highways england

POPE of LNMS

A31 Canford Bottom Roundabout Evaluation Report

January 2016

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Glossary

Term	a.k.a.	Definition
Accessibility	**-**	Accessibility can be defined as ‘ease of reaching’. The accessibility objective is concerned with increasing the ability with which people in different locations, and with differing availability of transport, can reach different types of facility
Annual Average Daily Traffic	**AADT**	The 24 hour total traffic flow for the average day of the year
Appraisal Summary Table	**AST**	This records the impacts of the scheme according to the Government’s five key objects for transport, as defined in **DfT** guidance contained on its **Transport Analysis Guidance** web pages, **WebTAG**
Asset Support Contractor	**ASC**	Responsible for the operation, maintenance, and improvement of the motorway and trunk road network of a Highways England area. First appointed in 2012, these replace **MAC**s
Automatic Traffic Count	**ATC**	An automated method of recording the volume (and sometimes classification) of vehicles passing a particular point on a road
Average Daily Traffic	**ADT**	The 24 hour total traffic flow on an average day over a certain time period (Monday – Sunday)
Average Weekday Traffic	**AWT**	The 24 hour total traffic flow on an average weekday over a certain time period (Monday – Friday)
Benefit Cost Ratio	**BCR**	Benefit Cost Ratio is a ratio identifying the relationship between cost and benefits of a proposed project
Capitalisation	**-**	The process by which benefits for a scheme are factored to give an estimate for the appropriate appraisal period
Department for Transport	**DfT**	A Government department whose objective is to oversee the delivery of a reliable, safe and secure transport system that responds efficiently to the needs of individuals and business whilst safeguarding our environment
Discounting	**-**	A technique used to compare costs and benefits that occur in different time periods and is the process of adjusting future cash flows to their present values to reflect the time value of money, e.g. £1 worth of benefits now is worth more than £1 in the future. A standard base year needs to be used which is 2002 for the appraisal used in this report
Dis-benefit	**-**	A negative benefit or something that detracts from the performance

Evaluation Summary Table	**EST**	In **POPE** studies, this is a summary of the evaluations of the **TAG** objectives using a similar format to the forecasts in the **AST**
First Year Rate of Return	**FYRR**	First Year Rate of Return is the ratio of money gained on an investment relative to the amount of money invested
Highways England	**-**	An Government-owned company**,** responsible for operating, maintaining and improving the strategic road network in England
Killed or Seriously Injured	**KSI**	A term used to describe the number of people killed or seriously injured as a result of **PIC**s
Local Network Management Scheme	**LNMS**	LNMS are improvement schemes where total overall estimated cost (including design, land, works, supervision, risk and VAT) is less than £10 million. They are categorised by the Government under Safety, Economy, Severance, Environment, Non-Appraisable and Non-NATA
Managing Agent Contractor	**MAC**	Responsible for the operation, maintenance, and improvement of the motorway and trunk road network of a Highways England area. These are being replaced by **ASC**s, the first of which was appointed in 2012
Optimism Bias	**-**	Is a demonstrated systematic, tendency for project appraisers to be overly optimistic, and in effect, results in an underestimation of scheme costs. The base cost estimate is adjusted to account for optimism bias in order to obtain more accurate cost estimates
Project Appraisal Report	**PAR**	A key document summarising the need for a project, plus its costs and benefits (including those that cannot be quantified in monetary terms)
Personal Injury Collison	**PIC**	A term commonly used to refer to road accidents
Post-Opening Project Evaluation	**POPE**	Before and after monitoring of all highway schemes in England
Present Value of Costs	**PVC**	Present Value of Costs is a term used in cost-benefit analysis and project appraisal that refers to the discounted sum, or Present Value, of a stream of costs associated with a project or proposal
Risk Allowance	**-**	**Risk** refers to identifiable future situations that could result in an over spend or under spend occurring. The base cost estimate is adjusted to account for risk in order to obtain more accurate cost estimates
Severance	**-**	Community severance is the separation of adjacent areas by road or heavy traffic, causing negative impact on non-motorised users, particularly pedestrians
-	**STATS19**	A database of injury accident statistics recorded by police officers attending accidents

Traffic Database System	**TRADS**	Traffic count database developed by Highways England, to hold data from traffic monitoring sites on the strategic network
Web-based Transport Analysis Guidance	**WebTAG**	The Department for Transport's transport appraisal guidance and toolkit, first issued in 2003

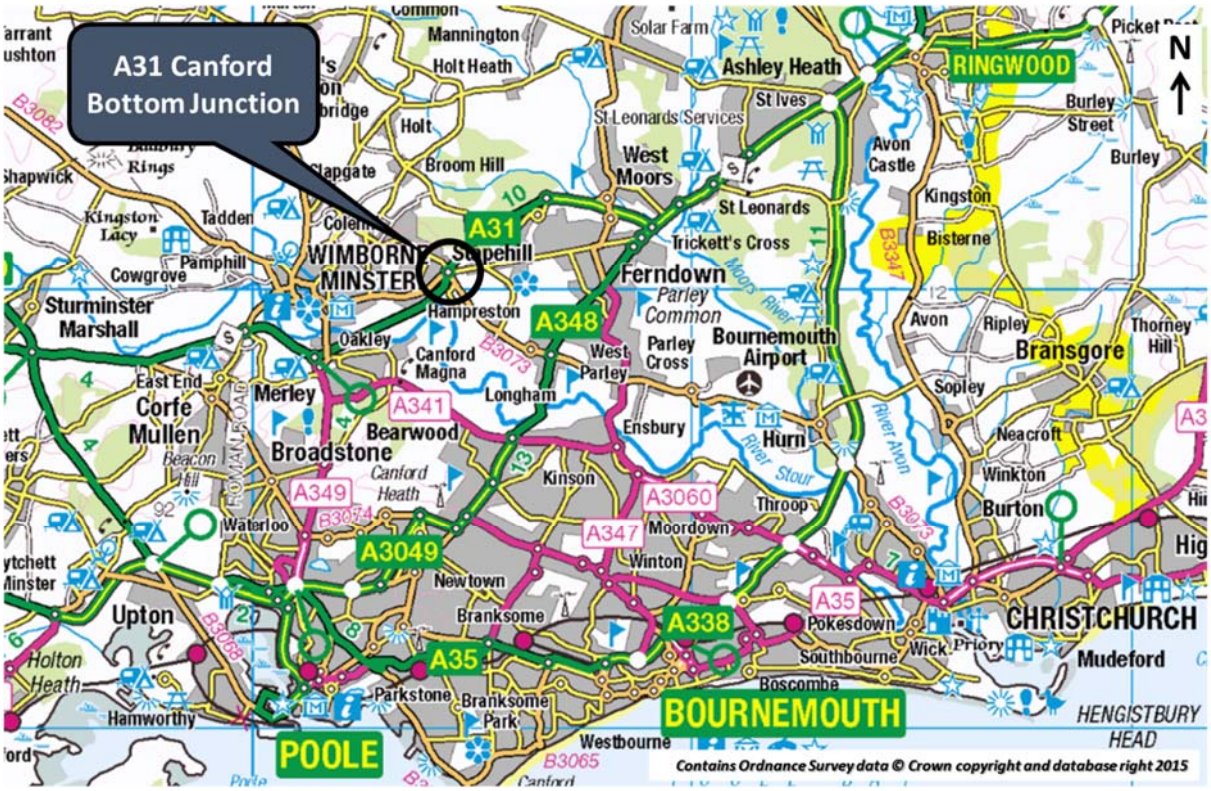
1. Introduction

Background

1.1. This report is the Post-Opening Project Evaluation (POPE) of the **A31 Canford Bottom Roundabout Improvements** Local Network Management Scheme (LNMS).

1.2. Canford Bottom Roundabout is a 6-arm junction situated on the A31, approximately 10km north of Poole and Bournemouth. The junction forms the interchange between the A31, the B3073 and two unclassified distributor roads named Wimborne Road West and Canford Bottom. The location of the junction is indicated in **Figure 1.1**.

Figure 1.1 – Location Plan



1.3. Before the scheme, the junction was a large priority 6-arm roundabout. The A31 approach arms were subject to severe delays during the busiest periods. As a result, the location was identified as a top congestion hotspot for Highways England (formerly Highways Agency). The junction also lies on a route which was designated as an 'Olympic Route' during the London 2012 Olympic Games which gave greater prominence to the congestion problems.

1.4. A scheme was developed to reconfigure the junction with the aim of addressing the issues of delays and congestion. A new 'hamburger' layout was introduced providing two traffic lanes through the centre of the roundabout in both directions along the A31. The whole junction was also signalised.

1.5. The local traffic modelling (approved by TAME) undertaken during the scheme development (in 2011) identified that traffic delays along the A31 with the

scheme in place will reach the same levels as 2011, by 2021. Therefore, a 10 year scheme life was defined.

1.6. Scheme construction began on 10th October 2011 and the scheme opened on the 20th June 2012. Based on Google Streetview photography, it is evident that yellow box markings were present in August 2012 but not in July 2012, meaning they must have only been added following scheme opening.

Purpose of this report

1.7. As part of an ongoing programme, whereby Highways England evaluates the impacts of trunk road schemes, Atkins is commissioned to undertake post-opening evaluations of LNMS with an implementation cost of up to £10m.

1.8. This report sets out the results of the POPE of the A31 Canford Bottom Roundabout Improvements LNMS. More specifically, this report examines the economic and safety impacts resulting from the improvements, with consideration also given to other impacts on the environment and society.

1.9. It is intended that the findings from this report will feed into a wider summary of the outcomes of POPE. This is a document (namely the LNMS Annual Evaluation Report) produced in the 4th quarter of each year outlining the key messages from the entire POPE of LNMS process.

2. Scheme Detail

Introduction

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

Background

2.2. The A31 Canford Bottom Roundabout Improvements LNMS involved the reconfiguration of the interchange to signalise the entire junction and create a 'hamburger' layout to allow A31 traffic to travel straight across the junction.

2.3. The introduction of the 'hamburger' included construction of a new 2-lane dual carriageway through the centre of the junction to connect the two A31 arms with local widening also undertaken to provide more exit capacity. The signalisation and hamburger changes were accompanied by new road markings and traffic signing. Supporting works included the installation of new street lighting, new shared use footway / cycleway & toucan crossings throughout the junction and upgrades to the highway drainage.

2.4. **Table 2.1** summarises the scheme details.

Table 2.1 – Summary of A31 Canford Bottom Roundabout Improvements LNMS

Scheme name	A31 Canford Bottom Roundabout Improvements
Area	3
Opening date	20th June 2012
Category	Economy
Reason for scheme	The scheme was developed to address issues with delays and congestion along the A31, especially during the busiest periods.
Objectives	The primary objective of the scheme was to reduce congestion and delays. The scheme also aimed to achieve safety and environmental benefits from the introduction of signal control and reduced queuing. Severance and integration benefits were also sought.
Alternative options	Information on alternative options was included within the PAR. The scheme development process involved initial options being investigated by Mott MacDonald with the hamburger junction solution identified as the optimal solution. Enterprise Mouchel progressed further studies considering a number of micro-options: 1) Number of lanes in the through road; 2) Partial signalisation with an internal through-road; 3) Local network arm closures in combination with the other options. The pros and cons of a flyover option were also investigated.

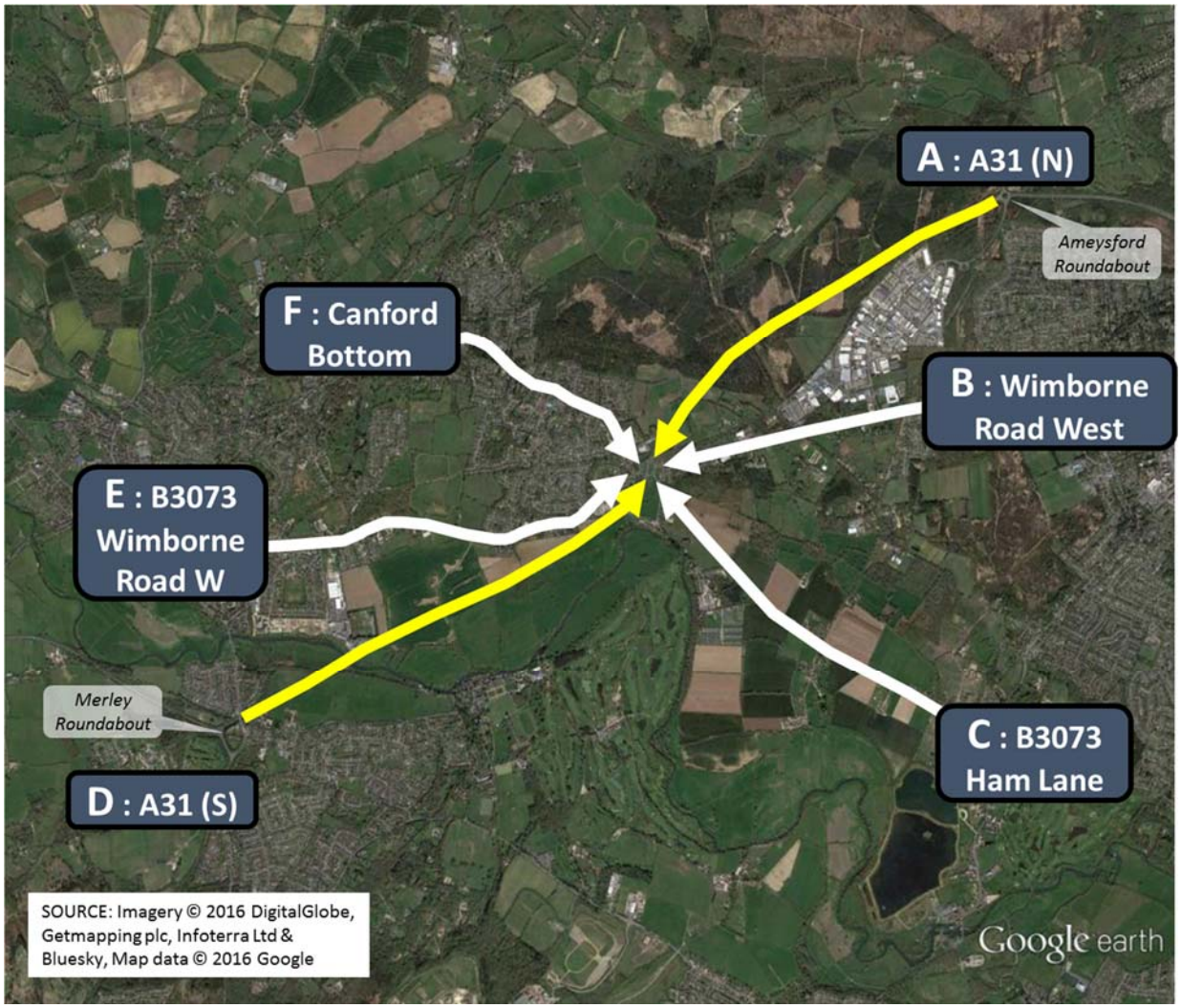
Location

2.5. The scheme is located within Canford Bottom in Dorset, around 10km north of Poole and Bournemouth.

2.6. The junction is located on the A31, between the Ameysford and Merley roundabouts. Canford Bottom village is to the immediate north-west of the junction and is one of a number of villages in the area. Ferndown Industrial Estate is also located to the east of the junction, and is bordered to the north and south by the A31 and Wimborne Road West respectively.

2.7. **Figure 2.1** indicates the local context of the junction and the six approach arms. The arms are labelled A to F, with the A31 arms highlighted in yellow.

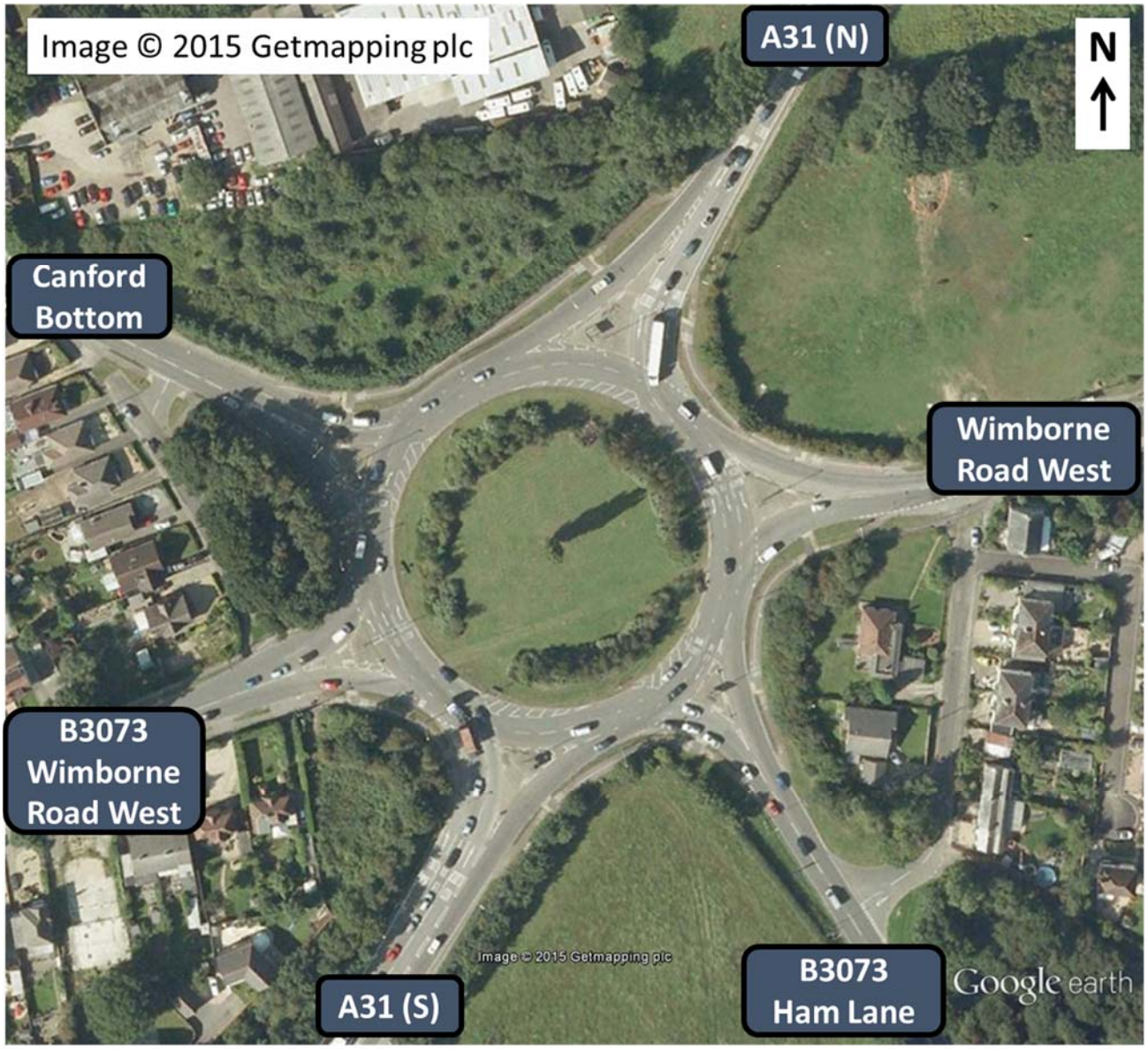
Figure 2.1 – Junction Location Context Plan



Pre-Scheme Junction Layout

2.8. Prior to the scheme, the interchange was a 6-arm priority roundabout as shown in **Figure 2.2**.

Figure 2.2 – Pre-Scheme Junction Layout



2.9. The two A31 approach arms were a single traffic lane which flared to provide three traffic lanes marked at the stop line. In each direction, the central lane was designated for straight ahead movements along the A31.

2.10. The other four approach arms were all also single traffic lane approaches which flared to typically operate as two lanes at the stop line, albeit this was not clearly defined in all locations by the road markings.

2.11. The circulatory carriageway was marked as two or three traffic lanes in different locations with hatching markings used to regulate vehicle movements around the junction. Lane designation markings were provided on the A31 approach arms and on some sections of the circulatory carriageway, but not on the other four arms.

2.12. Pedestrian and cyclist movements through the junction were supported by uncontrolled crossings on all of the approach arms, with dropped kerbs and tactile paving.

2.13. In developing the PAR, the area team prepared an economic assessment paper which assessed traffic volume and delay at the junction with a LinSig2[1] model developed to test the junction operation. In assessing the pre-scheme traffic conditions, the report noted regular issues with delays and congestion on the A31 approach arms, with weekday peak hours and weekends both identified as busy periods. With the proximity to coastal destinations, it was noted that summer weekends (or bank holidays) can be especially busy with south-westbound delays in the morning/lunchtime (as people travel towards the coast).

2.14. The economic assessment paper states that at the busiest times queues can extend along the A31 beyond the previous junctions; Ameysford Roundabout (around 2.9km north-east of Canford Bottom) and Merley Roundabout (around 3.2km south-west of Canford Bottom). This suggests a very significant congestion issue. As a result of the delays, the paper noted that some drivers would choose to divert off the A31 and choose alternative 'rat-runs' to avoid delays.

2.15. To support this assessment a 12-hour turning count was recorded at the junction on 20th May 2009 which identified all movements at the junction. Details for the 12 hour period (07:00-19:00) are presented in **Table 2.2**.

Table 2.2 – Pre-Scheme Junction Turning Flows

12 hour (0700-1900)		A	B	C	D	E	F	Total Flow From
		A31 (N)	Wimborne Rd W	B3073 Ham Lane	A31 (S)	B3073 Wimborne Rd W	Canford Bottom	
A	A31 (N)	**4** *0.0%*	**91** *0.2%*	**258** *0.5%*	**9,250** *19.4%*	**1,357** *2.8%*	**496** *1.0%*	**11,456** *24.0%*
B	Wimborne Rd W	**121** *0.3%*	**2** *0.0%*	**370** *0.8%*	**2,865** *6.0%*	**1,622** *3.4%*	**1,001** *2.1%*	**5,981** *12.5%*
C	B3073 Ham Lane	**795** *1.7%*	**364** *0.8%*	**4** *0.0%*	**2,331** *4.9%*	**2,683** *5.6%*	**2,026** *4.2%*	**8,203** *17.2%*
D	A31 (S)	**8,672** *18.2%*	**1,916** *4.0%*	**1,226** *2.6%*	**3** *0.0%*	**213** *0.4%*	**403** *0.8%*	**12,433** *26.0%*
E	B3073 Wimborne Rd W	**1,806** *3.8%*	**1,503** *3.1%*	**1,945** *4.1%*	**218** *0.5%*	**4** *0.0%*	**205** *0.4%*	**5,681** *11.9%*
F	Canford Bottom	**907** *1.9%*	**1,032** *2.2%*	**1,510** *3.2%*	**422** *0.9%*	**122** *0.3%*	**2** *0.0%*	**3,995** *8.4%*
	Total Flow To	**12,305** *25.8%*	**4,908** *10.3%*	**5,313** *11.1%*	**15,089** *31.6%*	**6,001** *12.6%*	**4,133** *8.7%*	**47,749**

[1] LinSig2 is an industry standard software application used for the assessment and design of traffic signal junctions.

2.16. This data demonstrates that before the scheme, the greatest traffic movement was between the two A31 approach arms with 19.4% of trips made south-westbound and 18.2% of trips made north-eastbound through the junction over the 12 hour period. The next largest movements are from Wimborne Road West to the A31 south-westbound (6.0%) and across the junction on the B3073, from Ham Lane to Wimborne Road West (5.6%). Together, the two A31 arms were used by 50.0% of all vehicle arrivals and 57.4% of all vehicle departures from the junction.

2.17. The B3073 Ham Lane was the third busiest approach, accounting for 17.2% of vehicles approaching. Even the least busy approach (Arm F: Canford Bottom) carried over 8% of vehicle arrivals across the 12 hours. The flows indicate that while there are clearly two dominant arms, there is no clear minor arm as all other arms supply relatively similar traffic flows.

2.18. As well as congestion issues, there was a safety issue associated with the junction, the PAR recording 59 Personal Injury Collisions (PICs) during a five year period prior to the scheme. This included 10 serious collisions and 49 slight collisions. The primary causation factor associated with these collisions was rear end shunts (53% of all collisions).

Post-Scheme Junction Layout

2.19. The scheme involved a complete reconfiguration of the junction layout to address the congestion and safety issues.

2.20. Traffic signals were added across the entire interchange to control traffic movements and improve Non-Motorised User (NMU) accessibility, and a carriageway section was built through the centre of the island to create a ‘hamburger’ layout. The re-configured layout is shown in **Figure 2.3**.

2.21. The key feature in the reconfiguration was the construction of a new 2-lane dual carriageway through the centre of the junction. This road section connects the two A31 arms to improve the ease of making this through movement across the junction. Local widening was also undertaken on the A31 exit arms to provide additional exit capacity. For traffic travelling on the A31 towards the junction there are now two ahead traffic lanes for through movements on the A31. The left-hand lane in each instance is used to access the circulatory carriageway of the ‘roundabout’ section of the junction which is used to make journeys to all four of the ‘minor’ arms.

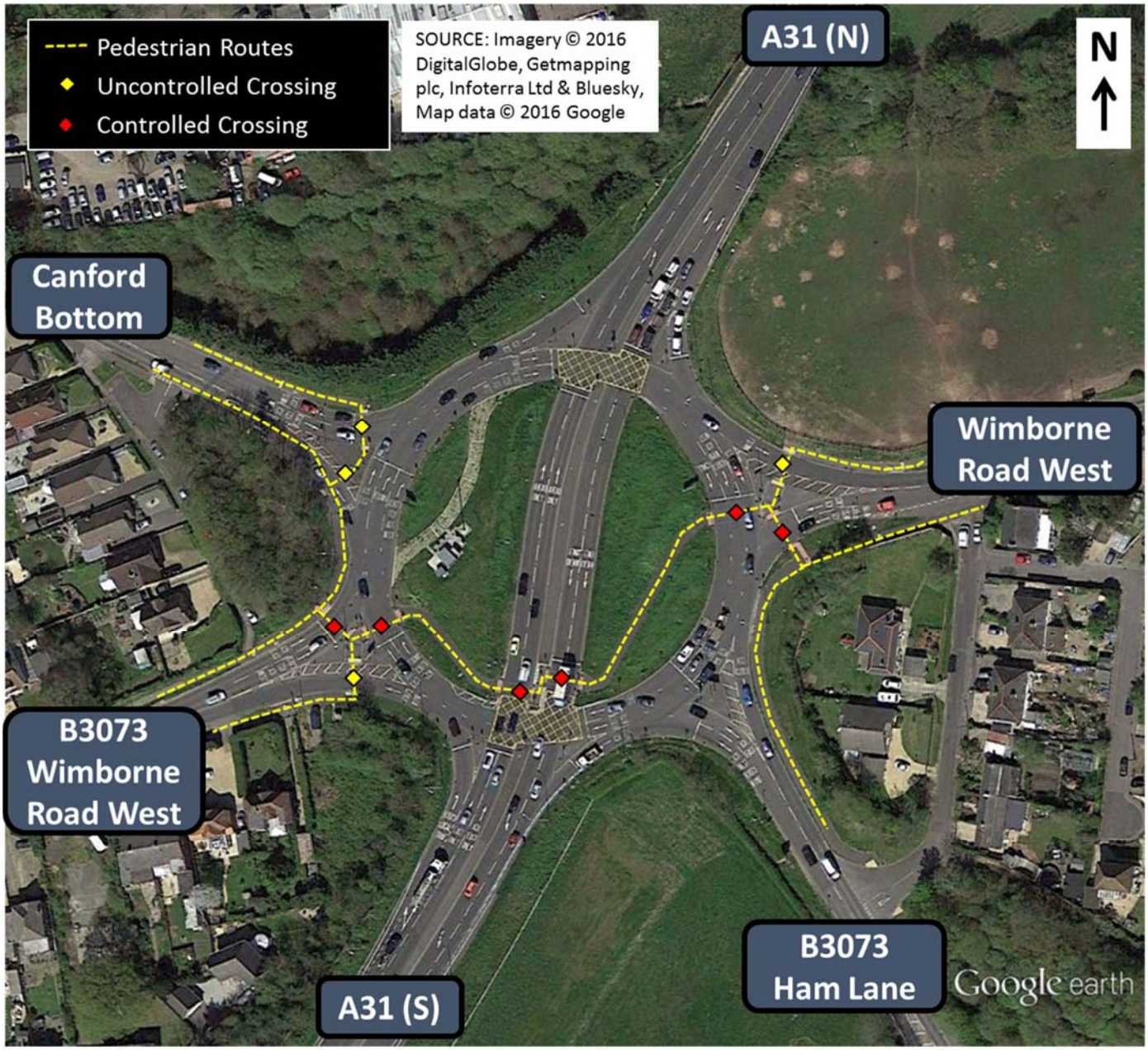
2.22. As well as the new through-route, the entire interchange was signalised with the installation of 72 sets of traffic signals. All approach arms became signal controlled, as well as all sections of the circulatory carriageway. The ‘roundabout’ section of the junction varies between providing two and three traffic lanes around its circulation.

2.23. These primary works were accompanied by new road markings and traffic signing. Lane designation markings have been improved to account for the new layout, and provided on all approach arms.

2.24. Supporting works included the installation of new street lighting, new shared use footway / cycleway & Toucan Crossings throughout the junction and upgrades to highway drainage. The crossings provided improved cycling facilities to navigate

the junction, which integrates with NCN Route 256 which comes in from the east on Wimborne Road West, and passes to the south down the B3073 Ham Lane.

Figure 2.3 – Post-Scheme Junction Layout



Post-Scheme Site Observations

2.25. A site visit was undertaken on Thursday 16th July 2015, with observations made during both the AM Peak (07:50-09:00) and the Inter Peak (12:00-12:20). The weather was dry and cloudy during both visits. There were no known incidents or roadworks close by on the network which would mean that traffic activity was atypical, although the overall traffic flow could be slightly lower than at other times of the year as a result of the start of the summer holiday period.

2.26. All of the scheme elements were seen to be in place and operational.

2.27. During the AM Peak site visit, traffic appeared to be moving well around the junction with minimal queuing on the approach arms.

2.28. With consideration of the A31 through movement, it was reported in the pre-scheme analysis that queues of up to 3km were typically observed in both directions on the A31 approach arms. However, on the day of the site visit there was only limited queuing (around 12 vehicles per lane) observed on either of the A31 approaches. **Figure 2.4** shows the A31 Northbound approach at 08:30 with vehicles approaching the stop line but no built-up traffic queues. The short cycle time of the hamburger layout helps to ensure that significant queues do not accumulate and throughout the AM Peak, all vehicles making the A31 Northbound through movement were observed to get through the stop line and into the junction during each cycle of the traffic signals.

2.29. Similar conditions were also observed on the A31 Southbound approach arm. A drive-through of the route (also during the AM Peak) identified that whilst traffic flow was busy enough to reduce vehicle speeds on the A31 to below the speed limit, vehicle flow was continuous up to the junction approach and all vehicles making the southbound A31 through-movement were able to get through the stop line and into the junction during each cycle of the traffic signals.

Figure 2.4 – A31 Northbound Approach (AM Peak)

2.30. The signal timings were also configured so that the central section of the hamburger was operating efficiently, as indicated in Figure 2.5.

Figure 2.5 – A31 Through-Route Section facing Northbound (AM Peak)

2.31. Whilst the A31 through-movements are significantly simplified by the hamburger layout, all other movements require use of the circulatory carriageway which is now more complex with a large number of lanes, multiple signal controls and short signal cycle times.

2.32. During the site visit, the junction generally appeared to operate within capacity, however there were instances when for short periods the circulatory sections became blocked up. An example from the northern side of the junction is shown in **Figure 2.6**.

2.33. Where there are yellow box markings in place these were being observed, and in the locations where yellow box markings are not in place drivers were generally sticking to the stop line and not pulling out to wait in areas which would block up the junction. This is usually a sign of short waiting times on the approach arms (low driver frustration). The short cycle times also help to keep traffic moving relatively well with traffic still filtering through the junction with relative ease.

Figure 2.6 – Blocking around the Circulatory Carriageway (AM Peak)

2.34. The six approaches to enter the circulatory carriageway all appeared to operate well, with no periods of significant queuing (less than 10 vehicles per lane). In most instances, all waiting vehicles were able to get through the stop line and into the junction during each cycle of the traffic signals. Where the circulatory carriageway did begin to block, the A31 approach arms (left hand lanes only are for entry to the circulatory carriageway) were most significantly impacted although the short cycle times meant that notable queues did not build up. There was also one instance where traffic on the B3073 Ham Lane approach appeared to build up although this congestion dissipated within a few minutes and a couple of cycles of the traffic signals. Generally, the Wimborne Road West approach (on the eastern side of the junction) appeared to be the quietest of the arms.

2.35. Conditions observed on the B3073 Wimborne Road West and Canford Bottom approach arms are shown in **Figure 2.7** and **Figure 2.8**.

Figure 2.7 – B3073 Wimborne Road West Approach (AM Peak)

Figure 2.8 – Canford Bottom Approach (AM Peak)

2.36. During the site visit, the conditions and facilities for non-motorised users were also assessed. The scheme included significant measures to assist pedestrians and cyclists make trips around and across the junction. The facilities provide good, integrated connections between the footpaths on the approach arms and offer safe routes for people to move around the junction. The short cycle times on the signals mean that crossing opportunities are frequent once a call button has been activated. Appropriate signage was also clearly present to provide way-finding information to local areas and amenities. Examples of the facilities are shown in **Figure 2.9.** During the AM Peak site visit, fewer than 5 people were observed using the facilities.

Figure 2.9 – Examples of Pedestrian and Cyclist Facilities

2.37. Further site observations were made for a shorter period during the Inter Peak Period at around 12:00. At this time, traffic flows were notably reduced from the morning and the junction appeared to operating effectively and within capacity. There were no instances of significant queuing on any approach arms and the circulatory carriageway was functioning more efficiently than in the morning with less blocking.

2.38. Overall, the site visit suggested that the junction now operates more effectively than the pre-scheme conditions described in the PAR (assuming like for like flow conditions), especially for A31 through-movement trips.

2.39. It was however noticeable that the introduction of significant infrastructure (especially the hamburger layout and the traffic signals) have had a large impact on the local area and the resulting road layout is highly complex. As a driver who was unfamiliar with the location, the junction was relatively difficult to understand at first as hamburger layouts are not commonplace. In particular, the requirement to use the left hand approach lanes to make right turning movements is not familiar. Signing on the approach denotes that for movements other than the A31, drivers must turn left at the junction. The signage approaching on the A31 in the northbound direction is shown in **Figure 2.10** (Google Streetview imagery). The signage does however not make clear that the highway layout of the junction resembles a ‘roundabout’ at all and so when arriving at the junction the layout is not expected.

Figure 2.10 – A31 Junction Approach Signage

2.40. As there are numerous arms at the junction, the signalisation has resulted in a large number of signals and stop lines meaning a full traversal of the junction is reliant on crossing many traffic signals.

Stakeholder Feedback

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

2.42. The major stakeholders who have provided feedback on the A31 Canford Bottom Roundabout Improvement scheme are:

- Highways England;
- EM Highway Services Limited (the current ASC and MAC during implementation);
- Cllr Janet Dover (County Councillor for Colehill and Stapehill Division); and
- Local Community.

2.43. The remainder of this section outlines the responses received from these stakeholders.

Highways England

2.44. The Project Sponsor from Highways England at the time of the scheme's implementation was contacted for comments on the scheme. The response is as follows:

"The scheme was developed as a congestion scheme but the opportunities to improve pedestrian and cyclist facilities added to the strength of the overall project. Dorset County Council had a nearby cycle path scheme on the fringe which linked well with the new toucan crossings proposed at Canford Bottom.

The local community weren't always keen on the scheme and wanted traffic removing from the area although – a tunnel, bypass or flyover – which were never feasible options.

In truth, the junction probably still does congest although I'm told it is better during Bank Holidays. Since its inception, traffic flows may have increased so it may be hard to identify if people are better moving.

It is a busy tourist route, with lots of caravans during the holiday season. It is also an intensive HGV route, carries local traffic to Wimborne and is smack in the middle of multiple school runs. There were therefore all sorts of expectations which were trying to be met. As soon as you leave the roundabout travelling towards Merley it drops to a single lane and so there was a feeling that the scheme only addressed half the problem and simply moved issues down the road."

EM Highway Services Limited

2.45. Comments were received from the ASC that are currently responsible for the area, and who were formerly the MAC that introduced the scheme. The key points from the response are as follows:

"Scheme establishment did not go very well unfortunately, most likely due to the unusual nature of the junction in what is on the whole a rural location. From memory, we had an accident very early on after opening the junction to traffic (plus a number of near misses).

Whilst we understand Highways England have classed the scheme a success[2] we have had, and continue to see, a number of complaints about traffic signal sequencing and what is perceived as a dangerous junction. I believe this comes down to public expectations of the scheme i.e. they thought the scheme would completely resolve traffic issues and congestion. Also, the shear amount of signals at a small junction like this will inevitably create a stop / start sequence along some of the routes whilst keeping congestion to a minimum across the junction from a holistic point of view."

Cllr Janet Dover

2.46. The County Councillor for the local area offered comments on the scheme, both in terms of her personal observations, and the perceptions offered to her by local people who live in the area as follows:

"a) The public's perception

Since the completion of the upgrade works I have received, and continue to receive, comments from the public regarding the current operation of the junction. These comments can be summarised as falling into two camps, Those who predominately use the junction east to west (and vice versa) along the A31

[2] These are the comments of the MAC contact and reflect their views only. The post-opening evaluation team would consider that the POPE process provides Highways England with information to allow an assessment of the success of the scheme to be formed. It is understood that Highways England have not previously stated whether or not they deem the scheme to be a success, and it is not known where the MAC contact has developed their views from.

and those who access the junction from local roads. The former group are broadly neutral. They think the queuing at peak flow times hasn't materially changed since the days before the upgrade and, therefore needs further work to speed through traffic onwards. They don't think the upgrade has made a material change to the time taken to go through the junction. They also believe that the Merley Roundabout requires improvement to aid traffic flow.

Local road users, however, tell a different tale. The vast majority now feel the junction is less safe than its previous design. The most cited reasons being

- *1) The lanes are too narrow especially for HGVs, articulated lorries and for cars towing caravans and trailers. This often results in side swipes or vehicles being forced or squeezed out of their lane.*
- *2) Confusing traffic lights. The multi sets of lights can catch people out when one set changes and is easily mistaken for the set affecting the lane the motorist is in.*
- *3)The lanes are too short between sets of lights which often results in lane blockages with motorist having to wait for several light changes before they can progress as there is no space for them to move into.*

A number of people have told me they avoid the junction at busy times and do long detours around other roads simply to miss the potential of an accident.

b) My own observations

This week alone on each of the last 3 days, I have personally witnessed someone missing a red light when a green has appeared further down the cycle of lights (intended for a different stop line at the junction). One could say it was a holidaymaker or someone unfamiliar with the junction, but for whatever the reason these all resulted in very near misses not least by the driver who pulled out in front of a flow of traffic that oh so nearly could have been a major accident. The junction is obviously confusing to those not familiar with it and lane changing is occurring often at the last minute. Adding this to the narrowness of the lanes on the local joining points and the room for error is minimal.

Having people avoiding the junction at peak times by using local and often residential roads at peak time rather defeats the purpose of having this junction upgrade. All that achieves is local congestion on unsuitable roads. Personally, I too, have taken to driving through Colehill and Wimborne town to join the A31 when going to Dorchester rather than my previous route of joining the A31 at Canford Bottom. This can save me 10- 15 minutes on journey time even though previously it was quicker for me to use the old Canford Bottom roundabout. I also perceive this as being a safer route for me."

Local Community

2.47. In researching information for the post-opening evaluation it was evident that there are a number of online articles which relate to the scheme and provide some context about how the scheme has been accepted by the local community.

2.48. Newspapers such as the Bournemouth Echo have carried articles relating to the junction in the months since the scheme opening which often refer to on-going problems and traffic issues. These articles (including letters to the editor

features) have continued into 2015 suggesting a longer-term disenchantment after the scheme has ‘settled in’.

2.49. This opinion is reinforced by some of the comments provided by Councillor Janet Dover.

Summary

2.50. The collection of feedback has indicated a range of views with regards to the scheme. There is evidence that considered within a wider context, the A31 continues to face capacity challenges and the Canford Bottom Roundabout is only one of the hotspots for drivers making route-length trips.

2.51. The scheme itself appears to have met its aims for the A31 arms, however it would seem the new layout has not been well received by the community. Reports of drivers choosing alternative routes which avoid the junction point to this. There also appears to be a perception that aesthetically, the provision of multiple sets of signals has had a detrimental change on the character of the area.

2.52. The Highways England contact indicated that in the scheme development process, alternative options which may have delivered the purely ‘traffic’ results which local people would like were not feasible for delivery for a number of reasons. The desired outcome for local people would be for A31 through movement traffic to be removed from the junction to leave a small local junction. However this would have required a substantial intervention such as a tunnel, flyover or bypass that may be dis-proportionate to the scale of the problem.

2.53. Operationally, it appears that the junction layout leads to some confusion and also a perception amongst some people that the signal timings are not always linked as well as they could be. It would be reasonable to assume that some of the negative reaction to the junction be in part linked to the added driver frustration created by its unconventional arrangement. The POPE team site visit would reaffirm this view that when approaching the junction along the A31, it is counter-intuitive to use the left hand traffic lane to make a right turn, despite the signage on approach.

3. Traffic Volumes

Introduction

3.1. This section of the report considers the impact that the A31 Canford Bottom Roundabout Improvements Large LNMS has had on traffic volumes.

Data Source

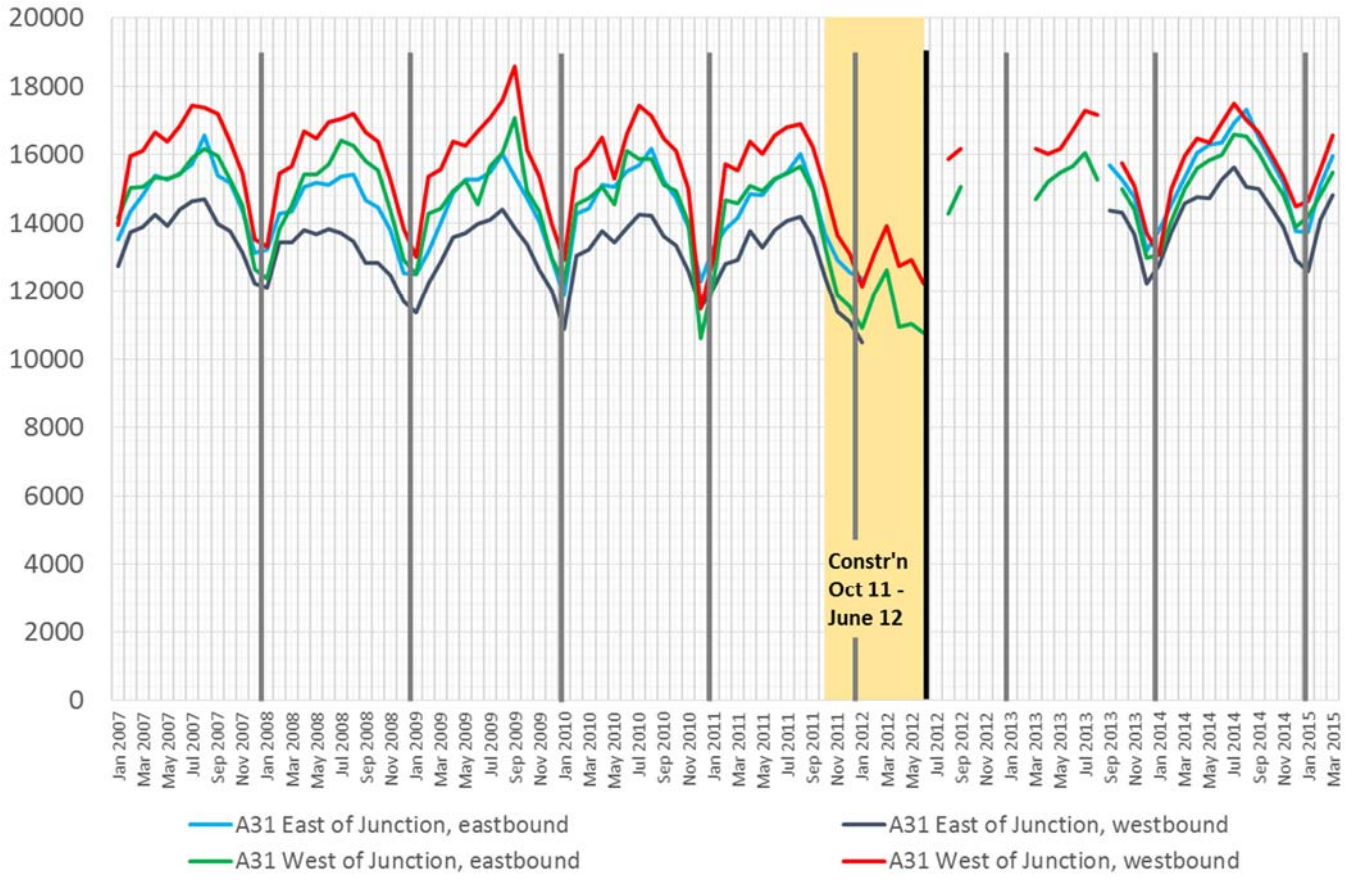
3.2. As scheme planning and construction is a process that takes a number of years, it is important to understand how traffic volumes have changed over time and whether this will impact the way the scheme performs. To understand this, traffic data from three sources has been assessed:

- Continuous ATC data collected on the A31 as collected by Highways England (TRADS);
- A turning count commissioned by the (then) MAC, undertaken on 20th May 2009; and
- A turning count commissioned by the POPE team, undertaken on 2nd July 2015.

Traffic Volume

3.3. TRADS data is continuously collected on the A31, on the eastern and western sides of the Canford Bottom Roundabout. The Average Weekday Traffic (AWT) on a monthly basis is shown in **Figure 3.1**.

Figure 3.1 – Monthly AWT on the A31



3.4. Considering seasonality of traffic volumes at this location, **Figure 3.1** shows some variation in flows, with higher traffic volumes during the summer months and reductions during each winter. The rises in flow during the summer months is understandable for this location as this section of the A31 is on a main route towards many coastal holiday destinations, including Bournemouth. The size of the flow in July are typically around 10% higher than in the 'neutral' month of March of the same year at both count sites. The reductions in flow during each winter are considered typical across the highway network as wintery bad weather tends to reduce the traffic on the network.

3.5. Considering the impacts of the scheme, data can be compared for the months before and after the scheme's construction. Although data for the 12 months after the opening of the scheme is only piecemeal, it is evident that traffic flow volumes on the A31 have remained relatively consistent in both directions before and after the implementation of the scheme, with only a small increase after the opening of the scheme. **Table 3.1** highlights how the AAWT has changed at the two count sites. It shows that any traffic growth is more significant to the east of the junction than to the west, but that increases do not exceed 9%.

Table 3.1 – Change in Traffic Volume Summary Table

12 month AAWT	A31 – Ameysford Roundabout (East of Junction)		A31 – Merley Roundabout (West of Junction)	
	Eastbound	Westbound	Eastbound	Westbound
Oct10 - Sep11	14,459	13,163	14,364	15,471
Oct13 - Sep14	15,525	14,305	15,092	15,785
Difference	**+1,065 (+7%)**	**+1,141 (+9%)**	**+728 (+5%)**	**+315 (+2%)**

3.6. The lower traffic flows during the first six months of 2012 can be attributed to the construction of the scheme which added delays and led to significant diversion routing away from the A31.

3.7. Historical flow information for the lesser four arms was not available for analysis.

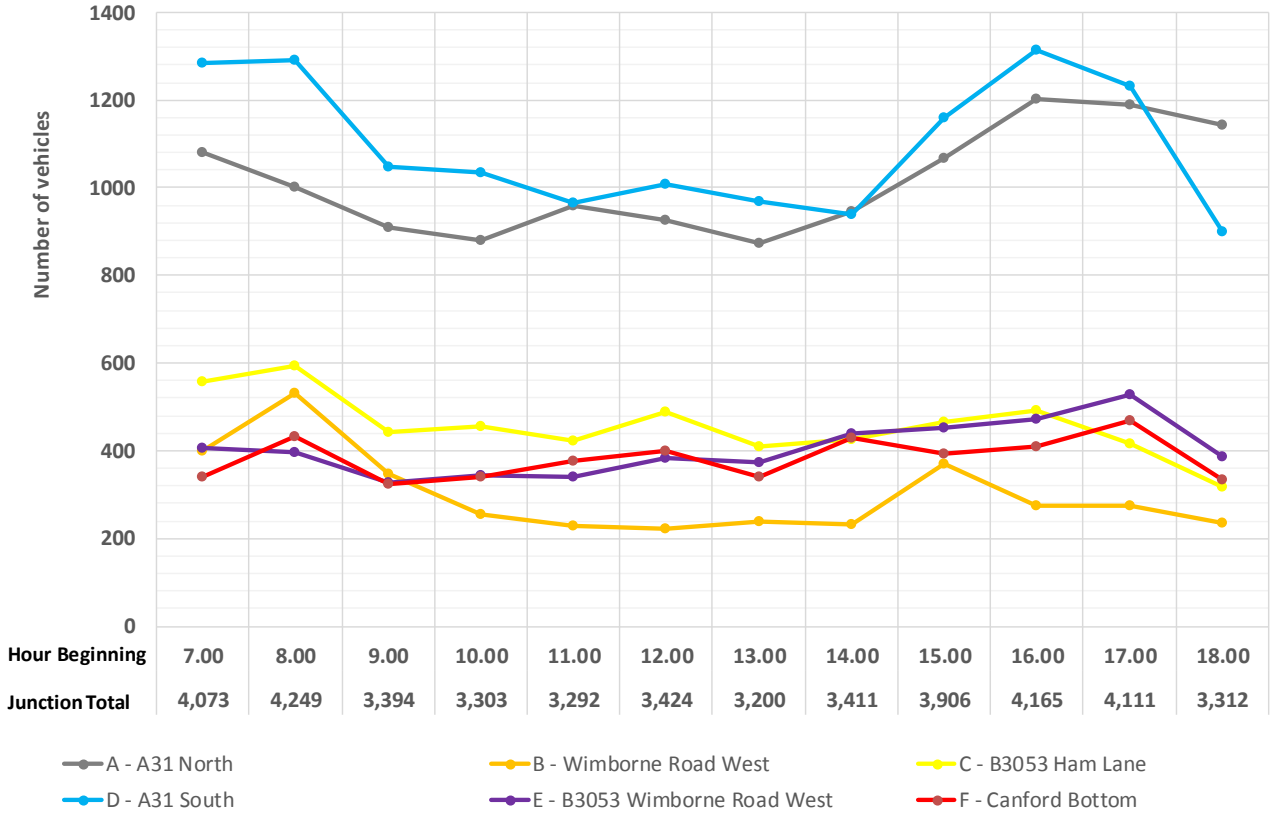
Daily Traffic Patterns

3.8. By studying the daily traffic patterns, it is possible to identify peak periods during which the junction is subject to high demand. This will help to understand journey times around the junction and when delays might be expected.

3.9. Based on available data sources, it is possible to consider the daily traffic patterns across the whole junction for a single typical weekday using the July 2015 12 hour turning count. The permanent TRADS count sites on the A31 arms then allow a wider analysis to be undertaken considering the typical daily traffic patterns over a much larger sample of data, including consideration of weekends.

3.10. The daily traffic profile observed for the junction from July 2015 turning count is presented in **Figure 3.2.**

Figure 3.2 – Single Weekday Traffic Profile (Whole Junction)



3.11. In summary:

- The junction as a whole experiences a single AM peak hour between 08:00 and 09:00, before a reduction of traffic into the Inter Peak period. The AM peak hour is the busiest time of the day with 4,249 vehicles entering the junction;
- Traffic flows rise consistently from 14:00 onwards, with the PM peak hour observed between 16:00 and 17:00. Generally, the PM peak is more spread than the morning with flows between 15:00 and 18:00 observed to be of a similar volume;
- The A31 approach arms are clearly dominant with the A31 South approach carrying the highest flow;
- Outside of the A31 approaches, the other four non-A31 arms all experience a similar level of flow in the Inter Peak and PM peak periods. There is a noticeable rise in the morning and a distinctive AM peak hour between 08:00 and 09:00 with a reduction after this time; and
- With the exception of the AM peak hour, Arm B (Wimborne Road West) carries the lowest approach flow for the majority of the day.

3.12. The TRADS sites located on the A31 can be used to validate the weekday profile observed in the July 2015 turning count (across a much wider data sample), as well as provide additional information on the weekend flow profile.

3.13. Weekday data is shown in **Figure 3.3**, and weekend data is shown in **Figure 3.4**.

Figure 3.3 – Average Weekday Hourly Traffic Flow into the Junction (A31 arms)

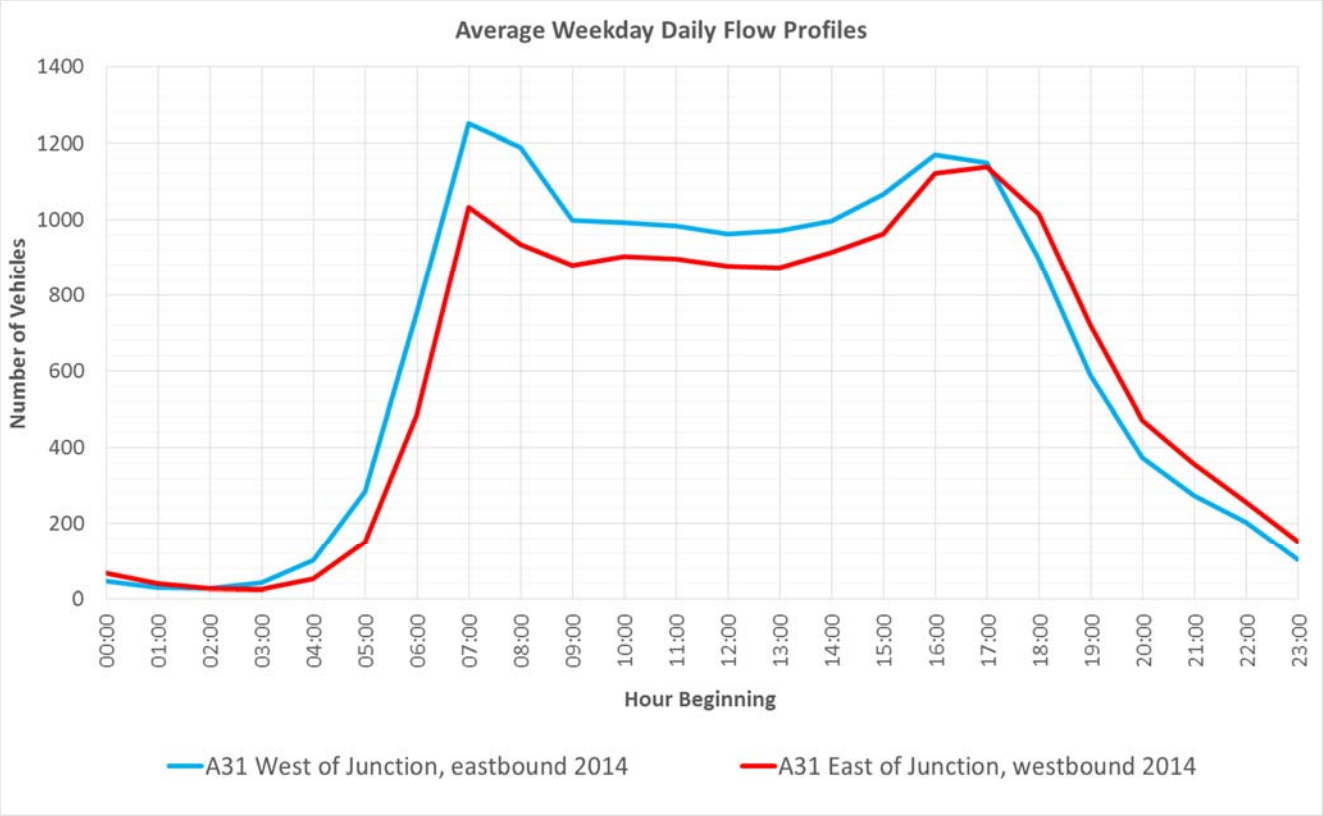
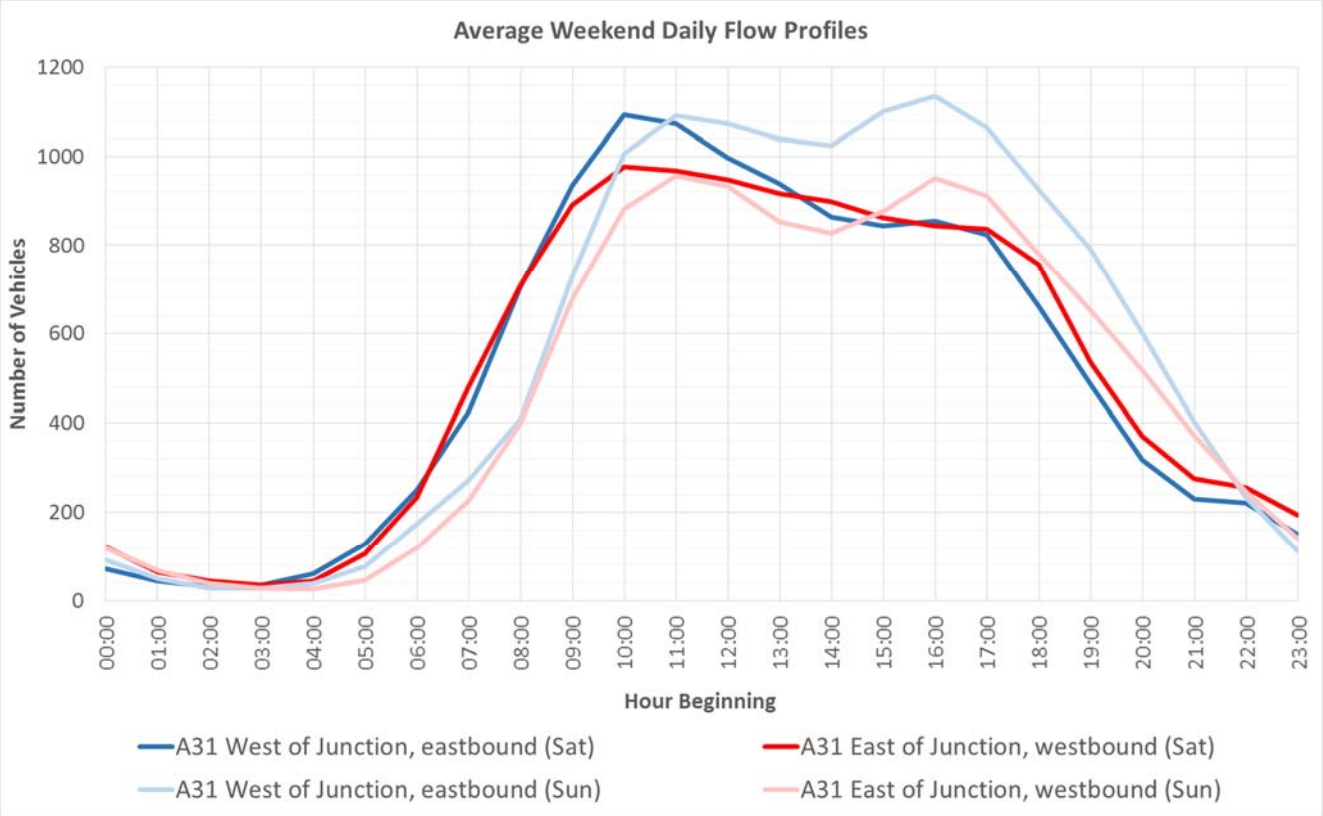


Figure 3.4 – Average Weekend Hourly Traffic Flow into the Junction (A31 arms)



3.14. In summary:

- There are similar flow profiles in both directions, although eastbound traffic is slightly higher throughout the average weekday before 17:00. After 17:00, westbound traffic flow is higher;
- The weekday AM peak is observed between 07:00 and 09:00, with the PM peak observed between 16:00 and 18:00;
- The Inter Peak period shows relatively stable traffic flow throughout the daytime, between 09:00 and 15:00;
- Other than the weekday peaks, there are similar traffic volumes observed on weekdays and at weekends. Daytime traffic flows on weekends are of a similar scale to the weekday Inter Peak, being between 900 and 1000 vehicles per hour in each direction;
- On Saturdays, traffic levels build up through the morning and peak flows are observed in the late morning (10:00-12:00). Traffic levels then decrease through the afternoon and reduce more significantly after 19:00; and
- Peak flows on Sundays are of a similar scale to Saturdays, however flows remain at this level for longer, and there is an early evening peak also observed. Flows rise through the morning in both directions and peak between 11:00 and 12:00. Whilst there is then a slight reduction in the early afternoon, traffic increases again in the late afternoon and reaches the Sunday peak level between 16:00 and 17:00. After 18:00 traffic volumes fall quickly.

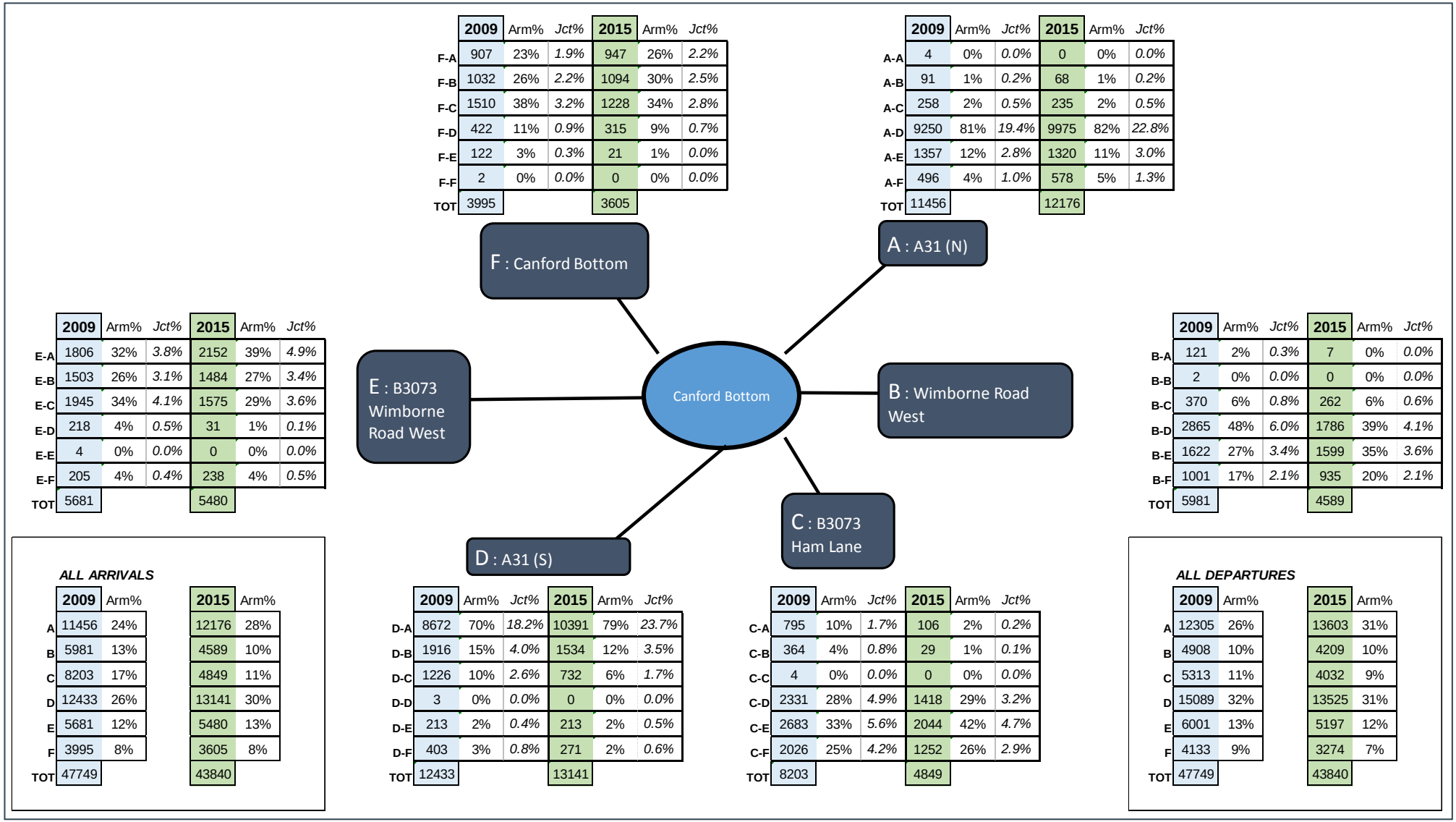
3.15. Overall, it is shown that there is a similar pattern observed between 07:00 and 19:00 in the July 2015 turning count (which recorded traffic approaching and exiting the junction on the A31) and the weekday data recorded by the permanent TRADS counts located immediately upstream and downstream of the junction.

Traffic Turning Movements

3.16. Vehicle turning movements around the junction have been assessed using a turning count collected before the scheme on Wednesday 20th May 2009 and after the scheme on Thursday 2nd July 2015. These turning counts both collected data for a 12 hour period (07:00-19:00).

3.17. The arm-to-arm movements are presented for the whole 12 hour period in **Figure 3.5**).

Figure 3.5 – 12 Hour (07:00-19:00) Vehicle Turning Proportions (May 09 & July 15)



	2009	Arm%	Jct%	2015	Arm%	Jct%
F-A	907	23%	1.9%	947	26%	2.2%
F-B	1032	26%	2.2%	1094	30%	2.5%
F-C	1510	38%	3.2%	1228	34%	2.8%
F-D	422	11%	0.9%	315	9%	0.7%
F-E	122	3%	0.3%	21	1%	0.0%
F-F	2	0%	0.0%	0	0%	0.0%
TOT	3995			3605		

	2009	Arm%	Jct%	2015	Arm%	Jct%
A-A	4	0%	0.0%	0	0%	0.0%
A-B	91	1%	0.2%	68	1%	0.2%
A-C	258	2%	0.5%	235	2%	0.5%
A-D	9250	81%	19.4%	9975	82%	22.8%
A-E	1357	12%	2.8%	1320	11%	3.0%
A-F	496	4%	1.0%	578	5%	1.3%
TOT	11456			12176		

	2009	Arm%	Jct%	2015	Arm%	Jct%
E-A	1806	32%	3.8%	2152	39%	4.9%
E-B	1503	26%	3.1%	1484	27%	3.4%
E-C	1945	34%	4.1%	1575	29%	3.6%
E-D	218	4%	0.5%	31	1%	0.1%
E-E	4	0%	0.0%	0	0%	0.0%
E-F	205	4%	0.4%	238	4%	0.5%
TOT	5681			5480		

	2009	Arm%	Jct%	2015	Arm%	Jct%
B-A	121	2%	0.3%	7	0%	0.0%
B-B	2	0%	0.0%	0	0%	0.0%
B-C	370	6%	0.8%	262	6%	0.6%
B-D	2865	48%	6.0%	1786	39%	4.1%
B-E	1622	27%	3.4%	1599	35%	3.6%
B-F	1001	17%	2.1%	935	20%	2.1%
TOT	5981			4589		

ALL ARRIVALS

	2009	Arm%	2015	Arm%
A	11456	24%	12176	28%
B	5981	13%	4589	10%
C	8203	17%	4849	11%
D	12433	26%	13141	30%
E	5681	12%	5480	13%
F	3995	8%	3605	8%
TOT	47749		43840	

	2009	Arm%	Jct%	2015	Arm%	Jct%
D-A	8672	70%	18.2%	10391	79%	23.7%
D-B	1916	15%	4.0%	1534	12%	3.5%
D-C	1226	10%	2.6%	732	6%	1.7%
D-D	3	0%	0.0%	0	0%	0.0%
D-E	213	2%	0.4%	213	2%	0.5%
D-F	403	3%	0.8%	271	2%	0.6%
TOT	12433			13141		

	2009	Arm%	Jct%	2015	Arm%	Jct%
C-A	795	10%	1.7%	106	2%	0.2%
C-B	364	4%	0.8%	29	1%	0.1%
C-C	4	0%	0.0%	0	0%	0.0%
C-D	2331	28%	4.9%	1418	29%	3.2%
C-E	2683	33%	5.6%	2044	42%	4.7%
C-F	2026	25%	4.2%	1252	26%	2.9%
TOT	8203			4849		

ALL DEPARTURES

	2009	Arm%	2015	Arm%
A	12305	26%	13603	31%
B	4908	10%	4209	10%
C	5313	11%	4032	9%
D	15089	32%	13525	31%
E	6001	13%	5197	12%
F	4133	9%	3274	7%
TOT	47749		43840	

3.18. In summary:

- Between the two counts, there has been a reduction in total vehicles passing through the junction during the 12 hour period (reduction by 3,909 vehicles or 8.2%);
- Despite this overall reduction, the number of arrivals on the two A31 approach arms has increased. There are around 700 more vehicles approaching via both Arm A and Arm D in 2015. Proportionally, the A31 approaches account for 58% of arrivals in 2015 compared to 50% in 2009;
- The A31 South approach is the busiest, both before and after the scheme's completion. It carries around 1,000 more vehicles than the A31 North approach in 2009 and 2015;
- The dominance of the 'through-movement' along the A31 has increased with the scheme. In 2009, 37.5% of all trips through the junction were across the A31 arms. In 2015, this has increased to 46.5% of all trips;
- The most notable reduction in arrivals is from Arm C (B3073 Ham Lane) which is used in 2015 by only 59% of the traffic volume observed in 2009. Traffic arrivals on Arm B (Wimborne Road West) have also decreased, with a reduction of 1,392 vehicles (or 23.3%);
- There is a small change in the profile of departures from the junction, with Arm A (A31 North) being the most common exit route in 2015. This exit carries marginally more trips than Arm D (A31 South). In the 2009 count, Arm D was the most common destination with around 2,700 more trips than Arm A; and
- Outside of the A31, the other 4 arms of the junction all have fewer departures in 2015 than in 2009. As a result, proportionally 62% of all trips are now leaving the junction along the A31, compared to 58% in 2009.

3.19. The same information is also presented for the AM Peak and PM Peak hours in **Appendix A.**

3.20. In summary:

- Overall traffic using the junction in both peaks is lower in 2015 than in 2009 (9.2% reduction in the AM peak and 7.6% reduction in the PM peak);
- Entries to the junction from the A31 arms have increased over the same period. The largest growth is observed from the A31 North approach in the AM Peak and from the A31 South approach in the PM Peak;
- The dominance of the 'through-movement' along the A31 has increased with the scheme during both peak periods. During the AM peak hour in 2009, 31.9% of trips were movements across the A31 arms of the junction, compared to 42.4% in 2015. Similarly in the PM peak hour, 48.0% of trips approach and exit via the A31 arms in 2015, compared to 36.5% in 2009; and
- In both peak periods there is a significant reduction in traffic entering the junction from Arm C (B3073 Ham Lane) and Arm B (Wimborne Road West). In the PAR, it was reported that queues on the A31 southbound meant some traffic would rat-run through a local industrial estate to approach the junction via Arm B rather than Arm A. It is possible that some of the changes in traffic patterns observed between 2009 and 2015 could be as a result of drivers no longer making this rat-run although the way that the difference is observed across the 12 hour counts (and not solely in the

peaks) suggests it may also be attributed to a wider change in traffic patterns.

Summary

- Available traffic data shows that there has not been a significant (+/- 10%) change in traffic levels using the A31, or the Canford Bottom junction, before and after the implementation of the LNMS;
- Proportionally, the amount of traffic using the A31 through-movement to travel straight across the junction has increased between 2009 and 2015.
- The A31 approaches are the dominant arms of the junction, accounting for 58% of all arrivals over a typical 12 hour weekday period (7am-7pm). 46.5% of all trips make the straight-across movement;
- Traffic using the A31 follows a traditional daily flow profile, with 2 hour AM (07:00-09:00) and PM (16:00-18:00) peak periods on weekdays. The AM peak is the busiest period of the day; and
- Weekend traffic at this location is significant. Saturday and Sunday daytime flows are of a similar scale to the weekday daytimes.

4. Journey Time Analysis

Introduction

4.1. As an economy scheme, the key justification for this LNMS is a journey time benefit for road users. The scheme has introduced signals across the junction and added new carriageway to reduce the distance required to traverse the junction between the two A31 arms.

4.2. To assess the impact, this report considers evidence from before and after the scheme to ascertain whether there has been a journey time benefit experienced due to the implementation of the scheme.

4.3. In developing the PAR, the MAC prepared an economic assessment paper which assessed traffic volume and delay at the junction with a LinSig2 model developed to test the junction operation. Conditions were assessed for four time periods (weekday AM Peak, weekday Inter Peak, weekday PM Peak and Saturday bank holiday). Overnight impacts were also quantified to account for increased delay in the low-flow conditions. The model outputs were inputted to JUICE to monetise the impacts to 2021.

Data Source

4.4. For the journey time analysis, Sat Nav data has been used to inform pre- and post-scheme journey times. This data is available from some motorists who use satellite navigation devices and allow their data to be used anonymously for the purpose of generating travel statistics. This data can provide crucial intelligence on the operation of the highway network. The data also has the benefit of being historic, so that it is possible to retrieve pre-scheme journey time data after the scheme has opened.

4.5. In order to conduct the analysis, seven time periods have been defined using the diurnal flow profiles presented in chapter 3 as a guide. The time periods have been defined to combine similar hours in terms of flow levels and trip purposes (commuting/leisure etc). The seven time periods used are listed in **Table 4.1**.

Table 4.1 – Journey Time Analysis: Time Period Splits

Period Name	Monday - Friday	Saturday	Sunday
Weekday AM Peak	07:00 – 09:00		
Weekday PM Peak	16:00 – 1800		
Weekday PM Shoulder	15:00 – 16:00 & 18:00 – 19:00		
Weekday Inter Peak	09:00 – 15:00		
Saturday Daytime		08:00 – 19:00	
Sunday Daytime			09:00 – 19:00
7-Day Overnight	19:00 - 07:00	19:00 – 08:00	19:00 - 09:00

4.6. Sat Nav data has been acquired for these time periods over a one year period before and after the scheme. These periods are defined as:

- Pre-scheme: October 2010 - September 2011; and
- Post-scheme: July 2012 – June 2013.

4.7. Although the route was a designated Olympic Route during the London 2012 Games (27th July 2012 – 12th August 2012), TRADS flow data analysis suggests that this did not have a significant enough effect on traffic volumes to make these dates unsuitable and hence it has been included in the analysis.

Journey Time Comparison

4.8. The impact of the scheme during each of these seven time periods has been considered separately.

4.9. Journey time changes have been calculated so that any movements which share a lane on approach to the junction has a common journey time to the stop line. Individual movements around the circulatory carriageway and exiting the junction are then calculated individually from the Sat Nav data (or aggregated using a number of other movements where sample sizes are insufficient). The methodology is explained in more detail in **Appendix B**.

4.10. **Table 4.2** presents the calculated change in journey time between the pre-scheme and post-scheme periods for each movement. Negative values indicate a journey time saving and hence a benefit.

Table 4.2 – Difference in Before and After Journey Times for Total Movements (seconds per vehicle)

Arm From	Arm To	AM Peak	PM Peak	PM Shoulder	Inter Peak	Sat Daytime	Sun Daytime	7-Day O/night
A – A31 North	B	-194.8	-71.5	-46.4	-55.4	-85.3	-7.3	6.2
	C	-189.5	-68.7	-43.0	-46.1	-83.3	-6.6	5.4
	D	-140.4	-59.5	-6.6	-36.3	-29.6	4.2	11.0
	E	-70.9	-13.0	36.7	-2.9	-6.9	35.9	34.4
	F	-66.5	-15.1	34.2	1.4	-2.5	38.1	39.1
B – Wimborne Road West	A	85.7	118.1	47.6	32.0	2.2	52.0	34.9
	C	17.4	47.9	10.2	-11.5	-28.7	-3.6	3.8
	D	64.3	103.1	67.6	11.8	-0.5	13.3	21.3
	E	60.6	84.9	33.6	14.3	-8.6	6.8	26.1
	F	41.5	71.6	11.5	25.7	-16.3	26.2	20.2
C – B3073 Ham Lane	A	48.1	-12.9	26.7	40.9	40.4	49.3	41.1
	B	44.3	-4.6	18.0	34.9	37.3	52.9	43.2
	D	16.8	-67.6	-0.4	8.6	16.6	16.5	18.2
	E	-93.8	8.9	-83.7	-8.5	5.7	11.3	15.7
	F	-102.1	25.8	-76.4	7.8	17.6	23.9	25.2
D – A31 South	A	-70.9	-111.3	-57.4	-38.1	-51.9	-26.9	6.0
	B	4.3	-32.2	-12.9	8.6	10.0	4.3	31.1
	C	29.2	-20.1	0.5	18.3	21.0	7.1	32.9
	E	-174.9	-18.0	-67.3	-25.5	-10.3	-24.6	2.0
	F	-18.0	-65.8	-25.5	-1.8	-24.6	2.0	7.6
E – B3073 Wimborne Road West	A	18.6	50.0	24.7	23.5	21.8	22.3	20.5
	B	23.6	68.3	18.0	14.8	15.8	10.9	18.8
	C	42.1	90.6	31.0	24.1	24.5	20.0	21.0
	D	100.2	144.5	73.4	71.6	73.6	51.9	4.3
	F	0.7	28.3	6.7	5.4	4.4	5.3	5.5
F – Canford Bottom	A	-75.3	17.0	8.9	0.6	8.3	2.3	19.9
	B	1.6	42.3	11.4	2.1	-13.5	14.1	18.7
	C	-35.6	49.3	21.0	16.3	13.5	11.0	22.6
	D	56.5	34.0	7.7	65.3	10.4	-8.7	-3.5
	E	61.7	95.4	62.8	59.7	55.4	72.9	38.6

Negative values indicate a journey time saving and hence a benefit. Savings > 20 secs are highlighted in Green. Positive values indicate an increase in journey time and hence a dis-benefit. Increases of > 20 seconds are highlighted in Red.

4.11. In summary:

- The movements which have benefitted from a journey time saving are primarily from Arms A and D, which are the A31 approaches. From these

approaches, there are benefits observed across most of the weekday periods, as well as Saturdays. There has been less of an impact on Sundays and some adverse impacts overnight;

- Across the other four arms, the impact has been largely negative, with journey time increases. In the AM Peak, PM Peak, PM Shoulder and Inter Peak periods, many of the possible vehicle movements from Arm B and Arm E are slower after the opening of the scheme. Although Arm F does show some improvements in the AM Peak (if travelling to Arms A or C), the impacts at other times are largely negative;
- The impact on Arm C (B3073 Ham Lane) is varied with benefits in the AM Peak and PM Shoulder periods if turning to Arms E or F, but dis-benefits if turning to Arms A or B; and
- Overnight there are only negative impacts. This is as expected as the signalisation of the junction will create additional delay during any time periods where flow is lower, and hence pre-scheme delay is smaller. A similar effect is also observed on Sundays.

4.12. The data demonstrates how the changes to the junction have improved the dominant traffic movements which are across the junction and along the A31 in both directions, during much of the week. This has however been to the detriment of the other arms, in many cases.

4.13. Whilst **Table 4.2** presents the change in journey times, the actual before and after journey times observed in the Sat Nav data are presented in **Appendix C** and **Appendix D** respectively.

Journey Time Reliability

4.14. The Sat Nav data also allows any change in journey time reliability to be quantified, by using the inter-quartile range journey times and the 5th to 95th percentile journey times. By considering how these ranges have changed from the pre-scheme year to the post-scheme year the reliability of journey times can be assessed.

4.15. As the Sat Nav data has been extracted with vehicles making individual arm-to-arm movements analysed together, it is possible to assess the change in journey time reliability for each of these individual arm-to-arm movements separately to make a robust assessment of how reliability has been affected.

4.16. As this analysis has considered for the 30 individual arm-to-arm movements during all seven analysis time periods, it has been considered proportional to review subsets of this data to assess the reliability impacts of the scheme.

4.17. **Table 4.3** presents the changes in 75th percentile and 95th percentile journey times for the AM and PM peak periods. The movements where there were fewer than 50 vehicle observations in either the pre- or post-scheme period are not included in the analysis as it is considered there is insufficient data to make a robust impact assessment.

Table 4.3 – Reliability: Difference in Before and After Key Percentile Journey Times for Total Movements (seconds)

		AM Peak				PM Peak			
Arm From	Arm To	5th %-ile	25th %-ile	75th %-ile	95th %-ile	5th %-ile	25th %-ile	75th %-ile	95th %-ile
A – A31 North	C	-2	-31	-319	-602	2	-13	-106	-244
	D	-4	-8	-223	-544	-7	-12	-82	-252
	E	5	9	-104	-334	3	8	-30	-125
	F	11	6	-146	-404	10	11	-16	9
B – Wimborne Rd West	D	2	8	63	240	-4	7	174	325
	E	3	11	72	254	5	15	128	228
	F	3	16	56	269	1	10	192	279
C – B3073 Ham Ln	A	6	18	89	92	5	15	-30	-214
	D	-1	1	14	-9	-4	-10	-102	-335
	E	2	5	24	6	-1	-2	-129	-343
	F	5	16	47	53	2	2	-120	-296
D – A31 South	A	-11	-17	-96	-256	-14	-29	-157	-352
	B	1	2	25	10	-1	-3	-49	-101
	C	3	12	44	-12	3	5	-41	-154
	E	-11	-9	-10	-132	4	2	-78	-256
	F	-6	-4	-7	-145	6	-10	-125	-364
E – B3073 Wimborne Rd West	A	2	5	2	72	4	10	42	207
	B	4	8	4	0	3	13	75	523
	C	6	11	18	235	5	20	94	237
F – Canford Bottom	A	-2	-7	-50	-185	2	3	24	32
	B	1	-7	-72	-246	4	7	43	87
	C	2	3	6	-41	5	10	65	142

Negative values indicate a journey time reduction with improvements of more than 30 secs highlighted in Green. Positive values indicate an increase in journey time with increases more than 30 seconds are highlighted in Red. Movements not shown had less than 50 observations in either the pre- scheme or post- scheme period and so there is insufficient data to make a robust impact assessment.

4.18. The data in **Table 4.3** shows that reliability during the peak periods has improved for trips approaching from Arm A, including a large improvement during the AM peak. There are also improvements on Arms C and D in the PM peak.

4.19. The graphs presented in **Appendix E** show the journey time reliability for all seven time periods on the following vehicle movements:

- Arm A (A31 North) to Arm D (A31 South);
- Arm D (A31 South) to Arm A (A31 North);
- Arm B (Wimborne Road W) to Arm D (A31 South);
- Arm C (B3073 Ham Lane) to Arm E (B3073 Wimborne Rd W);
- Arm E (B3073 Wimborne Rd W) to Arm A (A31 North)

4.20. This broad assessment suggests that the reliability has been impacted in a similar way to journey times with improvements across the main two traffic arms (Arms A and D), but with adverse impacts on the four other arms. Arm C shows some improvements, but during certain times of the week only.

Calculation of annual vehicle hour benefits

4.21. **Table 4.2** presented earlier in this section, demonstrates how journey times have changed for certain movements and time periods before and after the scheme's construction. It is assumed that these changes are a result of the scheme measures. Therefore, it is necessary to calculate the number of vehicle hours saved in the opening year, in order to understand and quantify the overall impact for this evaluation.

4.22. Weekly vehicle movement matrices have been calculated and are presented in **Appendix F**. In the absence of any observed turning count data, weekend and overnight flows are based on the July 2015 weekday count but factored using the permanent TRADS counts on the A31. It is assumed that the vehicle turning proportions on weekends and overnight are the same as observed during weekday Inter Peak period.

4.23. The arm-to-arm vehicle movements (outlined in **Appendix F**) are multiplied by the differences in journey times outlined in **Table 4.2** to identify the total weekly vehicle hour savings.

4.24. Weekly vehicle hour savings are multiplied by 52 to calculate the annual vehicle hour savings. The annual resulting vehicle hour savings are summarised, by approach arm, in **Table 4.4**.

4.25. A full breakdown of the vehicle hour savings by arm-to-arm movement is presented in **Appendix G**.

Table 4.4 – Annual Vehicle Hour Savings, by Approach Arm

Arm	Wkdy AM Peak	Wkdy PM Peak	Wkdy PM Shoulder	Wkdy InterPeak	Saturday Daytime	Sunday Daytime	7-Day O/night	Total
A – A31(N)	-19,572	-8,909	72	-12,687	-3,923	1,109	4,053	**-39,857**
B – Wimborne Road West	3,145	5,563	2,075	2,222	-465	676	2,500	**15,717**
C – B3073 Ham Lane	-3,405	-655	-3,429	285	709	916	2,220	**-3,359**
D – A31 (S)	-9,715	-17,671	-7,337	-12,473	-6,032	-3,098	3,127	**-53,200**
E – B3073 Wimborne Rd W	2,277	4,189	1,353	3,930	1,363	1,155	2,649	**16,916**
F – Canford Bottom	-2,125	1,419	594	1,409	142	327	1,461	**3,227**
Total	**-29,395**	**-16,064**	**-6,673**	**-17,313**	**-8,205**	**1,086**	**16,010**	**-60,555**

Negative values indicate a journey time saving and hence a benefit. These are highlighted in Green. Positive values indicate an increase in journey time and hence a dis-benefit. These are highlighted in Red.

4.26. **Table 4.4** demonstrates that:

- Overall, the scheme has resulted in a journey time saving of 60,555 vehicle hours in the opening year;
- Traffic entering the junction from Arms A and D (the A31 approach arms) are the reason for this positive impact, with a net benefit of over 93,000 vehicle hours observed between these arms in the opening year;
- The only one of the lesser arms to experience a net benefit across the year is Arm C which has a modest improvement;
- The other three lesser approach arms all experience a net dis-benefit with around 15,000-17,000 additional vehicle hours per annum observed for vehicles travelling through the junction from approach Arms B and E.
- The net dis-benefits from Arm F are more modest, helped by a net improvement of 2,125 vehicle hours per annum during the AM peak;
- As a whole, the junction demonstrates improved operation throughout an average weekday, with the most significant benefits during the AM peak. The improvements during the PM peak and Inter Peak are also notable; and
- As would be typical with a full-time signalisation scheme, there are net dis-benefits observed during the periods with lower vehicle flow (Sundays and overnight). During these periods the traffic signals add delay to vehicles which may usually not have experienced any congestion with the previous highway layout.

4.27. **Table 4.5** presents a breakdown of the annual journey time savings, by the scale of the journey time impacts.

Table 4.5 – Annual Vehicle Hour Savings, by Size of Impact

Change in JT (Secs per Veh)	Journey Time Benefits	Journey Time Dis-Benefits	Total Journey Time Impact
0 – 10	-1,972	+4,627	**+2,656**
10 – 20	-1,219	+13,168	**+11,950**
20+	-113,601	+38,441	**-75,160**
Total	**-116,792**	**+56,237**	**-60,555**

4.28. **Table 4.5** demonstrates that the scheme benefits are predominantly achieved as a result of large journey time improvements for individual movements. This gives confidence that the scheme has had an impact on journey times in real terms and that the reported journey time saving is not as a result of a collection of smaller changes which may not be truly perceivable.

Summary

- The scheme has met its objective of reducing journey times through the junction, resulting in 60,555 vehicle hours of journey time benefits in the opening year;
- The A31 approach arms are shown to experience the majority of the benefit, which is expected given the new ‘hamburger’ layout. The B3073 Ham Lane approach has also experienced a small net benefit across the year (Arm C);
- The other three lesser arms have been adversely impacted by the measures and demonstrate net dis-benefits during most time periods; and
- Considering the operation of the whole junction by time period, there are net benefits throughout an average weekday from 07:00 to 19:00, and on Saturdays from 08:00 to 19:00. Throughout the ‘Overnight’ period there is a net dis-benefit of almost 16,000 vehicle hours in the opening year.

5. Safety Impacts

Introduction

5.1. A critical component of any highway scheme is safety. This scheme aimed to reduce the number of accidents occurring at the junction, particularly those involving shunts. This section examines the safety impacts associated with the scheme, and compares the pre- and post-scheme opening accident rates to determine whether the scheme has resulted in a post opening safety benefit or dis-benefit. The earlier feedback from key stakeholders suggested some concern regarding the safety of the new layout.

Data Source

5.2. The PAR used accidents[3] from the five year period 1st January 2005 to 31st December 2009 as evidence for the pre-scheme conditions at the scheme site. The PAR stated that there had been 59 accidents during this period and that the scheme aimed to save 4.80 accidents in the opening year.

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

5.4. The delay between collecting evidence for a scheme and starting construction means the accident data used to evidence the situation before the scheme is often dated. As such, to understand just the impact of the scheme, a five year pre-construction accident analysis represents a better comparison to the outturn accident rate, and hence representation of scheme impacts.

5.5. With the PAR using accident data up until December 2009 and scheme construction not beginning until October 2011, there are 22 months between the evidence and the scheme, during which time the accident rate could have changed.

5.6. In reviewing the PAR analysis, it has also been considered that a smaller assessment area would be more appropriate than the area used in the PAR assessment. The PAR considered the lengths of the A31 extending as far as Ameysford Roundabout (around 2.9km north-east of Canford Bottom) and Merley Roundabout (around 3.2km south-west of Canford Bottom) as it was identified that on occasions, traffic queues could block back for these lengths. For evaluating the safety impacts of the junction improvement scheme, it is considered more appropriate to reduce this area and include only sections of 1.25km either side of the junction along the A31. This focuses the accident analysis to the road sections which are most directly affected by the typical conditions on the A31 and at the Canford Bottom Roundabout and discounts

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

road sections which may only be influenced during rare conditions of maximum queuing. The areas on the other four approach arms are taken as being the same as was used in the PAR analysis.

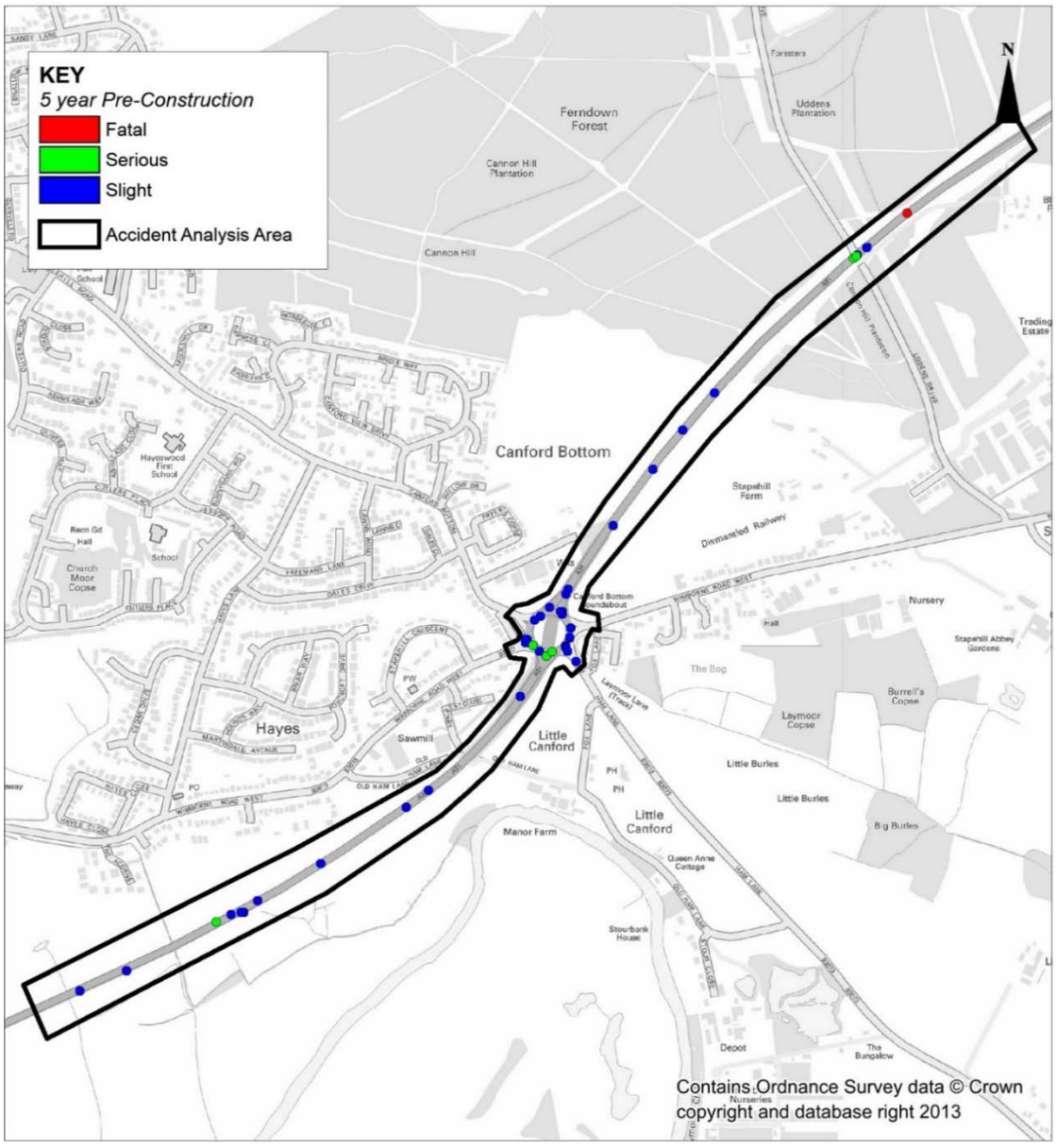
5.7. As such, to understand just the impact of the scheme, accident data has been analysed over this reduced area for a period of five years directly before construction began (1st October 2006 to 30th September 2011).

5.8. The results are presented in **Table 5.1** and **Figure 5.1**. A total of 41 accidents occurred during this pre-scheme period (average of 8.20 per year), with 1 fatal accident, 6 serious accidents and the remainder slight.

Table 5.1 – 5 Year Pre-Scheme Accident Rates

Accidents	Dates	Slight	Serious	Fatal	Rate	Severity Index
5yr Pre-Construction	10th October 2006 to 9th October 2011	34	6	1	8.20	17.1%

Figure 5.1 – 5 Year Pre-Scheme Accident Locations



Construction

5.9. It is important to consider the effect of construction on accidents. While this is not typically monetised in LNMS evaluations, it is informative to consider whether the construction process introduces accidents to the road network.

5.10. For the A31 Canford Bottom Roundabout Improvement scheme, the construction period was between 10th October 2011 and 20th June 2012.

5.11. During this period, there were two accidents recorded in the accident analysis area which equates to an annual rate of 2.67. One of these resulted in a fatality when a motorcycle was struck as it overtook moving traffic. The other incident was of slight severity. There is no evidence that either of the accidents can be attributed to the construction activities.

Post-Scheme

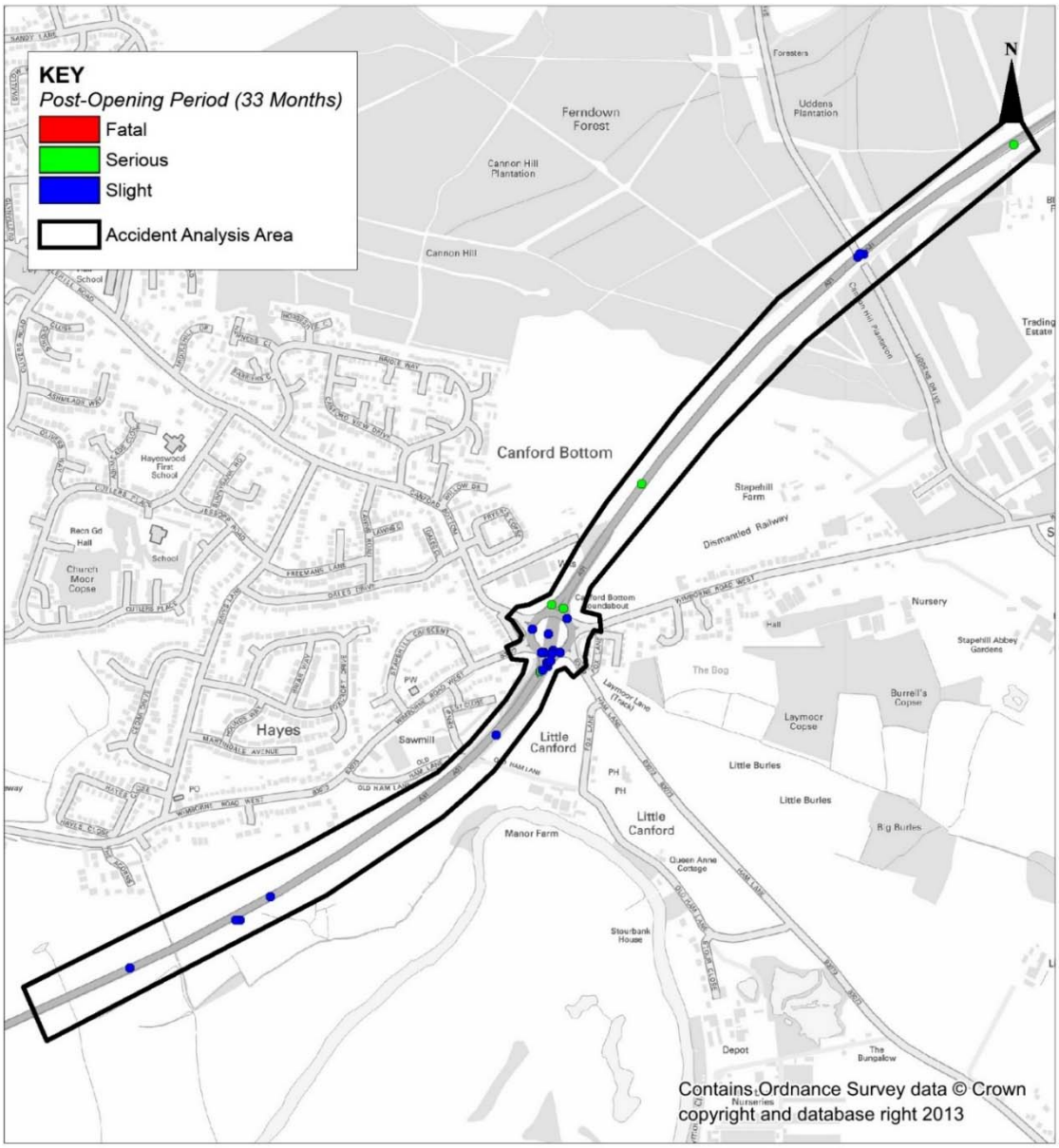
5.12. To understand the safety performance of the road network after the scheme implementation, data has been collected for the period since the scheme opened. The scheme opened on 20th June 2012 and data has been collected from this date to as recent a date as possible. For this scheme, data was available until the end of February 2015, meaning that there are 33 months (from 20th June) of data to interrogate post-opening for this scheme. The area considered includes around 1.25km sections of the A31 on either side of the junction, as outlined earlier.

5.13. The post-scheme accident data is outlined in **Table 5.2**, with the accident locations shown in **Figure 5.2**.

Table 5.2 – Post-Scheme Accident Summary

Accidents	Dates	Slight	Serious	Fatal	Rate	Severity Ratio
Post-Scheme	20th June 2012 – 28th February 2015	22	4	0	9.45	15.4%

Figure 5.2 – Post-Scheme Accident Locations



5.14. There have been 26 accidents since the scheme opened, with 4 serious accidents and 22 slight. The post-scheme accident rate is 9.45 accidents per annum; a slight increase on the five year pre-scheme accident rate as well as the pre-scheme rate reported in the PAR.

5.15. Of these accidents, two occurred within the first ten days after the scheme opened and were attributed to drivers not being familiar with the new highway layout and signals. Overall across the 33 months, there have been 7 accidents which appear to have occurred due to drivers not understanding the junction layout (attempting prohibited manoeuvres etc.), or proceeding illegally through a red stop light.

5.16. The plan shows that the accidents have generally been clustered around the southern side of the junction, with concentrations of accidents occurring around the circulatory carriageway near this location and on the A31 (S) exit arm.

5.17. The severity index is 15.4% which is slightly lower than before the scheme. Descriptions of the four serious incidents to occur since the opening of the scheme, can be summarised as:

- One occurred when a motorcyclist lost control and hit the kerb on the A31(N) exit arm, before being thrown off their vehicle;
- One occurred when a vehicle lost control and crossed into the opposite carriageway causing a collision;
- One occurred when a vehicle collided with the rear of another vehicle on approach to the lights on the A31(N) approach arm. The police records note a medical episode is also likely to have contributed towards causing the incident; and
- One occurred when a passenger jumped from a moving vehicle on the A31 (S) exit arm, after an argument with the driver.

5.18. Although the severity index is shown to have reduced slightly, the details of the serious accidents above suggest that two of these could not be designed-for and are in no way related to the highway layout.

Accident Rate Change

5.19. The key changes in accidents that can result from a scheme are:

- Change in the frequency of accidents; and
- Change in the severity of accidents.

5.20. By understanding the impact the scheme has had on these metrics, it is possible to draw conclusions on the safety aspects of the A31 Canford Bottom Roundabout Improvement scheme.

5.21. **Table 5.3** shows the accident rate and severity index for the pre-construction and post-scheme periods.

Table 5.3 – Impact of Scheme on Accident Rates

5yr Pre-Construction Period		Post-Scheme Period		Accident Rate Change
Accident Rate	Severity Index	Accident Rate	Severity Index	
8.20	17.1%	9.45	15.4%	+1.25

5.22. The table shows that following the completion of the scheme, the accident rate has increased by 1.25 accidents per year. This is in contrast to the forecast in the PAR which was to save 4.80 accidents per annum.

5.23. The post-scheme severity index of 15.4% indicates that the proportion of accidents resulting in fatal or serious injuries is slightly reduced compared to before the scheme. With regards to serious and fatal accidents, there are an average of 1.45 accidents per annum over the post-scheme period compared to 1.20 per annum during the pre-scheme period. Hence while the severity index has been reduced, the annual rate of serious or fatal accidents has increased.

Accident Causation

5.24. STATS19 accident data provides a comprehensive record of the accidents that have occurred. This makes it possible to go beyond the frequency and severity of accidents and consider the reasons why accidents have been occurring, by analysing the contributory factors recorded during accidents.

5.25. **Table 5.4** demonstrates the pre-scheme and post-scheme frequency of contributory factors. In the outturn column of these tables, savings above 0.2 accidents per annum are highlighted in green, increases above 0.2 accidents per annum are highlighted in red, while changes of 0.2 accidents per annum or less are highlighted in amber.

Table 5.4 – Impact on Contributory Factors to Accidents per Annum

Contributory Factor	5 Year Pre Construction	Outturn
Failed to look properly	3.8	2.5
Failed to judge other person's speed	3.0	2.5
Poor turn or manoeuvre	1.6	2.5
Following too close	1.4	0.4
Careless/Reckless/In a hurry	1.2	0.7
Travelling too fast for conditions	0.6	0.0
Ped - Dangerous action in carriageway	0.4	0.0
Junction overshoot	0.2	0.4
Sudden braking	0.2	0.4
Disobeyed automatic traffic signal	0.0	1.8
Loss of control	0.0	1.1
Road layout	0.0	0.4
Illegal turn or direction of travel	0.0	0.4
Failed to signal/misleading signal	0.0	0.4
Stationary or parked vehicles	0.0	0.4
Vision affected by road layout	0.0	0.4

5.26. This analysis shows that before the scheme, the main reasons for accidents occurring was people ‘failing to look properly’, or ‘failing to judge other’s people’s speed’. There were at least 3 accidents each year where this was cited as a reason for the incident. ‘Poor turn or manoeuvre’ was the third most commonly observed contributory factor, being attributed to 1.6 accidents per annum.

5.27. After the completion of the scheme, the same three contributory factors continue to be the primary reasons associated with accidents. However, whilst the number of accidents where ‘failing to look properly’, or ‘failing to judge other’s people’s speed’ were contributory factors has reduced with the scheme to 2.5 accidents per annum, the frequency of incidents where ‘poor turn or manoeuvre’ is cited as having contributed have increased per annum by 0.9 to 2.5. This may be an indication that the new junction layout has increased the likelihood of poor

manoeuvres being undertaken, due to its design or unclear information leading to poor road positioning.

5.28. The data does however also show how the introduction of the new layout, and traffic signals, has changed the accident causation profile. Following the opening of the scheme, there are now accidents which are caused by drivers 'disobeying traffic signals'. 'Loss of control' has also become a notable contributory factor (1.1 accidents per year are associated with this) which was not seen previously in the pre-scheme data.

Location Breakdown

5.29. To supplement the analysis, further interrogation has been undertaken to identify the change in accident rates in the immediate vicinity of the junction, compared to the lengths of the A31 on either side of the junction. This is summarised in **Table 5.5**.

Table 5.5 – Impact of Scheme on Accident Rates

	5yr Pre-Construction Period		Post-Scheme Period		Accident Rate Change
	Accident Rate	Severity Index	Accident Rate	Severity Index	
Within 100m Junction	4.60	13.0%	6.55	16.7%	+1.95
Other A31 Mainline Area	3.60	22.2%	2.91	12.5%	-0.69

5.30. This analysis shows that the overall increase in annual accident rate can be attributed to an increase in the frequency of accidents in the immediate vicinity of the junction. There has been a reduction in accidents on the A31 mainline section, but an increase close to the junction and within the circulatory carriageway. Given that journey time data indicates that congestion on the A31 has decreased, the reduction in accident rate on the A31 mainline sections could be attributed to the improved vehicle flow in that area.

5.31. The severity index data also shows that the mainline section has improved with the severity index reduced from 22.2% to 12.5%. Closer to the junction, the severity of incidents is now slightly worsened, increasing from 13.0% to 16.7%. However, the two post-scheme incidents which could be considered as atypical both occurred close to the junction and hence are contributing to this rise.

Security

5.32. The scheme's PAR considered that the measures would have a large beneficial impact on security as a result of new CCTV being installed as part of this scheme. The junction layout also allows for police vehicles to wait on the junction islands to allow for informal surveillance / traffic operations as necessary. Street lighting was also upgraded and the new pedestrian crossings facilities are provided in well-lit areas.

5.33. The site visit observed that the prescribed facilities were all in place, including CCTV, new pedestrian crossings and a vehicle lay-by provisions within the traffic

island. Overall, it is considered that the scheme has had a **slight beneficial** impact.

Summary

- The scheme has not been successful in achieving its safety objective, with a post-scheme increase of 1.25 accidents per annum. This compared to a PAR predicted saving of 4.80 accidents per annum;
- This increase is due to more accidents occurring close to the junction, rather than on the A31 mainline sections either side of the junction; and
- The scheme has resulted in a reduction in accidents occurring where a driver has failed to look properly or failed to judge another person's speed, but an increase in accidents due to a poor turn or manoeuvre which aligns with some of the stakeholder observations.

6. Other Impacts

6.1. This section of the report presents information relating to the WebTAG objectives which are not related to journey times, reliability or safety, as set out in the PAR's AST (as these have already been discussed in previous chapters).

6.2. This information will be compared to the forecasts made in the AST (provided in **Appendix H**). These comparisons are used to score the scheme against objectives based on the first year' observed findings and are recorded in the Evaluation Summary Table (EST). The EST can be found in **Appendix I**.

6.3. Other impacts from the AST which are not referred to in this section are considered to be 'not applicable'.

Environmental Impacts

Noise

6.4. The scheme's PAR considered that the scheme would have a neutral impact on noise following an assessment. This pre-scheme analysis concluded that with the introduction of the scheme, only one additional person was anticipated to be adversely impacted by the scheme. The average change in noise level at a property was predicted to be 0.1dB which is imperceptible to the local public according to guidance. This impact was calculated as a PVB of -£0.019m.

6.5. In line with the agreed methodology for POPE of LNMS, a desktop review has been competed of the location which indicates that there are homes within 300m of the scheme. An assessment for noise is therefore appropriate for this scheme. Any changes in traffic volumes, HGV proportions and vehicle speeds are used to identify if there has been a noise impact significant enough to be reported in the EST. PAR guidance suggests that impacts are only significant if:

- Traffic volume changes by more than 25%; or
- The HGV proportion changes by more than 20%; or
- Vehicle speeds change by more than 10kph.

6.6. The traffic volume analysis in Chapter 3 shows that traffic volumes travelling through the junction have changed by less than 25%. There is also no evidence that HGV proportions have changed significantly; certainly not by more than 20%. Furthermore, the net change in vehicle speeds across an average week is less than a 10kph change. The impacts are therefore considered to not be of a significant scale, and are assessed as **neutral**.

Local Air Quality

6.7. The PAR considered that the scheme would have a beneficial impact with 1,132 properties benefitting from improved local air quality, based on assessment of PM_{10} and NO_2 impacts.

6.8. In line with the agreed methodology for POPE of LNMS, a desktop review has been competed of the location which indicates that there are homes within 50m of the scheme. An assessment for local air quality is therefore required, based on change in AADT and vehicle speeds. PAR guidance suggested that local air

quality impacts are only significant if the AADT has changed by more than 700 vehicles or the vehicle speeds changed by >5kph. The traffic change also needs to be at least 10% higher or lower than the pre-scheme volume to be significant.

6.9. The traffic volume analysis in Chapter 3 shows that traffic volumes travelling through the junction have changed by less than 10%. Based on the lack of change in traffic volumes, it is considered that the changes in air quality are not significant and the EST therefore concludes with a **neutral** impact for local air quality.

Greenhouse Gases

6.10. The PAR considered that the scheme would have a beneficial impact with a reduction in carbon emissions over the assessment period. The benefits were to be accrued through the removal of congestion and associated reduction in traffic related emissions.

6.11. The post-opening evaluation has used the Design Manual for Roads and Bridges Screen Method assessment spreadsheet tool (v1.03c) to assess the difference in carbon emissions which has resulted due to the change in traffic conditions (vehicle flows and speeds) observed before and after the scheme. The net impact has then been monetised using the WebTAG Greenhouse Gases Workbook (Nov 2014 version).

6.12. The traffic analysis presented in this report has shown that the impact of the scheme has been to speed up some vehicle movements through the junction but slow down others. The assessment shows an additional 33 tonnes of Carbon are emitted in the opening year following the completion of the scheme (approximately 300 tonnes over the 10 year scheme life). Across the scheme life, this equates to a PVB of -£0.015m, which represents a **small adverse** impact.

Landscape

6.13. The PAR considered that the scheme would have a moderate adverse impact on landscape with localised impacts where views from listed buildings, properties and public rights of way are affected.

6.14. Due to the introduction of the new highway sections, a large amount of traffic signalling equipment and new road signing, it is considered that there has been a **moderate adverse** impact on landscape. This was based on the observations made on-site.

6.15. **Figure 6.1** demonstrates one view of the multiple signal heads which now exist following the full signalisation of the junction.

Figure 6.1 – Signals Equipment demonstrating impact on Landscape

Townscape

6.16. The PAR considered that the scheme would have a slight adverse impact on townscape due to elements of the scheme being slightly out of scale within the residential setting.

6.17. The post-opening evaluation considers that it is more appropriate for Landscape to be assessed for the Canford Bottom location. As such, the townscape impact is scored as ‘not applicable’.

Heritage and Historical Resources

6.18. The PAR considered that the scheme would have a neutral impact on the heritage and historical resources following an assessment. The assessment concluded a slight adverse impact due to four Grade II listed buildings in Little Canford village. However, the AST reported a neutral impact as the unfavourable affects were included within the landscape assessment and double-counting was avoided.

6.19. The post-opening evaluation has identified 5 listed buildings and 3 scheduled ancient monuments within close proximity to the junction. Based on the post-scheme site visit, it is considered that while the impact of the scheme in the local area is significant, it is unlikely that the scheme’s measures would change how the scheme appears from any of the heritage sites. As such, the outturn impact is considered **neutral**.

Biodiversity

6.20. The PAR records the impact on biodiversity as moderate adverse due to the potential for protected species including smooth snake, dormouse, common reptiles, badger and nesting birds to be present within the site. Habitats suitable to support these species were recorded as being present within the site. The PAR notes that ecological surveys for these species were being undertaken at the site but that the results were not yet available to inform the PAR. As such “*the overall Assessment Score has been based on worse case scenarios as*

ecological surveys are ongoing and therefore outcomes of surveys and extent of impacts are not yet known".

6.21. The following sources of information were available for this post-opening evaluation:

- General arrangement drawings; and
- Pre- and post-scheme photographs of the scheme to show the extent of works.

6.22. The area team did not provide any details regarding the scope or results of ecological surveys and assessment which were undertaken at the site nor details of any ecological mitigation or compensation measures that were undertaken for the scheme in light of the results of the surveys.

6.23. Without access to this information it is not possible to make an accurate post-opening evaluation of the impact of this scheme upon biodiversity. However, the post-completion photos show that the scheme has been constructed as per the general arrangement which was assessed in the PAR. The PAR based the overall assessment score on a worst case scenario pending the results of the ecological surveys. It is therefore considered unlikely that the extent of the impact was more severe than the impact predicted in the PAR. As such, the outturn impact is considered **moderate adverse**.

Water Environment

6.24. The PAR considered that the scheme would have a neutral impact on the water environment. A simple assessment of impact due to routine runoff was undertaken to evaluate this. The simple assessment confirmed that the changes to the drainage design were predicted to have a negligible impact on the River Stour, the receiving watercourse which provides a large amount of dilution and no mitigation measures were recommended for pollution prevention. It was however recommended that the existing assets were maintained following the standard maintenance schedule. Flood risk impacts of the scheme were not covered by the assessment, which would normally be required as there are changes to the drainage design.

6.25. This evaluation has identified that since the PAR was completed, the River Stour, located 400 metres from the roundabout, has improved its ecological status from 'poor' to 'moderate', and the chemical status has remained as 'good', based on the Environment Agency's catchment data explorer. These improvements show the wider context of the scheme's receiving water environment and could be due to a number of factors in a large river catchment. However, the status of the existing assets that were recommended to be maintained is unknown as a site visit was not undertaken and any localised impacts to the River Stour due to the scheme have not been assessed.

6.26. A desktop review of the methods undertaken for the scheme's PAR and simple assessment of impact due to routine runoff and spillage, suggest that the environmental parameters originally proposed and the methodology undertaken is in line with expectations, suggesting that the potential impact on the River Stour remains as **neutral**.

6.27. As flood risk was not originally assessed, it was not possible to assess this for the post-opening evaluation.

Physical Fitness

6.28. The scheme's PAR did not consider that the scheme would have any impact on physical activity.

6.29. The site visit observed that pedestrians and cyclists were using the controlled crossings implemented as part of the signalisation. Given the site location, there are a number of small villages surrounding the junction (e.g. Canford Bottom to the north, Little Canford to the south, Stapehill to the East, Wimborne to the West). The scheme has improved the connectivity between these villages and so it likely to have had a positive effect on the number of people that are now able to walk or cycle for more than 30 minutes per day, by removing a barrier to safe movement that existed previously. The scheme also provided improved cycling facilities to navigate the junction, which integrates with NCN Route 256. Therefore it is considered that the scheme has a **slight beneficial** impact on physical activity.

Journey Ambience

6.30. Journey Ambience is related to traveller care, views and stress. The scheme's PAR considered the scheme would have a moderate beneficial impact on journey ambience as a result of the reduction in congestion, new road surfacing, more attractive landscaping, better street lighting, a reduced fear of accidents and new signing to improve route clarity.

6.31. The introduction of traffic signals was intended to decrease driver stress. However, the atypical layout, and scale of the junction (with multiple signal heads) may in fact be perceived as being more complex and hence more stressful than the previous highway arrangement.

6.32. The nature of the hamburger junction layout (i.e. using the left-hand lanes to turn right at the roundabout), means that lane choices are potentially confusing for unfamiliar users, however for the dominant traffic movements (along the A31 across the roundabout) route uncertainty should be decreased as this is now a simpler movement to undertake.

6.33. Stakeholder feedback has suggested an increased level of frustration with the junction for local people. It has also been suggested some people avoid routes via the junction so they do not have to experience it. It is considered that for local trips, using the more minor arms the junction experience has probably been made more difficult.

6.34. The post-opening evaluation recorded a small increase in the annual accident rate, which is likely to have an adverse impact on journey ambience.

6.35. The post-opening evaluation has also demonstrated a large reduction in journey times for most movements at the junction. As most journeys are now faster, this reduction in congestion should mean a positive impact on journey ambience.

6.36. The road surfacing and markings have improved with the scheme, and lighting is better.

6.37. Taking all of the above into account, the outturn assessment has established the impact as **moderate adverse** for the scheme in terms of journey ambience.

Accessibility

Severance

6.38. The scheme's PAR considered that the measures would have a slight beneficial impact on severance as a result of the improved crossing and shared cycleway/footway facilities. The new layout also provides pedestrian facilities across the centre of the junction meaning fewer individual road crossings are required for someone to make trips across the junction on foot.

6.39. The site visit observed that the prescribed facilities were all in place and pedestrians and cyclists were observed using the controlled crossings and the shared cycleway/footway facilities. Given the complexity of the junction (with six traffic arms), and the provision of the signalised crossings where there were previously none, it is considered that the scheme has had a **moderate beneficial** impact.

Access to Transport Systems

6.40. The scheme's PAR considered that the measures would have a neutral impact on access to transport systems. However it did also observe that public transport services would benefit from improved speeds and reliability as congestion will be reduced. The new non-motorised user facilities would also make it easier for people to walk and cycle to/from public transport access points.

6.41. The post-opening evaluation has demonstrated that journey times through the junction have improved. However, the scheme has not significantly improved access to transport systems and hence the impact is considered to be **neutral**.

Integration

Land Use Policy

6.42. The PAR considered that the scheme would have a beneficial impact on land use policy.

6.43. The post-opening evaluation has not considered these impacts in detail. However, it is considered that the impact on land use policy is likely to have been **neutral**.

Other Government Policies

6.44. The scheme's PAR considered that the proposed intervention would have a beneficial impact on other government policy, as the A31 was a part of the Olympic Route Network (as a part of strategic trips to/from Weymouth where events were held).

6.45. The post-opening evaluation has not considered these impacts in detail. However as the measures have been introduced as planned, giving a considerable benefit to the A31 through movements at the junction, and were completed prior to the London 2012 games, it is considered that the **beneficial** impact score was achieved.

7. Economy

Introduction

7.1. This section of the report takes the journey time, safety and greenhouse gases impacts reported in Sections 4 to 6 and considers the monetary value of these impacts. These monetised benefits are then compared to the cost of scheme construction to inform two measures of value for money:

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

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

PAR and Outturn Comparison

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

7.4. The benefits calculated and discussed in this report can be monetised using standard value of time and accident values from WebTAG. A positive impact is considered to provide a monetary saving. Once monetised in this way, the impacts of the scheme are offset against the scheme costs to inform the overall Value for Money of the scheme package in both an opening year, and over a longer scheme life period of 10 years. The 10 year scheme life was defined during the development of the PAR as traffic modelling indicated that with the measures in place, traffic delay would reach pre-scheme 2011 levels by 2021.

7.5. **Table 7.1** summarises this comparison, presenting the PAR and Outturn costs and benefits of the scheme. It also includes opening year and scheme life figures for both costs and benefits of the scheme.

Table 7.1 – PAR and Outturn Economy Comparison

		PAR	Outturn
Opening Year (2012)	Total Cost (£)	5,836,350	7,964,917
	Opening Year Accident Saving (number)	4.80	-1.25
	Opening Year Accident Saving (£)	372,480	-97,353
	Opening Year Journey Time Benefits (£)	6,713,640	812,648
	Greenhouse Gases (£)	38,370	-1,667
	FYRR	122%	9%
Scheme Life (10 years)	Costs	£5.836m	£7.965m
	Safety Benefits	£3.641m	£-0.952m
	Journey Time Benefits	£67.129m	£8.126m
	Greenhouse Gases	£0.373m	£-0.015m
	BCR	12.1	0.9

Summary

7.6. Overall the scheme has been less successful than was predicted. While the scheme has a positive BCR of 0.9, it is not expected to recoup its cost over its scheme life.

7.7. It was anticipated that the scheme would deliver a large journey time saving, as well as preventing some of the accidents that were occurring at the junction. Overall the benefits were expected to be 95% economy and 5% safety.

7.8. Sat Nav data has provided evidence that the overall net journey time for all vehicles to move through the junction has decreased since the opening of the scheme, primarily due to the improvement for vehicles travelling across the junction on the A31 (via the new section of carriageway through the centre of the junction). Although many of the other movements now experience longer journey times, there is an overall net journey time economic benefit of £0.813m per annum, once all impacts are annualised.

7.9. Although primarily an economy scheme, it was also forecast that the measures would result in a reduction in the annual accident rate. It was anticipated that 4.80 accidents per annum would be prevented. Based on 33 months of post-scheme data, it is observed that the annual accident rate has increased (rather than decreased) by 1.25. As a result the economic safety impact is a net dis-benefit of £0.097m in the opening year.

7.10. There was also a small negative impact as a result of the change in Carbon emissions.

7.11. The outturn scheme costs were also notably higher than those predicted in the PAR, which has had a direct impact on the FYRR and BCR.

7.12. As the outturn costs were much higher than were expected, and the predicted journey times did not materialise to the extent which was forecast, the Value for Money is heavily affected. The scheme also resulted in a small increase in accidents, rather than achieving the saving which was forecast.

7.13. The outturn FYRR and BCR are therefore significantly lower than those forecast in the PAR, and over the 10 year scheme life, the BCR is less than 1 reflecting poor value for money.

8. Conclusions and Recommendations

8.1. This report presents the POPE for the A31 Canford Bottom Roundabout Improvement LNMS, completed by Area 3 in June 2012. The scheme evaluation has considered all elements of the NATA criteria. The evaluation team have worked closely with the MAC to ensure the best data possible was used and the scheme thoroughly understood.

8.2. The purpose of this section is to:

- Summarise the key impacts of the scheme and how these compare to forecasts; and
- Consider the lessons learnt and make recommendations to improve future LNMS.1

8.3. The A31 Canford Bottom Roundabout Improvement LNMS opened on 20th June 2012. The scheme signalised the whole of this 6-arm interchange roundabout, and introduced a new carriageway section through the centre of the junction, providing a more direct route for traffic travelling across the junction on the A31. As a result of this new highway construction, the junction was changed to a 'hamburger' layout. The scheme was initiated due to lengthy delays, especially on the A31 approach arms during the weekday peak periods and on Saturdays.

8.4. The journey time analysis identified that the scheme was successful in reducing journey times across the junction, but the reductions in journey time were significantly lower than those forecast in the PAR. The post-opening evaluation shows that the scheme has benefitted traffic travelling through the junction along the A31, but with many of the other movements adversely impacted. The net annual impact for all trips from the B3073 Ham Lane approach has been slightly beneficial, but the other three lesser arms journey times have been increased.

8.5. There was also anticipated to be an accident reduction due to the signalisation reducing the likelihood of vehicle conflicts. The evidence shows that this saving has not materialised and there has been a small increase in annual accident rate. There was also a small negative impact as a result of the change in Carbon emissions. The outturn costs were also much higher than predicted. Overall, the Value for Money is heavily affected with an outturn FYRR (9%) and BCR (0.9) which are significantly lower than those forecast in the PAR (119% and 11.9 respectively).

8.6. When considering all of the evidence, it would appear that the impacts of the scheme are complex. The conclusion that the movements along the A31 have benefited but to the detriment of the lesser four arms is in line with stakeholder feedback and local press interest, which appear to point towards an unhappiness with the scheme amongst local people. This strength of opinion is likely to be because it is primarily local residents who have to endure the adverse impacts on the local arms. Those who are benefiting from the faster strategic movement, may be more likely to live elsewhere and use this junction as a part of a through trip along the A31 only.

Scheme Specific Objectives

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

Table 8.1 – Scheme Specific Objectives

Objective	Evaluation Summary	
Economy: Achieve a significant economy benefit, by reducing delays and congestion during the busiest periods	The scheme has resulted in a decrease in journey times with 60,555 vehicle hours saved in the opening year. It is noted however that the benefit has largely been for through movements on the A31 and hence movements on other arms have not benefited to the same extent.	✓
Achieve a safety benefit from the introduction of a signalised junction	The scheme has been unsuccessful in reducing accidents, with the annual accident rate rising from 8.20 in the five year pre-construction period to 9.45 after the introduction of the scheme.	✗
Achieve an environmental benefit by reducing queue lengths	The scheme has demonstrated a large reduction in journey times for movements approaching the junction along the A31, meaning the length of traffic queues will have reduced. However the assessment of greenhouse gases suggests a very small negative PVB.	✗
Achieve accessibility and integration benefits	The scheme included the provision of new and upgraded pedestrian and cyclist crossing facilities across the whole of the junction.	✓

Lessons Learned

8.8. During the course of this evaluation, a number of findings have revealed ways in which the LNMS appraisal process could be adapted to improve the accuracy of pre-scheme forecasting.

8.9. This scheme is atypical in size and scale, and introduces a hamburger layout which is not common within the UK. Whilst the signals should have reduced vehicle conflicts, the post-opening evaluation has indicated an increase in annual accident rate in the areas closest to the junction, which suggests that some caution may be required in the future when looking to introduce other similar types of scheme.

8.10. It may be beneficial to give additional consideration during the design process to ensure that the layout is as intuitive as possible for users to minimise driver confusion which can lead to incidents.

Appendices

Appendix A. Peak Hour Junction Turning Proportions

AM Peak Vehicle Turning Proportions (May 09 & July 15)

7.30 - 8.30 AM

	2009	Arm%	Jct%	2015	Arm%	Jct%
F-A	140	28%	2.9%	154	32%	3.5%
F-B	118	24%	2.5%	132	27%	3.0%
F-C	178	36%	3.7%	178	37%	4.1%
F-D	61	12%	1.3%	21	4%	0.5%
F-E	4	1%	0.1%	2	0%	0.0%
F-F	0	0%	0.0%	0	0%	0.0%
TOT	501			487		

	2009	Arm%	Jct%	2015	Arm%	Jct%
A-A	0	0%	0.0%	0	0%	0.0%
A-B	10	1%	0.2%	3	0%	0.1%
A-C	7	1%	0.1%	9	1%	0.2%
A-D	702	89%	14.7%	889	83%	20.4%
A-E	62	8%	1.3%	130	12%	3.0%
A-F	10	1%	0.2%	46	4%	1.1%
TOT	791			1077		

F : Canford Bottom

A : A31 (N)

	2009	Arm%	Jct%	2015	Arm%	Jct%
E-A	290	41%	6.1%	267	42%	6.1%
E-B	191	27%	4.0%	165	26%	3.8%
E-C	192	27%	4.0%	190	30%	4.4%
E-D	27	4%	0.6%	4	1%	0.1%
E-E	0	0%	0.0%	0	0%	0.0%
E-F	12	2%	0.3%	15	2%	0.3%
TOT	712			641		

E : B3073 Wimborne Road West

Canford Bottom

B : Wimborne Road West

	2009	Arm%	Jct%	2015	Arm%	Jct%
B-A	12	2%	0.3%	0	0%	0.0%
B-B	0	0%	0.0%	0	0%	0.0%
B-C	27	4%	0.6%	26	6%	0.6%
B-D	412	57%	8.6%	160	39%	3.7%
B-E	178	25%	3.7%	140	34%	3.2%
B-F	95	13%	2.0%	85	21%	2.0%
TOT	724			411		

C : B3073 Ham Lane

D : A31 (S)

ALL ARRIVALS

	2009	Arm%	2015	Arm%
A	791	17%	1077	25%
B	724	15%	411	9%
C	858	18%	460	11%
D	1204	25%	1273	29%
E	712	15%	641	15%
F	501	10%	487	11%
TOT	4790		4349	

	2009	Arm%	Jct%	2015	Arm%	Jct%
D-A	826	69%	17.2%	953	75%	21.9%
D-B	243	20%	5.1%	214	17%	4.9%
D-C	105	9%	2.2%	79	6%	1.8%
D-D	0	0%	0.0%	0	0%	0.0%
D-E	13	1%	0.3%	8	1%	0.2%
D-F	17	1%	0.4%	19	1%	0.4%
TOT	1204			1273		

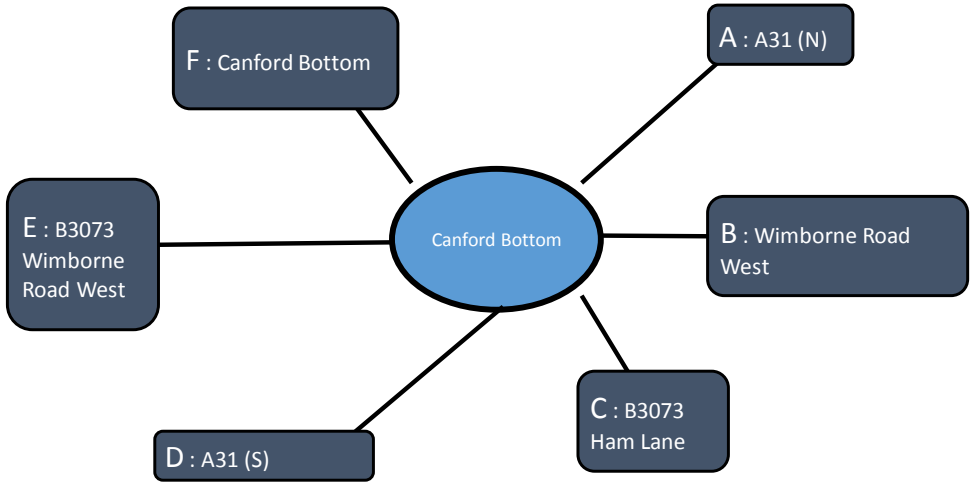
	2009	Arm%	Jct%	2015	Arm%	Jct%
C-A	60	7%	1.3%	13	3%	0.3%
C-B	38	4%	0.8%	1	0%	0.0%
C-C	0	0%	0.0%	0	0%	0.0%
C-D	255	30%	5.3%	126	27%	2.9%
C-E	267	31%	5.6%	214	47%	4.9%
C-F	238	28%	5.0%	106	23%	2.4%
TOT	858			460		

ALL DEPARTURES

	2009	Arm%	2015	Arm%
A	1328	28%	1387	32%
B	600	13%	515	12%
C	509	11%	482	11%
D	1457	30%	1200	28%
E	524	11%	494	11%
F	372	8%	271	6%
TOT	4790		4349	

PM Peak Vehicle Turning Proportions (May 09 & July 15)

4.30 - 5.30 PM



	2009	Arm%	*Jct%*	2015	Arm%	*Jct%*
F-A	98	25%	*2.1%*	76	30%	*1.8%*
F-B	97	24%	*2.1%*	82	32%	*1.9%*
F-C	153	39%	*3.3%*	78	30%	*1.8%*
F-D	32	8%	*0.7%*	20	8%	*0.5%*
F-E	16	4%	*0.3%*	0	0%	*0.0%*
F-F	1	0%	*0.0%*	0	0%	*0.0%*
TOT	397			256		

	2009	Arm%	*Jct%*	2015	Arm%	*Jct%*
A-A	0	0%	*0.0%*	0	0%	*0.0%*
A-B	9	1%	*0.2%*	6	0%	*0.1%*
A-C	9	1%	*0.2%*	18	1%	*0.4%*
A-D	851	80%	*18.5%*	999	80%	*23.5%*
A-E	146	14%	*3.2%*	151	12%	*3.5%*
A-F	48	5%	*1.0%*	73	6%	*1.7%*
TOT	1063			1247		

	2009	Arm%	*Jct%*	2015	Arm%	*Jct%*
E-A	191	40%	*4.1%*	216	45%	*5.1%*
E-B	101	21%	*2.2%*	122	25%	*2.9%*
E-C	158	33%	*3.4%*	117	24%	*2.8%*
E-D	10	2%	*0.2%*	1	0%	*0.0%*
E-E	1	0%	*0.0%*	0	0%	*0.0%*
E-F	18	4%	*0.4%*	24	5%	*0.6%*
TOT	479			480		

	2009	Arm%	*Jct%*	2015	Arm%	*Jct%*
B-A	10	1%	*0.2%*	0	0%	*0.0%*
B-B	1	0%	*0.0%*	0	0%	*0.0%*
B-C	18	2%	*0.4%*	11	2%	*0.3%*
B-D	395	54%	*8.6%*	177	39%	*4.2%*
B-E	170	23%	*3.7%*	150	33%	*3.5%*
B-F	131	18%	*2.8%*	117	26%	*2.8%*
TOT	725			455		

ALL ARRIVALS

	2009	Arm%	2015	Arm%
A	1063	23%	1247	29%
B	725	16%	455	11%
C	811	18%	526	12%
D	1131	25%	1290	30%
E	479	10%	480	11%
F	397	9%	256	6%
TOT	4606		4254	

	2009	Arm%	*Jct%*	2015	Arm%	*Jct%*
D-A	830	73%	*18.0%*	1041	81%	*24.5%*
D-B	149	13%	*3.2%*	162	13%	*3.8%*
D-C	82	7%	*1.8%*	49	4%	*1.2%*
D-D	0	0%	*0.0%*	0	0%	*0.0%*
D-E	21	2%	*0.5%*	17	1%	*0.4%*
D-F	49	4%	*1.1%*	21	2%	*0.5%*
TOT	1131			1290		

	2009	Arm%	*Jct%*	2015	Arm%	*Jct%*
C-A	53	7%	*1.2%*	8	2%	*0.2%*
C-B	11	1%	*0.2%*	0	0%	*0.0%*
C-C	2	0%	*0.0%*	0	0%	*0.0%*
C-D	260	32%	*5.6%*	167	32%	*3.9%*
C-E	240	30%	*5.2%*	203	39%	*4.8%*
C-F	245	30%	*5.3%*	148	28%	*3.5%*
TOT	811			526		

ALL DEPARTURES

	2009	Arm%	2015	Arm%
A	1182	26%	1341	32%
B	368	8%	372	9%
C	422	9%	273	6%
D	1548	34%	1364	32%
E	594	13%	521	12%
F	492	11%	383	9%
TOT	4606		4254	

Appendix B. Journey Time Analysis Methodology

The journey time analysis has been processed so that each movement has the same journey time up to the stop line of the junction, provided it would be using the same approach lane.

E.g. Arm B of the junction has two approach lanes. The right hand lane of Arm B is used by any vehicle travelling to Arms A or F. Regardless of which of the two movements is being made, any vehicle making either of these two journeys should have the same common journey time for the sections up to the stop line to the junction.

In interrogating the SatNav data, routes were extracted as 'full traversal' queries. E.g. vehicles making each individual movement were extracted as separate datasets. Comparing the data for journeys from Arm B to Arm A and from Arm B to Arm F indicated that there was some variance between journey times observed to arrive at the stop line across these two data sub-sets.

To ensure robustness, the evaluation has grouped all individual movements which share a lane at the stop line to the junction, meaning these movements all share a single journey time up to the stop line.

The Table below presents the change in journey time between the pre-scheme and post-scheme periods for each vehicle movement, up to the stop line only. This demonstrates how the provision of the signals has affected the ease of vehicles getting to the junction. Negative values indicate a journey time saving and hence a benefit.

In summary:

- Trips onto the junction from the A31 approach arms are significantly faster, with improvements of over three minutes observed in the AM peak for traffic travelling southbound on Arm A and making left-turn movements to Arms B or C. Although not of the same scale, times are faster throughout the weekdays and on Saturdays for both Arms A and D;
- The journey time to get onto the junction from Arm C is improved throughout the weekdays, with improvements of at least 68 seconds during the PM peak period;
- Trips onto the junction from Arm B are slower during the AM and PM peak periods, but there are improvements during the Inter Peak and at weekends; and
- On Arm E, the impacts are almost neutral, with the exception of the PM peak period when trips onto the junction are now much slower. The impacts on Arm F are similarly neutral but with the exception of the AM peak period when there is a different impact depending on the approach lane used. Trips on the left hand lane (to Arms A, B or C) are now 42 seconds faster to the stop line, but trips using the right hand lane (to Arms D or E) are now over 30 seconds slower.

Having entered the junction, it is reasonable that journey times differ for each individual arm-to-arm movement as vehicles will make different actions and lane choices as they travel around the circulatory carriageway and move to exit the junction.

The majority of analysis is under-taken using the 'full traversal' data, as observed by the Sat Nav technology Evaluating with this approach means the actual impacts for each vehicle movement are considered as accurately as possible.

Where the Sat Nav data sample only provided observations of 50 or fewer during the 12 months evaluation period (either pre- or post-scheme), an aggregated average journey time was instead calculated for that arm-to-arm movement using the other routes as they pass through the junction. This is to ensure a robust assessment, and to minimise any potential bias in the data where sample sizes are lower.

For example, the movement from Arm B to Arm A has only 20 observations during the Pre-Scheme period. The journey time is therefore calculated as:

- **Approach up to the stop line section**: the weighted average journey time for all vehicles travelling on the routes from B to A and B to F, as traffic making either of these movements would use the right hand approach lane to the stop line; and
- **Circulatory or exit section**: the vehicle-weighted average journey time for all vehicles travelling around the circulatory carriageway and exiting the roundabout via Arm A. E.g. A portion of movements C to A, D to A, E to A and F to A, as well as the observed B to A data.

This methodology is applied for all arm-to-arm movements at the roundabout, accounting to the changes in lane designation pre- and post-scheme on Arms A and D (where the hamburger layout now provides the two right hand lanes for ahead trips and all other movements use the left hand to join the circulatory.

Difference in Before and After Journey Times to Stop Line (seconds per vehicle)

Arm From	Lane No	Arm To	AM Peak	PM Peak	PM Shou'r	Inter Peak	Sat Daytime	Sun Daytime	7-Day O/night
A – A31 North	1	D	-164	-89	-28	-53	-45	-8	4
	2	B or C	-198	-77	-50	-60	-88	-10	3
	3	E or F	-133	-80	-16	-51	-50	-4	8
B – Wimborne Road West	1	C or D or E	16	46	9	-12	-30	-5	3
	2	F or A	9	58	-13	-9	-51	-7	4
C – B3073 Ham Lane	1	D or E or F	-3	-88	-19	-6	0	4	6
	2	A or B	-13	-68	-23	-10	-6	6	5
D – A31 South	1	A	-81	-117	-65	-47	-60	-35	2
	2	E or F	-35	-73	-38	-14	-37	-10	2
	3	B or C	-47	-94	-46	-31	-28	-37	5
E – B3073 Wimborne Road West	1	B or C or D	-1	35	-3	-6	-5	-5	3
	2	F or A	-4	27	3	2	1	2	4
F – Canford Bottom	1	A or B or C	-42	4	-3	-6	-3	-4	3
	2	D or E	33	-9	5	5	5	-4	-1

Negative values indicate a journey time saving and hence a benefit. Savings > 20 secs are highlighted in Green. Positive values indicate an increase in journey time and hence a dis-benefit. Increases of > 20 seconds are highlighted in Red.

Appendix C. Pre-Scheme Journey Times

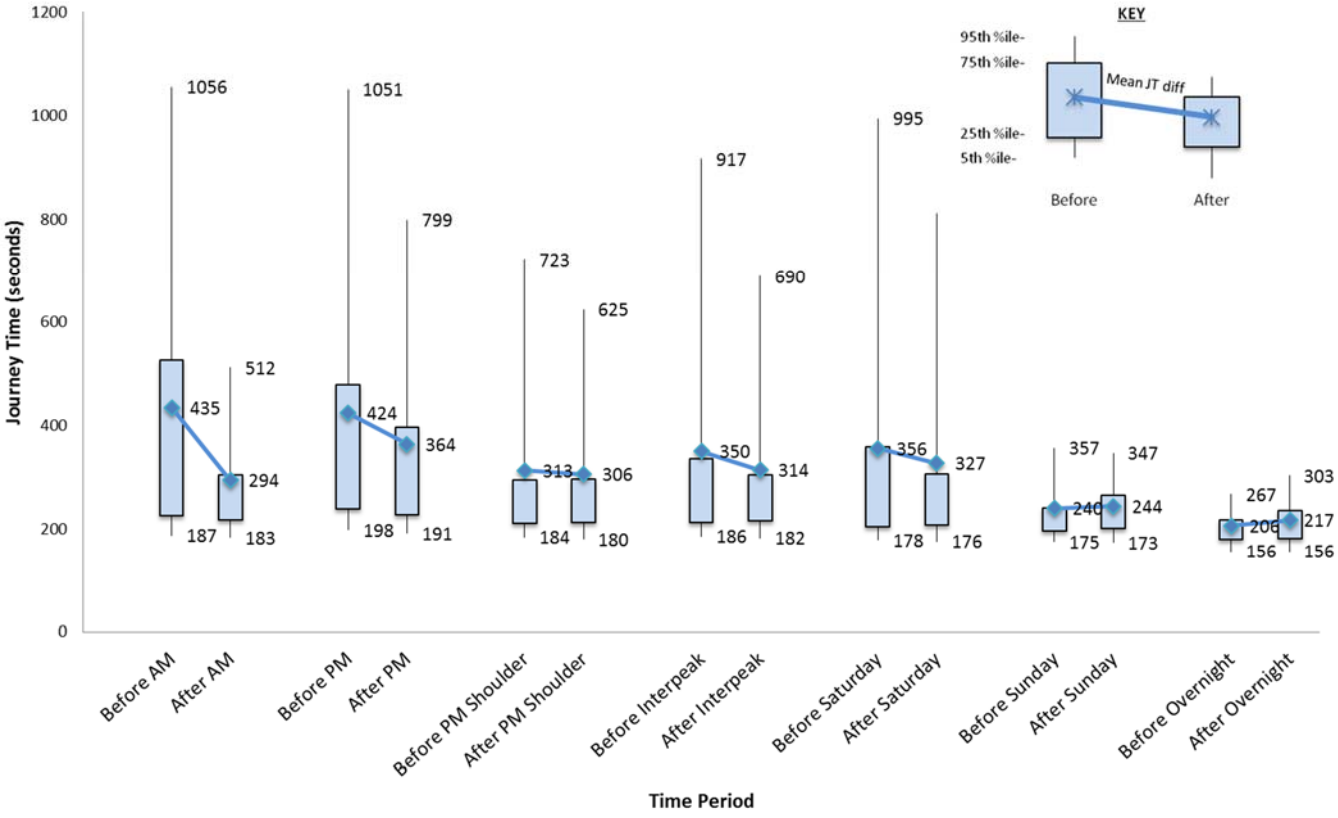
Arm From	Arm To	Wkdy AM Peak	Wkdy PM Peak	Wkdy PM Shoulder	Wkdy InterPeak	Saturday Daytime	Sunday Daytime	7-Day O/night
A – A31 North	B	407	308	246	268	287	176	148
	C	404	311	245	264	288	175	148
	D	435	424	313	350	357	240	206
	E	359	327	225	270	264	183	156
	F	368	330	232	274	271	192	160
B – Wimborne Road West	A	120	196	132	134	153	105	86
	C	78	172	99	105	99	61	52
	D	173	309	209	196	222	148	124
	E	113	221	142	125	144	95	79
	F	123	205	132	124	137	88	78
C – B3073 Ham Lane	A	126	211	141	124	112	105	89
	B	135	218	152	125	117	109	93
	D	185	307	199	180	172	148	124
	E	124	223	137	117	104	96	77
	F	128	227	141	121	107	100	83
D – A31 South	A	312	350	278	267	263	236	174
	B	308	331	260	246	225	236	172
	C	305	328	253	243	221	232	169
	E	284	302	237	218	224	198	166
	F	284	300	237	222	224	198	167
E – B3073 Wimborne Road West	A	109	73	71	74	69	66	57
	B	120	82	80	82	73	76	58
	C	119	80	76	79	70	72	55
	D	199	175	165	151	147	137	123
	F	94	60	57	60	56	53	47
F – Canford Bottom	A	188	94	92	96	85	87	61
	B	113	94	97	96	86	60	62
	C	167	90	88	89	83	82	60
	D	178	166	146	156	152	126	110
	E	117	79	82	85	78	76	63

Appendix D. Post-Scheme Journey Times

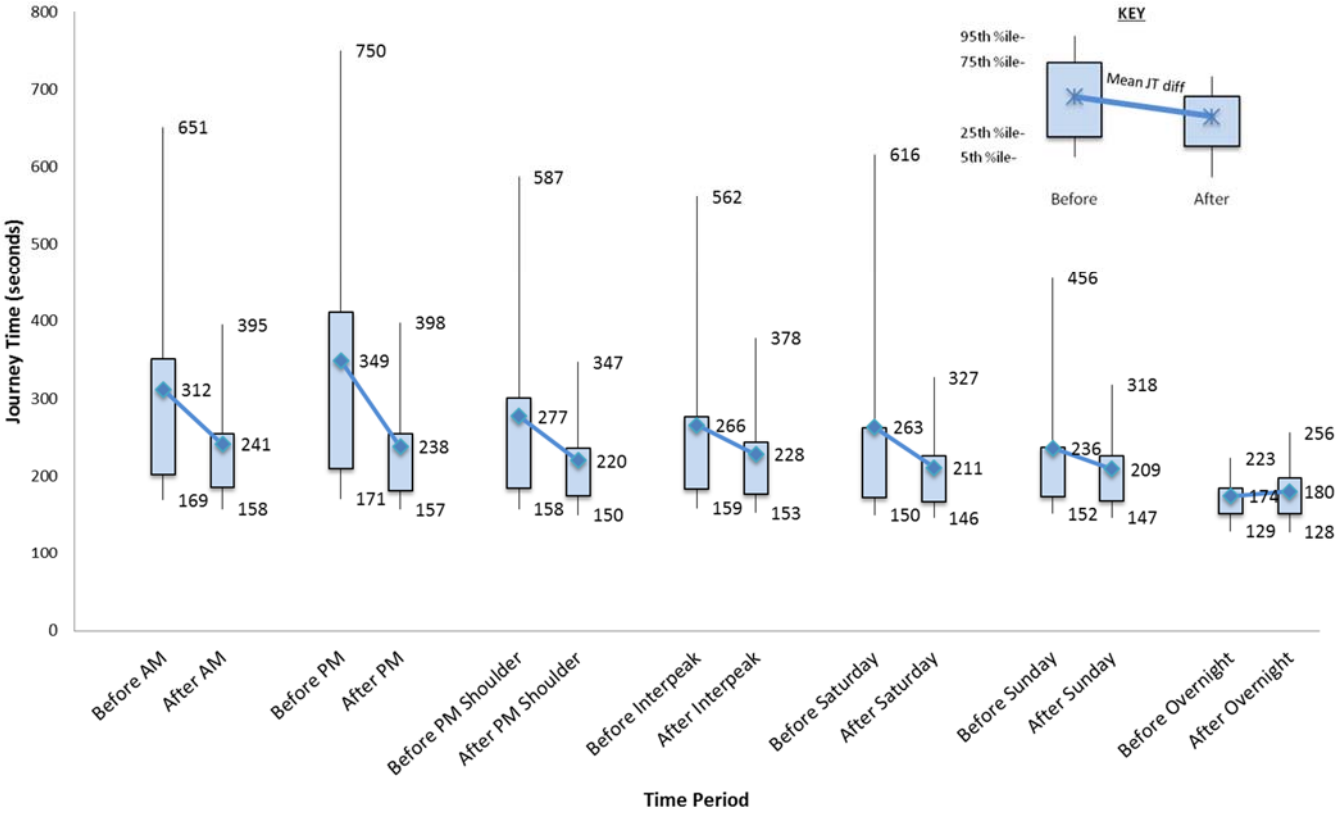
Arm From	Arm To	Wkdy AM Peak	Wkdy PM Peak	Wkdy PM Shoulder	Wkdy InterPeak	Saturday Daytime	Sunday Daytime	7-Day O/night
A – A31 North	B	212	237	200	212	202	169	155
	C	215	242	202	218	205	169	153
	D	295	365	306	314	327	244	217
	E	288	314	262	267	257	219	190
	F	301	315	266	275	268	230	199
B – Wimborne Road West	A	205	314	180	166	155	157	121
	C	95	220	109	93	70	57	56
	D	237	412	276	208	221	161	145
	E	174	175	139	136	102	105	113
	F	164	276	143	149	121	115	98
C – B3073 Ham Lane	A	174	198	168	164	152	154	130
	B	180	213	170	159	154	162	136
	D	202	239	199	189	189	164	142
	E	133	139	129	123	116	112	94
	F	154	151	149	138	131	126	102
D – A31 South	A	241	238	220	228	211	209	180
	B	313	299	247	255	235	240	203
	C	334	308	254	262	242	239	202
	E	266	235	212	208	200	200	175
	F	266	235	212	220	200	200	175
E – B3073 Wimborne Road West	A	128	123	95	97	91	89	77
	B	144	151	98	97	89	87	77
	C	161	170	107	103	95	92	76
	D	299	319	238	223	221	189	127
	F	95	89	64	65	60	58	53
F – Canford Bottom	A	113	111	100	96	93	89	81
	B	114	136	109	98	73	74	80
	C	131	140	109	106	96	93	83
	D	179	212	174	212	167	143	122
	E	178	175	145	145	133	149	102

Appendix E. Journey Time Reliability Comparison Graphs

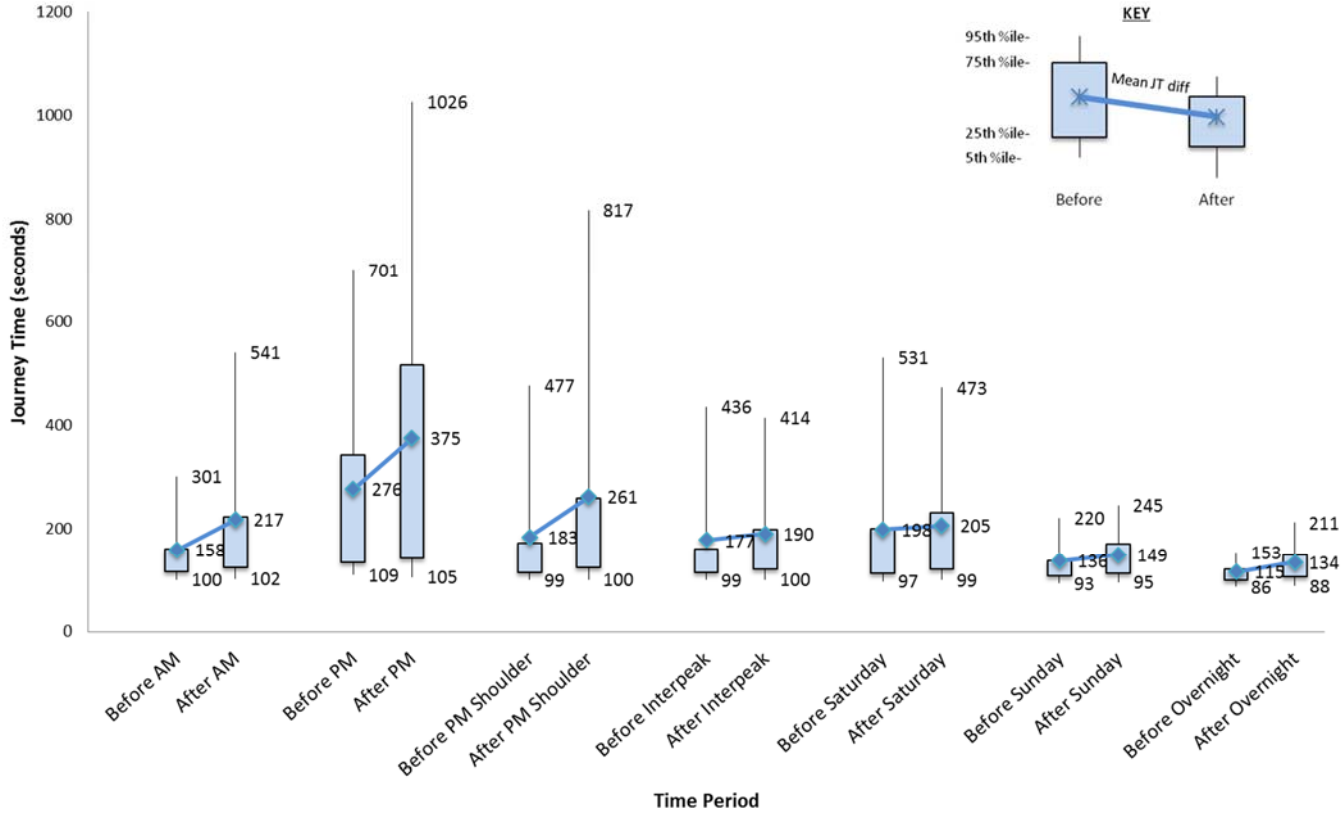
Arm A (A31 North) to Arm D (A31 South)



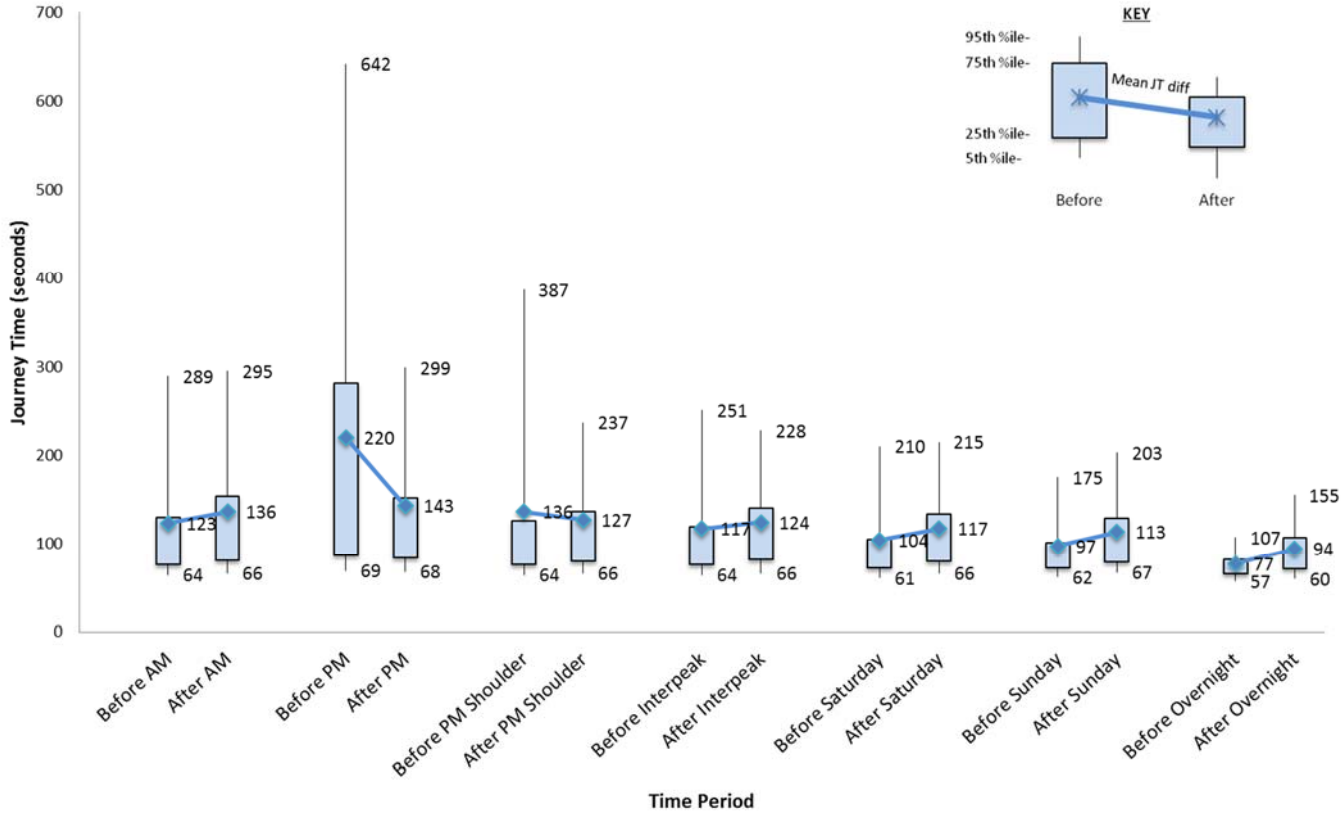
Arm D (A31 South) to Arm A (A31 North)



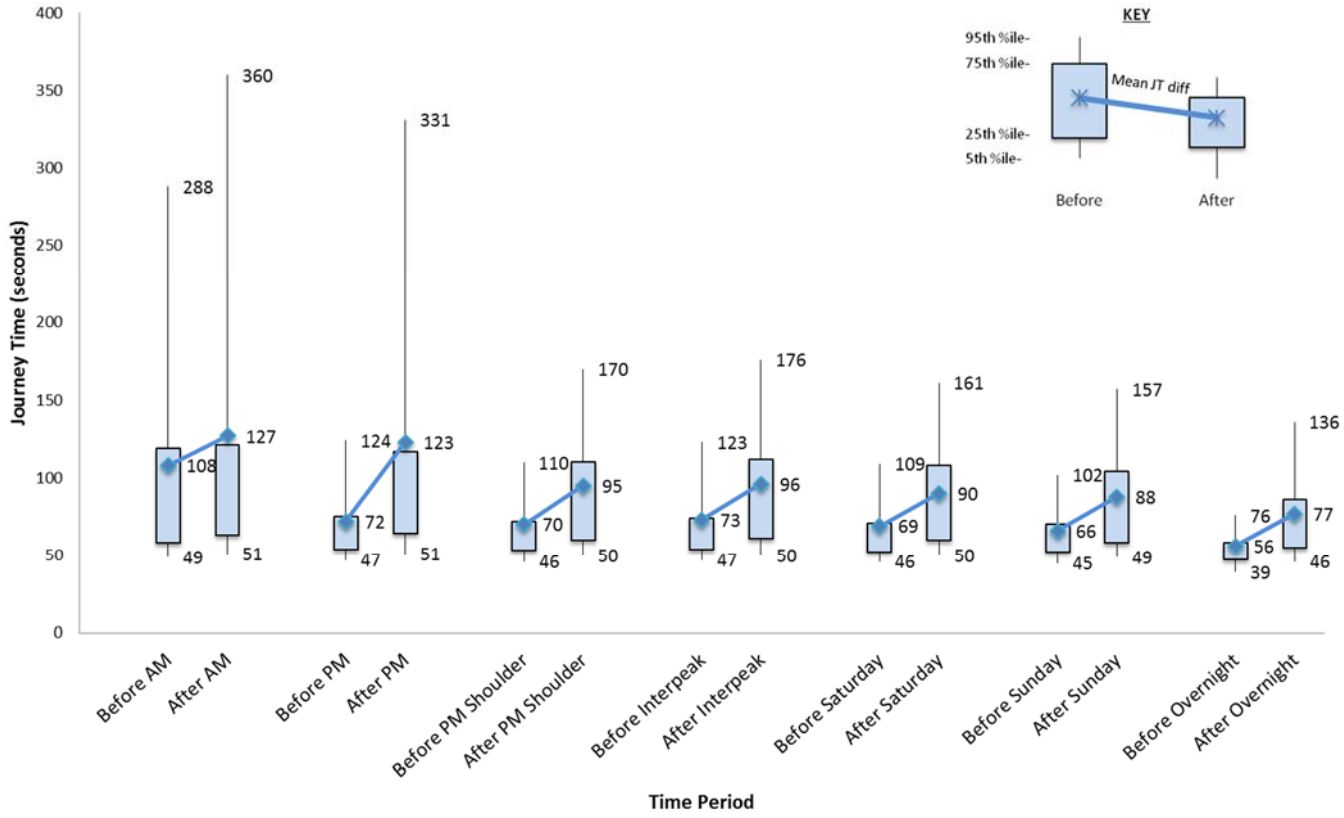
Arm B (Wimborne Road West) to Arm D (A31 South)



Arm C (B3073 Ham Lane) to Arm E (B3073 Wimborne Road West)



Arm E (B3073 Wimborne Road West) to Arm A (A31 North)



Appendix F. Total Weekly Flow Movements

Arm From	Arm To	Wkdy AM Peak	Wkdy PM Peak	Wkdy PM Shoulder	Wkdy InterPeak	Saturday Daytime	Sunday Daytime	7-Day O/night
A – A31 North	B	30	65	80	165	58	56	119
	C	185	125	100	765	269	261	551
	D	8,525	9,665	8,870	22,815	8,016	7,782	16,421
	E	1,250	1,430	1,345	2,575	905	878	1,853
	F	430	675	655	1,130	397	385	813
B – Wimborne Road West	A	5	0	0	30	11	10	22
	C	230	170	195	715	251	244	515
	D	1,700	1,740	1,320	4,170	1,465	1,422	3,001
	E	1,245	1,450	1,275	4,025	1,414	1,373	2,897
	F	685	1,040	835	2,115	743	721	1,522
C – B3073 Ham Lane	A	165	65	60	240	84	82	173
	B	30	10	5	100	35	34	72
	D	1,100	1,475	1,160	3,355	1,179	1,144	2,415
	E	1,775	2,000	1,565	4,880	1,715	1,665	3,512
	F	950	1,450	1,410	2,450	861	836	1,763
D – A31 South	A	9,630	10,275	8,255	23,795	8,360	8,117	17,126
	B	2,080	1,520	1,150	2,920	1,026	996	2,102
	C	885	510	435	1,830	643	624	1,317
	E	125	155	200	585	206	200	421
	F	170	275	245	665	234	227	479
E – B3073 Wimborne Road West	A	2,320	2,035	1,550	4,855	1,706	1,656	3,494
	B	1,415	1,185	1,055	3,765	1,323	1,284	2,710
	C	1,850	1,085	1,085	3,855	1,354	1,315	2,775
	D	30	20	20	85	30	29	61
	F	140	220	200	630	221	215	453
F – Canford Bottom	A	1,365	835	695	1,840	646	628	1,324
	B	1,225	835	960	2,450	861	836	1,763
	C	1,775	810	1,010	2,545	894	868	1,832
	D	265	260	355	695	244	237	500
	E	30	0	0	75	26	26	54
Total Weekly Traffic		41,610	41,380	36,090	100,120	35,177	34,151	72,060
		11.5%	11.5%	10.0%	27.8%	9.8%	9.5%	20.0%

Appendix G. Arm-to-Arm Annual Vehicle Hour Changes

Arm From	Arm To	Wkdy AM Peak	Wkdy PM Peak	Wkdy PM Shoulder	Wkdy InterPeak	Saturday Daytime	Sunday Daytime	7-Day O/night
A – A31 North	B	-84	-67	-54	-132	-72	-6	11
	C	-506	-124	-62	-510	-324	-25	43
	D	-17,288	-8,302	-849	-11,960	-3,423	473	2,618
	E	-1,280	-268	713	-107	-90	455	921
	F	-413	-148	323	23	-15	212	459
B – Wimborne Road West	A	6	0	0	14	0	8	11
	C	58	118	29	-119	-104	-13	28
	D	1,580	2,591	1,289	713	-10	274	925
	E	1,090	1,779	618	829	-176	135	1,091
	F	411	1,075	139	786	-175	273	445
C – B3073 Ham Lane	A	115	-12	23	142	49	58	103
	B	19	-1	1	50	19	26	45
	D	267	-1,441	-7	417	282	272	637
	E	-2,405	258	-1,891	-601	141	271	794
	F	-1,401	541	-1,556	277	219	289	641
D – A31 South	A	-9,858	-16,514	-6,842	-13,086	-6,262	-3,159	1,494
	B	130	-707	-214	364	148	62	943
	C	374	-148	3	483	195	64	625
	E	-316	-40	-194	-216	-31	-71	12
	F	-44	-261	-90	-18	-83	6	52
E – B3073 Wimborne Road West	A	625	1,469	552	1,645	537	534	1,035
	B	482	1,169	274	808	301	202	734
	C	1,125	1,420	485	1,340	480	380	840
	D	43	42	21	88	32	22	4
	F	2	90	19	49	14	17	36
F – Canford Bottom	A	-1,484	206	90	17	77	21	381
	B	28	510	158	74	-168	170	476
	C	-912	576	306	598	175	138	599
	D	216	128	40	656	37	-30	-26
	E	27	-	0	65	21	27	-

Appendix H. Appraisal Summary Table (AST)

	Sub-Objective	Qualitative Impact	Quantitative Measures	Assessment
ENVIRONMENT	Noise	Average noise level change at property is 0.1dB. Guidance suggests that this will be imperceptable to the local public as the minimum short term noise level change audible under project opening conditions is 1dB.	Population annoyed in Without Scheme: 376 Population annoyed in With Scheme: 377	Change in population annoyed = 1 PVB (Residential) = £-0.019M
	Local Air Quality	The proposed scheme does not lead to an increase in annual mean NO2 levels or PM10 levels.	Properties Improved: 1132 Properties Deteriorated: 0	PM10: -5.90 NO2: -71.05
	Greenhouse Gases	The key driver responsible for benefits observed with the proposed scheme is the removal of congestion and associated reduction in traffic related emissions. For consistency this sheet reports economic values over the 10 year assessment period. Calculations have been undertaken for the whole 60 year appraisal period, assuming there will be no further interventions after 10 years, and are readily available on request.	-6237 tonnes	£0.373M Carbon PVB
	Landscape	The proposed scheme is unlikely to give rise to significant impacts in the wider landscape. Localised impacts will be greater - retaining wall & traffic signals will affect views from listed buildings, properties & public right of ways. Awareness of the A31 will be increased within the visual envelope of the scheme, which is limited by existing semi-mature trees and shrubs south of the scheme. (Full assessment attached).		Moderate Adverse
	Townscape	The introduction of the proposed scheme will not give rise to significant impacts within the small settlement. Elements of the scheme are slightly out of scale within the residential setting creating slight impacts to the scale and appearance of the townscape, and adversely degrading the setting for historic buildings to the south of the scheme. Mitigation measures cannot properly mitigate the scheme due to the proximity and scale of the development within the residential setting. (See Attachments Page for the full assessment).		Slight Adverse
	Heritage and Historical Resources	The adverse impact on the 4 grade II listed buildings within Little Canford village is accounted for in the Landscape impact assessment. To avoid duoble counting of this impact, the assessment score for Heritage and Historic Resources is Neutral despite the Slight Adverse impact listed in the table above and in the attached full impact assessment.		Neutral
	Biodiversity	The above matrix provides a summary of a more detailed Biodiversity Assessment which is attached with this PAR. The overall Assessment Score has been based on worse case scenarios as ecological surveys are ongoing and therefore outcomes of surveys and extent of impacts are not yet known.		Moderate Adverse
	Water Environment	There is not expected to be any impact upon the water environment. The full assessment report can be provided on request.		Neutral
	Physical Fitness	Not applicable	N/A	N/A
	Journey Ambience	The score for this impact is due to the associated betterment to more than 10,000 vehicles per day. Environment; quieter road noise & smoother ride resulting from new road surface. Travellers' Views; cleaner street furniture, landscaped verges / islands. Frustration: Adverse impacts from the junction layout is over-shadowed by the benefits provided by enhanced performance characteristics - drainage / lighting. Fear of Accidents: The introduction of a signal controlled junction removes the fear of 'give-way' collisions. Route Uncertainty: New signing strategy throughout the junction.		Moderate Beneficial
SAFETY	Accidents	Accident impacts during construction and maintenance have not been investigated. Justification for the predicted Personal Injury Accident savings is attached to this PAR.	48 accidents saved.	£2.366m Accident PVB
	Security	CCTV will be installed as part of this scheme. Its primary function will be for traffic surveillance and traffic signal operation however the Police will be able to view / control the camera. Police lay-bys will be provided on the junction islands to allow for informal surveillance / traffic operations as necessary. Street lighting will be upgraded throughout. New pedestrian crossings and NMU links will be provided under lit areas.	Approximately 28,000 vehicles will travel through Canford Bottom every day. Traffic growth is approximately 16% over the 10 year assessment period.	Large Beneficial

	Sub-Objective	Qualitative Impact	Quantitative Measures	Assessment
ECONOMY	Public Accounts	None	PVC calculated from the LEVEL 1 Target Price.	£4.181m
	All Users	This is a ten year assessment, based on the likely life of the project in capacity terms. These calculations are based on a fixed, do minimum trip matrix and the corresponding levels of delay. In addition, peak growth and Saturday growth are capped at 2014, interpeak at 2019, as this is considered to reflect the realistic maximum capacity of the existing junction. Overnight is uncapped and Sundays are not modelled, while the Saturday model covers only the daytime hours on the busiest 16 Saturdays.	Over 80% of benefits are derived from the weekday AM and PM peaks. In addition, a broadly similar proportion of total benefit accrues to private vehicles.	£9.629m Business Users PVB
	Reliability	The reduction in queueing, the increased amount of roadspace available and the more efficient operation of the junction may be expected to contribute to a reduction in accidents and breakdowns and to reduce the duration of their impacts. This will enhance reliability by generating a reduction in day to day travel time variability.	This is a single carriageway scheme and entirely a junction improvement. The use of INCA is therefore inappropriate, as is the use of a CRFcalculation. See WebTAG 3.5.7, paras 13.1.7 and 8. The default CRF for a single carriageway is 22,000 (DMRB 5.1.3). This value has been used in the table above for completeness. The scheme is expected to save 50 injury accidents over the ten year period.	Slight Beneficial
	Wider Economic Impacts	Does not affect a Regeneration Area.	Does not affect a Regeneration Area.	Neutral
ACCESSIBILITY	Option values	Not applicable		N/A
	Severance	Equestrians do not use this junction due to high traffic flows. Equestrians have not been considered in the scheme design. An average 53 cyclist trips was recorded each day. The scheme design includes the provision of Toucan Crossings and shared use cycleway / footway to allow safe pedestrian movements across Canford Bottom to neighbouring shops, residential areas and recreational attractions such as Gardens, Parks & Public Houses.	A NMU survey was undertaken in 2009. Based on a 2-day, 12-hour sample, the average pedestrian trips made across the junction was 43 per day. Severance at Canford Bottom has been assessed as a whole rather than assessing each of the 6 adjoining arms.	Slight Beneficial
	Access to Transport System	Scored Neutral in strict accordance with WebTAG 3.6.3. However, this scheme will have a beneficial impact due to: * increased travel speeds whilst riding in a public transport vehicle - reduced queue lengths at the Canford Junction * increased reliability of vehicle times, hence reduced waiting times - reduced queue lengths at the Canford Junction * improved ease of access to the public transport system - improved crossing facility at the Canford Junction This cannot be quantitatively reviewed at this stage and so cannot be given a beneficial assessment score.		Neutral
INTEGRATION	Transport Interchange	Not applicable	N/A	N/A
	Land Use Policy	Local authorities should priortise		Beneficial
	Other Government Policies	This section of the A31 forms part of the Olympic Route Network (Sailing event in Weymouth). This scheme will asssist in the reduction of journey times along the A31 should it be constructed prior to the 2012 Games.		Beneficial

Appendix I. Evaluation Summary Table (EST)

	Sub-Objective	Qualitative Impact	Quantitative Measures	Assessment
ENVIRONMENT	Noise	Traffic volumes travelling through the junction have changed by less than 25%. Although speeds have improved, this change is less 10kph across the day. Based on the lack of change in traffic volumes and vehicle speeds, it is considered that the changes in noise are not significant and the EST therefore includes a neutral impact for noise.	-	Neutral
	Local Air Quality	Traffic volumes travelling through the junction have changed by less than 10%. Based on the lack of change in traffic volumes, it is considered that the changes in air quality are not significant and the EST therefore includes a neutral impact for local air quality.	-	Neutral
	Greenhouse Gases	The post-opening evaluation has used the DMRB tool (v1.03c) to assess the difference in carbon emissions and monetised the impact using the WebTAG Greenhouse Gases Workbook (Nov 2014 version). There are an additional 33 tonnes of Carbon emitted in the opening year following the completion of the scheme. Across the scheme life, this equates to a PVB of -£0.015m, which is a small adverse impact.	+300 tonnes (approximately) over the 10 year scheme life.	-£0.015M Carbon PVB
	Landscape	Due to the introduction of the new highway sections, and a large amount of traffic signalling equipment, it is considered that a moderate adverse impact on landscape has occurred.	-	Moderate Adverse
	Townscape	It is more appropriate for Landscape to be assessed for the Canford Bottom location. As such, the townscape impact is therefore scored as 'not applicable'.	-	Not Applicable
	Heritage and Historical Resources	The post-opening evaluation has identified 5 listed buildings and 3 scheduled ancient monuments within close proximity to the junction. Based on the post-scheme site visit, it is considered that while the impact of the scheme in the local area is significant, it is unlikely that the changes would change how the scheme appears from any of the heritage sites. As such, the outturn impact is considered neutral.	-	Neutral
	Biodiversity	Post-opening photos show that the scheme has been constructed as per the general arrangement which was assessed in the PAR. The PAR based the overall assessment score on a worst case scenario pending the results of the ecological surveys. It is therefore considered unlikely that the extent of the impact was more severe than the impact predicted in the PAR.	-	Moderate Adverse
	Water Environment	A desktop review of the methods undertaken for the scheme's PAR and simple assessment of impact due to routine runoff and spillage, suggest that the environmental parameters originally proposed and the methodology undertaken is in line with expectations, suggesting that the potential impact on the River Stour remains as neutral.	-	Neutral
	Physical Fitness	Given the site location, there are a number of small villages surrounding the junction. The scheme has improved the connectivity between these villages and so it likely to have had a positive effect on the number of people that walk or cycle for more than 30 minutes per day, by removing a barrier to safe movement that existed previously. Therefore it is considered that the scheme has a slight beneficial impact on physical activity.	-	Slight Beneficial
	Journey Ambience	There has been a small increase in the annual accident rate. There has been a net reduction in journey times across the junction although the journey times for many of the movements has increased. The road surfacing and markings have improved with the scheme, and lighting is better. There is a general view from stakeholders that the junction is now more confusing to use, less intuiative and more stressful. Taking all of the above into account, the outturn assessment has established as moderate adverse impact for the scheme in terms of journey ambience.	-	Moderate Adverse
SAFETY	Accidents	The annual accident rate has increased by 1.25 accidents per annum.	An additional 1.25 accidents per annum.	Slight Adverse
	Security	The scheme includes new CCTV, pedestrian crossings and a vehicle lay-by provisions within the traffic island for Police/traffic operations. Overall, it is considered that the scheme has had a slight beneficial impact.	-	Slight Beneficial

	Sub-Objective	Qualitative Impact	Quantitative Measures	Assessment
ECONOMY	Public Accounts	Outturn Cost as provided by the ASC	-	£6.588m
	All Users	The post-opening analysis indicated that for the two most dominant journey time movements (through the junction along the A31) journey times are improved during most times of the day. Acorss the whole junction there has been a net annual improvement, however there are many of the movements at the junction where journeys now take longer. Overall, the net impact is a moderate improvement.	60,555 vehicle hours saved per annum.	Moderate Beneficial
	Reliability	The post-opening analysis indicated that for the two most dominant journey time movements (through the junction along the A31) journey times are improved and trips are more reliable. However there are also many of the movements at the junction where journey times are now less reliable. Overall, it is considered that the net impact is a slight improvement.	-	Slight Beneficial
	Wider Economic Impacts	-	-	Neutral
ACCESSIBILITY	Option values	Not applicable	-	N/A
	Severance	The site visit observed that the prescribed facilities were all in place and pedestrians and cyclists were observed using the controlled crossings and the shared cycleway/footway facilities. Given the complexity of the junction (with six traffic arms), and the provision of the signalised crossings where there were previously none, it is considered that the scheme has had a moderate beneficial impact.	-	Moderate Beneficial
	Access to Transport System	The scheme has not significantly improved access to transport systems.	-	Neutral
INTEGRATION	Transport Interchange	Not applicable	-	N/A
	Land Use Policy	Not applicable	-	N/A
	Other Government Policies	As the measures were introduced prior to the London 2012 games, it is considered that the beneficial impact score was achieved.	-	Beneficial

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