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HIGHWAYS AGENCY

LNMS EVALUATION REPORT

M5 Junction 31 – Main Line Lane Drop at Parallel Diverge (Capacity Improvement)

February 2006

ATKINS

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1. Introduction

BACKGROUND

The Scheme

1.1 The M5 Junction 31 Main Line Lane Drop at Parallel Diverge (capacity improvement) opened on 13th March 2003. The scheme provided an additional lane changing the number of lanes from 3 to 4 in order to provide a main line lane drop at parallel diverge layout for the west bound carriageway.

1.2 Figure 1.1 shows the location of the scheme.

Figure 1.1 – M5 Junction 31 Capacity Improvement

1.3 Figure 1.1 shows that junction 31 lies just to the south of Exeter at the terminus of the M5. Figure 1.2 shows the location of the completed scheme in more detail.

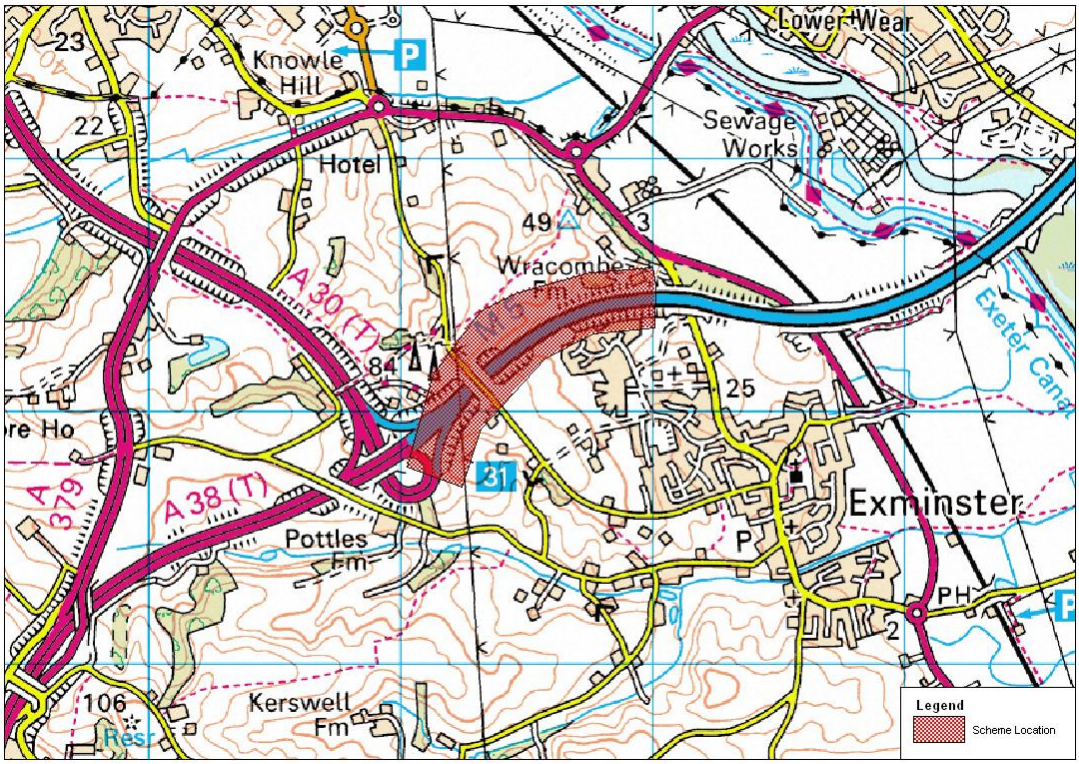

Figure 1.2 – M5 Junction 31 Capacity Improvement

1.4 Figure 1.2 shows that the new scheme is where the southbound M5 diverges into the A30 and the A38. The A38 is the main route to Plymouth and south Devon, whilst the A30 is the main route to North Devon and Cornwall.

Original PAR Document

1.5 The PAR was produced by consultant Mott McDonald with a date of last update being May 2002. The information provided to Atkins under this study comprised of a Tender stage PAR that included no worksheets and no AST. No further information was forthcoming.

SCHEME OBJECTIVES

1.6 The primary problem identified within the PAR was the low capacity of the single lane diverge to the A30. This resulted in traffic queuing on the M5 in lane 1; consequently vehicles not wishing to exit for the A30 were inadvertently joining this queue when out of sight of the junction. A high potential for accidents was evident caused by vehicles attempting to leave this queue or by vehicles trying to join this queue part way along.

1.7 The scheme set out to mitigate this problem by providing additional capacity for traffic diverging onto the A30 by provision of a four lane section with main line lane drop at parallel diverge. The four lane carriageway is configured as two lanes for the A30 and two for through traffic (A38). In addition improved lane and direction signs will improve traffic flow through the junction.

1.8 Figure 1.3 shows the new lane configuration of the scheme.

Figure 1.3 – Diverge at M5 Junction 31 (Friday 27th Aug)

1.9 From Figure 1.3 the two nearside lanes diverge to the A30 and the outside two lanes form the A38 westbound.

PURPOSE OF THE REPORT

1.10 The Highways Agency has a requirement to carry out the re-evaluation 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 represents the LNMS evaluation report for the M5 Junction 31 capacity improvement. This report has been prepared as part of the Post Opening Project Evaluation (POPE) Commission.

1.12 This report will initially undertake an assessment of the 'physical' impact of the scheme, namely:

- A comparison of the 'Before' and 'After' traffic volumes on the M5 to illustrate how traffic volumes have changed since the opening of the scheme;

- A comparison of 'Before' and 'After' journey times to illustrate how journey times have changed since the opening of the safety improvements; 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 as predicted since the opening of the scheme.

1.13 This is in turn followed 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 PAR2 (1994 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.

1.14 Following this introduction the report has been divided into five 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 volume and journey time changes attributable to the M5 Junction 31 Capacity Improvement;
- Section 4 presents an assessment of predicted and outturn economic benefits using the POPE journey time methodology;
- Section 5 presents the original Appraisal Summary Table (AST) for the M5 Junction 31 capacity improvement, and then re-evaluates these predictions with an Evaluation Summary Table (EST); and
- Section 6 summarises the main conclusions from the evaluations and the limitations to use.

1.15 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:

- Traffic Counts;
- VISSIM (Micro-simulation software); and
- Accident data.

2.2 Atkins has been unable to obtain this pre information from the consultants who produced the PAR as were informed that this data was unavailable.

AFTER SURVEYS

2.3 In the course of undertaking the LNM evaluation of the scheme, the following data was utilised:

- Automatic Traffic Counts from Traffic Monitoring South;
- Journey Time Data from Survey undertaken by Atkins on Friday 27th of August; and
- Accident Data from the Managing Agent.

Automatic Traffic Counts

2.4 Traffic data was obtained from Highways Agency permanent count sites, namely;

- Site 4561 - M5 Junction 31 SB Offslip;
- Site 5037 – M5 Junction 31 to 30 NB;
- Site 5038 – M5 Junction 30 to 31 SB;
- Site 4563 – M5 Junction 31 Main Carriageway after Offslip SB;

2.5 The data was requested from July 1998 – September 2004 with the following data received

- Site 4561 - M5 Junction 31 SB Offslip - 1998 to 2003;
- Site 5037 – M5 Junction 31 to 30 NB - 2000 to 2004;
- Site 5038 – M5 Junction 30 to 31 SB - 2000 to 2004;
- Site 4563 – M5 Junction 31 Main Carriageway after Offslip SB - 1998 to 2004;

Journey Time Surveys

2.6 Traffic counts were used to inform on the timing of the journey time surveys. For the purposes of this evaluation we needed to undertake journey time surveys during the busiest periods as there would be greater propensity for queuing, if queuing would still occur.

2.7 The traffic count data was interrogated to ascertain when the peak period of traffic on this stretch of route occurred. From the data it was apparent that the Friday and Saturday of the August bank holiday weekend was the busiest period of flow along this route. It was also observed that the peak hour flows on this stretch were between 4PM and 7PM.

2.8 Therefore, as a result of the analysis of the count data, Atkins undertook new journey time surveys on Friday 27th August 2004, between 4pm and 7pm.

2.9 Thirteen 'in vehicle' journey time runs were undertaken with the start of the journey time runs being the merge onto junction 30 and the end timing point being the diverge at junction 31.

Accident Data

2.10 Accident data was obtained for the period 1999 to 2003 from the local managing agent.

3. Scheme Impact

OVERVIEW

3.1 This section provides details of the outturn safety and traffic impacts of the scheme.

SAFETY

3.2 The original PAR forecast a slight beneficial impact from the scheme in terms of safety, however no quantification was presented of this accident saving.

3.3 In order to undertake an assessment of the impact of the scheme Atkins obtained accident information for the five year period 1999 to 2003 comprising of 51 months of pre-opening data, and 9-months of data since the scheme opening. The study area covered by this data included the junction together with the preceding four mile approach on the M5 south-west bound. A summary of this data is presented in Table 3.1.

Table 3.1 – Pre and Post Opening

Time Period	Slight	Serious	Total
1999	6	2	8
2000	6	3	9
2001	9	-	9
2002	8	-	8
2003 PRE	2	-	2
2003 POST	6	-	6
51 Months Pre Opening	25	5	31 (0.608 acc per month)
9 Months Post Opening	6	-	6 (0.667 acc per month)

No Fatal Accidents occurred during the five year period

3.4 Table 3.1 illustrates that in the 51 months prior to the opening of the scheme the accident rate was 0.608 accidents per-month, compared to a post-opening rate of 0.667 per month. This shows that there is no evidence as yet of an accident benefit attributable to the scheme.

3.5 Further detail on the analysis of accident data for this scheme is presented in Annex A.

TRAFFIC FLOW AND JOURNEY TIMES

3.6 The principal impact of the scheme was forecast to be in regard to a reduction in vehicle delay caused by queuing traffic. The PAR assessment stated that the under then existing conditions the average delay to vehicles at peak times was 30 minutes. The PAR forecast that this delay would reduce to only four minutes following the completion of the scheme. No detailed methodology or data was available in the PAR document to determine how this assessment had been calculated.

3.7 In order to validate the journey time benefits from the scheme it was necessary to compare pre and post opening journey times over the same section of carriageway. Given the lack of data regarding the pre-opening assessment it was necessary to accept this information as being representative. Therefore in turn it was necessary to undertake a further journey time assessment in similar peak conditions.

3.8 It was determined that the delay related to peak conditions, principally those experienced under Bank Holiday traffic conditions. Analysis of available ATC data showed that the busiest traffic conditions on the south-west bound approach to this junction occurred on the Friday prior to the August Bank holiday. Consequently the post-opening journey time assessment for this junction was timetabled to coincide with this period.

3.9 The journey time data collection was undertaken on Friday 27th August 2005 in the period 15:30 to 19:00. In this period a total of 13 journey time runs were undertaken on a 3.27 mile approach to the junction with the final section of the route chosen alternating between the A38 and A30 diverge.

3.10 The results of this assessment provided an average journey time over the period of 3 minutes and 15 seconds. Evidence of general traffic conditions during the surveys confirmed that traffic conditions were good and that there were no occasions when traffic was stationary.

3.11 Further detail on the assessment of ATC data is presented in Annex B, while further detail on the journey time surveys is presented in Annex C.

4. POPE Methodology

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 and actual journey time benefits. The re-evaluation, termed the Post Opening Project Evaluation (POPE) methodology, uses observed outturn journey time and accident savings to provide an economic assessment of the performance of the scheme. This result is presented in the scheme EST and is expressed in same terms as the original evaluation (present value year of 1994, and discount rate of 6 per cent).

ACCIDENTS

4.2 The original Mott McDonald assessment stated that this junction does not have a poor accident record. By removing the long queues, traffic will neither have to exit or join a queue for the A30.

4.3 **The evaluation of the observed accident data both for the period before and for the period after the completion of the scheme show that there is no evidence of an accident benefit that can be associated with the scheme.**

JOURNEY TIME BENEFITS/DISBENEFITS

4.4 The assessment of journey time benefits was the key element of the economic evaluation of the scheme.

4.5 The PAR assessment of the scheme forecast an opening year saving of 81,467 hours. However it was unclear as to how this information was calculated. In an effort to better understand this assessment Atkins has re-worked the information based on the total opening year journey time benefit (81,467 hours) and the average saving per vehicle (26 minutes). This re-working of the information is presented in Table 4.1.

Table 4.1 – Journey Time Savings

Period	Pre Opening Journey Time (mins)	Post Opening Journey Time (mins)	Minutes saved	Vehicles that Receive Time Saving (vehs)	Total Minutes Saved in Opening Year	Total Hours Saved in Opening Year
Predicted	30	4	26	188,000	4,888,020	81,467
Actual	30	3.25	26.75	188,000	5,029,021	83,817

4.6 Table 4.1 shows that in the absence of the calculation detailing how the journey time saving was calculated Atkins calculated how many vehicles the 81,467 hour saving was based upon. Within the PAR it was stated that the pre opening journey time was

30 minutes and the post opening journey time was predicted to be 4 minutes, a saving of 26 minutes per vehicle. 81,467 hours equates to 4,888,020 minutes, which means that if every vehicle experiences a 26 minutes journey time saving then 188,000 vehicles equate to a saving of 81,467 hours.

4.7 Post opening it was observed that there was an average journey time of 3 minutes and 15 seconds, which means that there was a 26.75 minute saving per vehicle (30 – 3.25). If this was applied to the 188,000 vehicles (that was predicted will experience a saving in journey time) then 83,817 vehicle hours would be saved.

4.8 Table 4.2 displays these journey time savings converted into 30 year benefits.

Table 4.2 – POPE Comparison: Journey Time Benefits

	First Year Benefit (hours)	30 Year Benefit (£m) (Using PAR 2 Worksheet 9)
Original Mott McDonald	81,467	£8,888,267
POPE	83,164	£9,144,670

All costs and benefits are 1994 prices discounted to 1994 at 6%.

4.9 **Table 4.2 demonstrates that there has been a slightly higher benefit accrued than forecast. What is important is the time period across which the journey time savings have been claimed.** Given that the PM flow on the Friday before the August Bank Holiday peaked at 5,200 vehicles, it suggests that the forecast level of benefit would accrue in only 36 hours of similar traffic conditions. As a result of the highly seasonal flows as shown in Figure B1 of Annex B we can conclude that this level of benefit is only accrued over the months of July and August, and within these months flow is peaked on the Friday and Saturday of these months i.e. 8 Friday and 8 Saturday as shown in Figures B2 and B4. If we assume approximately a 2 hour peak per Friday and per Saturday then there would be a total of 32 peak hours in a given year which **suggested that the level of benefit attributed to the scheme appears to be a good estimation.**

SCHEME COST

4.10 The Total Current predicted Project Cost was £2.55m, excluding VAT (or £2.996m including VAT), at 2002 quarter 2 prices.

4.11 The estimated outturn cost (2003) of the scheme was £2,970,000 this was provided by the Project Sponsor. This figure includes preparation and site supervision but it is not clear whether this figure includes or excludes VAT.

4.12 Table 4.3 presents the conversion of the outturn cost to the present value year of 1994.

Table 4.3 – POPE Comparison: Conversion of Outturn Cost to Present Value Cost

	Cost (1)	RPI (2003) (2)	RPF (2003) (3)	RPI (1994) (4)	Discount Factor (2003) (5)	Present Value Cost ((4*3*1)/2)*5
Original PAR	£2,996,000	-	-	**-**	-	**£1,742,769**
Actual Outturn	£3,489,750	181.3	0.99	**144.1**	**0.592**	**£1,625,614**

All Costs are in 1994 prices discounted to 1994 at 6%.

4.13 **Table 4.3 demonstrates that the outturn scheme cost was 7% lower than forecast**

SUMMARY

4.14 Table 4.4 presents a summary of the original PAR and POPE economic evaluation of the scheme. It should be emphasised that the assessment is expressed in terms of 1994 prices, discounted to 1994 at 6 per cent, and that the methodology used is in accordance with PAR2.

Table 4.4 – POPE Comparison: Summary

	Original Mott McDonald	POPE
Accidents	-	-
VOC	-	-
Journey Time	£8,888,267	£9,144,670
PVB	£8,888,267	£9,144,670
PVC	£1,742,769	£1,625,614
NPV	£7,145,498	£7,519,056
BCR	5.1	5.63

All costs and benefits are 1994 prices discounted to 1994 at 6%.

4.15 **From Table 4.4 it can be seen that as a result of slightly greater than predicted journey time savings and a slightly less than predicted scheme cost then the PVB, NPV and BCR are all greater than expected.**

4.16 The main points to note are:

- The original evaluation slightly underestimated the journey time benefits, although a number of assumptions were made during the post opening calculations due to a lack of data; and,
- The outturn scheme cost was 7 per cent lower than forecast.

4.17 **Overall the scheme represents good value for money.**

5. Summary of Appraisal and Evaluation Summary Tables

INTRODUCTION

5.1 In order to fully evaluate the effects of the traffic safety measures scheme, Atkins has undertaken a review of the original PAR document prepared by Mott Mcdonald.

5.2 The Atkins review focused on the PAR document itself as no Appraisal Summary Table (AST) was included in the PAR document that Atkins received.

PAR DOCUMENT

5.3 The main points to note from the PAR document of the M5 Junction 31 – Main Line Lane Drop at Parallel Diverge are as follows:

Environment – Local Air Quality

5.4 Slight beneficial impact predicted in terms of local air quality. This was justified with the prediction that flowing traffic will reduce the pollution currently generated by slow moving queuing traffic.

Environment - Landscape

5.5 Slight adverse impact predicted in terms of landscape. This was justified with the statement that existing trees and vegetation will have to be removed from the highway to accommodate the widening.

Safety

5.6 Slight beneficial impact predicted in terms of safety. This was justified with the following statement. Although the junction does not have a poor accident record, by removing the long queues, traffic will neither have to exit or join a queue for the A30. This will therefore remove a potential cause of traffic accidents.

Economy – Journey times & Vehicle Operating Costs and Journey Time Reliability

5.7 Moderate beneficial impact in terms of journey times and vehicle operating costs predicted.

5.8 Moderate beneficial impact predicted in terms of journey time reliability.

5.9 These two predictions of moderately beneficial impacts were justified with the statement that by removing the queues, the time taken to travel through the section of the M5 between Junctions 30 and 31 currently subject to queues, is estimated to reduce from 30 minutes to 4 minutes. There was no direct statement with regard to journey time reliability.

5.10 It was predicted that 81,467 vehicle hours would be saved in the Opening Year.

5.11 All other effects are neutral.

Other Qualitative Impacts

5.12 The extended traffic queue lengths and time lost in queuing during peak traffic flows causes substantial delays to traffic movements through Junction 31 of the M5 motorway.

5.13 The M5 bifurcates at junction 31 to feed traffic onto the A30 and A38 trunk roads. These two trunk roads are the two main arterial routes into the south and west of Devon and Cornwall. Any serious traffic congestion on the M5 caused by traffic flow problems at junction 31 has a serious impact for the economies of this region.

5.14 Mott McDonald were contacted regarding the before work and stated the following "An amount of observation/survey was undertaken by the maintenance team at Sowton and this was used in conjunction with traffic modelling and VISSIM simulation to make an assessment of the likely suitability of the layout (now constructed). Again from memory the economic benefits in the PAR were only taken over a limited number of holiday period weekends. If this is the case, it is likely that the benefit assessment in the PAR was pessimistic, as it did not look at the benefits available over a full year through non peak periods and non holiday periods".

5.15 It was not possible to ascertain the traffic modelling, economic evaluation and VISSIM models for this junction.

APPRAISAL SUMMARY TABLE (AST)

5.16 We were unable to ascertain an AST for this scheme so the following section details what was included on the initial assessment form, included as part of the PAR. This form only details the prediction not the justification behind it. The justification was included elsewhere in the PAR document and was included above.

Environment

- Noise - Neutral
- Local Air Quality – Slight Beneficial
- Landscape – Slight Adverse
- Biodiversity – Neutral
- Heritage – Neutral
- Water – Neutral

Safety

- Slight Beneficial

Economy

- Journey times and vehicle operating costs – Moderate Beneficial.
- Cost – Substantial adverse.
- Journey time reliability – moderate beneficial.

- Regeneration – neutral.

Accessibility

- Accessibility Pedestrians and others – neutral.
- Accessibility – Access to public transport - neutral.
- Accessibility – Community Severance - neutral.

Integration

- Integration – neutral.

OUTTURN IMPACTS

5.17 Section three discussed the economy and safety impacts of the scheme. This section concentrates on the other three impacts included in the original PAR document, 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.

5.18 The assessments that follow are all subjective assessments from members of the evaluation team. A summary of the overall findings of Atkins post opening evaluation is presented in Annex D of this report.

5.19 The following reiterates the statements that accompanied these impacts before providing photographic evidence that the mitigating measures have been implemented.

Environment

Local Air Quality – flowing traffic will reduce the pollution generated by slow moving queuing traffic. Slight Beneficial.

5.20 As the previous section detailed the journey time between junction 30 and 31 in a southbound direction has reduced, in peak times, from 40 minutes (PAR prediction) to 3 minutes 15 seconds (Actual). No queues were observed on site during the journey time survey period.

5.21 As a result of no queuing being observed and journey time reducing drastically, during peak hours, then the slight beneficial impact given in the PAR is seen as a fair reflection. On the other hand, not mentioned in the PAR, is that an increase in speed will result in an increase in traffic noise but this was assessed as neutral in the PAR.

Landscape – existing trees and vegetation will have to be removed from the highway to accommodate the widening. Slight Adverse.

5.22 Figures 5.1 and 5.2 shows the scheme and the widened carriageway.

Figure 5.1 – Widened Carriageway

Figure 5.2 – Widened Carriageway

5.23 As the highway has indeed been widened to accommodate an extra lane then it has been assumed that the trees and vegetation were indeed removed and Mott Mcdonald's assessment of a slightly adverse impact is agreed with.

6. Summary of Conclusions

6.1 In summary, the main points to note from the Evaluation of the M5 Junction 31 Lane Drop at diverge are:

PAR Document and Associated Data

6.2 The evaluation was limited due to limited information available in the PAR (**NO AST**) and the associated data not being provided.

Safety

6.3 Accident descriptions identified that 9 accidents pre opening and 1 accidents post opening were caused by queuing. This equates to an accident saving of 0.8 accidents a year;

6.4 Accident severity has reduced as a result of the scheme but this is only based on 9 months of post opening data; and

6.5 In examination of total accidents (those associated with merge + other) 0.608 accidents per month pre opening (51 months) and 0.667 accidents per month post opening (9 months) were attributable to the scheme.

6.6 The PAR predicted that the scheme would remove the cause of accidents which in this case is queuing. From site observations on the day of the highest throughput of vehicles in a year it is apparent that this is true, there is no queuing. Therefore the scheme could be assumed to have delivered the slight benefit as predicted. But this will become more apparent in the future when more time has passed since scheme opening and a more comprehensive evaluation can be undertaken.

Traffic Flow

6.7 Traffic peaked heavily during the summer months with traffic approximately 75% higher during August than January;

6.8 Traffic is at its greatest in August, with traffic on a Friday and Saturday approximately a third higher than all other days in the month;

6.9 The highest flows of the year occur on the Friday and Saturday of the August bank holiday weekend with peak flows occurring between 4PM and 7PM;

Journey Times

6.10 Atkins undertook Journey time surveys on Friday 27th August 2004 (Bank Holiday weekend);

6.11 As our journey time surveys encapsulated the three highest peak hours at the junction (4PM – 7PM) we would have expected queuing to occur if the scheme had not mitigated the problem; however, no queuing occurred. Consequently, the scheme can be judged as a success;

6.12 Average post journey times of 3 minutes 15 seconds for the whole carriageway, 3 minutes 9 seconds diverging to the A38 and 3 minutes 23 seconds diverging to the A30 has been observed. These compare to a 30 minute journey time pre opening; and

6.13 Pre opening there was an average speed of 7 mph over this section, which was predicted to increase to 49 mph post opening. Observed post opening speeds have actually increased to 62 mph.

Economy

6.14 The scheme delivered a saving of 83,164 hours which is slightly greater than that predicted 81,467. It should be noted that this is based on a number of assumptions due to the lack of pre information.

Environment

6.15 The scheme has delivered benefits in local air quality as predicted.

Accessibility

6.16 No predictions were made hence no evaluation was undertaken.

Integration

6.17 No predictions were made hence no evaluation was undertaken.

Economic Evaluation

6.18 The scheme delivered more journey time benefit than predicted, with £9,144,670 over 30 years compared to £8,888,267 predicted pre opening (1994 values and prices discounted to 1994).

6.19 The scheme was delivered for slightly less cost than predicted, with a PVC of £1,625,614 compared to £1,742,769 (1994 values and prices discounted to 1994).

6.20 As a result of the slightly greater journey time benefits than predicted and slightly less scheme costs, the scheme delivers a BCR of 5.63 compared to 5.10.

6.21 It is considered that 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.

Observations

6.22 Before the improvements to this junction, the problems caused by the diverging arrangement were seen as a major problem on the route into Devon and Cornwall. This was perceived to have a negative impact on the economies of the region by putting off some people from visiting. The new scheme has alleviated any queuing that occurs and therefore this perceived barrier to the region has now been removed.

Overall

6.23 Overall the scheme is judged to have been a success.

Annex A –Analysis of Accident Data

Safety

The original Mott McDonald PAR predicted a slight beneficial impact in terms of safety although no quantification of the scale of the accident benefit was undertaken. No worksheet was completed for safety. As a result of no worksheet and no more information forthcoming we have undertaken both pre and post opening accident evaluation to establish whether the scheme has provided benefits and as a result could be assessed to be slight beneficial.

Atkins obtained accident data from the managing agent for the five year period of 1999 to 2003 and have examined both pre and post accidents in the vicinity of the scheme. The purpose of this assessment was to see if the scheme has provided an accident benefit by removing a cause of traffic accidents, queuing. This period includes 51 months of pre opening data and 9 months of post opening data. It should be noted that some of the pre data may be affected during the construction period.

It is usual for accident savings to be evaluated at least three years after opening in order to get a fair reflection in the number of accidents and as a result this scheme evaluation should be taken as a preliminary evaluation of the accidents.

The PAR document states that the junction has a poor accident record and by removing the queues, traffic will neither have to exit or join a queue for the A30 and therefore as a result this will therefore remove a potential cause of traffic accidents. As detailed later in this report the route is no longer subject to queuing, hence if the PAR statement is used for evaluation purposes we can conclude that the new scheme has removed a potential cause of traffic accidents by removing queuing vehicles.

For the purposes of the evaluation the accident data was interrogated so that only accidents on the southbound carriageway and up to 4 miles away from the junction on the proceeding carriageway were used. It was assumed that any pre opening queuing caused by the diverge arrangement at Junction 31 would be covered by the 4 mile catchment.

Table A1 details the selected accidents.

Table A1 – Pre and Post Opening

Time Period	Slight	Serious	Total
1999	6	2	8
2000	6	3	9
2001	9	-	9
2002	8	-	8
2003 PRE	2	-	2
2003 POST	6	-	6
51 Months Pre Opening	25	5	31 (0.608 acc per month)
9 Months Post Opening	6	-	6 (0.667 acc per month)

No Fatal Accidents occurred during the five year period

From Table A1 it appears that the number of accidents has increased marginally post opening when compared with pre opening, but as this is only based on 9 months of data no firm conclusion can be drawn.

The same can be inferred of severity, with 5 accidents pre opening being of a severity greater than slight whilst post opening there were no accidents with a severity of greater than slight. Therefore it could be argued that the scheme has reduced accident severity.

Figure A1 shows pre and post opening accidents in the vicinity of Junction 31.

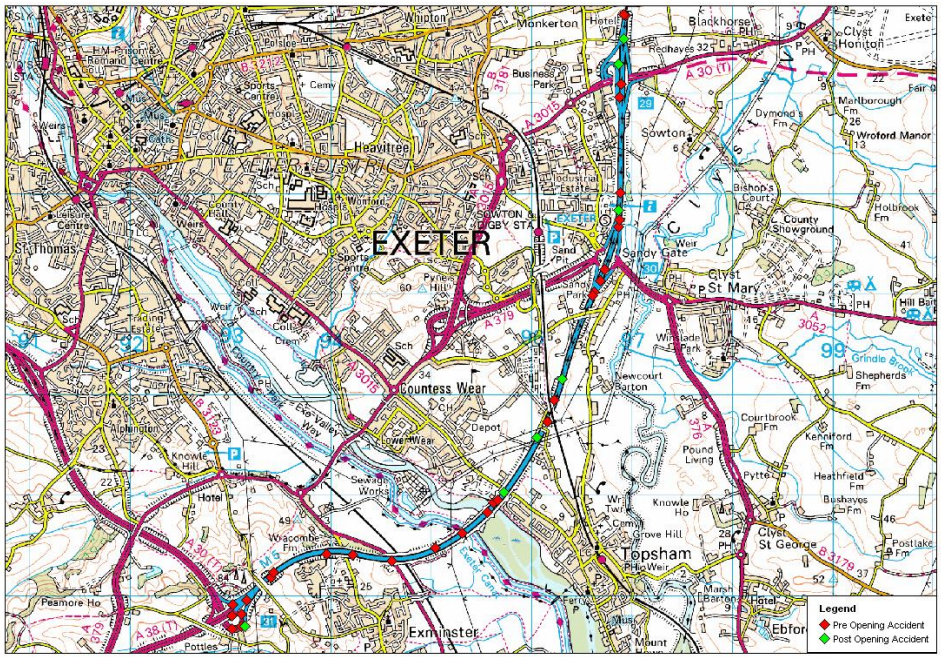

Figure A1 – Pre and Post Opening Accident Data

No firm conclusions can be drawn from examining the accident locations as shown in Figure A1.

Analysis of Accident Descriptions

The accident data was interrogated to see which accidents were related to queuing traffic as one of the objectives of the scheme was to remove queuing traffic as a cause of accidents. It should be noted that the accident descriptions could be fairly arbitrary and therefore difficult to interpret.

All accidents that were associated with slowing traffic or an inadvertent change in lanes were assumed to be associated with queuing traffic. It was also assumed that the queuing traffic was associated with the scheme.

It was identified that 9 accidents that occurred in the pre opening period could have been caused by queuing traffic and 1 accident in the 9 months post opening could have been caused by queuing traffic. The following describes one of the pre opening accidents

> *ALL VEHS TRAVELING IN THE SAME DIR, VEH2,3,4 ALL SLOW DUE TO TRAFFIC IN FRONT, VEH1 FAILS TO STOP COLLIDES WITH VEH3 WHICH GOES INTO VEH2 THEN VEH4*

This equates to 0.176 accidents a month pre opening and 0.111 accidents a month post opening, an accident saving of 0.8 accidents a year.

The main points to note from the safety section are:

- Scheme has removed queuing (identified later) so has removed a potential cause of accidents;
- Accident descriptions identified that 9 accidents pre opening and 1 accidents post opening were caused by queuing. This equates to an accident saving of 0.8 accidents a year;
- Accident severity has reduced as a result of the scheme but this is only based on 9 months of post opening data; and
- 0.608 accidents per month pre opening (51 months) and 0.667 accidents per month post opening (9 months).

Annex B –Analysis of Traffic Flow Data

Traffic Flow Analysis

Traffic flow data was obtained from the Highways Agency permanent monitoring sites.

Pre Survey Flows

Figure B1 shows the monthly average daily traffic between January 2001 and August 2004. The A38 data is taken from count site 4563 (M5 after M5 Junction 31 diverge) and the A30 data is taken from count site 5038 (A30 diverge from M5 junction 31).

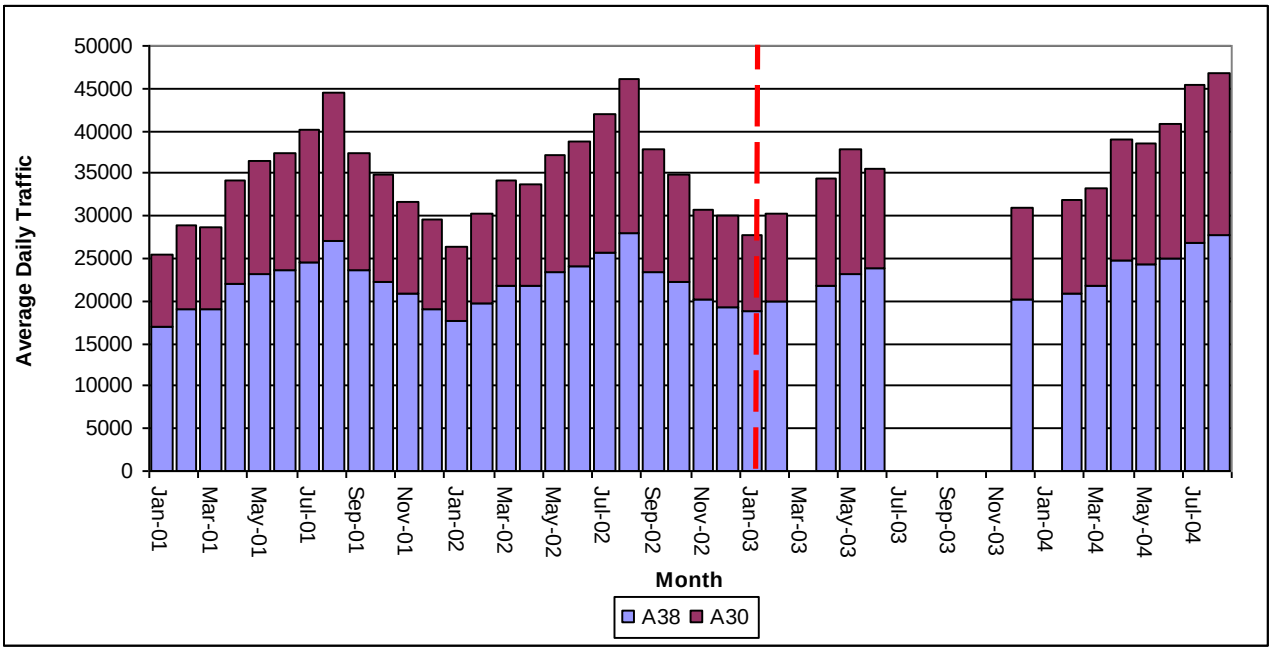

Figure B1 – Monthly Average Daily Traffic at the A30/A38 Diverge

Data from the March 2003, July 2003, August 2003, September 2003, October 2003, November 2003 and January 2004 are incomplete or missing.

Figure B1 shows that the traffic is heavily peaked during the summer months, this is to be expected as this is the main route into Devon and Cornwall, which are renowned holiday destinations. For example comparing August 2002 to January 2002 there are approximately on average 20,000 more vehicles passing through the junction in August 2002 than January 2002. This equates to approximate 75% more vehicles in August than January.

Due to the lack of data it is hard to conclude from Figure B1 whether since the scheme opened in March 2003 that there has been any marked increase in the flow of traffic through the junction.

Figure B1 shows that the highest peak flows occurs during the month of August. Figure B2 shows a daily flow profile during the month of August 2002.

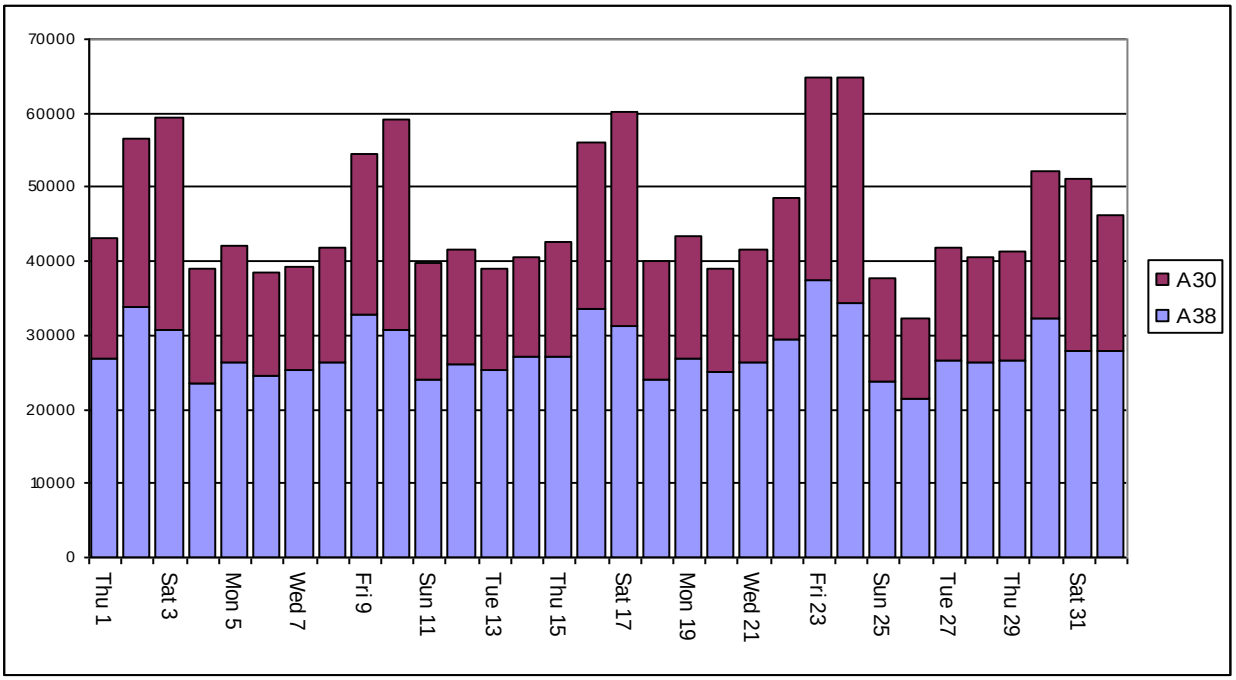

Figure B2 – August 2002 Daily Traffic Flow

From Figure B2 it is apparent that the highest flows occurred on Friday 23rd and Saturday 24th of August. This is the Friday and Saturday before the bank holiday weekend and was, as a result, used for the day of our journey time surveys in 2004 (Friday 27th August 2004). (Unfortunately data was incomplete for August 2003).

Figure B3 details the flows on the Friday before the August bank holiday weekend for 1998 to 2002.

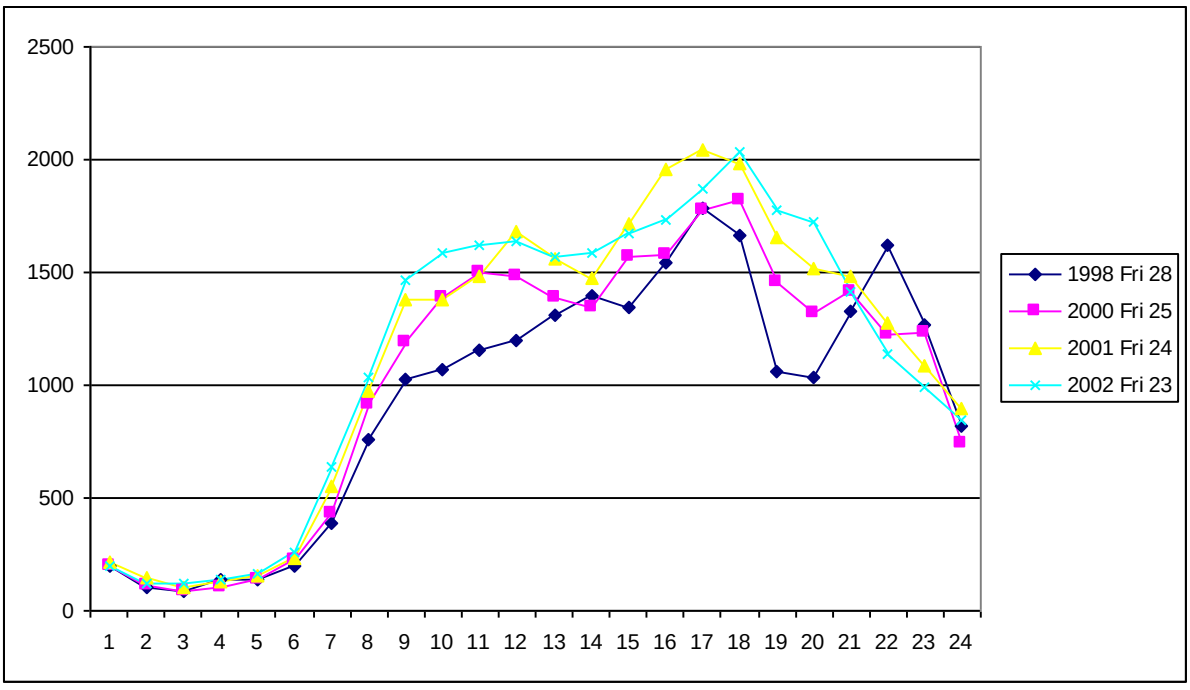

Figure B3 – Friday before August Bank Holiday Weekend Traffic Profiles

From Figure B3 it is apparent that the peak period for traffic flow is between the hours of 4PM and 7PM. Hence these were the hours used for the survey on Friday 27th August 2004.

Post Survey Flows

Traffic flow information was obtained from Traffic Monitoring South to encompass our survey day; this section displays the flows from this period.

Figure B4 details average daily traffic flows including August 2004. From examination of the graph it is apparent that the amount of flow has remained reasonably constant between August 2002 and August 2004.

Figure B4 details the flows at the M5 Junction 31 junction SB for August 2004.

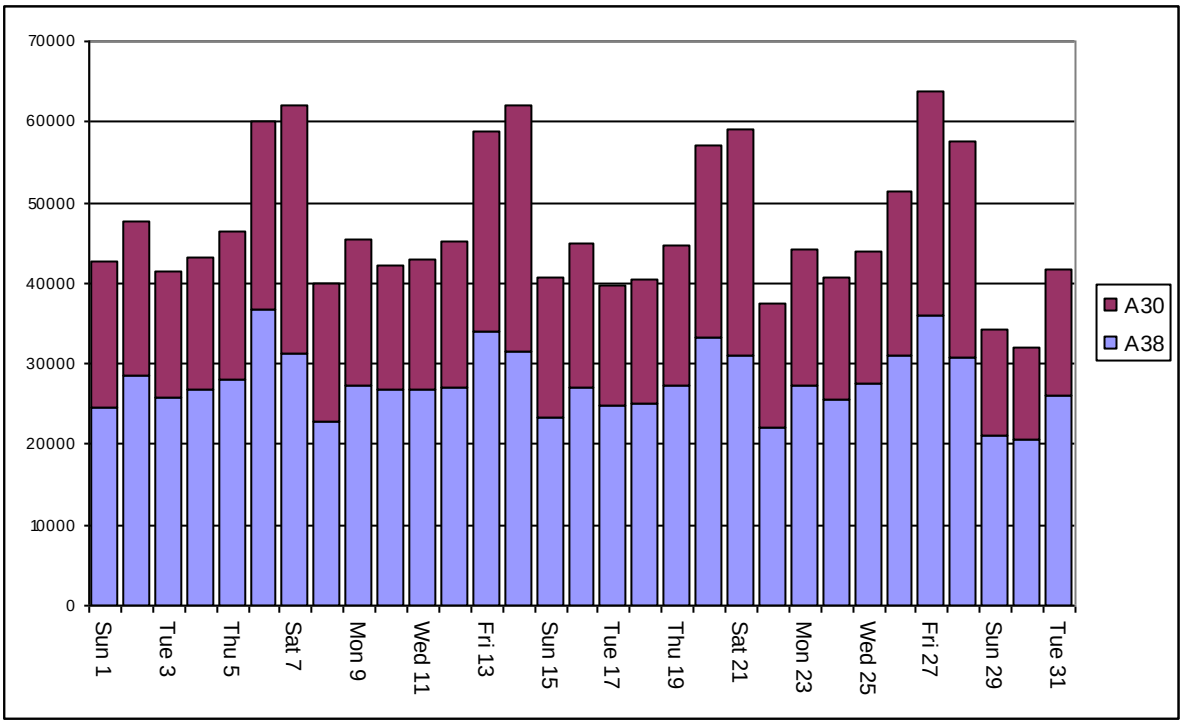

Figure B4 – August 2004 Daily Traffic Flows at M5 Jct 31

Figure B4 shows that the day with the highest vehicle flow was Friday 27th August 2004. Hence it shows that the survey day was representative of a day when the highest flows occur along the route.

Figure B5 shows the hourly flow profile along the route at the M5 junction 31 diverge.

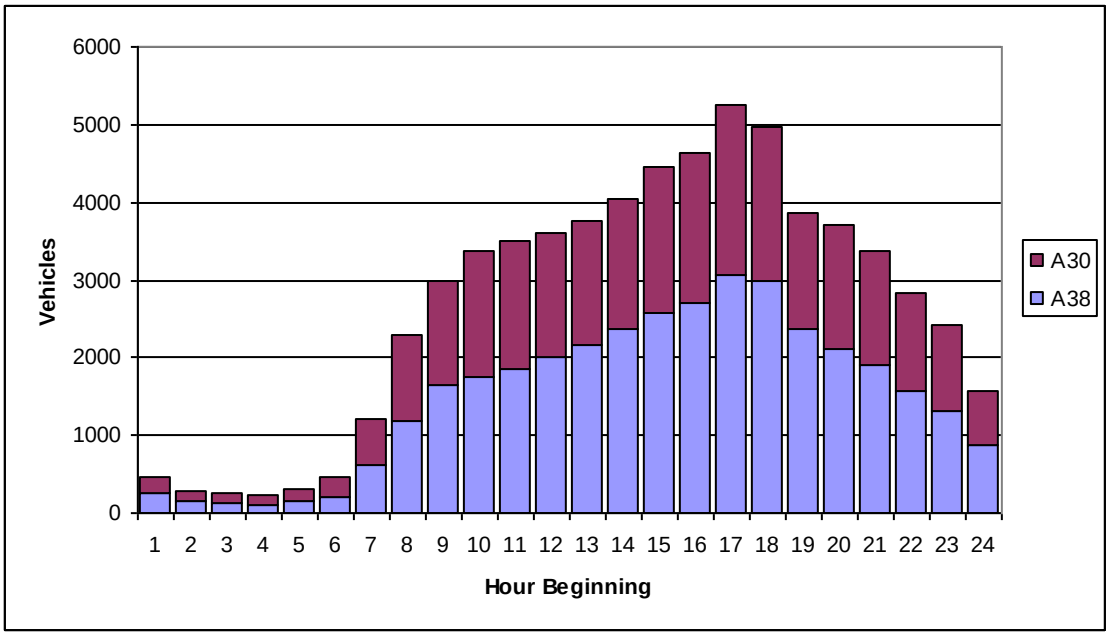

Figure B5 – Hourly Flow Profile on 27/08/04 at M5 Jct 31

From Figure B5 it is apparent that the peak hour flow falls between 17:00 and 18:00, our hours of survey were from 16:00 to 19:00 which were when the three highest hours in terms of traffic flow.

Figure B6 shows a comparison between the flows for the Friday before the August bank holiday weekend in 2002 and 2004.

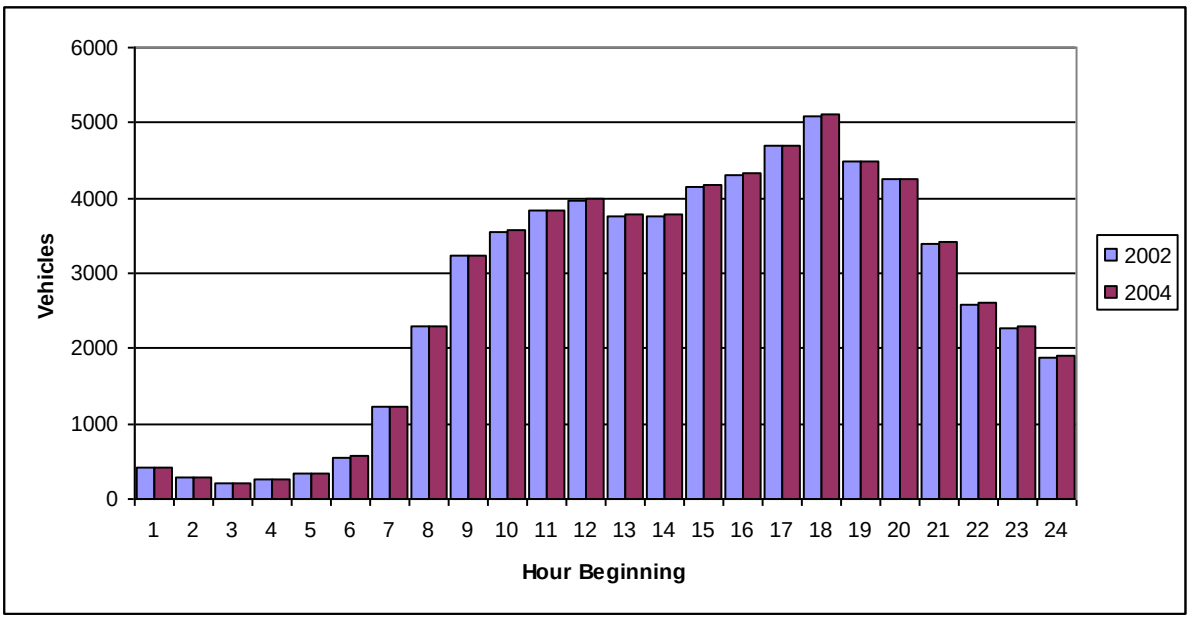

Figure B6 – Friday before August Bank Holiday in 2002 and 2004

From Figure B6 it is apparent that the flows follow a remarkably similar profile and that there hasn't been an significant increase in the amount of throughput of the junction both before and after opening.

The main points to note from the traffic flow section are:

- Two Highways Agency Monitoring Sites counts were amalgamated to give a total flow diverging. A38 – Site 4563 A30 – Site 5038;
- Traffic heavily peaked during the summer months with traffic approximately 75% higher during August than January;
- Traffic is heavily peaked during the summer months which is to be expected as this junction is a key point for tourists in their routes into Devon and Cornwall. A38 Plymouth and South Devon and A30 North Devon and Cornwall;
- August is where traffic is at its greatest with traffic on a Friday and Saturday in August approximately a third higher than all other days in August;
- The highest flows of the year occur on the Friday and Saturday of the August bank holiday weekend with peak flows occurring between 4PM and 7PM; and
- The Friday before the August bank holiday weekend had a remarkably similar (almost identical) flow profile in 2002 and 2004 (2003 data was incomplete).

Annex C –Analysis of Journey Time Data

Mott McDonald in their PAR stated that by removing the queues, the time taken to travel through the section of the M5 between junctions 30 and 31, that is currently subject to queues is estimated to reduce from 30 minutes to 4 minutes.

On worksheet 9 of the PAR document it is predicted that 81,467 vehicle hours will be saved in the opening year. If each vehicle saves 26 minutes then we can estimate that 188,000 vehicles will experience the journey time saving.

From the lack of pre information the most complete Post opening evaluation that we could undertake was to visit the scheme on its busiest day to see whether or not there was queuing and establish how long it would take to travel between junctions 30 and 31.

From examination of yearly and monthly count data (Figure B1 and B2) it was ascertained that the busiest days of the year were the Friday and Saturday of the August bank holiday weekend and the busiest time. Therefore the site visit and journey time surveys were programmed for 27th August 2004. Post survey counts verified this information that 27th August 2004 was the day where there were the highest flows along this route.

From the count data (Figure B4) it was apparent that the peak periods during the Friday before the August bank holiday weekend fell between the hours of 4PM and 7PM and as a result this was when the journey time surveys were undertaken.

The journey time surveys had a start point of the end of the merge from junction 30 (southbound direction) and finished at the back of the nose of the A30 diverge at junction 31. Figure C1 shows the journey time route.

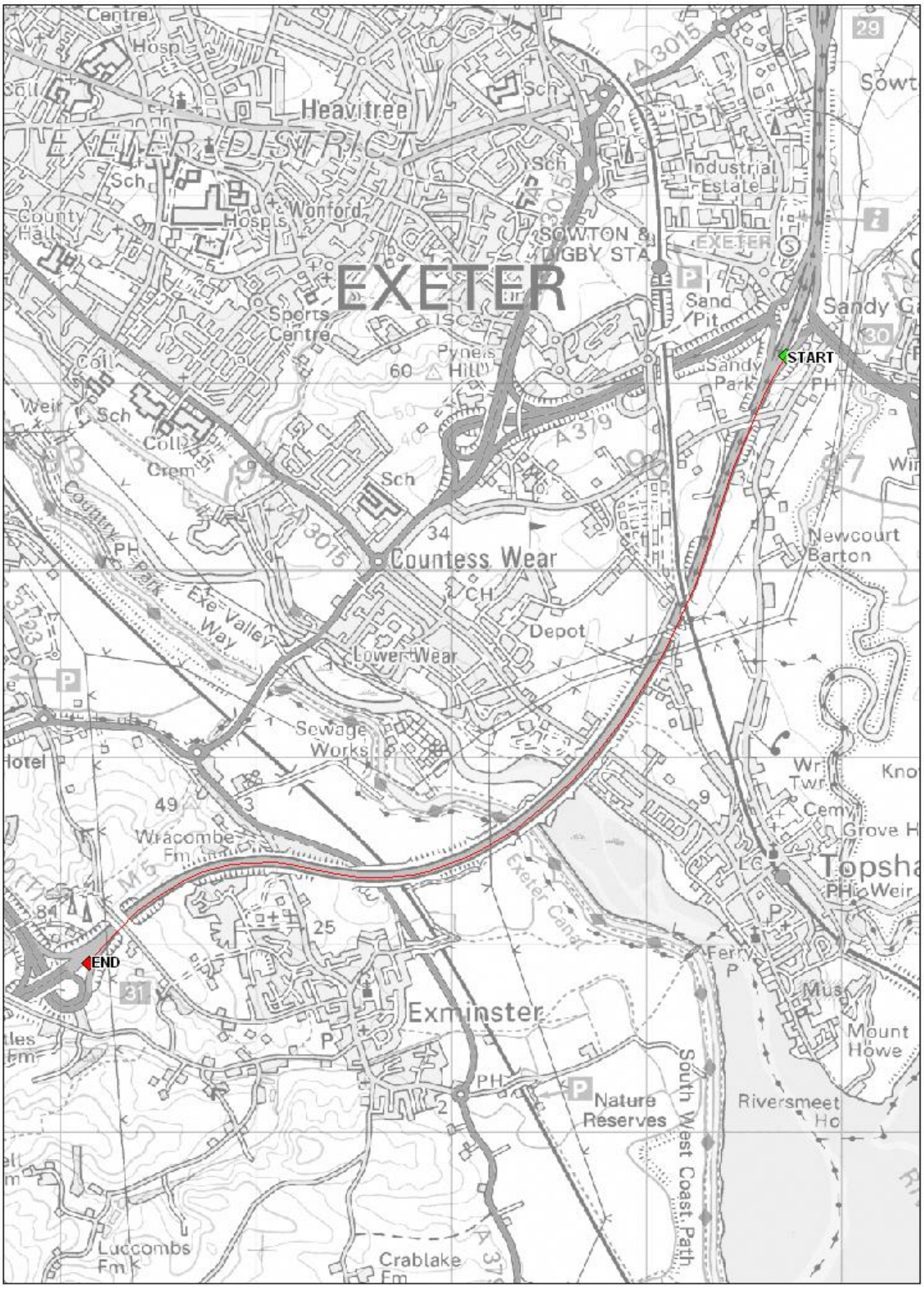

Figure C1 – Journey Time Survey

In order to get a fair representation of journey times the lanes used for each survey run were alternated so approximately that half of the surveys were undertaken on the A30 diverge and half

were undertaken on the A38 diverge. The moving observer method was adhered to where possible.

Table C1 shows the journey time runs undertaken on Friday 27th August 2004. There was no queuing during the survey period and the weather was fine.

Table C1 – Journey Time Runs

Start Time	A30 or A38	Time of Run
15:35	A38	3 mins 36 secs
15:49	A30	3 mins 53 secs
16:07	A38	3 mins 2 secs
16:21	A30	3 mins 24 secs
16:39	A38	2 mins 56 secs
16:52	A30	3 mins 28 secs
17:10	A38	3 mins 19 secs
17:20	A30	3 mins 14 secs
17:51	A38	3 mins 2 secs
18:03	A30	2 mins 52 secs
18:18	A38	3 mins 17 secs
18:31	A30	3 mins 28 secs
18:44	A38	2 mins 55 secs
A38 Average	-	3 mins 9 secs
A30 Average	-	3 mins 23 secs
Total Average	-	3 mins 15 secs

As can be seen from Table C1 the A38 average journey time was 3 minutes and 9 seconds to travel the 3.27 mile scheme distance whilst the A30 average was 3 minutes and 23 seconds. From site observations it is possible that the A30 average speed would be slower as the diverge for the A30 is from the inside two lanes of the M5 (lanes for slower moving traffic) whilst the A38 diverge runs from the outside two lanes (lanes for faster moving traffic) of the M5.

Table C2 compares the pre opening PAR predictions with the post opening actual journey times. In the absence of more pre opening data and more post opening journey time runs this is the best evaluation which can be made.

Table C2 – Pre and Post Opening Journey Times

Route	Time	Distance (miles)	Average Speed (mph)
Pre Opening Pre Scheme Prediction	30 minutes	3.27	7 mph
Post Opening Prediction	4 minutes	3.27	49 mph
Post Opening Actual A38	3 minutes 9 seconds	3.27	62 mph
Post Opening Actual A30	3 minutes 23 seconds	3.27	58 mph
Post Opening A38 + A30	3 minutes 15 seconds	3.27	60 mph

As is apparent from Table C2 the scheme has actually delivered more benefit than predicted and the scheme can cope with traffic at its peak throughout the year.

The main points to note regarding journey times are:

- Limited information included in the PAR;
- Predicted of journey times reduced to 4 minutes from 30 minutes and 81,467 vehicle hours saved;
- Counts were used to ascertain that the peak period for flows, and therefore increased likelihood of queuing, was on the Friday of the August bank holiday weekend between 4PM and 7PM;
- Atkins undertook Journey time surveys on Friday 27th August 2004;
- Count data subsequently collected for this site established that the peak period for flows was indeed on Friday 27th August 2004 with the peak falling between the hours of 5 and 6PM;
- As our journey time surveys encapsulated the three highest peak hours at the junction (4PM – 7PM) we would have expected queuing to occur if the scheme had not mitigated the problem but no queuing occurred so the scheme can be judged as a success;
- Average post journey times of 3 minutes 15 seconds for the whole carriageway, 3 minutes 9 seconds diverging to the A38 and 3 minutes 23 seconds diverging to the A30; and
- Pre opening there was an average speed of 7 mph over this section, which was predicted to increase 49 mph post opening and actually increased to 62 mph.

Annex D – Atkins EST

M5 Junction 31 Lane Drop at Diverge Scheme*		The provision of an additional lane changing the number of lanes from 3 to 4 in order to provide a main line drop at parallel diverge layout for the westbound carriageway.		
PROBLEMS		The low capacity of the single lane diverge to the A30 resulting in traffic queuing on the M5 in Lane 1, consequently vehicles not wishing to exit for the A30 were inadvertently joining this queue out of the site of the junction. A high potential for accidents was evident caused by vehicles attempting to leave this queue or by vehicles trying to join this queue part way along.		
OTHER OPTIONS				
OBJECTIVES		QUALITATIVE IMPACTS	QUANTITATIVE MEASURE	ASSESSMENT
ENVIRONMENT	Noise	Noise levels will increase as the level of queuing is reduced, primarily due to increased traffic flow	Not Assessed	Slight Adverse
CO_2: tonnes added Nil	Local air quality	As a result of a reduction of queuing and hence journey times it is likely that local air quality has improved.	Not Assessed	Slight Beneficial
	Landscape	Trees and vegetation will have been removed from the highway to accommodate widening	Not Assessed	Slight Adverse
	Biodiversity	Not Assessed	Not Assessed	Neutral
	Heritage	Not Assessed	Not Assessed	Neutral
	Water	Not Assessed	Not Assessed	Neutral
SAFETY	-	No significant change in the accident rate at the schemes location.	Accidents Deaths Serious Slight Accident Rate: 0.667 acc per month	Neutral PVB £0
ECONOMY	Journey times & VOCs		83,164 Hours saved in Opening Year	PVB £9,144,670
	Cost			PVC £1,742,769
	Journey time reliability		Not Assessed	Neutral
	Regeneration		Not Assessed	Neutral
ACCESSIBILITY	Pedestrians and others		Not Assessed	Neutral
	Access to public transport		Not Assessed	Neutral
	Community severance		Not Assessed	Neutral
INTEGRATION			Not Applicable	Neutral
Version of 04/04/01	Cost Benefit Analysis		PVB £9.145m, PVC £1,626m, NPV £7.519m, BCR 5.63	

*Note all values in 1994 prices and values, discounted @ 6%.