peak using the same ARCADY model as used for PAR assessment. The turning movement counts as observed during the
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survey (June 2005) along with the junction geometric details (as used in the PAR assessment) formed the model inputs. The summary of the delays as collated from the ARCADY outputs for the pre-opening (PAR assessed), post-opening (PAR forecast) and the evaluated post-opening (based on observed flows in 2005) scenario are as presented in Table 3.1

**Table 3.1 – Summary of ARCADY results for traffic on A483 (N)**

Scenario	Delays in minutes to traffic during		
	AM Peak (0800 to 0900 hours)	PM Peak (1700 to 1800 hours)	Inter Peak (0900 to 1700 hours)
A - Pre-Opening (PAR assessment)	53.9	6470.1	52.4
B - Post opening (PAR forecast)	26.8	101.3	28.1
C - Post Opening (Evaluated in 2005)	29.5	1404.9	38
Scenario	Journey time savings in minutes to traffic during		
	AM Peak	PM Peak	Inter Peak
D = (A-B) PAR Predicted	27.1	6368.8	24.3
E = (A-C) Observed	24.4	5065.2	14.4
F = (D-E)/D Percentage Difference	10%	20%	41%

- 3.7 From Table 3.1 it can be observed that the evaluated post-opening journey time delays through the roundabout are higher than the predicted journey time delays to traffic approaching the junction from A483 (N). The difference between the two is highest during the inter-peak (41%). These higher than expected delays could possibly be due to the increase in total traffic approaching the interchange from all arms from the 2002 traffic flows (at the time of PAR assessment), which is around 8%, 5% and 10% higher for the AM, PM and the Inter-peak respectively. This increase in traffic can be attributed to the annual growth in traffic along with additional traffic generated due to the development of the Chester Business Park.

#### *Journey Times*

- 3.8 As a part of the evaluation, journey time surveys were undertaken as discussed in sections 2.5 and 2.6. The average journey times were recorded for vehicles travelling between each of the arms with a start and finish point being 200 meters upstream and downstream of the junction during the AM, PM and inter-peak respectively. Appendix B shows the journey times for each movement from all arms and Table 3.2 below summarises the results for traffic from A483 (N) from Chester to all other arms

**Table 3.2 – Observed journey times in seconds for traffic on A483 (N) from Chester to all arms as observed (June 2005)**

FROM	TO --->	A55 (WB) To North Wales	A483 (SB) To Wrexham	A55 (EB) to Manchester	A483(NB) to Chester
A483 (N) from Chester	<b>AM peak</b>	<b>99</b>	<b>126</b>	<b>57</b>	<b>137</b>
	<b>PM peak</b>	<b>158</b>	<b>107</b>	<b>131</b>	<b>417</b>
	<b>Inter-peak</b>	<b>133</b>	<b>82</b>	<b>55</b>	<b>130</b>

Note: AM peak=0800 to 0900; PM peak=1700 to 1800 hours; and inter peak=0900 to 1700 hours

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- 3.9 From Table 3.2 it can be observed that the average journey time per vehicle for traffic from A483 Chester to A55 east bound (From arm D to arm C) during the PM peak is more than double the journey times during the AM peak and the Inter-peak.
- 3.10 As journey time data for pre-opening was not collected, the post-opening journey times could not be compared with the pre-opening journey times to be able to comment on the actual changes in journey times due to the scheme. .
- 3.11 Further detail on the analysis of the journey time information is presented in Appendix B.

### SAFETY

- 3.12 The original PAR assessment had predicted a negligible impact of the scheme on safety and hence it was not assessed using the PAR methodology. The Appraisal Summary Table (AST) reported that the shunt type accidents were expected to reduce but the scheme was expected to result in more accidents at the merge on the slip. So the net impact of the scheme on accidents was assumed to be negligible.
- 3.13 For the evaluation, it was considered useful to assess the impact of the scheme on safety by analysing changes in accidents pre-opening and the post opening of the scheme. Accidents reported from 1995 to April 2005 were obtained from the Highways Agency's area team. This provided a total of 101 months pre-opening accident data (from 1995 till May 2003), and 23 months post-opening accident data (June 2003 till April 2005).
- 3.14 Accidents which were beyond the scheme and not related directly to the scheme were excluded from the analysis. Therefore analysis focussed on accidents on A483 (N), A55 (E) and the turning path for A483 traffic from Chester to A55 eastbound. Table 3.3 gives the summary of the accident analysis.

**Table 3.3 – Accident Analysis**

Scenario	Number of Months	Observed Number of Accidents	
		Over observed period	Per Year
Pre-Opening (1995 to May 2003)	101	10	1.2
Post Opening (June 2003 to April 2005)	23	5	2.6
<b>Increase in accidents in the opening year</b>			<b>1.4</b>

- 3.15 The analysis presented in Table 3.3 shows that in the first 23 months after opening the scheme has resulted in an increase in 1.4 accidents per annum.
- 3.16 Accident data shows that whilst the pre-opening accidents were mainly shunt type, the main cause for the post-opening accidents is reported to be collisions while entering the slip road from A483 (N) to A55 (E) or while merging with A55 Eastbound.
- 3.17 Further detail of the analysis of accident data is presented in Appendix C.

**SUMMARY**

3.18 In summary, the overall evaluation of impacts of the scheme 23 months after opening shows that:

- ◆ Post opening delays to traffic approaching the junction on A483 (N) (Modelled using the observed 2005 traffic flows) are higher than the predicted delays (as in PAR Assessment), which are around 10%, 20% and 41% higher for the AM, PM and the inter peak, indicating that the scheme has had lower than expected journey time savings; and
- ◆ There has been an increase of around 1.4 accidents per annum post opening of the scheme, indicating that the scheme has had some adverse effect on the safety as against the assumption about the negligible effect of the scheme on safety.

## 4. Economic Evaluation

### INTRODUCTION

- 4.1 This section assesses the level of economic benefits predicted for the scheme and compares these predictions with actual benefits accrued when considering actual traffic volume changes, actual journey time benefits and actual safety benefits/disbenefits of the scheme. The re-evaluation, termed the Post Opening Project Evaluation (POPE) methodology, uses observed accident and link transit savings to provide an economic assessment of the performance of the scheme. This result is presented in the scheme Evaluation Summary Table (EST) and is expressed in the same terms as the original evaluation (present value year of 1998, and discount rate of 6 per cent).

### JOURNEY TIME BENEFITS

- 4.2 It was recognised within the PAR assessment that the scheme would have an impact on A483 (N) and the impact on other arms would be negligible. The current evaluation as discussed in this section is hence based on the same assumption.
- 4.3 PAR assessment had predicted annual journey time saving of 28,728.6 vehicle hours per year resulting in monetary savings, in 1998 prices discounted to 1998, of £257,822 in the opening year. This when capitalised over the assessment period of 30 years predicted monetary savings, in 1998 discounted to 1998, of £5,249,257 and £5,795,839 for the low and high growth forecasts respectively.
- 4.4 POPE evaluation of journey time benefits as discussed section 3.6 estimated annual saving of 22,482 vehicle hours per year resulting in monetary savings, in 1998 prices discounted to 1998, of £195,426 in the opening year. This when capitalised over the assessment period of 30 years predicted monetary savings, in 1998 discounted to 1998, of £3,952,302 and £4,351,363 for the low and high growth forecasts respectively. Table 4.1 shows the POPE comparison of the journey time benefits.
- 4.5 For details of estimation of annualised vehicle hour savings please refer to Table B1 and B2 in Appendix B.

**Table 4.1 – POPE Comparison: Journey Time Benefits**

	Opening Year Vehicle Hours Saved (hours/year)	Opening Year Monetary Benefits (£)	30 Year Monetary Benefits (£)
<b>Original PAR</b>			
Low Growth	28,728.6	0.257m	5.249m
High Growth	28,728.6	0.257m	5.795m
<b>POPE: Assessment</b>			
Low Growth	22,482	0.195m	3.952m
High Growth	22,482	0.195m	4.351m

All costs and benefits are 1998 prices discounted to 1998 at 6%.

- 4.6 Table 4.1 shows that the opening year journey time savings in vehicle hours saved per year as estimated for the evaluation are around 22% lower than the predicted journey time savings. The evaluated monetary benefits for the opening year and over the 30 year assessment period are around three quarters of the predicted journey time benefits as estimated in the PAR assessment. To ensure a comparison on like by like basis this evaluation is based on the comparison of the benefits to traffic on A483 (N) only and not the entire roundabout, as done for the PAR assessment.

### ACCIDENTS

- 4.7 The original PAR assessment assumed the impact of the scheme on safety to be negligible. AST reported that a reduction in the shunt type accidents consequential to the scheme was expected to be counter balanced by the increase in the accidents at the merge, thus having a negligible impact on safety.
- 4.8 For evaluation, it was decided to assess the safety impacts of the scheme to get a more realistic view of the actual impacts of the scheme. Section 3 presented Atkins analysis of the observed post-opening increase in accidents by 1.4 accidents per year. This when capitalised over the 30 year assessment period would result in increase in accidents by 40 and 50 accidents for the low and high growth scenario. The observed increase in accidents has in turn been used to forecast monetised accident disbenefits from the scheme, as detailed in Table 4.2.

**Table 4.2 – POPE Assessment of Safety Impacts**

Growth Scenario	Opening Year Accident Increase	Opening Year Accident Disbenefits	30 Year Accident Increase	30 Year Accident Disbenefits
Low	1.4	£90,147	40	£1.432m
High	1.4	£90,147	45	£1.549m

All costs and benefits/disbenefits are 1998 prices discounted to 1998 at 6%.

- 4.9 Table 4.2 illustrates that the scheme has resulted in accident disbenefits, at 1998 prices discounted to 1998, of £90,147 in the opening year which when capitalised over 30 year project period results in an accident disbenefits, at 1998 prices discounted to 1998, of £1.432m and £1.549m for the low and the high growth scenario. This indicates that the scheme has had some adverse impact of safety.

### SCHEME COST

- 4.10 The original PAR predicted the total Present Value Cost (PVC) of the scheme, in 1998 market prices, discounted to 1998, to be £1.09m with the estimate year as 2001 quarter 4.
- 4.11 The outturn cost of the scheme as provided by the project sponsor for the scheme of June 2003 was £1,150,693 (including preparation and site supervision). In the absence of more detailed information it is assumed that the value excludes VAT.
- 4.12 Table 4.3 presents the conversion of the outturn cost to the present value year of 1998.

**Table 4.3 – Conversion of Outturn Cost to Present Value Cost**

	Total Current Project Cost (A)	Latest RPI (B)	Latest RPF (C)	RPI (1998) (D)	Discount Factor (E)	Present Value Cost $((D * C * A) / B) * E$
Actual Outturn	£1,150,693	181.3	(P)1.00	162.8	0.75	<b>£936,922</b>

All Present Value Costs are in 1998 prices discounted to 1998 at 6%. RPI's and RPF's for Q2, 2003 used.

- 4.13 Table 4.4 compares the predicted cost and the outturn costs for the scheme. It shows that the outturn scheme cost was around 14% below the predicted value as given in the original PAR for the scheme.

**Table 4.4 – Comparison of predicted and outturn costs**

Present Value Costs		Percentage Difference
Original PAR Predicted(A)	Outturn(B)	Outturn vs. PAR Predicted Corrected(B-A)/A
£1,095,136	£936,922	<b>14% lower</b>

**SUMMARY**

- 4.14 Table 4.5 presents a summary of the original PAR and POPE economic evaluation of the scheme. The assessment is expressed in terms of 1998 prices, discounted to 1998 at 6 per cent, and that the methodology used is in accordance with Full PAR version 3.0.January 2002

**Table 4.5 – POPE Comparison: Summary**

	Original PAR Assessment	POPE Assessment
<b>*Journey Time Benefits/Disbenefits</b>		
Opening Year	£0.257m	<b>£0.195m</b>
End of Assessment period	£5.522m	<b>£4.151m</b>
<b>*Accident Benefits/Disbenefits</b>		
Opening Year	Not Assessed	<b>- £0.090m</b>
Assessment Year (PVB)	Not Assessed	<b>- £1.491m</b>
<b>*Net Benefits/ Disbenefits (PVB)</b>		
Opening Year	£0.257m	<b>£0.105m</b>
Assessment Year (PVB)	£5.522m	<b>£2.660m</b>
<b>Scheme Costs &amp; Value</b>		
PVC	£1.095m	<b>£0.936m</b>
NPV (PVB-PVC)	£4.427m	<b>£1.724m</b>
<b>*First Year Rate of Return (FYRR) and Cost Benefit Ratio</b>		
FYRR	23.5%	<b>11%</b>
BCR	5.04	<b>2.84</b>

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All costs and benefits are 1998 prices discounted to 1998 at 6%.

\*These figures are based on the average of the low and the high forecast scenario

4.15 The main points to note are:

- ◆ The evaluated journey time benefits in the first year after the scheme opening are around 24% lower than the predicted journey time benefits. Over the 30 year assessment period the forecasted journey time benefits based on the current evaluation are around 25% lower than the predicted journey time benefits in the original PAR;
- ◆ The evaluation shows that the scheme has resulted in accident disbenefits of around £90,147 per year (at 1998 prices, discounted to 1998) in the opening year and when capitalised over a 30 year assessment period the accidents disbenefits are expected to be around £1,491,262 (average of low and high growth scenario). This indicates that the PAR assessment's assumption of the impact of the scheme being negligible on safety, does not seem to hold true, as observed during the POPE assessment;
- ◆ The outturn scheme cost was around 14% lower than PAR predicted;
- ◆ The FYRR of the scheme is around 11%, which is lower than the predicted FYRR of 23.5%; and
- ◆ The benefit cost ratio is 2.84, which is approximately 44% lower than original PAR predictions.

**4.16 Overall the scheme continues to represent greater benefits than the costs with a BCR of 2.84, yet the evaluation shows a lower than predicted (PAR assessment) BCR inspite of lower than predicted costs. This could be attributed to:**

- ◆ Lower than predicted journey time benefits; and
- ◆ Disbenefits due to increased accident rate consequential to the scheme.

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## 5. Summary of Appraisal and Evaluation Summary Tables

### INTRODUCTION

- 5.1 In order to fully evaluate the effects of the segregated left turn from A483 Chester to A55 Eastbound, Atkins has undertaken a review of the original PAR document which was also prepared by Atkins. The Appraisal Summary Table (AST) from this document, which summarises the predicted impact of the scheme under the five objectives of environment, safety, economy, accessibility and integration, is presented as Appendix D in this report.
- 5.2 The review focused on:
- ◆ The main body of the PAR document itself; and,
  - ◆ The Appraisal Summary Table (AST) from the PAR.
- 5.3 Each of these is dealt with in turn below.

### PAR DOCUMENT

- 5.4 The main points to note from the PAR document of the A55/A483 Junction Improvement scheme are as follows.

#### *Environment*

- 5.5 No assessment was made of the environmental impact of the scheme.

#### *Safety*

- 5.6 The PAR has predicted that the net impact of the scheme on the number of accidents is negligible. Shunt type accidents at the roundabout will be reduced but, additional accidents will be introduced at the merge of the slip road, thus resulting in an insignificant change in the number of accidents per year.

#### *Economy*

- 5.7 PAR predicted that the proposed junction improvements would result in a decrease in journey times resulting in journey time savings of 28,729 vehicle hours in the opening year. PAR predicted monetised benefits of £257,822 in the opening year and £5, 522,546 over the 30 year assessment period.

#### *Accessibility*

- 5.8 No assessment was made of the scheme's impact on accessibility.

#### *Integration*

- 5.9 No assessment was made of the scheme's impact on integration.

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### Appraisal Summary Table (AST)

5.10 The main points to note from the AST of the A55 / A483 Junction Improvement Scheme are:

#### *Environment*

5.11 No assessment made

#### *Safety*

5.12 The AST predicts that no impact will be made on safety by the improvements. Shunt type accidents at the roundabout approach will be reduced, but additional accidents will be introduced at the merge of the slip road. Thus it is assumed that the net impact will be negligible.

#### *Economy*

5.13 The AST states that there would be a reduction in delays to traffic approaching the junction from A483 (N) from Chester, particularly in the PM peak period due to approximately 50% of the traffic on this arm using the left turn lane.

5.14 It is predicted that this would result in journey time saving of 28,729 hours in the opening year and this equates to a Net Present Value (NPV) of £4.43m for users.

#### *Accessibility*

5.15 No assessment made

#### *Integration*

5.16 No assessment made

### OUTTURN EFFECTS

5.17 In order to assess the actual or outturn effects of the opening of the scheme, we have produced an Evaluation Summary table (EST), which mirrors the appearance of the AST, and includes details of the actual sub objectives that have been evaluated. The EST is presented in Appendix E.

5.18 Section three discussed the economy and safety impacts of the scheme. The AST had not assessed the other three impacts, namely

- ◆ **Environmental Impacts** such as noise, local air quality, landscape, biodiversity, heritage and water;
- ◆ **Accessibility Impacts** such as change in access to public transport, severance within communities and impact on pedestrian and other modes; and
- ◆ **Integration** measured by how the scheme accords with policy.

5.19 The assessments that follow are all subjective assessments from members of the evaluation team and wherever possible provides a photographic evidence of it.

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## Environment

### Landscape

- 5.20 Plantation along the scheme as seen in Figure 5.1 was observed during site visit. This is expected to shield the few properties, which are in the proximity, from the view of the slip road. The scheme thus would have a slight positive impact on the landscape.



**Figure 5.1 – Plantation along Segregated left turn from A483(N) to A55(E)**

### Accessibility

- 5.21 The scheme does not seem to have had any adverse impact on the accessibility in terms of severance as it does not seem to separate communities from each other or from any community facilities.
- 5.22 Access to transport system does not seem to be affected as well. Figure 5.2 shows the bus stop before the segregated left turn, which is expected to cater to the public transport users.
- 5.23 Thus it can be assumed that the scheme has had no adverse impact on accessibility.

### Integration

- 5.24 This impact was not assessed for evaluation



**Figure 5.2 – Bus Stop: Accessibility to Public transport**

## 6. Conclusions

- 6.1 The main points to note from this evaluation of the A55/A483 Junction Improvement Scheme: Segregated left turn from A483(N) to A55(E) are:

### *Traffic Volumes*

- 6.2 The scheme has moved traffic from A483(N) Chester to A55(E) from the roundabout to the segregated left turn, this has resulted in a reduction in traffic approaching the A483 (N) arm of the junction from the flows preceding the opening of the scheme. However there has been an increase in total traffic entering from all arms which seems to be consequential to the additional traffic generated due to Chester Business Park development.

### *Journey Times*

- 6.3 ARCADY evaluation based on the post-opening observed flows shows that there are journey time benefits because of scheme but they are around 25% lower than as predicted during PAR assessment.

### *Safety*

- 6.4 The scheme has delivered an annual increase of 1.4 accidents and the following points should be noted:
- ◆ The shunt type accidents have reduced;
  - ◆ The accidents while entering the segregated slip lane has increased; and
  - ◆ The accidents at the merge of A483 with A55 have increased.
- 6.5 The scheme seems to have some adverse impacts on the safety.

### *Scheme Costs*

- 6.6 The scheme was built at a cost which is around 14% less than the predicted costs.

### *Economic Evaluation – POPE Methodology*

- 6.7 The scheme provides lower than predicted journey time benefits and some adverse impacts on safety than that were predicted during the PAR assessment. In spite of the PVC being around 14% less than predicted, the scheme has resulted in a lower than predicted NPV and benefit cost ratio, which are around 61% and 44% lower than those predicted in PAR assessment. This is possibly because of lower than predicted benefits of the scheme.

### *Overall*

- 6.8 The scheme appears to have delivered less benefit than predicted (as a result of lower than predicted benefits along with accident disbenefits). The lower than predicted costs was offset by these resulting in the lower than predicted benefit cost ratio and FYRR.
- 6.9 The scheme should be re-evaluated in future years when more post opening data is available. This will enable more robust conclusions to be drawn.
-

- 6.10 The evaluation considers the benefits to the traffic approaching the junction from A483 (N) and not the entire roundabout. The POPE evaluation has adopted the approach followed by PAR assessment, which assumes that the impact of the scheme on other arms would be negligible.
  
- 6.11 The post opening accident benefits are estimated based on accident information for only 23 months. Actual estimation based on more data could result in different accident benefits/disbenefits.

## **Appendix A – Analysis of Traffic Flow Data**

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### *Turning Movement Count Information*

#### *Pre-Opening data*

Turning movement count data collected in March 2001, factored using NRFT growth rates to 2002 turning flows was used for the PAR assessment. The data was collected on Tuesday 6<sup>th</sup> March 2001 between 0700 and 1900 hours.

NRFT central forecasts were used to factor this to 2002 turning flows which formed the input to the ARCADY model along with other inputs like the junction geometrics

#### *Post-Opening Surveys*

Turning movement count data was collected for the after evaluation of the scheme. The survey was conducted on Wednesday 22<sup>nd</sup> June 2005 between 0700 and 1900 hours. Count-on-us was commissioned to conduct the surveys.

The site was surveyed using telescopically mounted video cameras as shown in Figure A1 from which the information was subsequently extracted. Vehicles were classified as Light and Heavy vehicles and all information was collected in fifteen minute intervals.



**Figure A1 – Turning Count Survey using Telescopic Mounted Video Camera**

#### *Post Opening Turning Movement count results*

The twelve hour data was analysed to estimate the average hourly traffic classified as light and heavy vehicles during the AM, PM and inter-peak. Figure A2 shows the estimated hourly traffic flows for each turn movement for the AM, PM and inter-peak

A55/A483 Junction Improvement Scheme: Segregated left turn from A483(N) to A55(E)

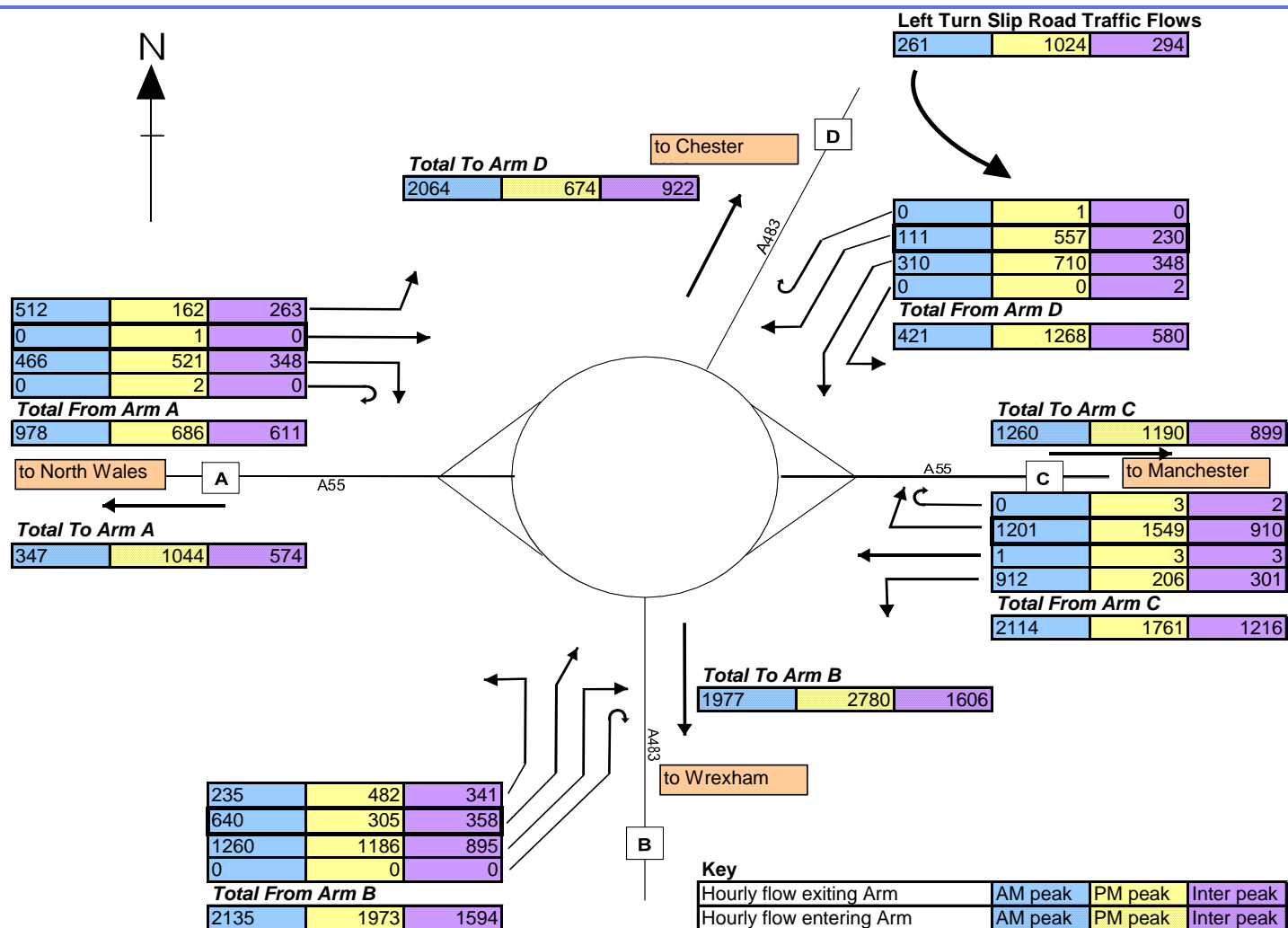


Figure A2 – Turning Movement Flows in vehicles per hour (June 2005)

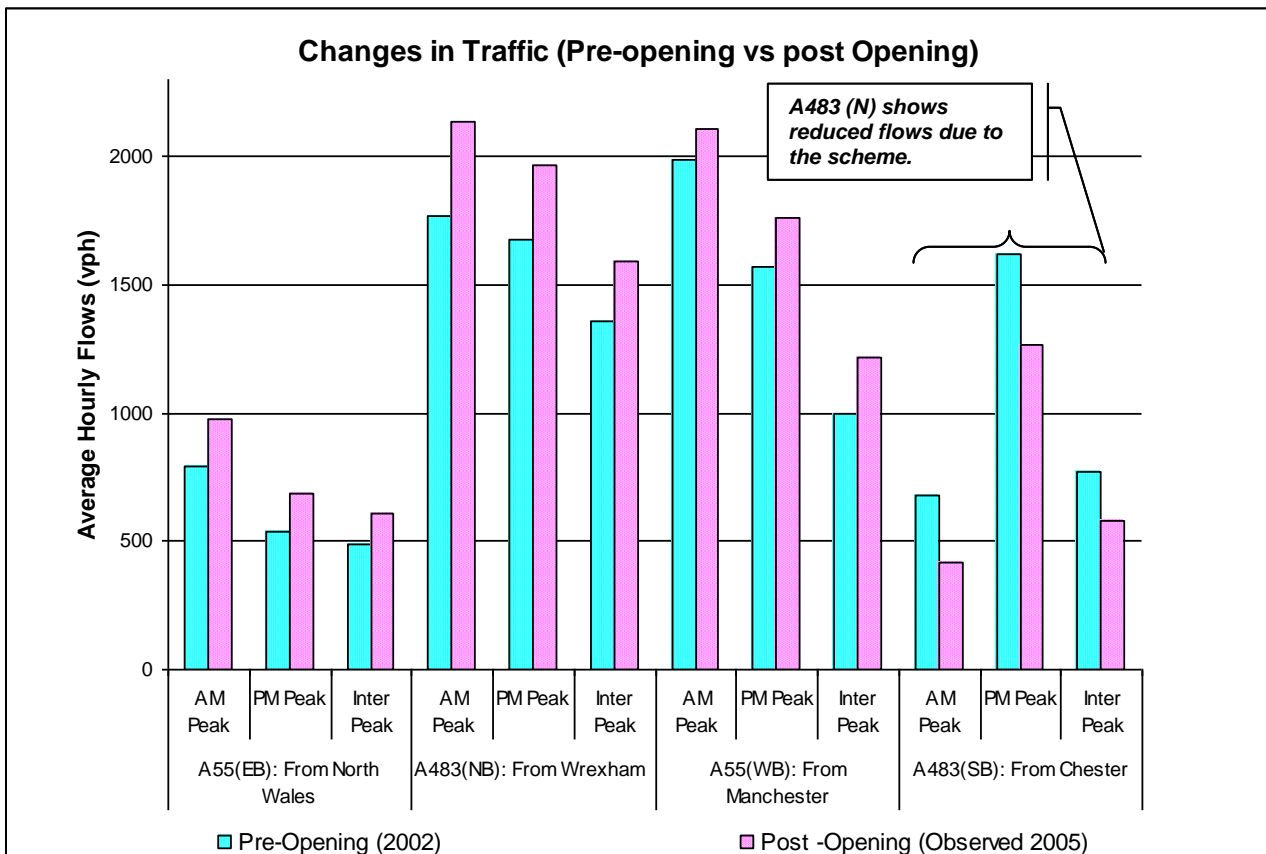
Traffic Volume Changes

Figure A3 and Table A1 shows the changes in the hourly flows for the AM, PM and inter peak between the pre-opening and the post opening of the scheme. It is observed that the approach traffic on all arms except A483 (N) from Chester has shown a considerable increase in traffic.

This increase can be attributed to the annual growth in traffic and the development of the Chester business park. It is however difficult to conclude that the scheme has generated any additional traffic from this information. However, the traffic from A483(N) Chester to A55 (E) has decreased, yet it is higher than the predicted Do-Something flows (PAR post-Opening).

**Table A1: Changes in Traffic Flows approaching the A55/A483 Junction**

Scenario	A55(EB): From North Wales			A483(NB): From Wrexham			A55(WB): From Manchester			A483(SB): From Chester		
	AM Peak	PM Peak	Inter Peak	AM Peak	PM Peak	Inter Peak	AM Peak	PM Peak	Inter Peak	AM Peak	PM Peak	Inter Peak
Pre-Opening (2002)	790	540	490	1770	1680	1360	1990	1570	1000	680	1620	770
Post -Opening (Observed 2005)	980	690	610	2140	1970	1590	2110	1760	1220	420	1270	580
Annual growth	24%	28%	24%	21%	17%	17%	6%	12%	22%	-38%	-22%	-25%



**Figure A3 – Changes in turning movement (vph)**

## **Appendix B – Estimation of Journey Time Benefits**

**JOURNEY TIME BENEFITS USING ARCADY****Introduction**

The original PAR and AST forecast that the scheme would result in reduction in delays on the A483 approach to the junction from Chester, particularly in the PM peak period, due to approximately 50% of the traffic on this arm using the segregated left turn lane. This would result in journey time benefits to the users. In order to evaluate whether these forecast savings have occurred or will occur, Atkins has undertaken an initial evaluation of journey time benefits accrued post opening.

**Basis for PAR predictions:**

PAR assessment of the journey time benefits was based on the ARCADY model. Turning flows from each arm to all other arms were observed for twelve hour period from 0700 to 1900 hours on a regular weekday in 2001. NRTF central growth forecasts were used to project these turning flows to 2002 turning flows, which were used as input to ARCADY model, along with other inputs like the junction geometrics.

The ARCADY model was run to estimate the do-nothing (Pre-Opening) and do-something (Post-Opening) delays on each arm for the AM, PM and the inter peak. The left turn flows from A483 (N) Chester to A55 eastbound were assumed to use the segregated left turn (the scheme) and hence were removed from the turning movement data which was input for the do-something PAR assessment. It was recognised within the PAR assessment that the scheme would have an impact on A483 (N) from Chester and the impact on other arms would be negligible. Thus the journey time benefits due to reduction in delays to traffic on A483(N) from Chester was estimated as a part of the PAR assessment. Table B1 shows the PAR assessment of the vehicle hours saved in the opening year

**Table B1 – PAR assessment of vehicle hours saved in opening year (As predicted)**

Time Period (A)	Delays in minutes		Benefit/Hour (D= B-C)	No. of Hours (E)	Weekday Benefits (F=DxE)	Weekend/Bank holiday benefits (G)
	Do Nothing (B)	Do Something (C)				
AM Peak	53.9	26.8	27.1	1	27.1	0
PM Peak	6470.2	101.3	6368.9	1	6368.9	0
Off Peak	52.4	28.1	24.3	12	291.6	340.2
Night	0	0	0	10	0	0
<b>Total Benefits per day in minutes (H)</b>					6687.6	340.2
<b>Total Benefits per day in hours (I=H/60)</b>					111.5	5.67
<b>Annual Benefits in vehicle hours ( *252 x I &amp; 113 x I)</b>					28088	641
<b>Total vehicle hours saved in opening year</b>					<b>28728.6</b>	

\* Assumption of 252 weekdays and 113 days for weekend and Bank holidays in an year

As seen from Table B1, PAR assessment had predicted annual journey time saving of 28,728.6 vehicle hours per year resulting in monetary savings, in 1998 prices discounted to 1998, of £257,822 in the opening year. This when capitalised over the assessment period of 30 years predicted monetary savings, in 1998 discounted to 1998, of £5,249,257 and £5,795,839 for the low and high growth forecasts respectively.

**Basis for Evaluation:**

For the purpose of this evaluation the ARCADY model was revisited to assess the pre and post opening journey time benefits. Turning Movement count surveys to record flows from each arm to all other arms were conducted for twelve hour period from 0700 to 1900 hours on a Wednesday 22<sup>nd</sup> June 2005 as detailed in Appendix A. These turning flows were used as input to ARCADY model, all other inputs being the same as used for the PAR assessment.

The ARCADY model was run to estimate the observed delays (Post-Opening delays based on the observed 2005 turning flows) on each arm for the AM, PM and the inter peak. For comparison of likes it was decided to estimate the post-opening journey time benefits due to reduction in delays to traffic on A483 (N) from Chester as estimated during the PAR assessment. Table B2 shows the estimation of the vehicle hours saved in the opening year as evaluated.

**Table B2 – Evaluation of vehicle hours saved in opening year (As observed)**

Time Period (A)	Delays in minutes		Benefit/ Hour (D= B-C)	No. of Hours (E)	Weekday Benefits (F=DxE)	Weekend/ Bank holiday benefits (G)
	Do Nothing (B)	Do Something based on 2005 flows(C)				
AM Peak	53.9	29.5	24.4	1	24.4	0
PM Peak	6470.2	1404.9	5065.3	1	5065.3	0
Off Peak	52.4	38	14.4	12	172.8	201.6
Night	0	0	0	10	0	0
<b>Total Benefits per day in minutes (H)</b>					5262.5	201.6
<b>Total Benefits per day in hours (I=H/60)</b>					87.7	3.4
<b>Annual Benefits in vehicle hours (*252 x I &amp; 113 x I)</b>					22103	380
<b>TOTAL ANNUAL BENEFITS in vehicle hours</b>					<b>22482</b>	

\* Assumption of 252 weekdays and 113 weekend and Bank holidays in an year

POPE evaluation of journey time benefits as shown in Table B2 estimated annual saving of 22,482 vehicle hours per year resulting in monetary savings, in 1998 prices discounted to 1998, of £195,426 in the opening year. This when capitalised over the assessment period of 30 years predicted monetary savings, in 1998 discounted to 1998, of £3,952,302 and £4,351,363 for the low and high growth forecasts respectively.

From the evaluation, it can be observed that the opening year journey time savings in vehicle hours saved per year are around 22% lower than the predicted journey time savings. The evaluated monetary benefits for the opening year and over the 30 year assessment period are around 75% of the predicted journey time benefits as estimated in the PAR assessment.

## JOURNEY TIME SURVEYS –POST OPENING

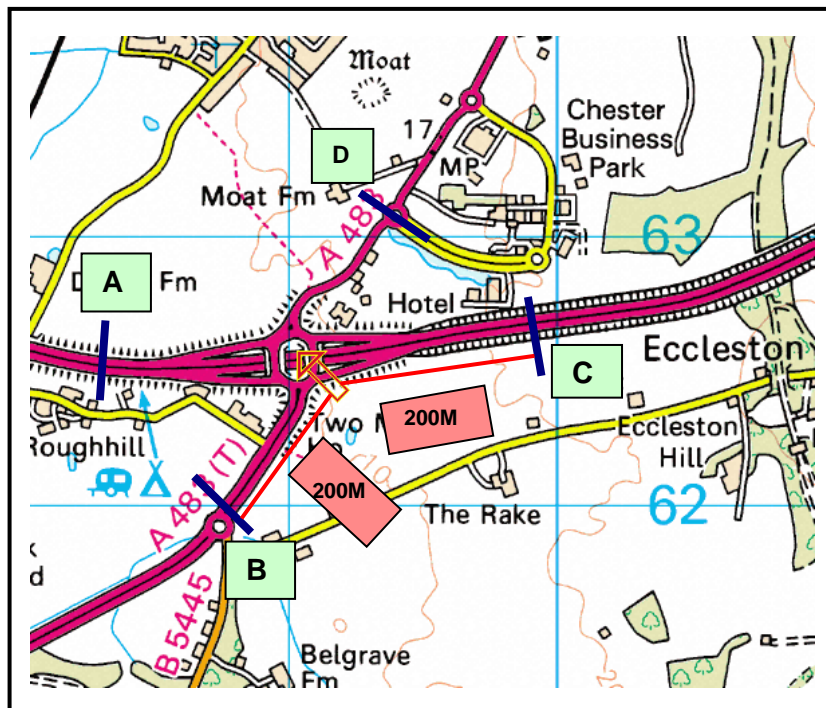
### Introduction

A direct comparison of the changes in the observed journey times pre and post opening of the scheme would have enabled a more realistic estimation of the actual journey time benefits. Journey time surveys, pre-opening of the scheme were however not undertaken; hence this comparison could not be made for the evaluation. It was still considered useful to undertake the journey time surveys to estimate the journey times post opening of the scheme.

### Journey Time Survey

#### Objective

Count- on- us was commissioned to carry out journey time surveys to determine the time taken to access and get through the roundabout along each of the arms. To achieve this journey times were recorded for vehicles travelling between each of the arms with a start and finish point being 200 meters upstream and downstream of the junction respectively as shown illustrated in Figure B1.



**Figure B1 – Schematic representation of Journey time surveys**

#### Duration

The journey time surveys were undertaken simultaneously with the Turning movement surveys on Wednesday 22<sup>nd</sup> June 2005 during:

- ◆ AM peak, 0800 to 0900 hours;
- ◆ PM peak, 1700 to 1800 hours; and
- ◆ Inter peak, 0900 to 1700 hours.

PAR assessment had made the predictions based on these time intervals. So to ensure the comparison of likes the same time intervals were used for the evaluation.

Though it was aimed to do six runs for each turn movement, given the time constraint this could not be achieved completely.

**Methodology**

The survey was conducted using the moving car method wherein the driver drives along the survey route maintaining the speed of other vehicles and without exceeding the speed limit. The journey start and end times are recorded to estimate the journey times.

**Results**

Table B3 gives the summary of the journey times averages over all runs for vehicles travelling between each of the arms with a start and finish point being 200 meters upstream and downstream of the junction during the AM, PM and inter-peak respectively in seconds as below:

**Table B3 – Summary of average journey times in seconds as observed (June 2005)**

FROM ARM	TO ARM --->	A	B	C	D
A	AM peak	280	360		291
	PM peak		189	72	79
	Inter-peak	106	112	61	88
B	AM peak	248	300	249	253
	PM peak	85	193	173	95
	Inter-peak	78	130	73	112
C	AM peak		90	191	109
	PM peak	71	112		91
	Inter-peak	68	57	95	58
D	AM peak	99	126	57	137
	PM peak	158	107	131	417
	Inter-peak	133	82	55	130

Note: A = A55 (W), B = A483 (S), C= A55 (E), D= A483(N)  
 AM peak=0800 to 0900; PM peak=1700 to 1800 hours; and inter peak=0900 to 1700 hours

**Conclusion**

As journey time data for pre-opening was not collected, the post-opening journey times could not be compared with the pre-opening journey times to be able to comment on the actual changes in journey times due to the scheme.

## **Appendix C –Analysis of Accident Data**

*Introduction*

The original PAR assessment assumed that the scheme would have negligible impact on safety and hence did not assess the safety impact of the scheme. AST reported that whilst the scheme would reduce the shunt type accidents, additional accidents would be introduced at the merge of A55 (E) resulting in the net impact being negligible. It was considered useful to undertake an initial evaluation of accident savings accrued post opening.

It is usual for accident savings to be evaluated at least three years after opening in order to get a fair reflection of the accident changes in the vicinity of the scheme. Therefore this evaluation should be considered to be an initial view based upon 23 months of available data.

*Basis for Evaluation:*

Accident information from 1995 to April 2005 was used to assess the impact of the scheme on safety. The scheme was opened to traffic in June 2003. Therefore, accident information from 1995 to May 2003 was used to assess the pre-opening accidents and the information for 23 months (from June 2003 to April 2005) was used to estimate the post-opening average accidents per year.

Accidents which were beyond the scheme and not related directly to the scheme were excluded from the analysis. Therefore analysis focussed on accidents on A483 (N) from Chester, A55 (E) to Manchester and the turning path for A483 traffic from Chester to A55 eastbound. Table C1 summarises the relevant accidents.

**Table C1 – Selected Accidents on the A419**

Year	Slight	Serious	Fatal	Total
1995	1	0	0	1
1996	1	0	0	1
1997	3	0	0	3
1998	1	0	0	1
1999	1	0	0	1
2000	0	0	0	0
2001	0	0	0	0
2002	1	0	0	1
January to May 2003	2	0	0	2
<b>Pre-Opening (101 months)</b>	<b>10</b>	<b>0</b>	<b>0</b>	<b>10</b>
<b>Pre-Opening accidents per year</b>				<b>1.19</b>
June to December 2003	1	0	0	1
2004	4	0	0	4
January to April 2005	0	0	0	0
<b>Post Opening (23 months)</b>	<b>5</b>	<b>0</b>	<b>0</b>	<b>5</b>
<b>Post-Opening accidents per year</b>				<b>2.61</b>

*A55/A483 Junction Improvement Scheme: Segregated left turn from A483(N) to A55(E)*

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From Table C1 it can be seen that there were five accidents in around 23 months of post opening of the scheme. The comparison of accidents per year for the pre and the post scheme opening scenario shows an increase of around 1.42 accidents per year (from the pre-opening accidents of 1.19 per year to 2.61 accidents per year for the post-opening scenario).

#### *Accident Severity*

All pre and post opening reported accidents relevant to the scheme are slight in severity. Accident records shows that whilst pre-opening accidents were mainly shunt type; the post opening accidents are mainly due to collisions while entering the slip road from A483 (N) to A55 (E) or while merging with A55 Eastbound. Therefore it could be argued that the scheme has not only resulted in an increase in accidents per year but had also changed the cause of accidents, although this will need to be examined in greater detail in future.

The main points to note from the safety section are:

- ◆ Evaluation shows that between 1995 and May 2003 around 10 accidents occurred in the 101 months pre opening period, which gives an approximate of 1.19 accidents per year;
- ◆ Consequential to the scheme there were five accidents in the 23 months period post scheme opening which is around 2.61 accidents in the opening year. The scheme has thus resulted in an increase of around 1.4 accidents a year; and
- ◆ There are some accident disbenefits from the scheme and thus the assumption that the scheme would have a negligible impact on safety in the PAR assessment does not seem to hold true.

## **Appendix D – Original Scheme AST**

**Original AST**

Option SEGREGATED LEFT TURN LANE		Road No. and Project Name A55 / A483 JUNCTION IMPROVEMENT SCHEME	Current Cost £1.095m	
OBJECTIVES	SUB-OBJECTIVE	QUALITATIVE IMPACTS	QUANTITATIVE MEASURE	ASSESSMENT
ENVIRONMENT	Noise	Not Assessed	Not Assessed	Not Applicable
	Local air quality	Not Assessed	Not Assessed	Not Applicable
	Greenhouse Gases	Not Assessed	Not Assessed	Not Applicable
	Landscape	Not Assessed	Not Assessed	Not Applicable
	Townscape	Not Assessed	Not Assessed	Not Applicable
	Heritage of Historic Resources	Not Assessed	Not Assessed	Not Applicable
	Biodiversity	Not Assessed	Not Assessed	Not Applicable
	Water Environment	Not Assessed	Not Assessed	Not Applicable
	Physical Fitness	Not Assessed	Not Assessed	Not Applicable
	Journey Ambience	Not Assessed	Not Assessed	Not Assessed
SAFETY	Accidents	No impact-shunt type accidents at the roundabout approach will be reduced, but additional accidents will be introduced at the merge on the slip road. Assumed net impact is negligible.	0 accidents saved	PVB £0 <i>Neutral</i>
	Security	Not Assessed	Not Assessed	Not Applicable
ECONOMY	Transport Economic Efficiency	Reduction in delays from the A483 approach to the junction from Chester, particularly in the PM peak period, due to approximately 50% of the traffic using the left turn lane.	£28,729 vehicle hours saved in opening year	Users: NPV £4.43m Private providers: NPV n/a Public Providers: NPV n/a Other Government: NPV n/a
	Reliability	Not Assessed	Not Assessed	Not applicable
	Wider Economic Impacts	Not Assessed	Not Assessed	Not applicable
ACCESSIBILITY	Option Values	Not Assessed	Not Assessed	Not Applicable
	Access to public transport	Not Assessed	Not Assessed	Not Applicable
	Access to the Transport System	Not Assessed	Not Assessed	Not Applicable
INTEGRATION	Transport Interchange	Not Assessed	Not Assessed	Not Applicable
	Land-Use Policy	Not Assessed	Not Assessed	Not Applicable
	Other Government Policies	Not Assessed	Not Assessed	Not Applicable

Note: This Table reproduces the AST of the PAR document, all costs and benefits are in 1998 prices, discounted to 1998 at 6%.

## **Appendix E – Atkins EST**

**Atkins EST**

Option SEGREGATED LEFT TURN LANE		Road No. and Project Name A55 / A483 JUNCTION IMPROVEMENT SCHEME		Current Cost £0.936m
OBJECTIVES	SUB-OBJECTIVE	QUALITATIVE IMPACTS	QUANTITATIVE MEASURE	ASSESSMENT
ENVIRONMENT	Noise	Not Assessed	Not Assessed	Not Applicable
	Local air quality	Not Assessed	Not Assessed	Not Applicable
	Greenhouse Gases	Not Assessed	Not Assessed	Not Applicable
	Landscape	Some Plantation along the slip lane observed	Not Assessed	Slight beneficial
	Townscape	Not Assessed	Not Assessed	Not Applicable
	Heritage of Historic Resources	Not Assessed	Not Assessed	Not Applicable
	Biodiversity	Not Assessed	Not Assessed	Not Applicable
	Water Environment	Not Assessed	Not Assessed	Not Applicable
	Physical Fitness	Not Assessed	Not Assessed	Not Applicable
	Journey Ambience	Not Assessed	Not Assessed	Not Assessed
SAFETY	Accidents	No impact-shunt type accidents at the roundabout approach will be reduced, but additional accidents will be introduced at the merge on the slip road. Assumed net impact is negligible.  The assumption of change in nature of accidents is as predicted but the evaluation shows that the scheme would have some adverse effect on safety	Increase in around:  1.4 accidents per year- Opening year; 40 or 45 accidents -30year assessment period for low or high forecasts	PVB - £0.090m Opening year -£1.491m Assessment period  Adverse
	Security	Not Assessed	Not Assessed	Not Applicable
ECONOMY	Transport Economic Efficiency	Reduction in delays from the A483 approach to the junction from Chester, particularly in the PM peak period, due to approximately 50% of the traffic using the left turn lane.  The delays have reduced from A483	£22,482 vehicle hours saved in opening year	Users: NPV £1.72m Private providers: NPV n/a Public Providers: NPV n/a Other Government: NPV n/a
	Reliability	Not Assessed	Not Assessed	Not applicable
	Wider Economic Impacts	Not Assessed	Not Assessed	Not applicable
ACCESSIBILITY	Option Values	Not Assessed	Not Assessed	Not Applicable
	Access to public transport	Bus stop observed just before the slip road indicating that access to public transport has not been affected	Not Assessed	Neutral
INTEGRATION	Access to the Transport System	Not Assessed	Not Assessed	Not Applicable
	Transport Interchange	Not Assessed	Not Assessed	Not Applicable
	Land-Use Policy	Not Assessed	Not Assessed	Not Applicable
	Other Government Policies	Not Assessed	Not Assessed	Not Applicable

All costs and benefits are in 1998 prices discounted to 1998 at 6%