Aberdeen Access from the South Appendix D

Aberdeen City Council, Aberdeenshire Council, Nestrans

Medium Term (2012 with AWPR) S-Paramics Testing

MEDIUM TERM (2012 WITH AWPR) S-PARAMICS TESTING

Description:

Aberdeen Access from the South Appendix D

Author:

Julie Sey/Alasdair Kay/Peter Stewart

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SIAS Limited
13 Rose Terrace
Perth PH1 5HA
UK

tel: 01738 621377
fax: 01738 632887
perth@sias.com
www.sias.com

MEDIUM TERM (2012 WITH AWPR) S-PARAMICS TESTING

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1 INTRODUCTION

1.1 Purpose of Report

SIAS Limited has been commissioned by Aberdeen City Council (ACC) to providing traffic modelling support and advice with regard to the Aberdeen Access from the South Study.

This technical report details the medium term option testing considered for the Aberdeen Access from the South Study.

The medium term testing sits within a structured testing regime to consider measures to improve access to Aberdeen from the South in the:

- Short term testing – 2008
- Medium term testing – 2012 with Aberdeen Western Peripheral Route
- Long term testing – 2027 with Aberdeen Western Peripheral Route

While this study aims to minimise the need to go beyond existing highway boundaries, it is recognised that in order to facilitate travel demand to Aberdeen from the South in the short, medium and long term, upgrades to existing infrastructure will be required. To that end, and within the context of conceptual design, SIAS has deemed to keep any proposed infrastructure away from property but has in some instances used open land and wide verges to facilitate enhancements to the road network. No investigation of land ownership or utility locations has been undertaken within this study though it is recommended that this be undertaken in any detailed evaluation.

1.2 Short Term Measures

The short term option testing was reported in a separate draft briefing note (See SIAS Ref. TPATCAFS/68177). Following the short term testing the measures proposed to be taken forward to the medium term testing were:

1. Segregated left turn lane Great Southern Road to King George VI Bridge
2. Segregated left turn lane King George VI Bridge to West Tullos Road
3. Segregated left turn lane Wellington Road to Hareness Road
4. Segregated left turn lane Great Southern Road to Stonehaven Road
5. Extended 3 lanes on Wellington Road northbound approach to Hareness Roundabout
6. Adjusted traffic signals Souterhead Roundabout
7. Adjusted traffic signals Balnagask Road/ Somerfield junction
8. Adjusted traffic signals Wellington Road/Greenbank Road

These measures are illustrated in Figure 1.1.

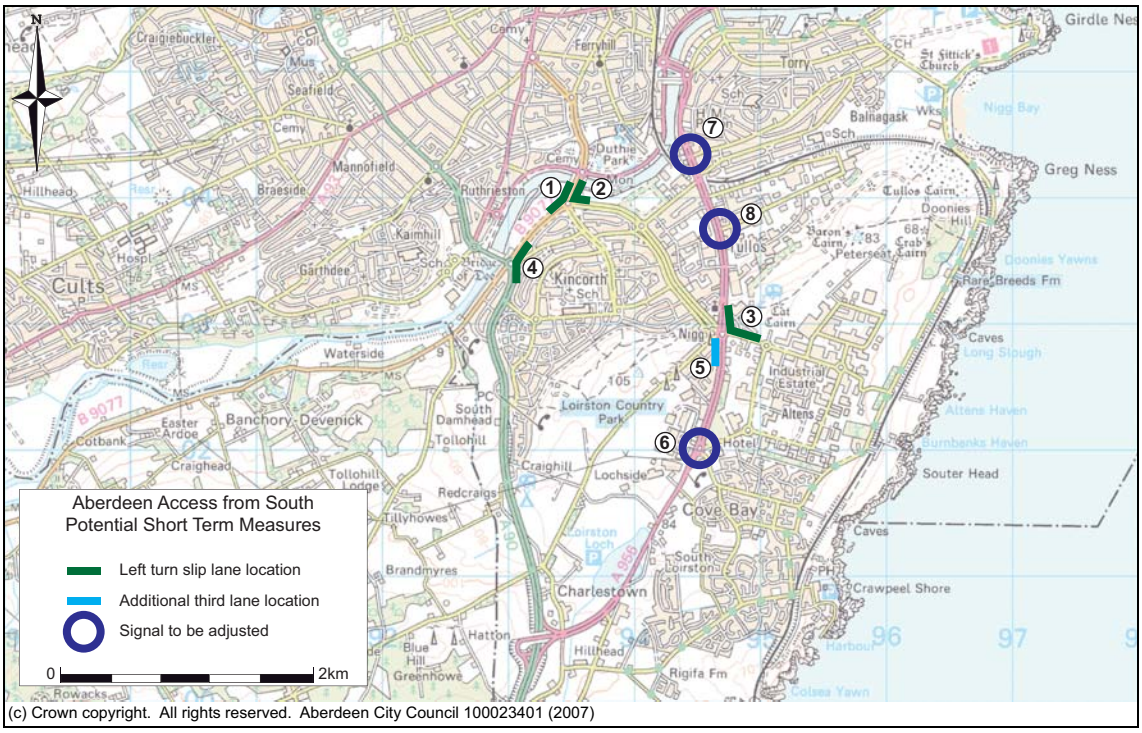

Figure 1.1 : Potential Short Term Measures

2 DEVELOPMENT OF MEDIUM TERM OPTIONS

2.1 Medium Term Do-Minimum Model

The medium term Do-Minimum model is based on the short term testing and includes the most successful package of short term testing as discussed in Chapter 1.

The medium term model represents an assessment year of 2012 and includes additional infrastructure:

- New Schoolhill interchange
- New Charleston Interchange to accommodate Aberdeen Western Peripheral Route (AWPR)

All medium term testing includes the impact of AWPR within the forecast travel demand estimates.

2.2 Medium Term Growth

The medium term Do-Minimum model represents an assessment year of 2012 and growth was derived from the Aberdeen Sub Area Model (ASAM3b) model. Details of growth are reported in the ASAM3b iteration technical report (Appendix A).

The growth as applied to the 2004 base model, using ASAM3b forecasts to form the 2012 future year models (with Aberdeen Western Peripheral Route), can be summarised as follows for the AM and PM peak periods:

- AM Peak 2004 Base 31475 vehicles growth of 3.9% (1,212 vehs) to 2012 giving 32687 vehicles in 2012 in the AM peak period
- PM peak 2004 base 40496 vehicles with growth of 4.6% (1,873 vehs) to 2012 giving 42369 vehicles in 2012 in the PM peak period

2.3 Schedule of Medium Term Option Testing

A workshop, involving key stakeholders, was held on 6 March 2007 to develop further ideas for short, medium and long term options. An option sifting process was then carried out which involved scoring each of the possible options generated at the workshop against the key planning objectives, to ascertain which options met the objectives.

Options were then assessed for their ability to be tested using the S-Paramics models, and medium term options which met the appropriate criteria were grouped into work packages.

The packages of medium term (2012 with AWPR) option testing for application within the S-Paramics model were discussed between Aberdeen City Council, Nestrans and SIAS to ensure focused testing and agreement prior to undertaking any network evaluation.

The meeting was conducted at St Nicholas House, Aberdeen on 12 July 2007 and this combined with subsequent email communication, outlined six key medium term packages for consideration. Over the course of the modelling work SIAS has evolved and distilled these tests into potential solutions for the Aberdeen South area. The full schedule of tests considered is provided in Table 2.1.

Table 2.1 : Medium Term Packages Considered

Reference	Package	Description	Rationale
Base	Base 04	JMP Validated Base 04	Provides a comparitive base to existing conditions
Do-Min	Do Min 2012 (with ST Imp)	2012 forecast demand with recommended short term measures	Provides an assessment baseline for comparison
1	P 1-1	Signalise all four terminal junctions at KGVI Bridge and Bridge of Dee through replacing roundabouts with traffic signals	Provides an assessment of demand management opportunities for these key approaches to and from Aberdeen
2	P 1-2	Signalise Bridge of Dee Junction with Stonehaven Rd	Provides an assessment of demand management opportunities for this key approach to Aberdeen from the South and potential for future demand management
3	P 1-3	Signalise KGVI Bridge Northern Junction with Riverside Drive	Provides an assessment of demand management opportunities for this junction which is currently limited within the existing roundabout configuration
4	P 2-1	Add new pedestrian/cycle bridge and remove footways on Bridge of Dee and signalise Hareness Road / Wellington Road, incorporating pedestrian crossings	Provide pedestrian/cyclist improvements and also alieviate congestion, particularily in the PM peak for this key industrial access and provide opportunities for appropriate demand management
5	P 3-1	One way Gyratory System using Bridge of Dee and KGVI Bridge	Assess measure considered from previous study but also consider pedestrian crossings
6	P 4-1	Replace Souterhead Roundabout with signal controlled junction	To alieviate congestion, particularily in the PM peak for this key industrial access and provide opportunities for appropriate demand management
7	5-1a	Park and Ride at Schoolhill with no new bus priority measures	Provide a baseline for assessment of Park and Ride bus priority measures
8	5-1b	Park and Ride at Schoolhill with existing lane on Wellington Road northbound given over to public transport to form bus lane between Charleston and QEII Bridge	Assess the impact of a complete lane being given over to public transport where possible on Wellington Road Northbound between Charleston and QEII Bridge
9	5-1c	Park and Ride at Schoolhill with existing lane on Wellington Road northbound given over to public transport to form bus lane between Charleston and new Souterhead Junction	Assess the impact of a complete lane being given over to public transport where possible on Wellington Road Northbound between Charleston and new Souterhead Junction
10	5-1d	Park and Ride at Schoolhill with existing lane on Wellington Road northbound given over to public transport to form bus lane between new Souterhead Junction and Hareness Road	Assess the impact of a complete lane being given over to public transport where possible on Wellington Road Northbound between new Souterhead Junction and Hareness Road
11	5-1e	Park and Ride at Schoolhill with existing lane on Wellington Road northbound given over to public transport to form bus lane between Hareness Road and QEII Bridge	Assess the impact of a complete lane being given over to public transport where possible on Wellington Road Northbound between Hareness Road and QEII Bridge
12	5-1f	Park and Ride at Schoolhill, Loch Inch and Charleston with **additional** lane provided on Wellington Road to develop bus lane between Charleston and QEII Bridge	Assess the impact of a new lane being provided for public transport over this section of Wellington Road
13	P 6-1	HOV Lane (using existing infrastructure between Schoolhill and Bridge of Dee (finishing approximately 100m prior to Bridge of Dee Roundabout to allow weaving)	75% - 25% split assumed for SOV and HOV respectively
14	P 6-2	HOV Lane (using existing infrastructure between Schoolhill and Bridge of Dee (finishing approximately 100m prior to Bridge of Dee Roundabout to allow weaving)	70% - 30% split assumed for SOV and HOV respectively
15	P 6-3	HOV Lane (using existing infrastructure between Schoolhill and Bridge of Dee (finishing approximately 100m prior to Bridge of Dee Roundabout to allow weaving)	65% - 35% split assumed for SOV and HOV respectively
16	P 6-4	HOV Lane (using existing infrastructure between Schoolhill and Bridge of Dee (finishing approximately 100m prior to Bridge of Dee Roundabout to allow weaving)	60% - 40% split assumed for SOV and HOV respectively

3 PACKAGE 1 – TRAFFIC SIGNALS AT BRIDGE OF DEE & KING GEORGE VI JUNCTIONS

3.1 Introduction

The main focuses of Package 1 are the terminal junctions on the Bridge of Dee and King George VI Bridge crossings. The existing junctions are all roundabouts and all suffer from congestion and delays during peak periods. There is no demand control and it can be difficult for pedestrians and cyclists to negotiate the junctions safely.

3.2 Aim

The aim of Package 1 was to identify whether the installation of traffic signals would assist in managing vehicular demand throughout the area by providing linked signal timings between the two bridge crossings. This may in turn allow a better transition of vehicles between junctions and would also allow for better pedestrian and cyclist provision.

3.3 Development of Package 1

Package 1 involved signalisation of the junctions at each end of the Bridge of Dee and King George VI Bridge. This package was split into 3 different parts, detailed below:

- Package 1-1 Bridge of Dee and KGVI Bridge – Signalise 4 junctions and link
- Package 1-2 Bridge of Dee – Signalise South of bridge junction only
- Package 1-3 King George VI Bridge – Signalise North of bridge junction only

Preliminary designs for signalised junctions were developed, based on available space and desired traffic flows. Pedestrian crossings were incorporated into all four junctions, which allowed removal of the existing remote pedestrian crossing facilities. A TRANSYT assessment of the four junctions was carried out in order to provide optimum linked signal timings, which were input into the S-Paramics model.

The forecast traffic flows used in the assessment of the three sub packages of Package 1 are shown in Figure 3.1 for the AM Peak Hour. Forecast flows for the PM peak hour are shown in Figure 3.2.

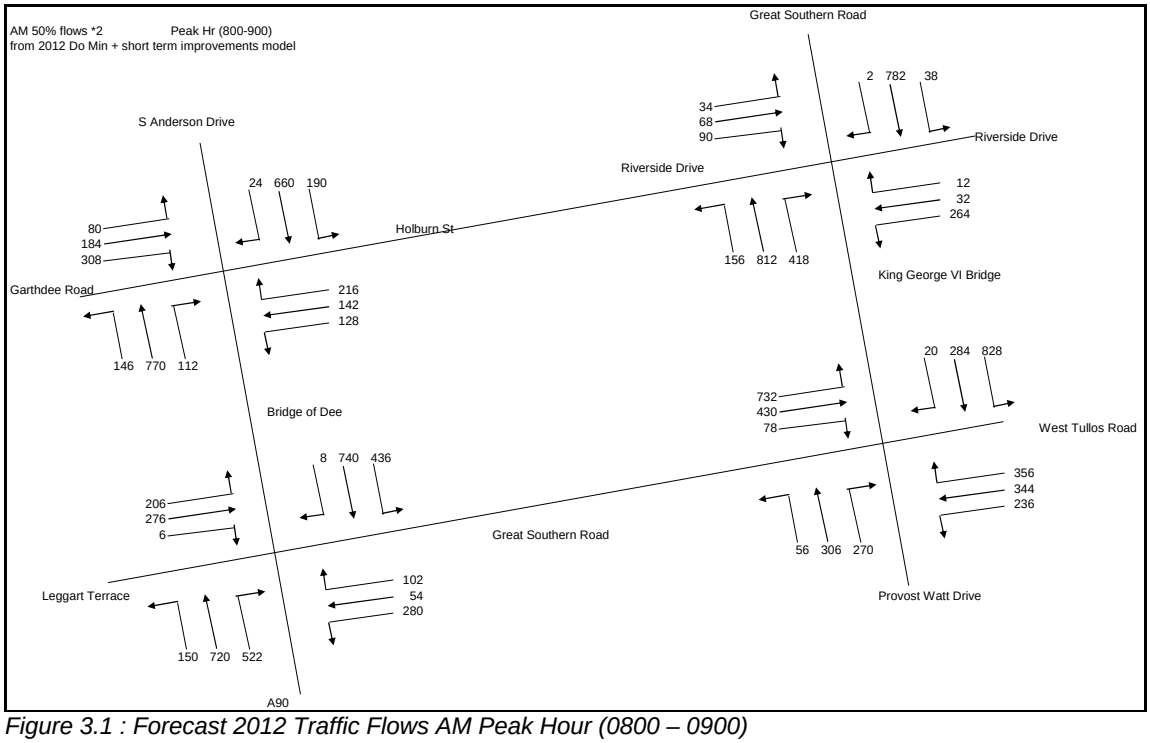

Figure 3.1 : Forecast 2012 Traffic Flows AM Peak Hour (0800 – 0900)

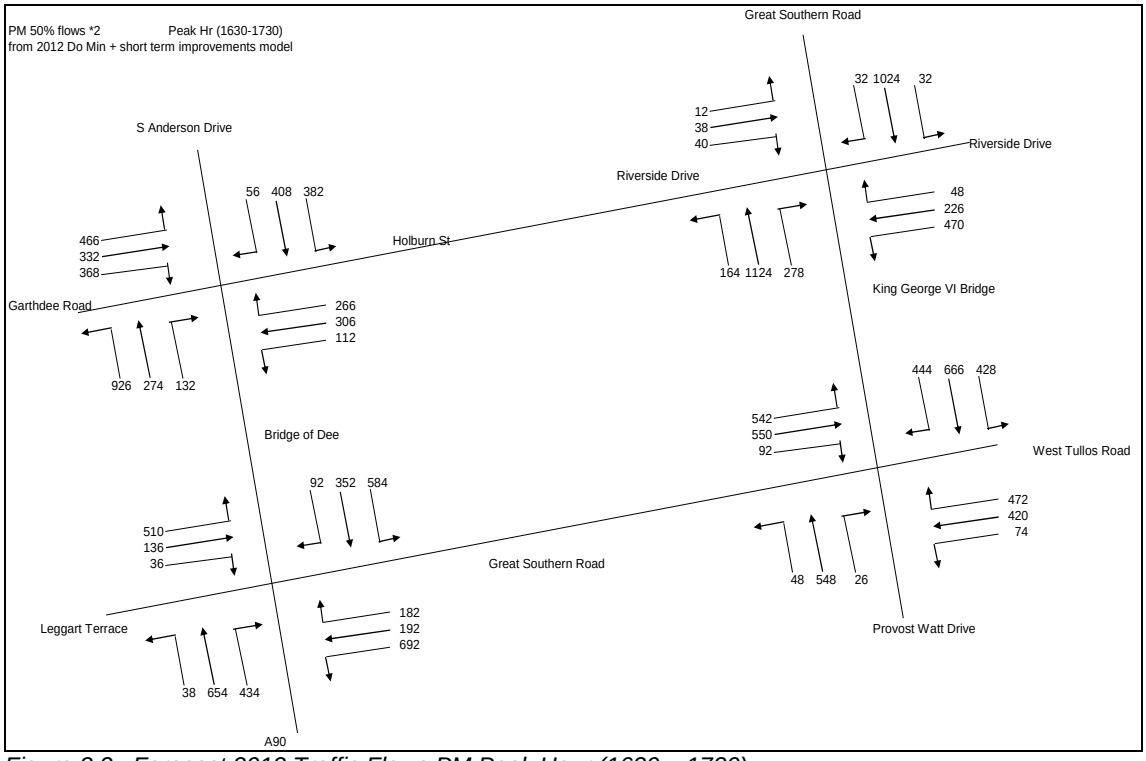

Figure 3.2 : Forecast 2012 Traffic Flows PM Peak Hour (1630 – 1730)

3.3.1 Package 1-1

This package involved signalising all four junctions at either end of both the Bridge of Dee and King George VI Bridge. The preliminary designs for the junctions are shown in Figures 3.3 and 3.4.

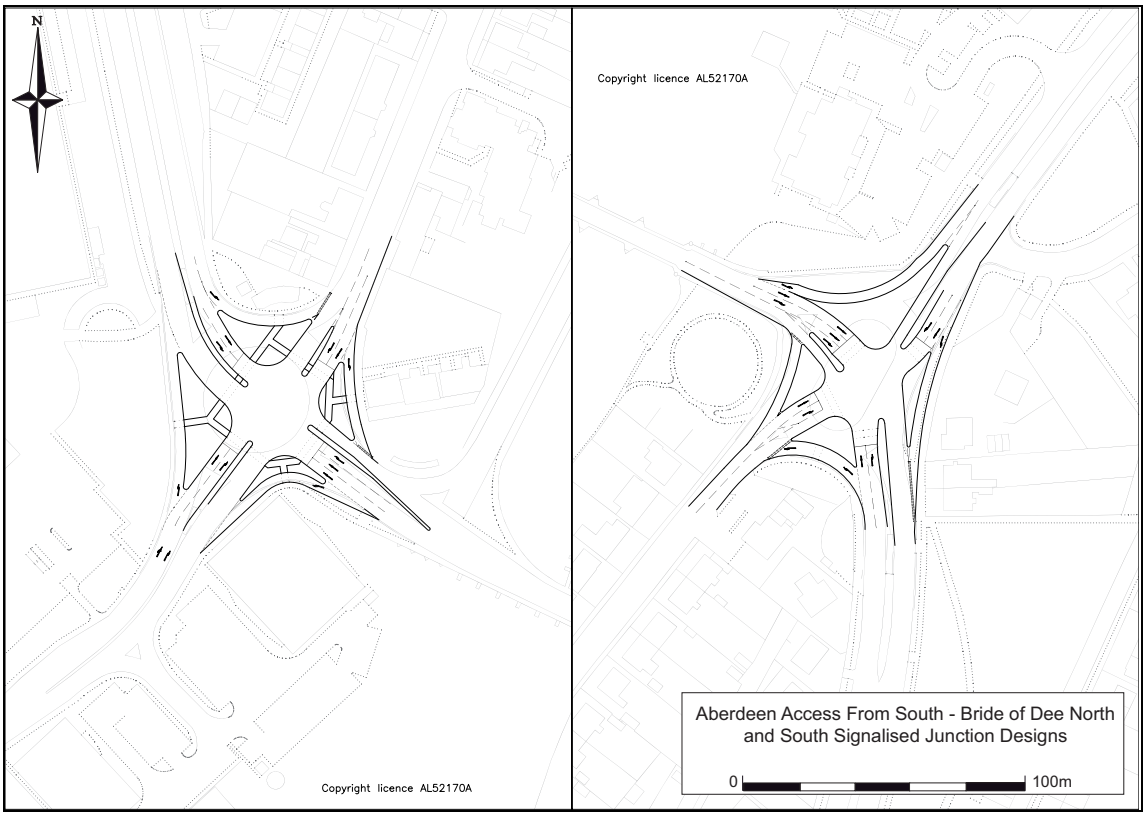

Figure 3.3 : Bridge of Dee North and South Signalised Junction Designs

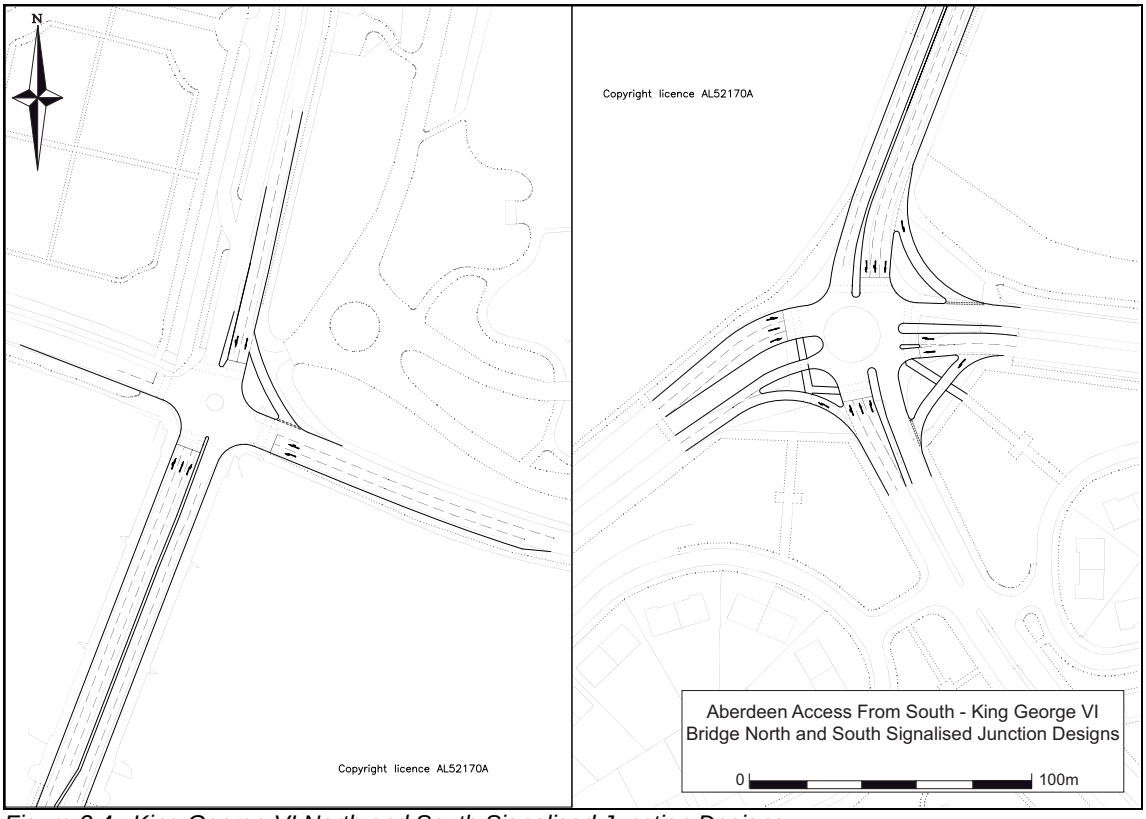

Figure 3.4 : King George VI North and South Signalised Junction Designs

All junctions have been designed to maintain footways at a minimum of 2.0m. At King George VI Bridge, assuming OS plans are accurate and do not include significant bridge parapet dimensions, existing footways appear to be around 4.5 metres wide. In this testing the footway width has been reduced to 2.5 metres to provide a fifth lane for back-to-back right turns to Riverside Drive and Great Southern Road respectively.

Figure 3.5 shows the traffic signal timings that have been calculated using TRANSYT for the AM Peak.

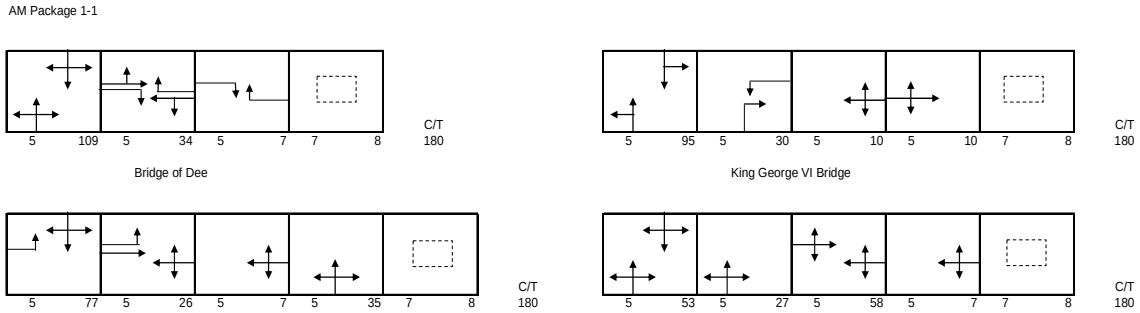

Figure 3.5 : AM Peak Signal Timings (Package 1-2)

Figure 3.6 shows the PM Peak signal timings.

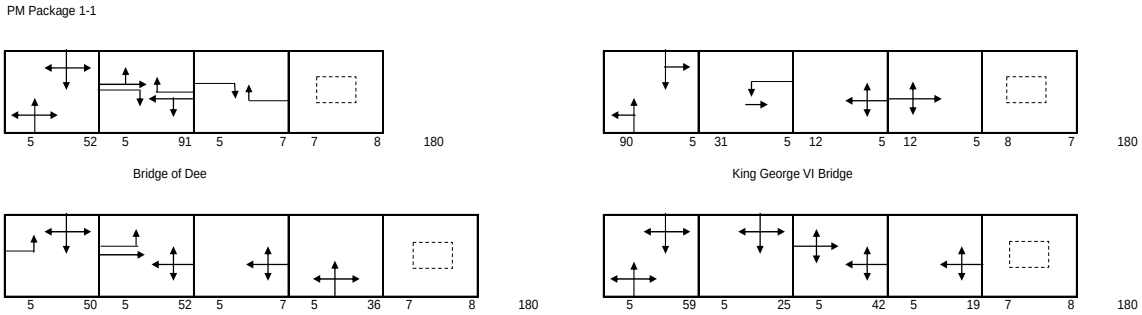

Figure 3.6 : PM Peak Signal Timings (Package 1-1)

Package 1-1 did not work satisfactorily. Figure 3.2 shows that there are some significant vehicle numbers with a desire to make certain manoeuvres, for example, the left turn from the Bridge of Dee to Garthdee Road is a movement that is made by 926 vehicles, assuming 2 seconds for each vehicle to cross the stop line, this movement requires almost 2,000 seconds in the hour, out of a total of 3,600 seconds, therefore 55% of the capacity is used on one arm, leaving only 45% of capacity for the other arms.

The most significant design limitation is insufficient stacking capacity for vehicles on the Bridge if Dee, due to the fact that the bridge is only one narrow lane wide in each direction. When the signals at the north end of the bridge are at red, the queue very quickly tails back into the South junction and the system very quickly gridlocks. Equally, when the signals at the south end of the bridge are at red, the queue blocks back through Holburn Street and beyond.

3.3.2 Package 1-2

This package involved signalising only the south junction of the Bridge of Dee. The remaining 3 junctions were left as roundabouts.

The aim of this package was to identify whether there was merit in providing traffic signal control at Stonehaven Road/Bridge of Dee only. This could allow the opportunity to provide demand management through stacking vehicles on the A90 which might allow better facilities at the junction for pedestrians and cyclists.

The traffic signal timings developed using Transyt are shown in Figure 3.7 for both the AM and PM Peaks.

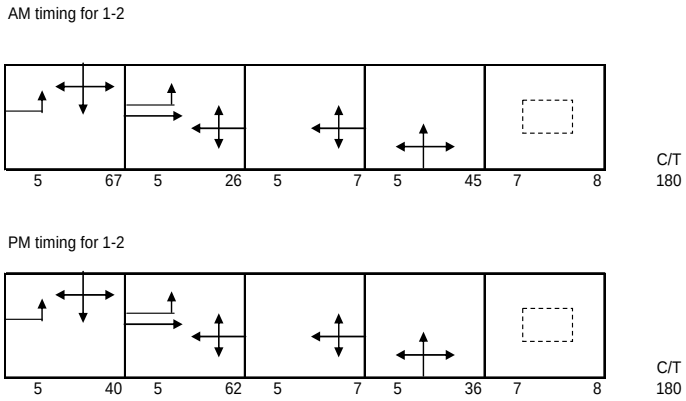

Figure 3.7 : AM and PM Peak Signal timings (Package 1-2)

Again, this option was not successful, mainly due to the single lane on the Bridge of Dee. A queue very quickly develops across the bridge and causes problems at the Holburn Street Roundabout when the traffic signals for the bridge are at red.

3.3.3 Package 1-3

This package involved signalising only the North junction of the King George VI Bridge and the remaining 3 junctions were left as roundabouts.

Analysis of the forecast demand flows suggests that, of all the junctions, King George VI/Riverside Drive had the most chance of accommodating the predicted volumes through traffic signal control. Package 1-3 aimed to evaluate the merits of installing traffic signals at this location independent of any changes to the other three junctions.

The traffic signal timings developed using the Transyt program are shown in Figure 3.8.

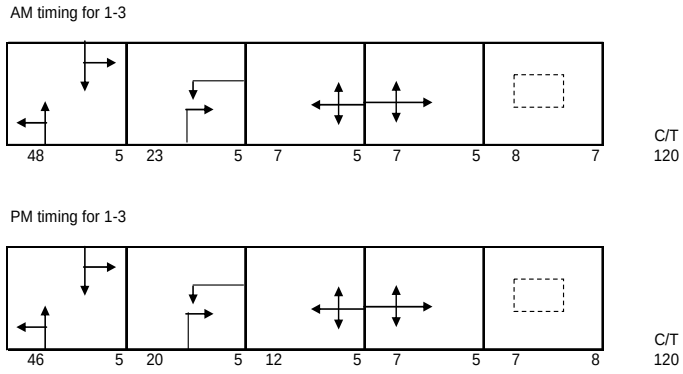

Figure 3.8 : AM and PM Peak Signal timings (Package 1-3)

Package 1-3 did not fail, but it operated in a similar manner to the existing roundabout in the AM peak. The queue that exists at present on Riverside Drive was still evident in the PM Peak, even with the introduction of the traffic signals and the queueing on Great Southern Road extended beyond the extents of the modelled network presenting worse conditions than the Do-Minimum.

It is not felt that the introduction of the traffic signals at this junction provides benefits to the network, the design and implementation would also prove challenging to reduce footway width to provide an extra lane for general traffic movements.

3.4 Network Performance (Package 1)

The mean travel time was extracted from all the scenarios tested, as a general indicator of network performance and congestion. Tables 3.1 and 3.2 show the mean travel time for the AM and PM peaks based on an average of 5 S-Paramics model runs.

Table 3.1 : AM Peak – General Network Statistics (Package 1)

Network	Traffic Demand	Mean Travel Time (min:sec)	Mean Speed (mph)
Base	2004	04:51	31.2
Med Term	2012 With AWPR + ST Improvements	04:39	31.3
Med Term	Package 1-1	10:46	12.8
Med Term	Package 1-2	09:34	14.8
Med Term	Package 1-3	05:07	28.3

It can be seen from Table 3.1, that Packages 1-1 and 1-2 show disbenefits in terms of both mean travel time and mean speed in the AM Peak when compared with the 2012 with AWPR and short term improvements.

As previously stated, the effect of package 1-3 is not as big as 1-1 or 1-2, but there is still a minor disbenefit in terms of both mean travel time and mean speed.

The results for the PM Peak can be seen in Table 3.2.

Table 3.2 : PM Peak – General Network Statistics (Package 1)

Network	Traffic Demand	Mean Travel Time (min:sec)	Mean Speed (mph)
Base	2004	04:45	27.5
Med Term	2012 With AWPR + ST Improvements	05:27	23.3
Med Term	Package 1-1	15:07	7.7
Med Term	Package 1-2	14:51	8.0
Med Term	Package 1-3	06:06	20.8

It can be seen from Table 3.2 that the same occurs in the PM Peak, both Packages 1-1 and 1-2 show worse results than the 2012 with AWPR and short term improvements, and Package 1-3 shows a minor disbenefit compared to the 2012 Do-Minimum.

3.5 Findings from Package 1

The three scenarios tested in Package 1 have shown that the local geography and forecast traffic flows make implementing traffic signals difficult at any of the terminal crossings for Bridge of Dee or King George VI Bridge.

The analysis of forecast flows shows that most of the junctions would be operating well over capacity, this combined with the constraints arising from bridge widths and lack of land due to bridge parapets and abutments rules out the implementation of successful traffic signalised junctions.

It is therefore recommended that no changes are made to the 4 junctions at either ends of the Bridge of Dee and King George VI Bridge. While there will still be some congestion issues, with the reduction in flows due to the introduction of the AWPR, the present roundabouts are considered to provide the best solution to cater for forecast travel demand in the medium term.

4 PACKAGE 2 - IMPROVEMENTS AT HARENESS ROAD, SOUTERHEAD AND PROVISION OF PEDESTRIAN/CYCLE BRIDGE NEXT TO EXISTING BRIDGE OF DEE

4.1 Introduction

The existing footways on Bridge of Dee are of 1.1 metre to 1.2 metres in width which is well current design standard minimum of 1.8 metres. This places pedestrians, including those in wheelchairs and young children, extremely close to the high volumes of passing vehicles creating an uncomfortable environment that is worsened on days of high wind and rain. Any pedestrians going in the opposite directions on a footway have to wait at one of the six passing places, which are provided at approximately 18 metre intervals.

The inclusion of these limited pedestrian facilities restricts the running carriageway width with a resultant width restriction preventing HGVs from crossing. There is a need to provide significantly better facilities for both pedestrians and cyclists alike at this location to provide a safe alternative to private car use. Due to the width restriction on the Bridge of Dee, most HGV traffic from the A90 South Anderson Drive must re-route via Holburn Street, Riverside Drive and Great Southern Road to continue their journey on the A90 Stonehaven Road and vice versa from the A90 Stonehaven Road to the A90 South Anderson Drive.

The expansion of Altens Industrial Estate and the increase in housing at Cove in the medium term are likely to exacerbate the congestion and queueing currently occurring around the Hareness Rd/Wellington Road roundabout and also the Souterhead Roundabout.

4.2 Aims

While the safety and comfort benefit of a separate pedestrian/cycle bridge cannot be quantified, providing such a facility would also allow the removal of the current width restriction on Bridge of Dee. Although the introduction of the Aberdeen Western Peripheral Route by 2012 will attract strategic HGV movements, those HGVs wishing to access the local area would benefit as a result of this package through reduced travel times as they would no longer have to divert via King George Bridge and thus reduce the congestion and environmental impact caused by this additional journey length.

In addition, in Package 2, a further review of the Hareness Rd/Wellington Rd junction has been carried out to assess full signalisation. The Hareness Rd/Wellington Rd roundabout suffers significant delays, particularly in the PM peak for vehicles exiting the industrial areas around Hareness Rd.

Package 2 also considers some remedial treatments at Souterhead roundabout to resolve existing queueing and delay problems on Souterhead Road and Langdykes Road through the provision of extended entry lanes from:

- An extra lane for traffic from Cove towards the AWPR was introduced
- An extra lane from Souterhead Road was introduced

In summary, the measures considered in Package 2 are:

- pedestrian footbridge over River Dee which also enables removal of footways and width restriction on Bridge of Dee aiding local HGV trips
- Replace Hareness Rd/Wellington Rd roundabout with fully signalised junction
- At Souterhead Roundabout
    - An extra lane for traffic from Cove towards the AWPR was introduced
    - An extra lane from Souterhead Road was introduced

4.3 Development of Package 2

The most significant area of concern identified during initial testing of the medium term was the congestion occurring around the Hareness Road/Wellington Road junction. This problem area became the main focus for the success of Package 2 testing.

The traffic flows at Hareness roundabout were assessed and a preliminary design for a signal controlled junction at this location was developed, based on these flows and the available space. Pedestrian crossing facilities were also provided, resulting in the existing remote crossings being removed.

Forecast traffic flows for Hareness are shown in Figures 4.1 and 4.2 for the AM and PM peaks respectively.

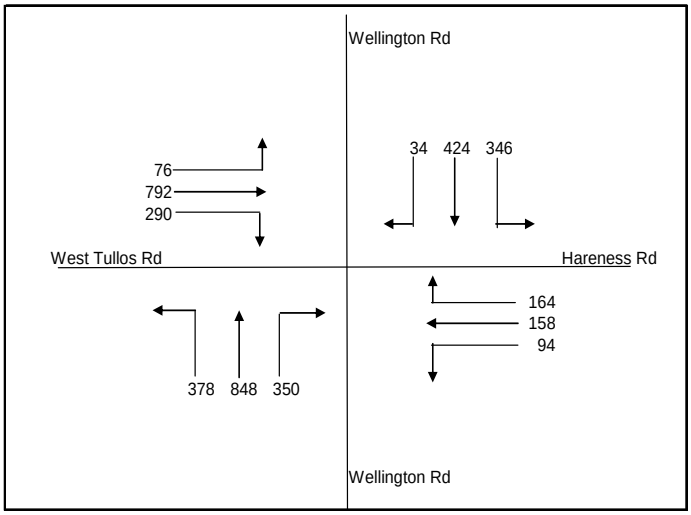

Figure 4.1 : Forecast 2012 Traffic Flows AM Peak Hour (0800 – 0900)

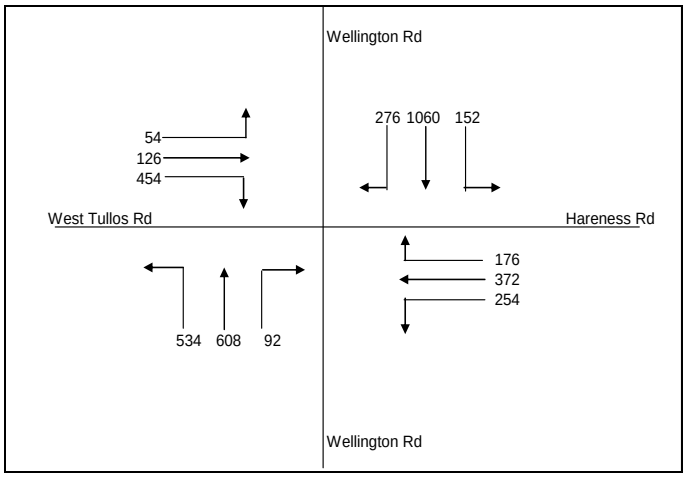

Figure 4.2 : Forecast 2012 Traffic Flows PM Peak Hour (1630 – 1730)

Figure 4.3 shows the junction design for the new Hareness signalised junction.

Figure 4.3 : Hareness Signalised Junction Design

The re-design as shown in Figure 4.3 provides four lanes on Wellington Road northbound using a realignment of Wellington Southbound combined with a removal of the left slip into Loriston House to provide the required road width.

Hareness Road westbound is widened to provide two lanes from the junction of Crawpeel Road to Wellington Road. Hareness Road eastbound is also widened to bring two lanes through from West Tullos Road but merge them prior to Altens Farm Road.

Accommodating the existing bus route at this location is a problem in the existing configuration (Figure 4.4) and will also pose a design challenge for any future solution.

Figure 4.4 : Existing Public Transport Egress from Abbotswell Crescent to West Tullos Road

The bus route is not modelled to a sufficient level to allow a detailed assessment to be made however it may be possible to include the access from Abbotswell Crescent into the signal design of Hareness Road/Wellington Road. It is likely that the time lost to the main movements through the inclusion of this movement will cause delays to the network.

As an alternative, it may be possible to break through onto West Tullos Road further west to accommodate the bus flow away from the critical Hareness Road location giving safe egress to the primary road network for the bus routes affected. Figure 4.5 shows some preliminary options around Nigg Way.

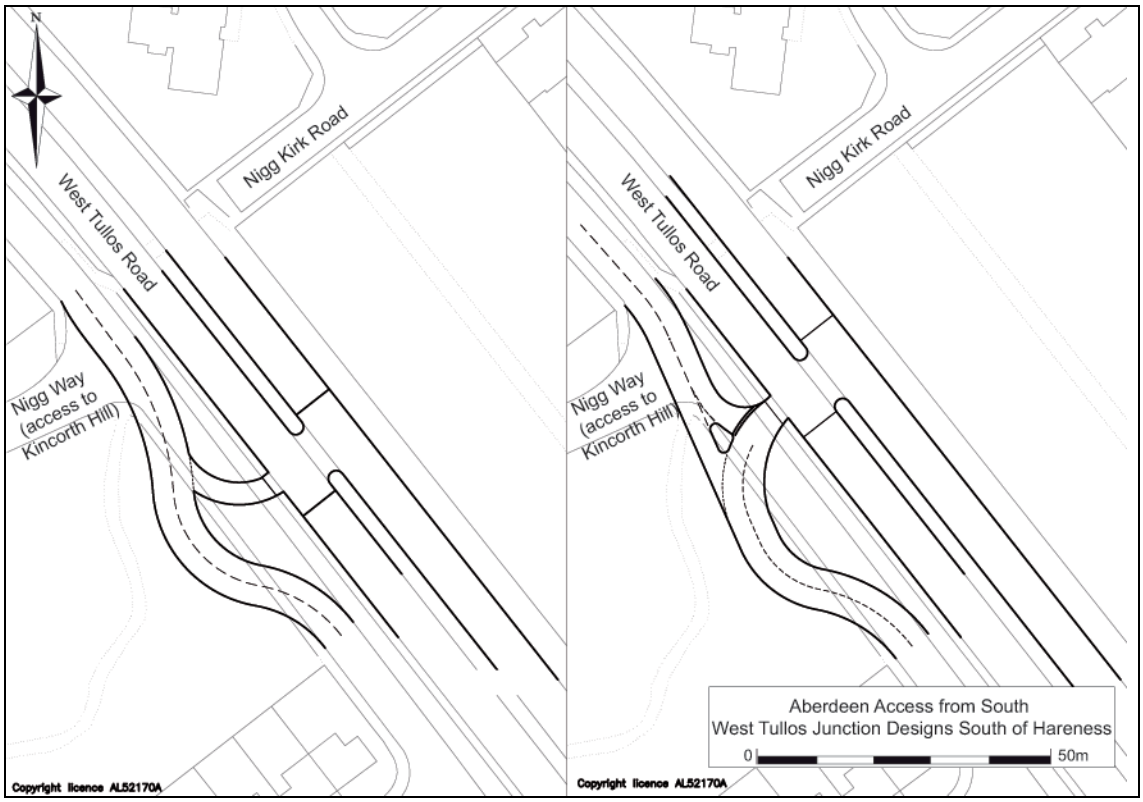

Figure 4.5 : West Tullos Junction Design South of Hareness

The designs above would both require some land take from an existing area of open ground. It is likely that objections would be met, however, if a viable option, significant benefits to safe public transport routeing could be made.

The revised traffic signal timings at the new Hareness junction are shown in Figure 4.6. In this staging arrangement pedestrian 'walk with traffic' crossing facilities can be provided.

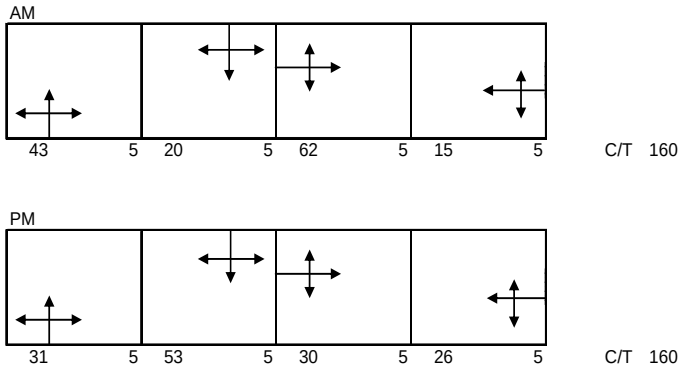

Figure 4.6 : Traffic Signal Timings – Hareness Roundabout (Package 2)

The removal of the HGV ban from Bridge of Dee will require removal of the Bridge of Dee footways in order to widen the lanes to accommodate HGV traffic. In terms of traffic modelling, the existing base restriction has simply been removed from the model code to allow HGV traffic.

The adjustments to lane allocations at Souterhead Roundabout (an extra lane for traffic from Cove towards the AWPR and an extra lane from Souterhead Road) were also simple items to add within the modelling context and no preliminary design drawings have been generated.

4.4 Network Performance (Package 2)

4.4.1 Mean Travel Time

The mean travel time was extracted from Package 2, and was compared against the 2004 base and 2012 Do-Minimum as a general indicator of network performance and congestion. Tables 4.1 and 4.2 show the mean travel time for the AM and PM peaks based on an average of 5 S-Paramics model runs. The 2012 Do-Minimum is referred to as the 2012 with AWPR + ST Improvements.

Table 4.1 : AM Peak – General Network Statistics (Package 2)

Network	Traffic Demand	Mean Travel Time (min:sec)	Mean Speed (mph)
Base	2004	04:51	31.2
Med Term	2012 With AWPR + ST Improvements	04:39	31.3
Med Term	Package 2	04:47	30.3

In the AM Peak, Package 2 shows an improved mean travel time when compared against the 2004 Base, and is only slightly worse than the 2012 Do-Minimum. It is worth considering though, that although there is a slight disbenefit, safe pedestrian crossing facilities have been provided at Hareness junction. Table 4.2 shows the results for the PM Peak.

Table 4.2 : PM Peak – General Network Statistics (Package 2)

Network	Traffic Demand	Mean Travel Time (min:sec)	Mean Speed (mph)
Base	2004	04:45	27.5
Med Term	2012 With AWPR + ST Improvements	05:27	23.3
Med Term	Package 2	05:26	23.2

In the PM Peak, both the 2012 Do-Minimum and Package 2 shows longer mean travel time than the 2004 base, but Package 2 shows an improvement over the Do-Minimum. Given that safe crossing facilities are provided at Hareness, and the HGV diversion over King George VI Bridge has been removed, it is worth considering Package 2 as the network performance is relatively consistent with the Do-Minimum.

4.4.2 Key Journey Time Comparisons

The average journey times between certain zones have been extracted from the models for all vehicles and for HGVs only to show any benefits from the introduction of the improvement schemes. Journey times have been extracted for the following movements;

- A90(S) to South Anderson Drive
- South Anderson Drive to A90(S)
- A90(S) to South College Street
- South College Street to A90(S)
- Hareness Road to all destinations
- Souterhead Rd to all destinations
- All origins to Hareness Road
- All origins to Souterhead Road

Table 4.3 shows the results for the AM Peak, for all vehicles.

Table 4.3 : Journey Time Comparison – AM Peak All Vehicles (Package 2)

	2004 Base	2012 Do Min	Package 2
A90 (S) to South Anderson Dr	10:58	09:22	09:13
South Anderson Dr to A90 (S)	11:15	11:02	11:08
A90 (S) to South College St	12:41	13:38	11:33
South College St to A90 (S)	12:23	12:27	12:49
Average JT from Hareness Rd	05:24	04:37	05:40
Average JT to Hareness Rd	05:49	05:44	06:36
Average JT from Souterhead Rd	04:40	04:32	05:13
Average JT to Souterhead Rd	06:03	06:32	07:10

It can be seen that, in the AM Peak in the Northbound direction (the dominant direction of travel), there is an improvement of over 2 minutes in Package 2 when compared against the 2012 Do-Minimum from A90 (S) to South College Street and a slight improvement from A90 (S) to South Anderson Drive.

Journey times from Hareness and Souterhead do increase slightly, but given the small numbers of vehicles doing this in the AM, the benefits have been given to the mainline traffic.

Table 4.4 shows the results for the AM peak for HGVs only.

Table 4.4 : Journey Time Comparison – AM Peak HGVs only (Package 2)

	2004 Base	2012 Do Min	Package 2
A90 (S) to South Anderson Dr	14:01	11:48	09:32
South Anderson Dr to A90 (S)	n/a	n/a	n/a
A90 (S) to South College St	13:09	14:03	14:38
South College St to A90 (S)	13:06	12:58	13:16
Average JT from Hareness Rd	04:25	04:13	05:15
Average JT to Hareness Rd	05:33	08:41	06:27
Average JT from Souterhead Rd	04:02	04:02	04:05
Average JT to Souterhead Rd	04:42	06:37	05:32

The main change for HGVs is the removal of the restriction banning them from the Bridge of Dee. It can be seen from the results that from the A90(S) to South Anderson Drive, there is an improvement of approximately four and a half minutes when compared to the 2004 base and an improvement of over 2 minutes when compared against the 2012 Do-Minimum.

In the Southbound direction, there were no HGV of restricted width making the movement within the modelled matrices. It is considered likely that in reality there will be HGVs affected during the AM peak and a significant benefit will be realised.

Tables 4.5 and 4.6 show the results for the PM Peak (All Vehicles) and PM Peak (HGV Only) respectively.

Table 4.5 : Journey Time Comparison – PM Peak Period All Vehicles (Package 2)

	2004 Base	2012 Do Min	Package 2
A90 (S) to South Anderson Dr	09:05	08:59	08:52
South Anderson Dr to A90 (S)	11:55	15:16	15:09
A90 (S) to South College St	12:24	11:38	12:31
South College St to A90 (S)	13:13	13:17	13:39
Average JT from Hareness Rd	06:41	24:04	05:50
Average JT to Hareness Rd	05:31	05:56	06:37
Average JT from Souterhead Rd	08:53	06:40	05:35
Average JT to Souterhead Rd	06:04	07:26	07:29

It can be seen from Table 4.5 that the biggest benefits in the PM Peak are for traffic exiting the Industrial Estates at Hareness and Souterhead. In particular, there is a saving of nearly 20 minutes on Hareness Road with the introduction of the traffic signals when compared against the Do-Minimum. At Souterhead Road, with the extra lane there is a saving of nearly 1 minute when compared against the 2012 Do-Minimum.

There are only small changes to the mainline journey times in the PM Peak, the benefits being accrued to the side roads.

Table 4.6 : Journey Time Comparison – PM Peak Period HGVs Only (Package 2)

	2004 Base	2012 Do Min	Package 2
A90 (S) to South Anderson Dr	10:51	11:02	09:22
South Anderson Dr to A90 (S)	16:12	19:39	12:22
A90 (S) to South College St	12:47	12:20	13:54
South College St to A90 (S)	14:02	13:50	13:28
Average JT from Hareness Rd	05:45	24:33	05:14
Average JT to Hareness Rd	05:06	05:25	06:26
Average JT from Souterhead Rd	06:32	05:42	04:02
Average JT to Souterhead Rd	04:17	04:53	05:37

Table 4.6 shows significant benefits in removing the HGV restriction on the Bridge of Dee. In the northbound direction there is a saving of just under two minutes when compared against the 2012 Do-Minimum, and a saving of around seven minutes in the southbound direction in the PM Peak.

4.4.3 Hareness Junction Queue Length Comparisons

The average maximum queue length at the improved Hareness junction has been analysed using the S-Paramics DAT (Data Analysis Tool) package, graphs illustrating the results are provided in Appendix A. The queues have been compared against the 2004 base and the 2012 Do-Minimum for all arms in both the AM and PM Peaks. The following summarises the queue length results:

- AM Peak
  - Wellington Road southbound with the introduction of the traffic signals at Hareness Rd, there is an improvement in the queue length from a maximum of approximately 200m in the 2004 base to approximately 50m in package 2 on Wellington Road Southbound.
  - Hareness Road westbound shows that the queue increases slightly in the AM Peak due to the balancing of the queues with the introduction of the traffic signals.

- Wellington Road northbound shows that with the introduction of traffic signals the queues are longer, due to the delay introduced by the traffic signals. It should be borne in mind that there is the benefit of the safe operation of the junction and improved pedestrian and cyclist facilities.
- West Tullos Road Eastbound again shows increased queuing with the traffic signals, mainly concentrated in the AM Peak Hour.

- PM Peak
  - Queue lengths on Wellington Road Southbound are very similar to the 2004 Base and 2012 Do-Minimum with the introduction of the traffic signals.
  - Hareness Road westbound shows that the maximum queue length is greatly reduced from 600 metres to a short 200 metre peak with the introduction of the traffic signals when compared against the 2012 Do-Minimum on Hareness Road in the PM Peak.
  - Wellington Road northbound queues show that with the introduction of traffic signals the queues are longer, due to the delay introduced by the traffic signals. It should be borne in mind that there is the benefit of the safe operation of the junction and improved pedestrian and cyclist facilities.
  - Queueing on West Tullos Road has remained fairly consistent between the different scenarios. There is only a slight increase with the introduction of the signals.

The introduction of traffic signals has shown to manage and balance the queue lengths on each arm of the junction while giving the benefits of controlled pedestrian movements. It is likely that sophisticated traffic signal installation (MOVA) could further improve the performance of the junction. The most significant queue length reduction is at Hareness Road in the PM peak which provides a benefit for the Altens industrial area.

4.4.4 Wellington Road Corridor (Cordon Queue)

An average delay cordon for the Wellington Road corridor has also been analysed using DAT in order to assess overall levels of queuing for the Southern area. The cordon was set up and the average number of vehicles queuing in the cordon was extracted. The extent of the cordon is shown in Figure 4.7.

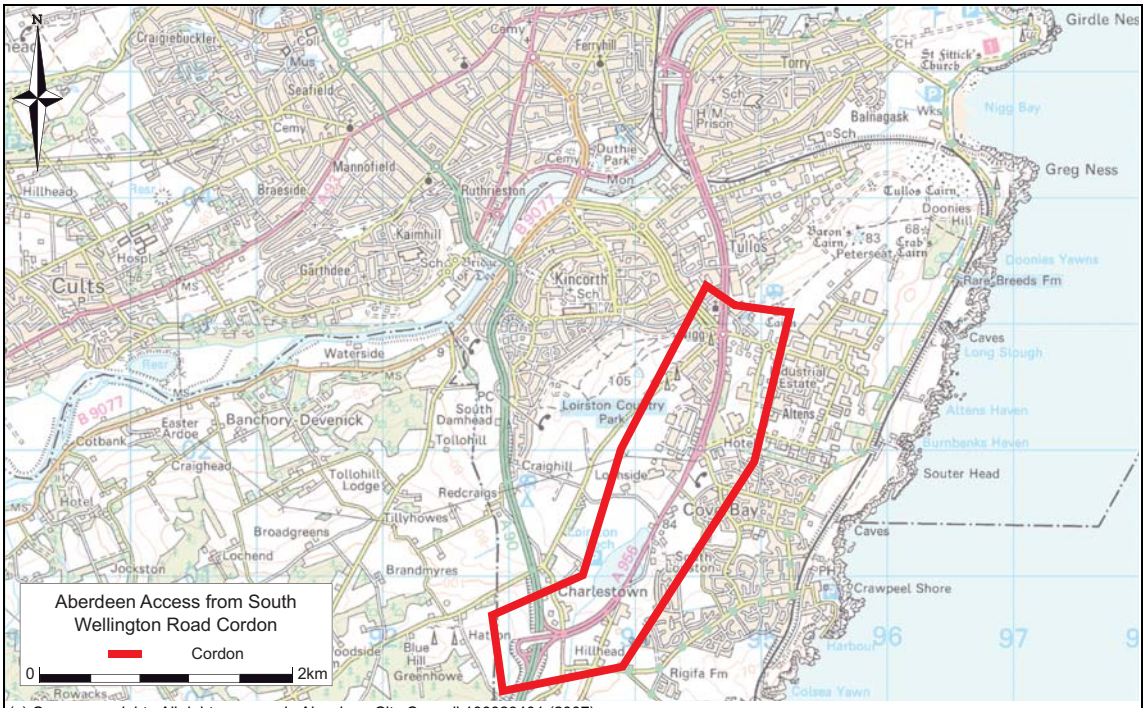

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Figure 4.7 : Wellington Road Cordon

Figure 4.8 shows the results for the AM Peak in Package 2.

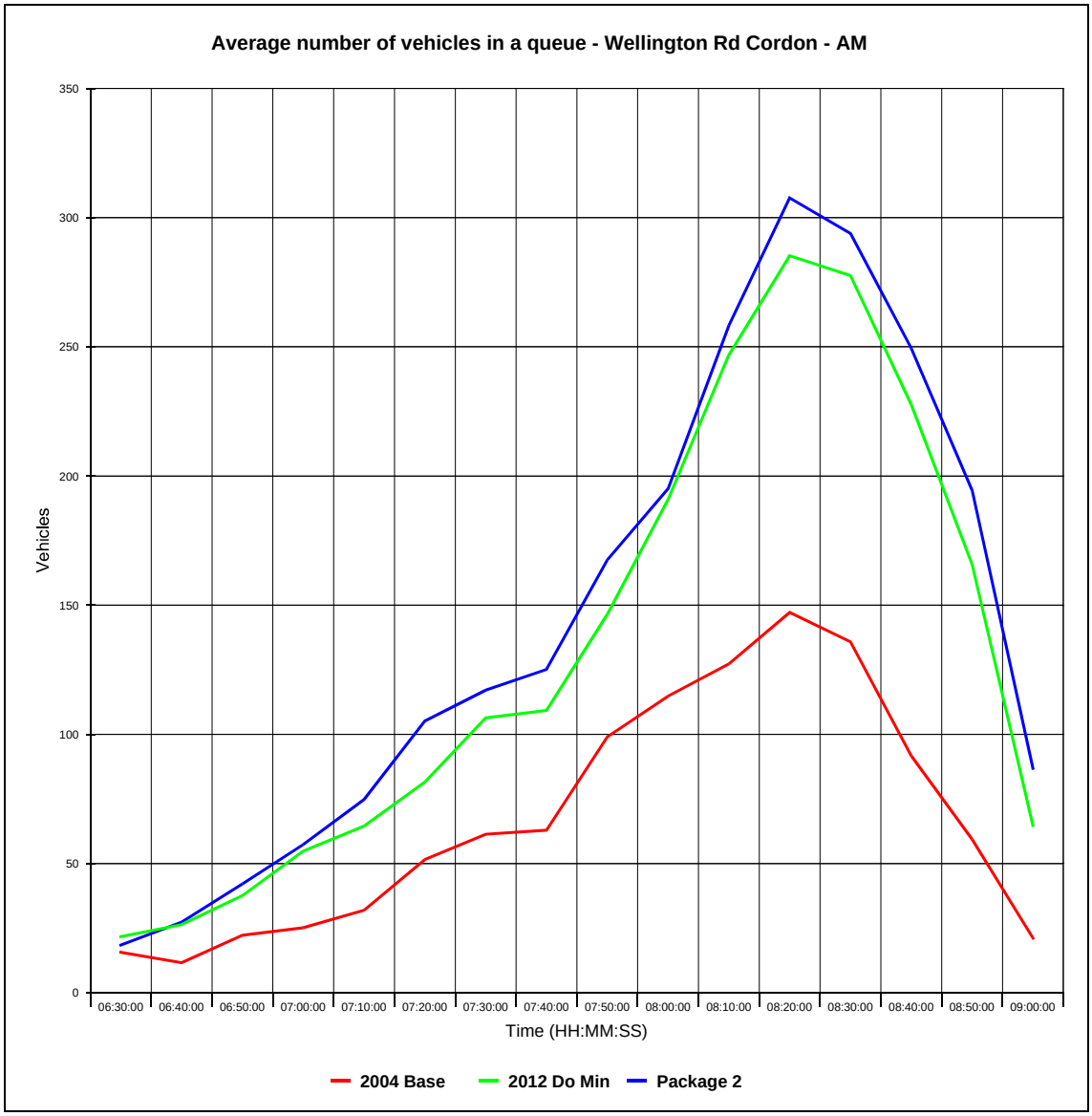

Figure 4.8 : Wellington Road Cordon Delay – AM Peak

Figure 4.8 shows that the delay between the 2012 Do-Minimum and Package 2 is very similar, with only slightly more delay in Package 2 due to the additional vehicles queuing at the traffic signals.

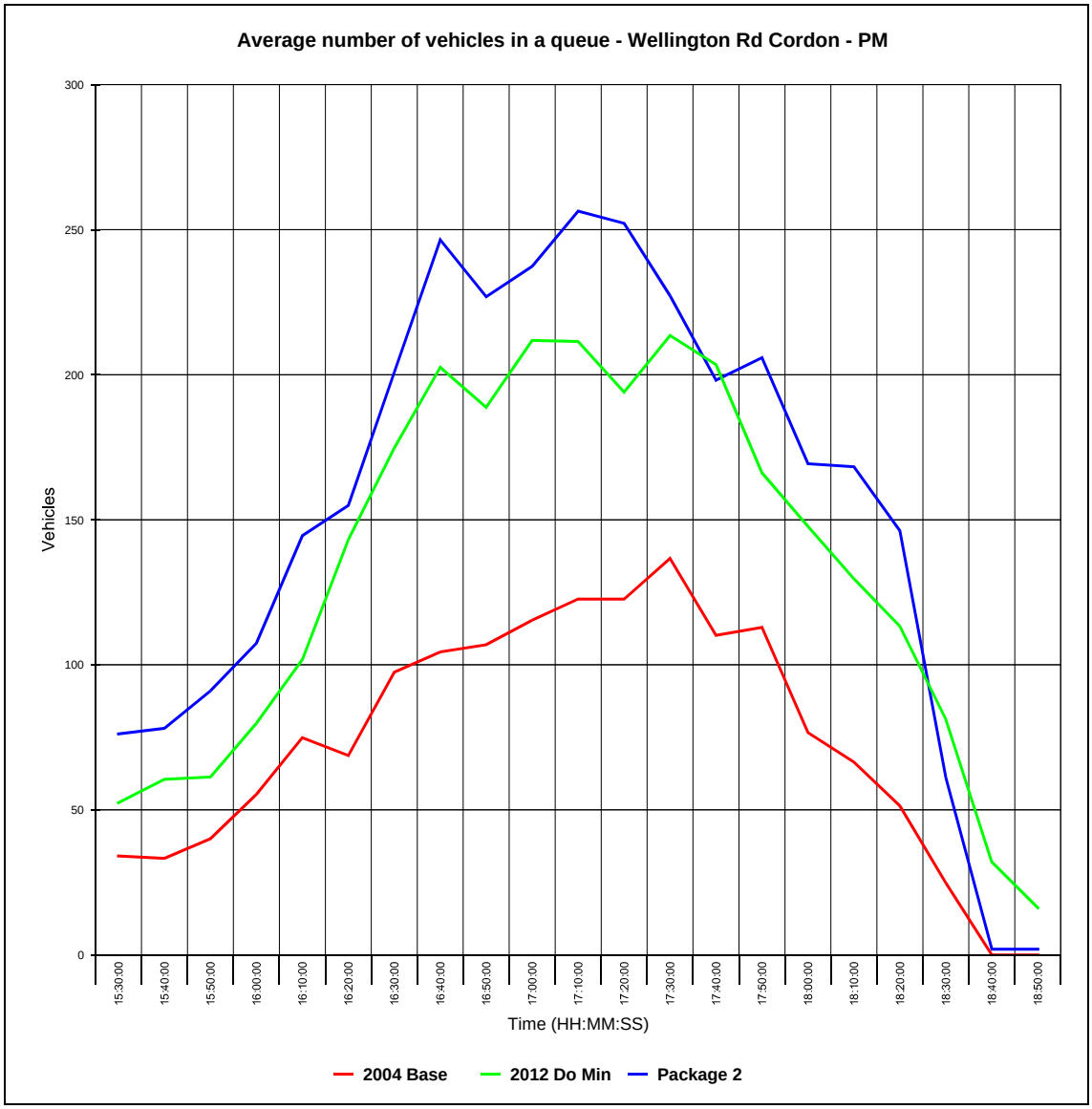

Figure 4.9 : Wellington Road Cordon Delay – PM Peak

Figure 4.9 is misleading in that the full extent of the vehicles queued in the 2012 Do-Minimum is not reflected. The queue cordon only accounts for vehicles queued on the network and examination of the 2012 Do-Minimum shows significant levels of traffic queued off the network into the zones on Hareness and Souterhead Roads. This is equivalent to an extra 300 to 400 vehicles during the peak and, with no vehicles queued in the zone for Package 2, demonstrates a dramatic improvement overall through the inclusion of the measures prescribed.

4.5 Findings from Package 2

The main components of the Package 2 testing have all shown some benefit for the Aberdeen South area and in the first instance a new pedestrian/cycle bridge at Bridge of Dee would significantly enhance facilities at this key crossing location which also aids HGV journey times which have improved as a result of the removal of the HGV ban on Bridge of Dee.

Installation of traffic signals at Hareness Road/Wellington Road has shown significant benefits in the PM peak for traffic leaving the Altens Industrial Estate. In the AM peak the traffic signals do introduce some

minor increases to overall delay, however the queuing on each arm generally clears in the signal phasing and facilities for cyclists, pedestrians, public transport and HGV turning have been significantly improved. Journey times for vehicles exiting Souterhead Road also show improvements in both the AM and PM peaks.

All components of Package 2 show results which are beneficial to the road users in South Aberdeen. In addition, the implementation of traffic signals at this location will provide the option to apply demand management in the future. Queueing on Wellington Road between Souterhead Road and Hareness Road could be controlled to allow any future public transport initiatives to be competitive against private car journeys.

5 PACKAGE 3 – BRIDGE OF DEE/KING GEORGE VI GYRATORY

5.1 Introduction

Package 3 assumes the removal of the HGV ban on Bridge of Dee to assess the performance of a one-way gyratory system. The one way gyratory system tested is as proposed by JMP during the original Access from South Study.

5.2 Aim

Package 3 consisted of testing a one way gyratory, developed by JMP, to investigate whether this could provide better use of the existing carriageway widths. The aim of the one-way gyratory is to resolve the existing queueing and congestion problems occurring around the bridge crossings through linked management of traffic signals between Bridge of Dee and King George VI Bridge.

5.3 Development of Package 3

The traffic signals designed by JMP provided 'walk with' traffic pedestrian crossings at most junctions, however the traffic signals did not allow for pedestrian movement at the following locations:

- Across the Southern end of the Bridge of Dee
- Northern junction of the Bridge of Dee in the AM peak
- Northern junction of King George VI Bridge

At these locations a pedestrian stage was added to the signal stages. The signal staging was also changed at a number of locations, as JMP had conflicting movements with a major priority in the same signal stage.

Figure 5.1 shows the one way gyratory plan.

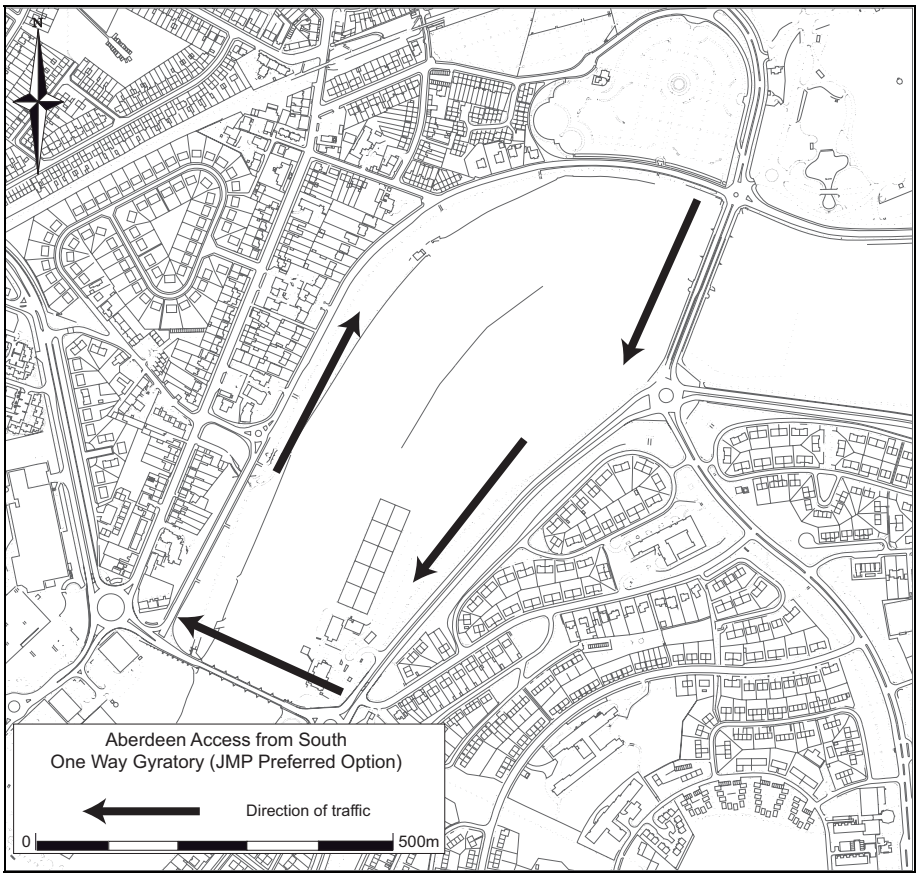

Figure 5.1 : One Way Gyratory (JMP Preferred Option)

5.4 Network Performance (Package 3)

The mean travel time was extracted from scenario 3, and was compared against the 2004 base and 2012 Do-Minimum as a general indicator of network performance and congestion. Tables 5.1 and 5.2 show the mean travel time for the AM and PM peaks based on an average of 5 S-Paramics model runs.

Table 5.1 : AM Peak – General Network Statistics (Package 3)

Network	Traffic Demand	Mean Travel Time (min:sec)	Mean Speed (mph)
Base	2004	04:51	31.2
Med Term	2012 With AWPR + ST Improvements	04:39	31.3
Med Term	Package 3	09:03	15.9

Table 5.1 shows that with the inclusion of the one way gyratory preferred option in the AM Peak, the results is that the mean travel time in the model almost doubles in length. The mean speed of vehicles also almost halves during the simulation.

Table 5.2 : PM Peak – General Network Statistics (Package 3)

Network	Traffic Demand	Mean Travel Time (min:sec)	Mean Speed (mph)
Base	2004	04:45	27.5
Med Term	2012 With AWPR + ST Improvements	05:27	23.3
Med Term	Package 3	20:38	5.8

Table 5.2 shows that with the introduction of the one way gyratory in the PM peak, the mean travel time is almost four times the length of the 2012 Do-Minimum. The mean speed of vehicles also reduces by nearly 15mph, from 23.3mph to only 5.8mph.

5.5 Findings from Package 3

Observation of the S-Paramics network performance has shown significant congestion problems as a result of the one-way gyratory option. In the PM peak the mean travel time for the network is almost four times that occurring in the 2012 Do-Minimum.

These problems are created by the significant increase in journey length and the delays at the traffic signals. Modelling results indicate that there are no benefits to creating a one-way gyratory in the medium term.

6 PACKAGE 4 – SOUTERHEAD ROUNDABOUT REDESIGN

6.1 Introduction

Souterhead Roundabout is currently part signalised and is subject to congestion and queueing on the main approaches during the AM and PM peaks. The roundabout suffers from a poor geometric layout making full signal control difficult.

6.2 Aim

The main aim of Package 4 was to assess potential solutions to the existing congestion concerns and incorporate better pedestrian and cycle facilities.

6.3 Development of Package 4

Package 4 carried forward the recommendations from Package 2 but also incorporated a full re-design at Souterhead to replace the existing junction with a staggered signal controlled junction. Figure 6.1 demonstrates schematically the basic junction concept and potential alternative options available. In order to keep the number of tests to a minimum only Option 1 has been assessed in the S-Paramics traffic modelling.

Figures 6.2 and 6.3 show the preliminary designs for Option 1 and 2 to provide a more detailed consideration of the proposals.

Due to low volumes of traffic between Langdykes Road and Wellington Circle in both the AM and PM periods (Figure 6.4) these movements have been barred in the Option 1 design and signal phasing to improve junction efficiency.

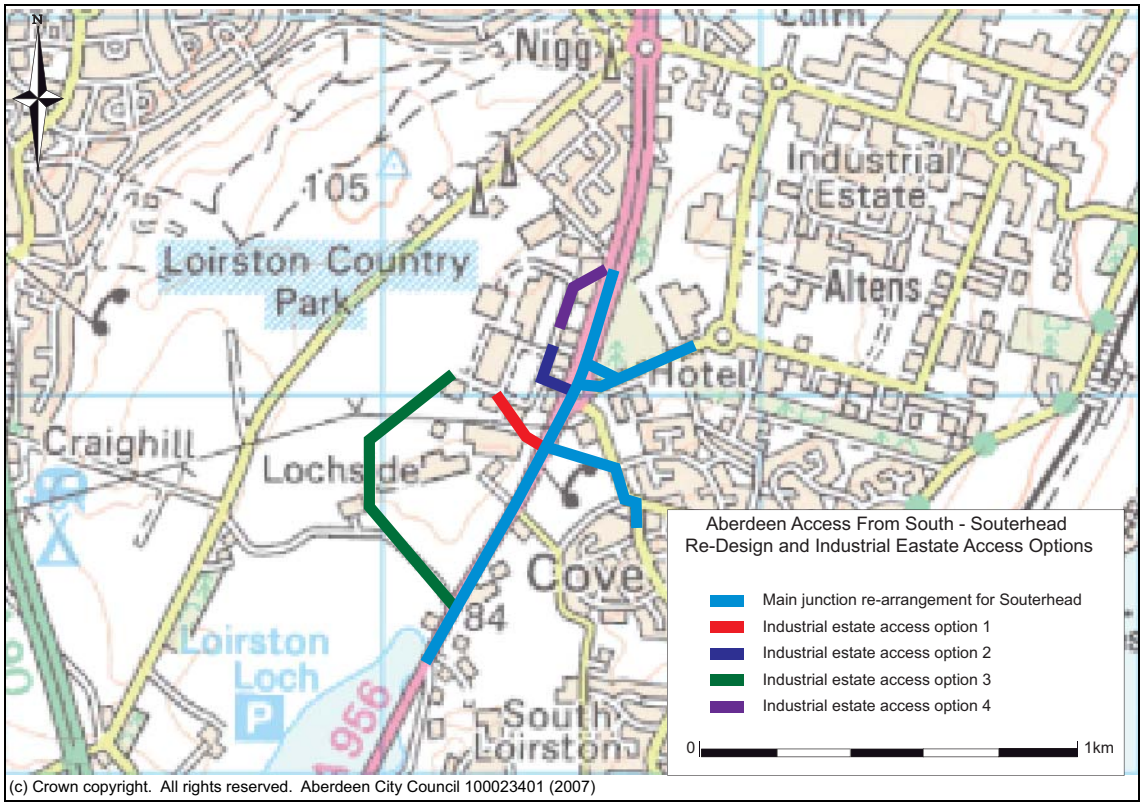

Figure 6.1 : Souterhead Redesign and Industrial Estate Access Options

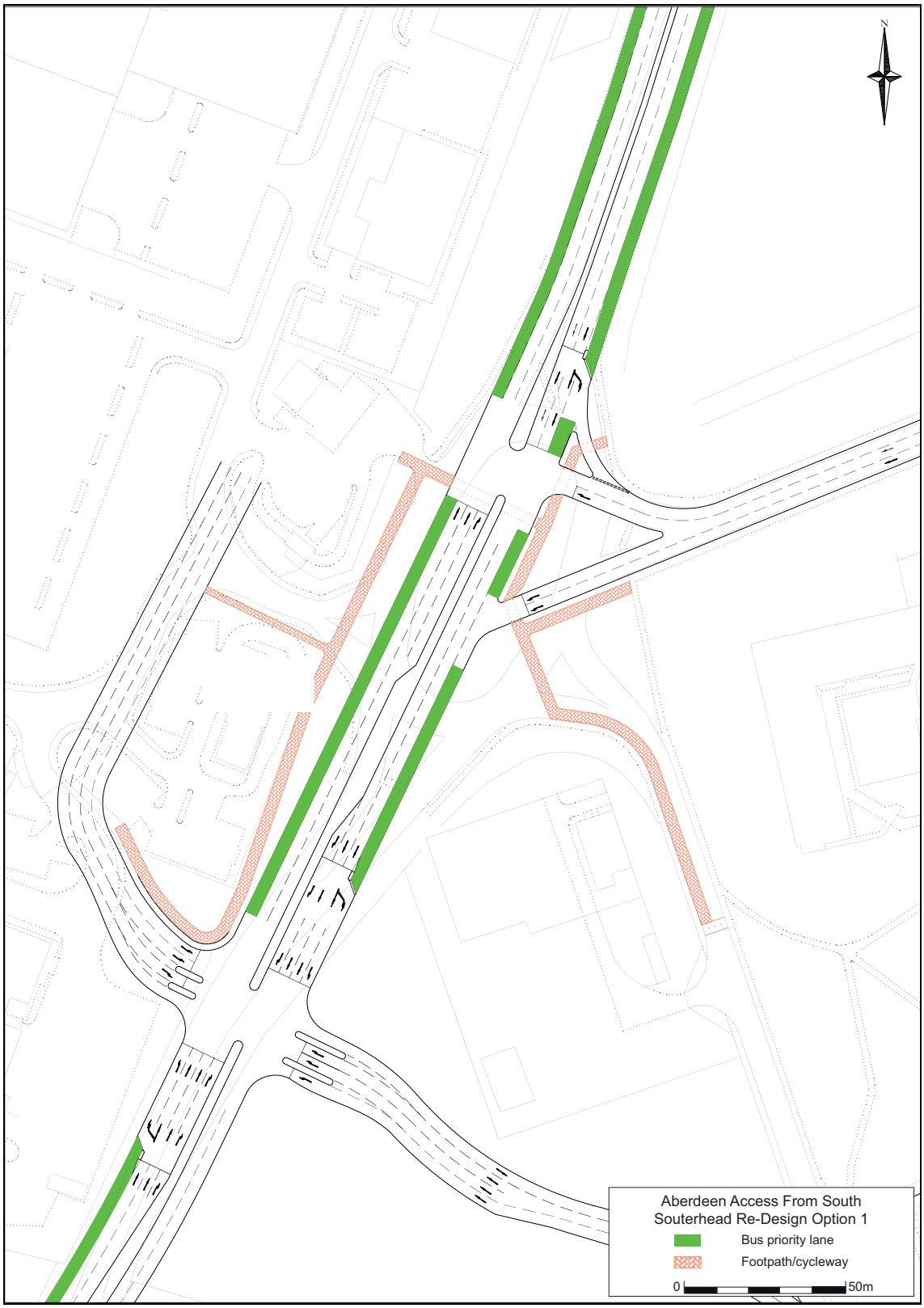

Figure 6.2 : Souterhead Re-Design Option 1

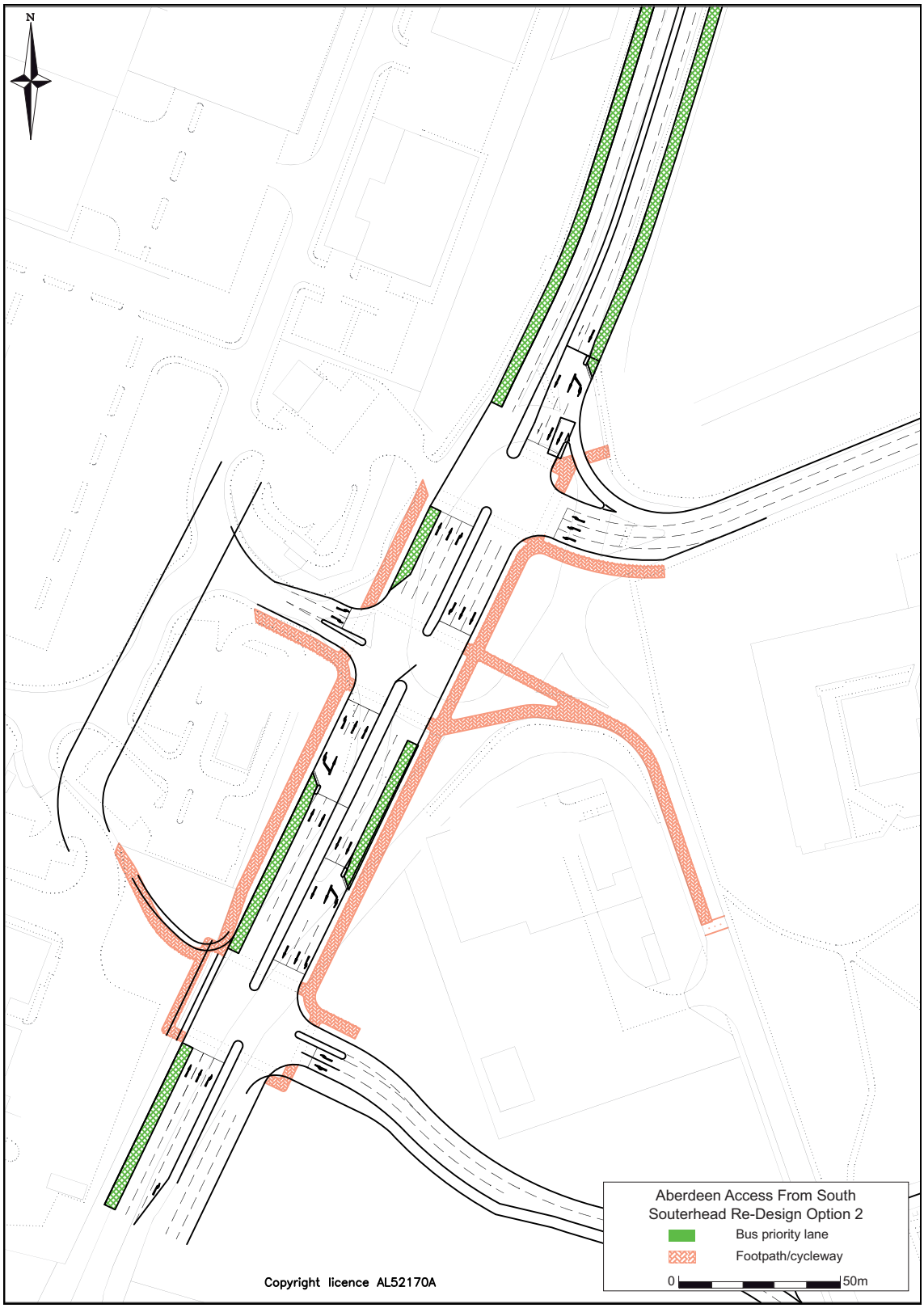

Figure 6.3 : Souterhead Re-Design Option 2

The Souterhead Roundabout forecast demand flows are shown in Figure 6.4. These flows have been used to design the proposed access layouts and develop the traffic signal staging and timings.

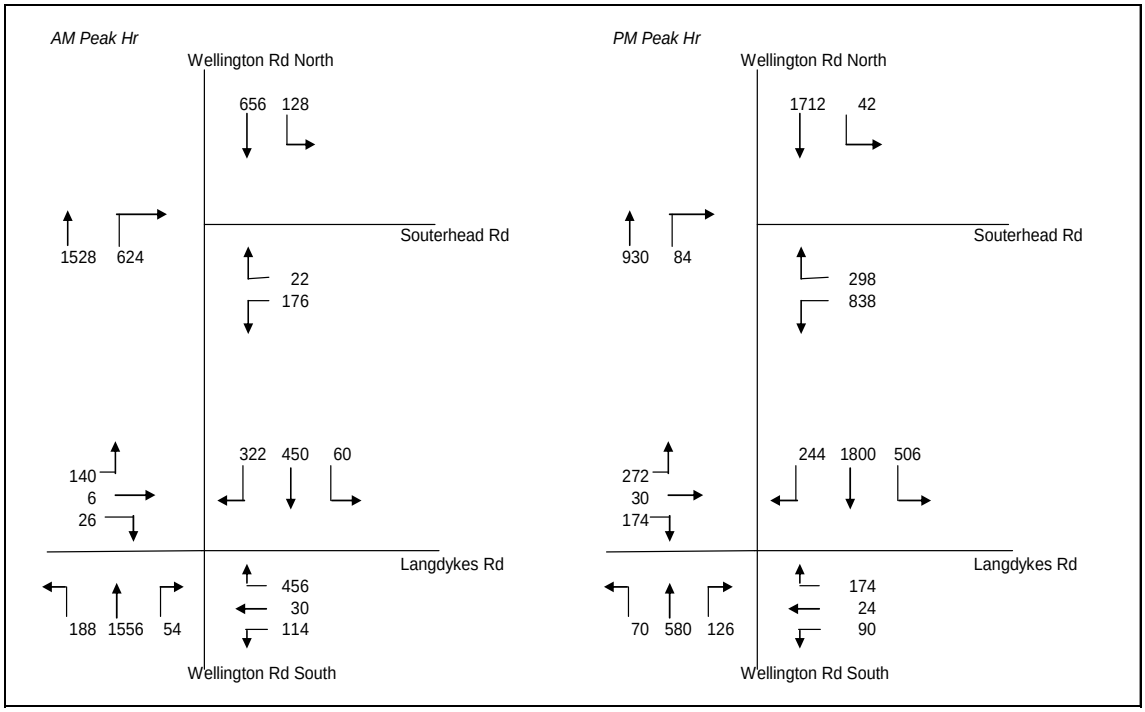

Figure 6.4 : Souterhead Medium Term (2012 with AWPR) Forecast Design Flows

The signal stages and timings used at the new Souterhead signal controlled junction are shown in Figure 6.5.

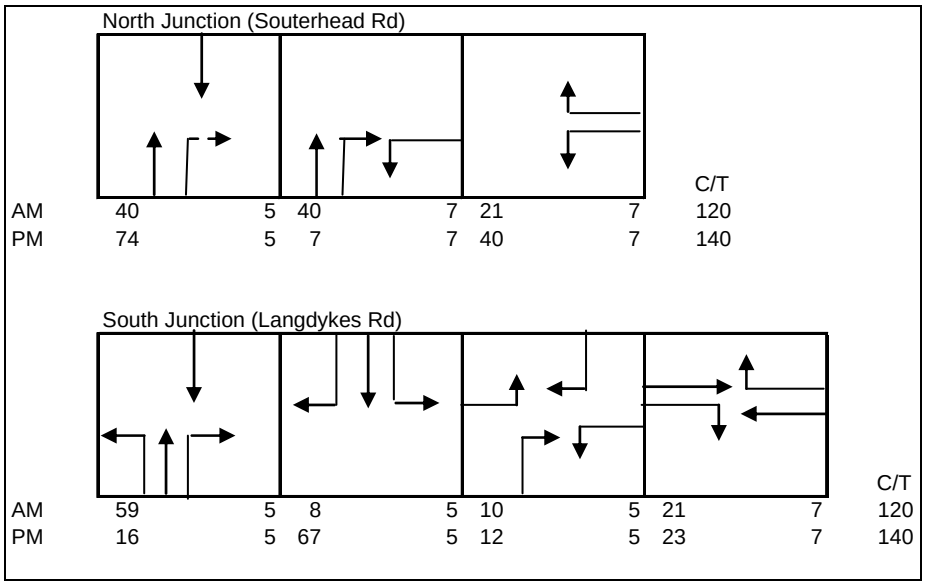

Figure 6.5 : Traffic Signal Timings – Souterhead (Package 4)

6.4 Network Performance (Package 4)

6.4.1 Mean Travel Time

The mean travel time was extracted from Package 4, and was compared against the 2004 base and 2012 Do-Minimum as a general indicator of network performance and congestion. Tables 6.1 and 6.2 show the mean travel time for the AM and PM peaks based on an average of 5 S-Paramics model runs.

Table 6.1 : AM Peak – General Network Statistics (Package 4)

Network	Traffic Demand	Mean Travel Time (min:sec)	Mean Speed (mph)
Base	2004	04:51	31.2
Med Term	2012 With AWPR + ST Improvements	04:39	31.3
Med Term	Package 4	04:51	30.0

In the AM Peak, Package 4 shows an unchanged mean travel time when compared against the 2004 Base, and is only slightly worse than the 2012 Do-Minimum. It is worth considering though, that although there is a slight disbenefit, safe pedestrian crossing facilities have been provided at Hareness and Souterhead junctions. Table 6.2 shows the results for the PM Peak.

Table 6.2 : PM Peak – General Network Statistics (Package 4)

Network	Traffic Demand	Mean Travel Time (min:sec)	Mean Speed (mph)
Base	2004	04:45	27.5
Med Term	2012 With AWPR + ST Improvements	05:27	23.3
Med Term	Package 4	05:24	23.5

In the PM Peak, both the 2012 Do-Minimum and package 4 shows longer mean travel time than the 2004 base, but Package 4 shows an improvement over the Do-Minimum. Given that safe crossing facilities are provided at both Hareness and Souterhead, and the HGV diversion over King George VI Bridge has been removed, it is worth considering package 4.

6.4.2 Key Journey Time Comparison

The average journey times between certain zones have been extracted from the models for all vehicles and for HGVs only to show any benefits from the introduction of the improvement schemes. Journey times have been extracted for the following movements;

- A90(S) to South College Street
- South College Street to A90(S)
- Hareness Road to all destinations
- All origins to Hareness Road
- Souterhead Road to all destinations
- All origins to Souterhead Road
- Langdykes Road to all destinations
- All origins to Langdykes Road

Table 6.3 shows the results for the AM Peak, for all vehicles.

Table 6.3 : Journey Time Comparison – AM Peak All Vehicles (Package 4)

	2004 Base	2012 Do Min	Package 4
A90 (S) to South College St	12:41	13:38	13:58
South College St to A90 (S)	12:23	12:27	13:15
Average JT from Hareness Rd	05:24	04:37	06:03
Average JT to Hareness Rd	05:49	05:44	06:28
Average JT from Souterhead Rd	04:40	04:32	05:44
Average JT to Souterhead Rd	06:03	06:32	06:42
Average JT from Langdykes Rd	05:31	04:52	06:34
Average JT to Langdykes Rd	05:48	06:50	07:02

It can be seen, that while there are increased journey times due to the introduction of traffic signals the junctions are now considered safer for pedestrians and cyclists alike.

Table 6.4 shows the results for the PM Peak.

Table 6.4 : Journey Time Comparison – PM Peak All Vehicles (Package 4)

	2004 Base	2012 Do Min	Package 4
A90 (S) to South College St	12:24	11:38	15:31
South College St to A90 (S)	13:13	13:17	14:24
Average JT from Hareness Rd	06:41	24:04	05:58
Average JT to Hareness Rd	05:31	05:56	07:21
Average JT from Souterhead Rd	08:53	06:40	06:08
Average JT to Souterhead Rd	06:04	07:26	08:24
Average JT from Langdykes Rd	05:43	05:04	06:28
Average JT to Langdykes Rd	06:11	07:07	08:06

It can be seen from Table 6.4 that the biggest benefits in the PM Peak are for traffic exiting the Industrial Estates at Hareness and Souterhead. In particular, there is a saving of nearly 20 minutes on Hareness Road with the introduction of the traffic signals when compared against the Do-Minimum. At Souterhead Road, there is a saving of nearly 30 seconds when compared against the 2012 Do-Minimum.

There are only small changes to the mainline journey times in the PM Peak, the benefits being given to the side roads.

6.4.3 Queue Length Comparisons for Souterhead Junction

The average maximum queue length at the improved Souterhead junction have been analysed using the S-Paramics DAT (Data Analysis Tool) package and are detailed in Appendix B. The queues have been compared against the 2004 base and the 2012 Do-Minimum for all arms in both the AM and PM Peaks. The follow provides a summary of queue length results:

- AM Peak
  - Wellington Road southbound queue lengths remain relatively consistent at between 50 and 100 metres
  - Wellington Road northbound queue is reduced by around 200 metres to 400 metres during the peak. The time period of peak queueing is also around 20 minutes shorter than the Do-Minimum

- Souterhead Road queueing is similar for both the Do-Minimum and Package 4
- There is a slight increase in queueing on Langdykes Road to around 100 metres, this is due to the queue balancing of the traffic signals

- PM Peak
  - Wellington Road southbound queueing is around 100 metres longer at 200 metres than the Do-Minimum
  - In Package 4, Wellington Road northbound reaches a sharp peak of 500 metres at 17:20 before dissipating. The Do-Minimum queue was around 100 metres
  - On Souterhead Road the Do-Minimum showed significant queueing throughout the peak period and observations showed a significant number of vehicles queued into the zone. Package 4 significantly reduces queueing at this location
  - Langdykes Road queue is a constant 50 metres or so throughout the PM peak period

The introduction of traffic signals has shown to manage and balance the queue lengths on each arm of the junction while giving the benefits of controlled pedestrian movements. It is likely that sophisticated traffic signal installation (MOVA) could further improve the performance of the junction. The most significant queue length reduction is at Souterhead Road in the PM peak which provides a benefit for the industrial area.

6.4.4 Wellington Road Corridor (Cordon Queue)

The average delay cordon for the Wellington Road corridor were also analysed in DAT in order to assess levels of queuing. The cordon was set up and the average number of vehicles queuing within the cordon was extracted. The extent of the cordon is shown in Figure 6.6.

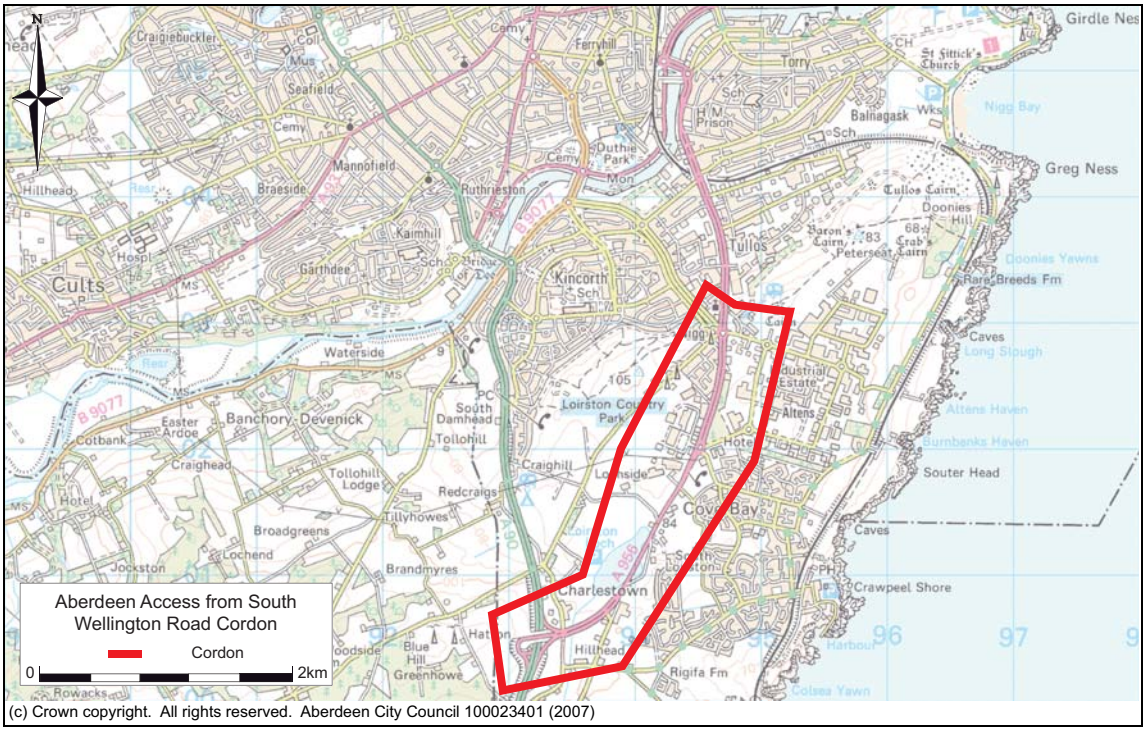

Figure 6.6 : Wellington Road Cordon

Figure 6.7 shows the results for the AM Peak in Package 4.

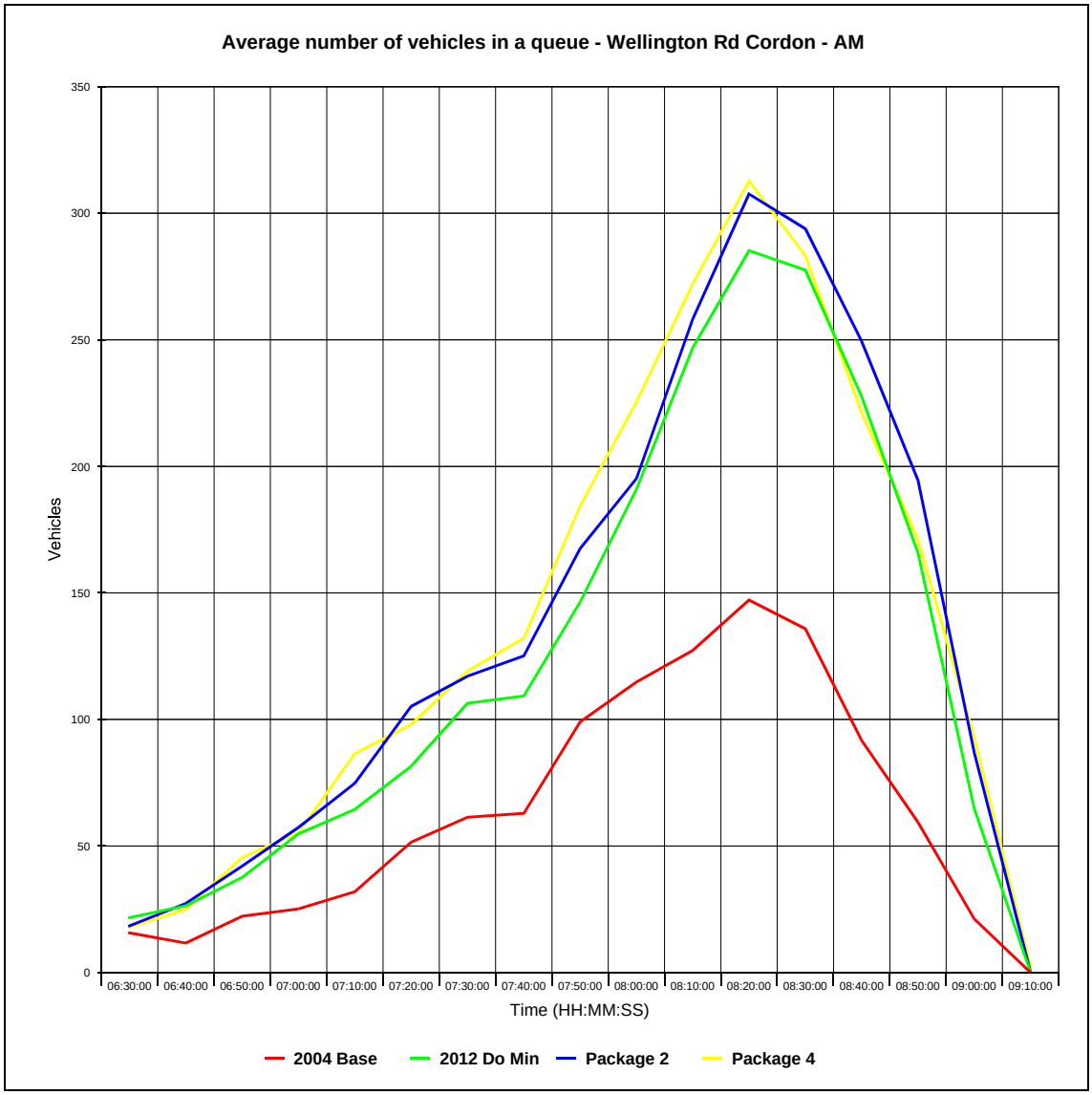

Figure 6.7 : Wellington Road Cordon Delay – AM Peak

Figure 6.7 shows that the delay between the 2012 Do-Minimum, Package 2 and Package 4 is very similar, with only slightly more delay in packages 2 and 4 due to the additional vehicles queuing at the traffic signals.

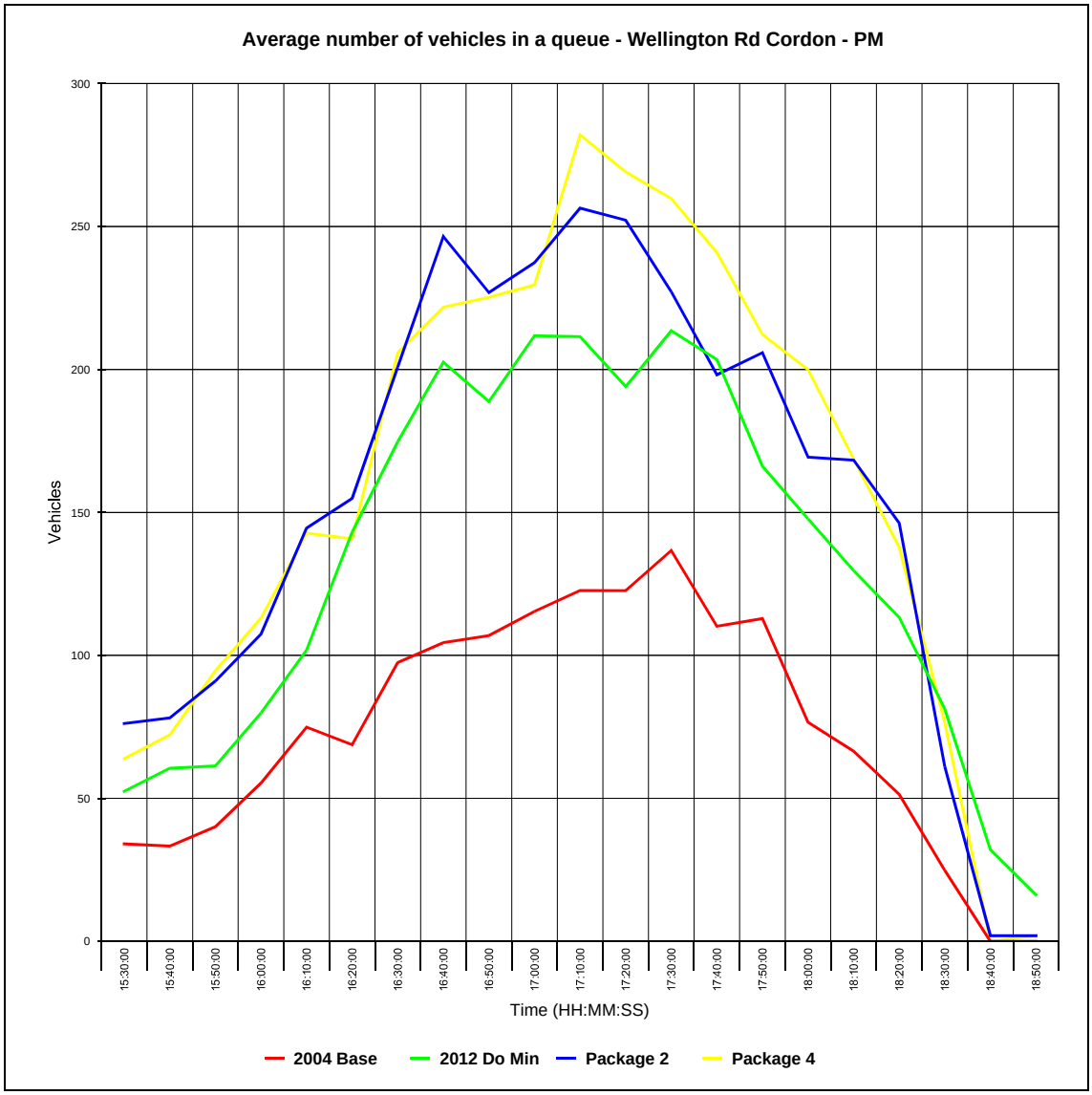

Figure 6.8 : Wellington Road Cordon Delay – PM Peak

Figure 6.8 shows that the results are very similar to the AM Peak, with slightly more delay caused by the queuing at the traffic signals. These graphs do not take account of vehicles unable to load onto the network and therefore do not take account of the problems observed in the Do-Minimum network where a significant number of vehicles were queued into the Hareness and Souterhead zones during the PM peak.

6.5 Findings from Package 4

The results and model observations demonstrate the proposals in Package 4 are beneficial to the road users in South Aberdeen, in particular pedestrians, cyclists and public transport. Movement of HGVs would also benefit as traffic signals are easier for them to negotiate than roundabouts. Significant HGV benefits would be achieved through the removal of the HGV ban on Bridge of Dee as described in Package 2.

In summary, following the Package 4 model testing, the measures which model results indicate are worthy of consideration in the medium term are:

- HGV ban removed from Bridge of Dee by creating a separate pedestrian bridge
- Hareness Road/Wellington Road roundabout replaced with traffic signals with a bus only link onto West Tullos Road further south from Abbotswell Crescent.
- Souterhead Roundabout replaced with a staggered signalised junction

The introduction of traffic signals has shown to manage and balance the queue lengths on each arm of the Souterhead and Hareness junctions while giving the benefits of controlled pedestrian movements. It is likely that sophisticated traffic signal installation (MOVA) could further improve the performance of the junction. The most significant queue length reductions are at Hareness Road and Souterhead Road in the PM peak which provides a benefit for the industrial areas.

7 CONSIDERATION OF PARK AND RIDE AND BUS PRIORITY

7.1 Study Brief

Part of the Aberdeen Access from South study brief required a review of Traffic and Transportation impacts of the Park and Ride options. To that end, this chapter details the methodology, assumptions used to undertake the traffic review as well as providing reference to relevant sections of previous studies.

Preferred Park and Ride sites will be evaluated using the S-Paramics model to assess the traffic operation and ensure good access/egress opportunities are available. The Park and Ride will be considered assuming a similar service and frequency as provided by the Bridge of Don Park and Ride site with measures introduced to ensure reliability of journey times.

While this study aims to minimise the need to go beyond existing highway boundaries, it is recognised that in order to facilitate travel demand to Aberdeen from the South in the medium and long term upgrades to existing infrastructure will be required. To that end, and within the context of conceptual design, SIAS has deemed to keep any proposed infrastructure away from property but has in some instances used open land and wide verges to facilitate enhancements to the road network. No investigation of land ownership or utility locations has been undertaken within this study though it is recommended that this be undertaken in any detailed evaluation.

7.2 Background Documents

A number of studies and reports have been produced and have been used to assist with the review of options, the documents used include:

- *A956 (South) Corridor Park and Ride Site Identification and Assessment*, October 2000 – Halcrow Fox
- *A956 (South) Corridor Park and Ride Site Identification and Assessment* (*Supplementary Sites*), February 2002 – Halcrow Group Limited
- *Aberdeen South Access Study Final Report* (*Draft*), August 2006 – JMP Consulting
- *Future Development of Park and Ride in Aberdeen City and Aberdeenshire Final Report*, Faber Maunsell – December 2006

7.3 History of Park and Ride Appraisal

7.3.1 Halcrow Fox 2000 Study

The initial study undertaken by Halcrow Fox focused very much on the A956 corridor and opportunities for a Park and Ride site from Charleston Interchange through to Nigg. In all, nine sites were identified and assessed through a consideration of:

- Planning context and land value
- Environmental Effects, including effects upon:
    - Humans
    - Buildings
    - Man-made Features
    - Flora and Fauna
    - Geology
    - Topography
        - Water

    - Air/Climate
- Landscape Effects including:
    - Existing landscape character and pattern
    - Fit to topography
    - Visibility
    - Visual mitigation
- Traffic and Transportation
- Engineering

Figure 7.1 shows the locations of the initial nine sites considered. The conclusion of this study recommended that the Charleston site be considered as the preferred site:

(Source: A956 (South) *Corridor Park and Ride Site Identification and Assessment*, October 2000 – Halcrow Fox, Page 56, paragraph 6.1.8)

> *…The balance of the appraisal is that the site at Charleston is that preferred, since:*
>
> - *The site is visible from the A956, but may have landscaping developed both the provide a suitable level of screening to the site and to protect the amenity of the adjacent properties;*
> - *Provision of a new traffic signal controlled junction would provide priority for buses entering and leaving the site, which, integrated with new bus lanes between the site and Souterhead Roundabout, would protect the reliability of the Park and Ride Service;*
> - *Provision of these signals would allow the opportunity to rationalise the junctions on the A956, and provide a new link to Cove;*
> - *The site is located beyond the point generally considered congested by morning peak hour queues from Souterhead Roundabout;…*

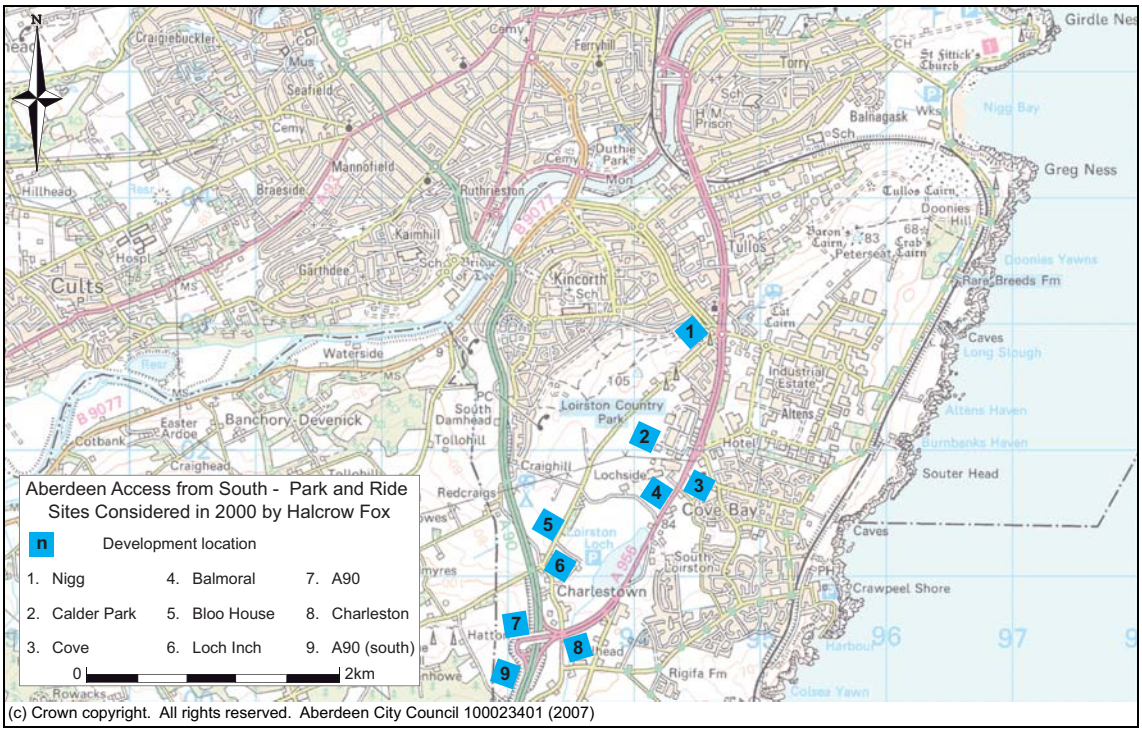

Figure 7.1 :Park and Ride Site Locations considered in 2000 by Halcrow Fox

7.3.2 Halcrow Group Limited 2002 Study

Further to the development proposals for the Schoolhill interchange, in February 2002 Halcrow Group Limited reported on supplementary sites around this location. Four supplementary sites were identified and are illustrated in Figure 7.2.

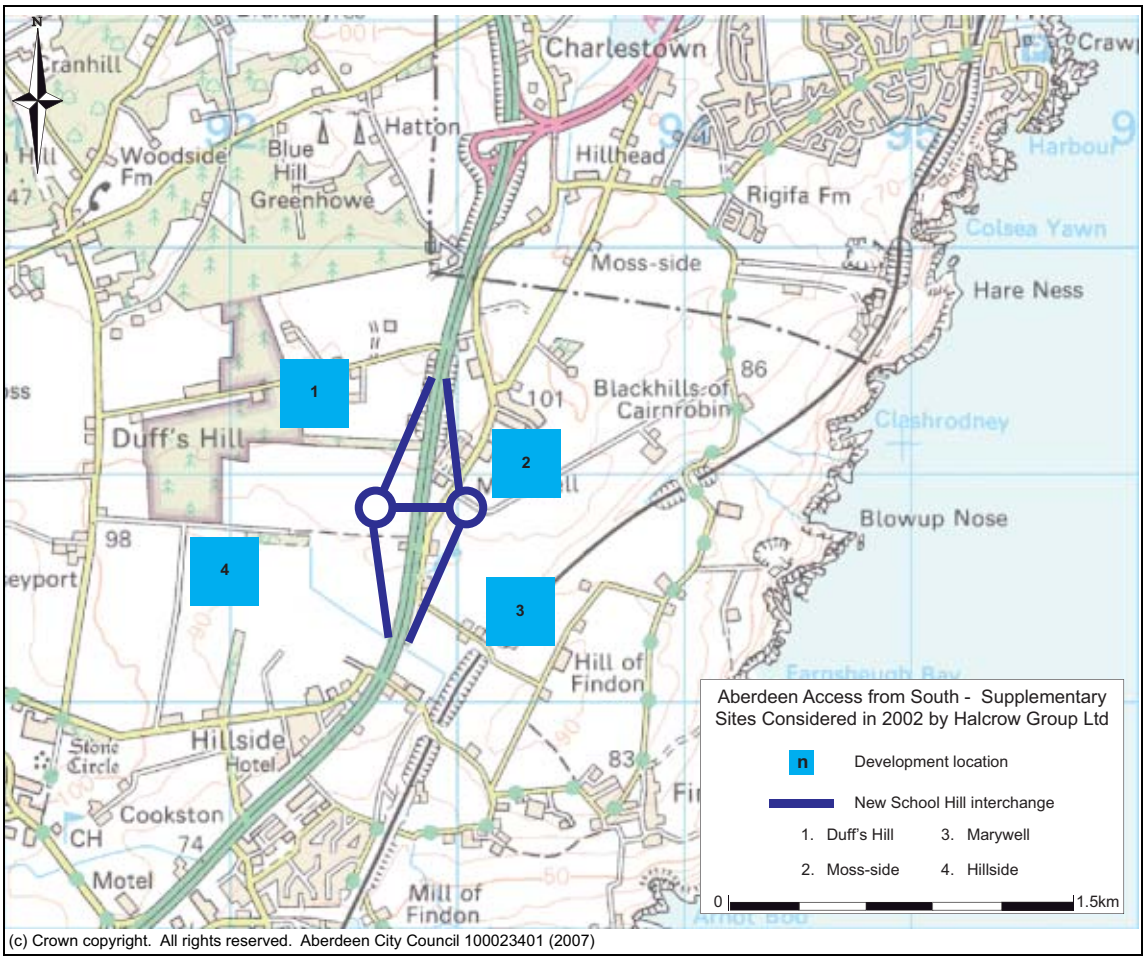

Figure 7.2 : Supplementary Sites Considered in 2002 by Halcrow Group Limited

The four supplementary sites around Schoolhill were considered against the same criteria as the original nine sites between Charleston and Nigg. The conclusions of the Halcrow Group report found that:

(Source: *A956 (South) Corridor Park and Ride Site Identification and Assessment* (*Supplementary Sites*), February 2002 – Halcrow Group Limited, Page 35, Para 4.2.1)

> *It is clear from the Appraisal Summary table that each of the four sites has some advantages, however, those associated with Sites 1 (Duff's Hill) and 4 (Marywell) are considered most favourable. In the case of Duff's Hill, considerable resistance and objection may still be encountered from environmental interests, while the value and existing plans for the Marywell site may preclude its use. Both sites offer advantages over Charleston due to their remoteness from existing properties, topography, access and drainage.*

7.3.3 JMP 2006 Study

The 2006 JMP study considered, in terms of traffic operation, five sites namely:

- Loch Inch
- Charleston
- Schoolhill
- Calder Park
- Balmoral

The site documented as Schoolhill in the JMP study appears to be that documented as Duff's Hill in the 2002 Halcrow Group report.

The conclusions of the JMP study found that:

(Source: *Aberdeen South Access Study Final Report* (*Draft*), August 2006 – JMP Consulting, Page 41, Para 3.89)

> *Under the circumstances where there is maximum congestion on the network due to minimal mitigation measures being introduced, then Schoolhill is the preferred site due to the following factors:*
>
> - *Easy access onto the site via the new grade separated junction over the A90;*
> - *Bus priority measures on Redmoss Road would ensure reliability of the Park and Ride bus service is preserved, and mitigate against the increased running time incurred with the increased distance from Souterhead Roundabout;*
> - *The site is located beyond the modelled end of the morning peak queue whether grade separation occurs at Souterhead or otherwise;*
> - *Many of the potential visual impacts will be lessened when considered in conjunction with the proposed Schoolhill residential development and upgrade of the Charleston Interchange;*
> - *Due to proximity to residential development, opportunities to access site by cycle and foot can be encouraged;*
> - *No major earthworks are required at this location and no major drainage issues prevail; and*
> - *The site has the potential to attract drivers from the A90…*

7.3.4 Faber Maunsell 2006 Study

The study undertaken by Faber Maunsell in 2006 was a more general consideration of Park and Ride opportunities on all principal radial roads into Aberdeen.

Key points extracted and worthy of noting for this Access from South study are:

(Source: *Future Development of Park and Ride in Aberdeen City and Aberdeenshire Final Report*, Faber Maunsell – December 2006)

Page 10 '*The Bridge of Don Park and Ride site currently has capacity for 600 cars and is well used throughout the week with utilisation of typically 85% and over (510 vehicles).*'

Page 65' …*A site could be considered north of the A956 to allow the AWPR to feed into this site provided that this can be accommodated prior to any traffic congestion…*'

8 SIAS PARK AND RIDE ASSESSMENT

8.1 Sites

It was agreed with Aberdeen City Council Officers that SIAS should reassess, in terms of traffic operation, the merits of four sites. Figure 8.1 illustrates the four sites to be considered.

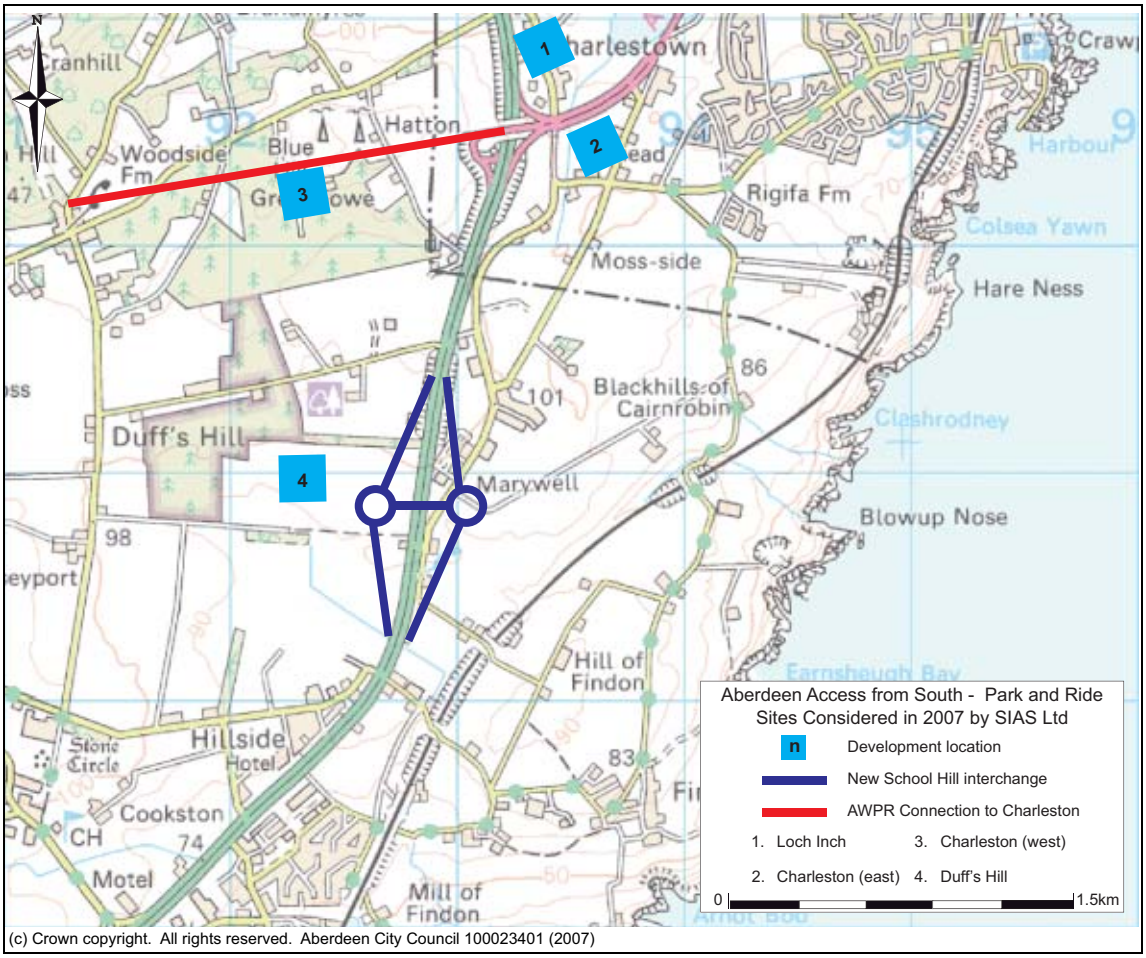

Figure 8.1 : SIAS Site Consideration 2007

The Halcrow Fox study in 2000 produced well documented reasoning for discounting sites north of the Souterhead Roundabout, while documenting the reasoning behind the preferred location of Charleston. The 2002 study identified two sites, Duff's Hill and Marywell in preference over Charleston but also anticipated existing plans may preclude the use of Marywell.

Discussions between Aberdeen City Council officers and SIAS identified a further potential site west of Charleston. This site was subsequently discounted from further consideration following the advice of the AWPR managing agents who commented that no junction connecting to the AWPR would be considered at this location. For transparency and completeness the West of Charleston site is included in Figure 8.1.

In summary SIAS will assess, in traffic operational terms on the Access from South S-Paramics model networks the potential Park and Ride sites at:

- Loch Inch
- Charleston (East)
- Schoolhill (Duff's Hill)

8.2 Medium Term Park and Ride Methodology

8.2.1 Park and Ride Trip Attraction

For the purpose of traffic modelling it is necessary to forecast the likely trip attraction for the Park and Ride site in order to identify the likely trips intercepted by a Park and Ride.

General Park and Ride assumptions:

- Operates in a similar manner to Bridge of Don
- Has a car park capacity of 1000
- Served by bendibus vehicles with a capacity of 140 passengers
- Single Park and Ride route, from site to bus station with no intermediate stops, route remains on Wellington Road
- 10 minute service frequency
- This allows a total pass/hr figure of 840 passengers
- Assume peak 0800 – 0900 operating at about 65% capacity gives 546 pass/hr
- 1.2 persons per vehicle gives 455 cars in peak
- 0700 – 0800 attracts 40% of that in peak, therefore an additional 182 cars
- 0630 – 0700 no usage of Park and Ride
- This will give a total intercept of 637 cars in the AM 2.5hr period, for simplicity assume intercept of 650 cars.

Some of the key reasons for drivers using a Park and Ride include:

- Serves a urban city centre area
- Costs of parking (at destination compared to that at Park and Ride site)
- Lack of parking at destination
- High frequency of service
- Security
- Facilities at Park and Ride site
- Congestion on route served with bus priority measures
- Park and Ride site located beyond the normal congestion point

The difficulties in attracting drivers with a destination outwith the immediate city centre can be a result of:

- free parking at place of employment
- final destination beyond reasonable walking distance of the Park and Ride drop off point resulting in the need to transfer to another bus service thus increasing interchange time and cost

SIAS does not believe that having the Park and Ride site on the A956 would encourage more usage by drivers on the AWPR. Having consideration of the future aspirations for Park and Ride sites around the primary radial routes into Aberdeen as documented in the 2006 Faber Maunsell report SIAS anticipates that potential Park and Ride users would be intercepted before getting to a southern site and as such the ability to intercept vehicles from the AWPR is not considered a key factor in locating the southern site.

The other disadvantage of a site on the A956 has is the additional delays transmitted to the AWPR/Charleston interchange through pulling Park and Ride traffic through the signalised junctions which may in-itself cause congestion at this location.

Assuming the Park and Ride serves in the main the city centre of Aberdeen, and on review of the travel demand matrices within the S-Paramics model the intercept of the 650 trips has been applied at the following rates for the medium term at 2012.

Intercepted origins of traffic by Park and Ride over AM 2.5 hr period:

- 77% from A90 South (500 cars)
- 23% from Portlethen (150 cars)

Intercepted destinations of traffic by Park and Ride over AM 2.5 hr period:

- 45% to South College St/North Esplanade West (290 cars)
- 8% to Holburn Street (50 cars)
- 30% to Great Southern Rd (200 cars)
- 17% to South Anderson Drive (110 Cars)

For simplicity, these figures are reversed during the PM period.

8.3 Bus Priority Options

A number of S-Paramics tests have been undertaken to assess the complimentary bus priority on Wellington Road (A956) to accompany the Park and Ride service. In order to provide a comparative baseline and to reduce the number of model test scenarios, Schoolhill has been used as the main test bed to assess the performance of sections of bus priority. Table 8.1 provides details of the tests undertaken with bus priority sections illustrated in Figure 8.2.

Table 8.1 : Park and Ride S-Paramics Testing Schedule

Ref	Bus Priority Measure	Northbound Bus Lane Sections	Southbound Bus Lane Sections	Sites Considered	Rationale
1	No bus priority	N/A	N/A	Schoolhill	To provide baseline jouney times for Cars and Buses
2	Using existing lane where possible btwn Charleston and QEII Bridge	A to D	D to B	Schoolhill	Assess impact of section of bus lane
3	Using existing lane where possible btwn Charleston and Souterhead	A to B	D to B	Schoolhill	Assess impact of section of bus lane
4	Using existing lane where possible btwn Souterhead and Hareness Rndbt	B to C	D to B	Schoolhill	Assess impact of section of bus lane
5	Using existing lane where possible btwn Hareness Rndbt and QEII Bridge	C to D	D to B	Schoolhill	Assess impact of section of bus lane
6	Additional Bus Lane btwn Charleston and Hareness Rndbt	A to B	D to B	Schoolhill, Loch Inch, Charleston	Assess impact of section of bus lane

The most significant bus priority measure has been identified as providing an additional lane from Charleston to Hareness Roundabout. All three sites (Schoolhill, Loch Inch and Charleston) were assessed and compared using this scenario to gauge the success in traffic operational terms of each Park and Ride site.

In the case of Charleston, the use of the Marywell link road was quickly discounted as an access route to the Park and Ride site as any upgrade of this route may encourage ‘rat running’ from the A90 to the A956 avoiding the traffic signals at the AWPR/Charleston Interchange.

In the case of Schoolhill, the Marywell link road could provide an alternative route for the Park and Ride to access the A956 and avoid any delays due to traffic signals on the AWPR/Charleston Interchange. This would require an investigation of the link to ensure its appropriateness for buses and would also require a

bus only section to ensure rat running is discouraged. All S-Paramics traffic model testing has been undertaken assuming the Park and Ride service remains on the A90 and uses the Charleston Interchange.

This study does not consider land ownership or utility locations which will require a thorough investigation prior to any detailed design stage.

Where an additional lane is proposed to facilitate a bus lane, bus priority pre-signals will be used to ensure a smooth transition for Public Transport through signal controlled junctions.

Figure 8.2 illustrates the start and end points of the sections of bus priority considered for the A956.

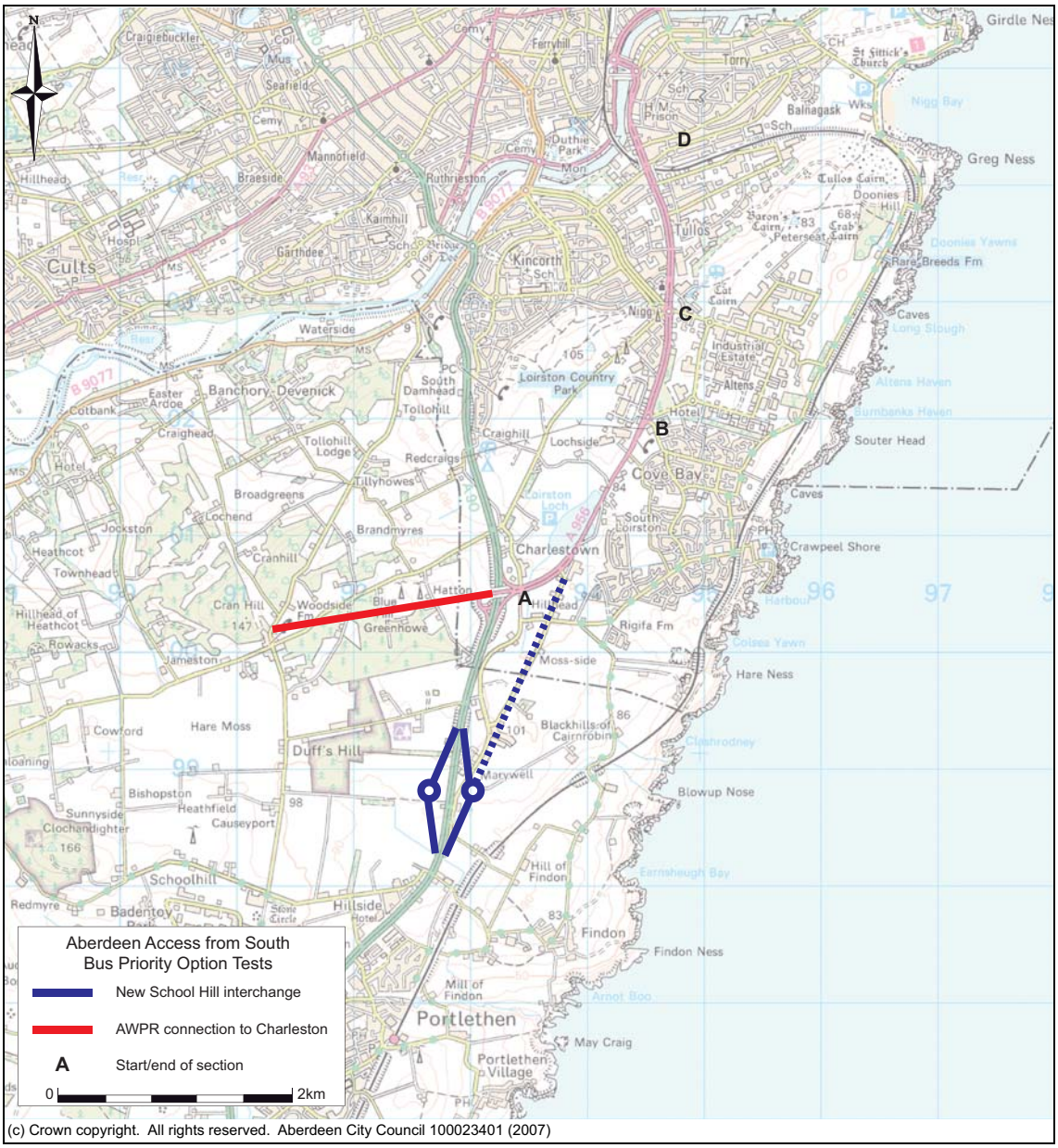

Figure 8.2 :Bus Priority Option Tests

8.4 Network Performance

SIAS has considered the Loch Inch, Charleston and Schoolhill sites for carrying out the analysis. In the first instance, the journey times were compared from the A90 (South) to South College Street to see how

the introduction of each of the sites affected the operation of the network. Tables 8.2 and 8.3 show the summary information.

Table 8.2 : A90(S) to South College Street Journey Time – AM Peak Period

Movement	Site		
	Loch Inch	Charleston	Schoolhill
Average A90 (s) to S. College St	00:15:05	00:13:55	00:13:28
Average S. College St to A90 (s)	00:13:06	00:12:49	00:13:15

Table 8.2 shows that Schoolhill allows the shortest journeys times for Northbound traffic in the AM Peak. In the case of the Loch Inch site, it is possible that additional delays could occur at Charleston Interchange when additional traffic from Holburn St/Great Southern Rd and South Anderson Drive are destined for the Park and Ride site have to go through this junction. Additional traffic signal optimisation in the medium term may be required in order to accommodate increased right turning vehicles from the A90 (T) to the A956 Wellington Road with a Park and Ride situated at Loch Inch.

The site at Schoolhill has the advantage of removing the traffic prior to the Charleston Interchange, thus reducing potential delay through the junction.

Table 8.3 : A90(S) to South College Street Journey Time – PM Peak Period

Movement	Site		
	Loch Inch	Charleston	Schoolhill
Average A90 (s) to S. College St	00:13:28	00:13:26	00:13:26
Average S. College St to A90 (s)	00:13:27	00:13:46	00:13:24

The results in the PM Peak in Table 8.3 also show that the Schoolhill Site also produces slightly better results

Graphs have been produced for the six scenarios for Schoolhill Park and Ride, which compares the bus journey time from the Park and Ride site, against the car from the A90 at Schoolhill to Market Street.

Figure 8.3 shows the AM Peak for Northbound Journeys in Scenario 1 (No bus priority).

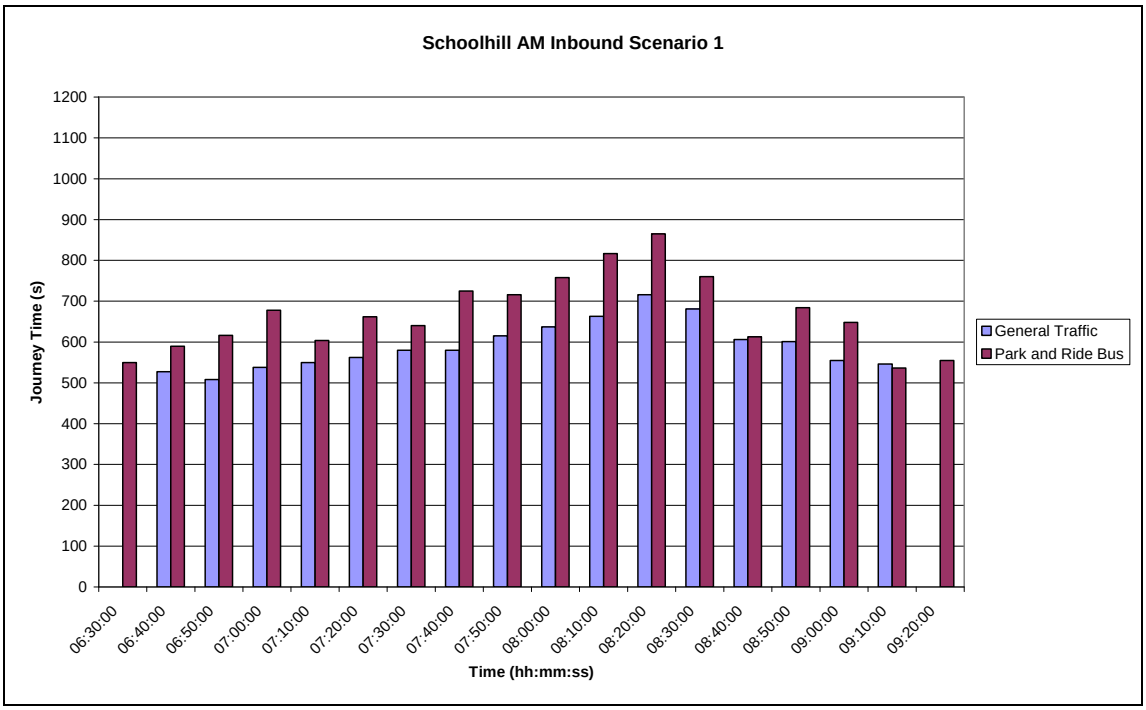

Figure 8.3 : Schoolhill Park and Ride AM Peak Scenario 1 (No bus priority)

Figure 8.3 shows that in Scenario 1 with no bus priority, the car is always quicker than the bus.

Figure 8.4 shows the AM Peak for Northbound journeys in Scenario 2 (Convert existing lane to bus lane between Charleston and the QEII Bridge).

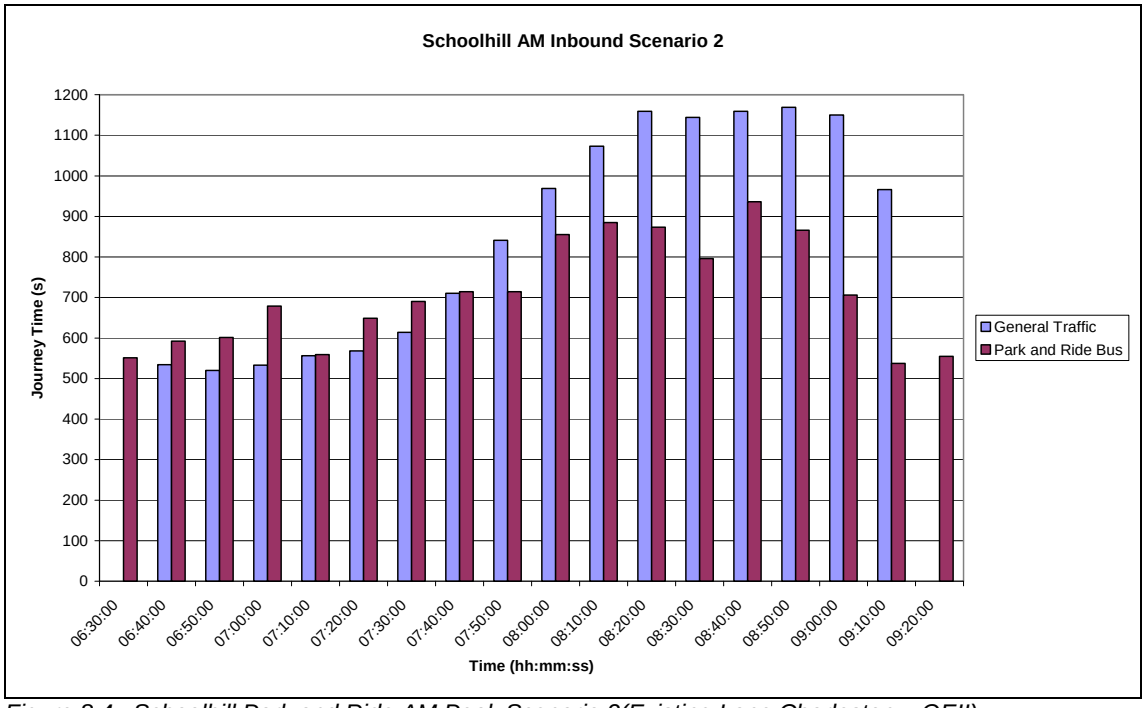

Figure 8.4 : Schoolhill Park and Ride AM Peak Scenario 2(Existing Lane Charleston – QEII)

Figure 8.4 shows that when an existing lane is converted to bus only between Charleston and the QEII Bridge, the bus is quicker than the car in the AM Peak Hour, with the car taking nearly 1200 seconds compared to the bus at around 900 seconds.

Overall, while the Park and Ride journeys are quicker than the private car in Scenario 2, they are generally slower than the Park and Ride journey time in Scenario 1 where no bus lanes are provided.

Model observations showed that during the peak, queueing on Wellington Road was almost back to the Charleston Interchange which could impact upon the AWPR and A90 operation in the future. Queue management would be required to ensure the operation of the Charleston Interchange is not affected.

Longer term aspirations for the Cove Housing and Altens Industrial areas will likely focus more traffic on the Wellington Road corridor and again the impact of bus lanes on the Charleston Interchange will require careful consideration.

Figure 8.5 shows the AM Peak for Northbound journeys in Scenario 3 (Convert existing lane to bus lane between Charleston and Souterhead).

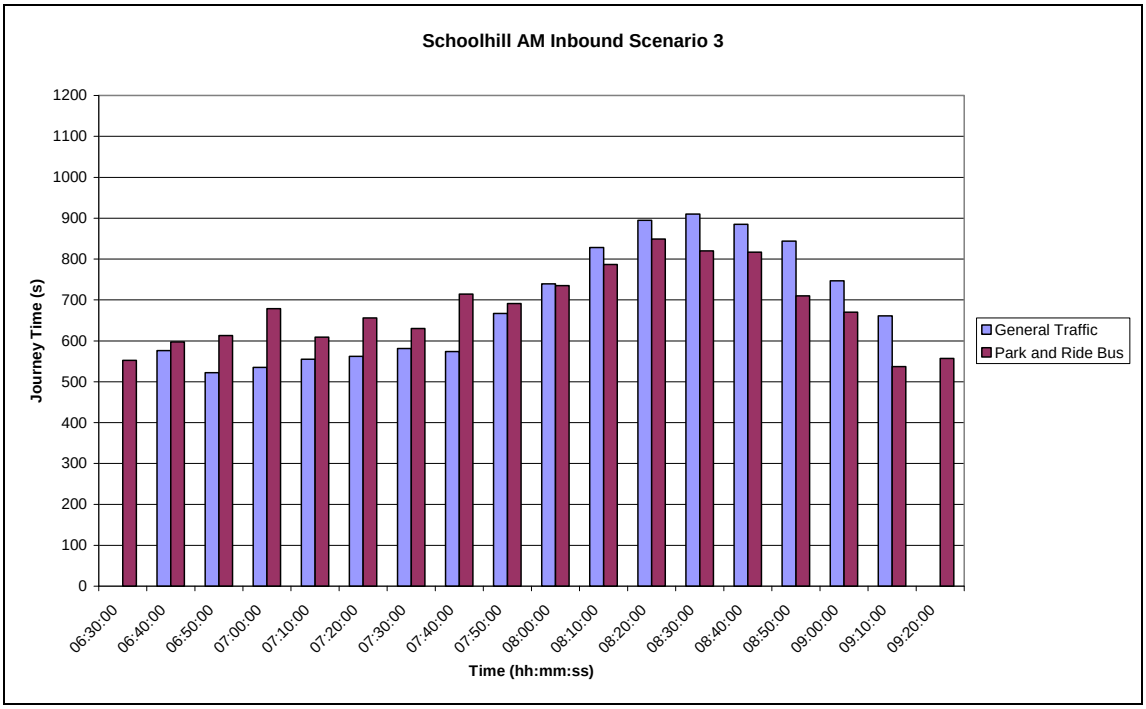

Figure 8.5 : Schoolhill Park and Ride AM Peak Scenario 3 (Existing Lane Charleston – Souterhead)

Figure 8.5 shows that when an existing lane is converted to bus only between Charleston and Souterhead, the bus is again quicker than the car in the AM Peak Hour, with the car taking nearly 900 seconds compared to the bus at around 825 seconds, both considerably less than in Scenario 2.

Queue management would again be required on Wellington Road northbound during the AM peak to ensure that queueing does not affect the operation of the AWPR and the A90 at Charleston Interchange.

Figure 8.6 shows the AM Peak for Northbound journeys in Scenario 4 (Convert existing lane to bus lane between Souterhead and Hareness).

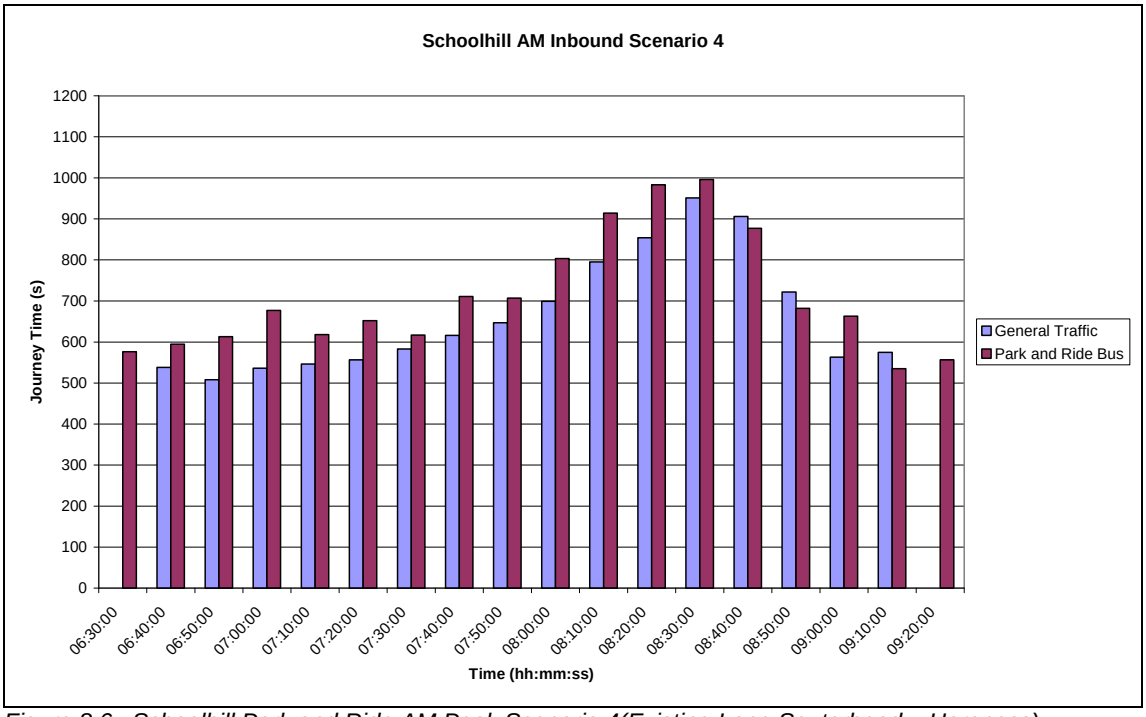

Figure 8.6 : Schoolhill Park and Ride AM Peak Scenario 4(Existing Lane Souterhead – Hareness)

Figure 8.6 shows that when an existing lane is converted to bus only between Souterhead and Hareness, the bus is slightly slower than the car in the AM Peak Hour.

Model observation showed that the queue on Wellington Road northbound from Hareness Road extended back to the Souterhead traffic signals and caused delays between Charleston and Souterhead. This has a direct impact on the journey time for Park and Ride buses. Queue management would be required on Wellington Road between Souterhead and Hareness to ensure the operation of the Souterhead signals is not impeded by queues tailing back from Hareness as a result of the bus priority measures.

Longer term aspirations for the Cove Housing and Altens Industrial areas will likely focus more traffic on the Wellington Road corridor and again the impact of bus lanes on the corridor will require careful consideration.

Figure 8.7 shows the AM Peak for Northbound journeys in Scenario 5 (Convert existing lane to bus lane between Hareness and the QEII Bridge).

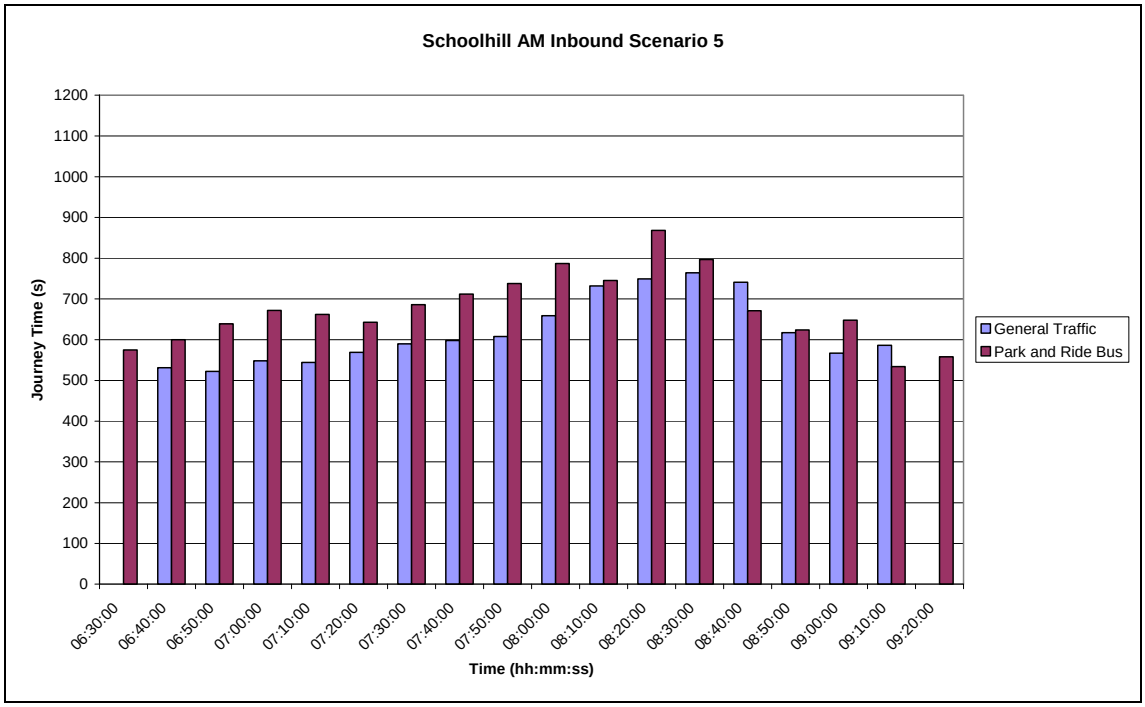

Figure 8.7 : Schoolhill Park and Ride AM Peak Scenario 5(Existing Lane Hareness – QEII Bridge)

Figure 8.7 shows that when an existing lane is converted to bus only between Hareness and the QEII Bridge, the bus and car journey times are mixed when it comes to the quickest.

Due to the proximity of business premises and the spacing of junctions, there is very little opportunity for increased bus priority on Wellington Road between Hareness Road and QEII Bridge. Only short sections have been included within the model testing and these show very little benefit.

Figure 8.8 shows the AM Peak for Northbound journeys in Scenario 6 (New bus lane between Charleston and Hareness Road).

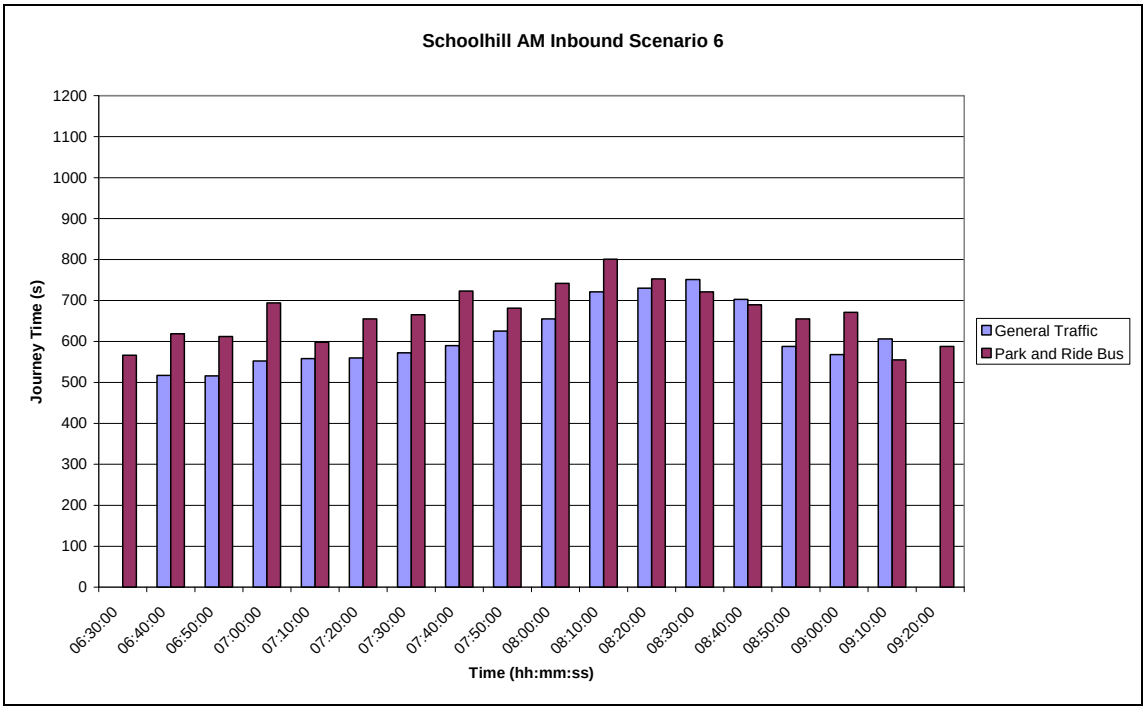

Figure 8.8 : Schoolhill Park and Ride AM Peak Scenario 6(New Bus Lane Charleston – Hareness Road)

Figure 8.8 shows that when a new lane is constructed for buses only between Charleston and the Hareness Road, the bus and car journey times vary between which is the faster, both are quicker than the alternatives modelled in previous scenarios. The journeys times are much shorter when compared against Scenario 2 (same bus lane but in existing lane), when cars were around 1200 seconds.

Providing a new lane for buses northbound on Wellington Road between Charleston and Hareness Road allows both the Park and Ride service and the private car to achieve reliable and quick journey times. The addition of the extra lane presents greater opportunities to provide demand management to ensure the Park and Ride service is quicker than the private car. Queue management should still be considered to ensure upstream junctions are not impeded.

Figure 8.9 shows the PM Peak for Southbound journeys in Scenario 1.

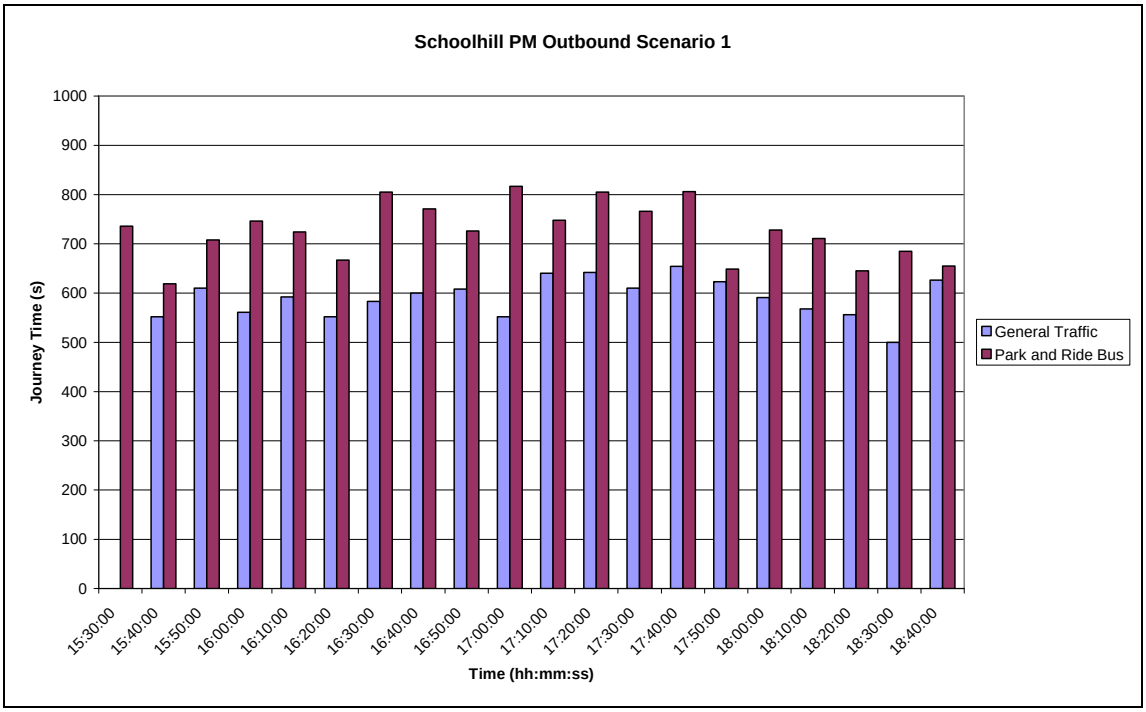

Figure 8.9 : Schoolhill Park and Ride PM Peak Scenario 1(No Bus Priority)

Figure 8.9 shows that when there is no bus priority the car is always quicker than the bus between South College Street and Schoolhill.

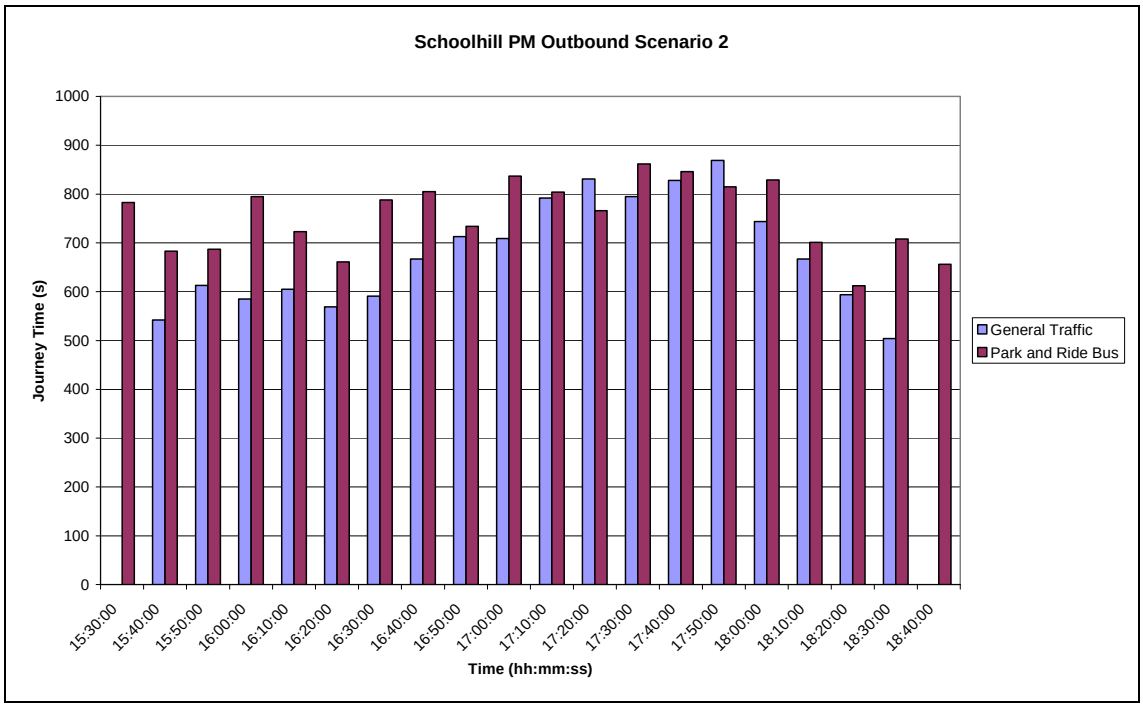

Figure 8.10 : Schoolhill Park and Ride PM Peak Scenario 2 (Existing Lane Southbound as per Fig 8.2)

Figure 8.10 shows there is very little difference between the car and the bus journey times in the PM Peak.

Figure 8.11 shows the results when an existing lane is converted between Charleston and Souterhead.

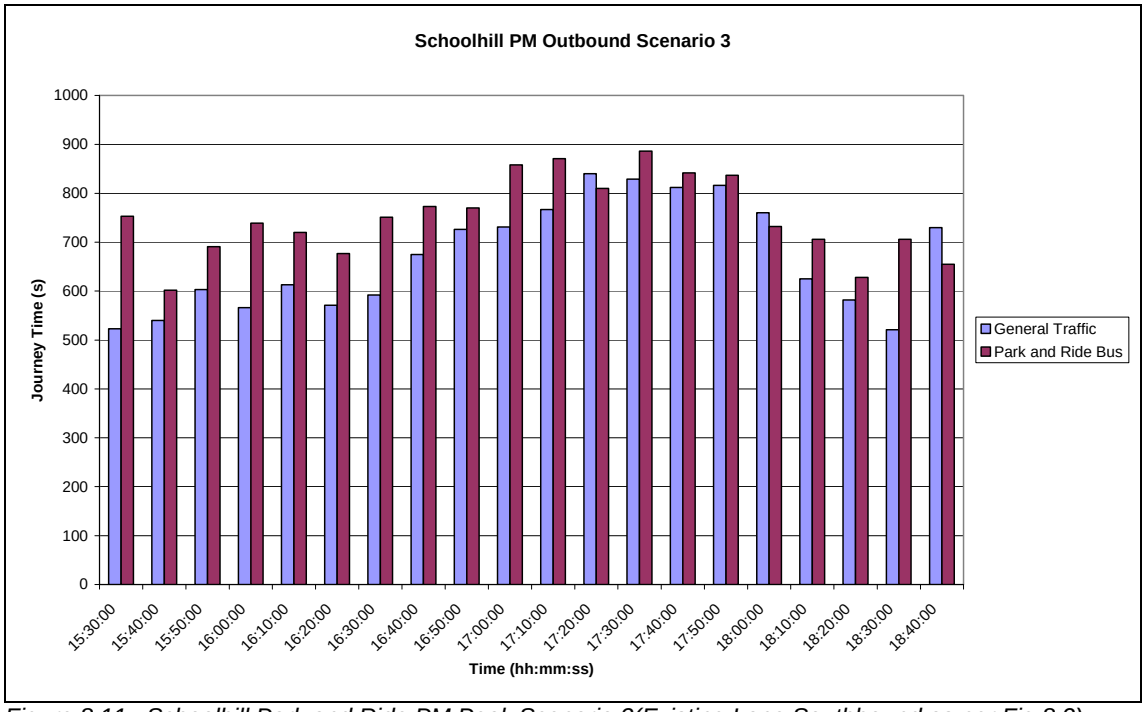

Figure 8.11 : Schoolhill Park and Ride PM Peak Scenario 3(Existing Lane Southbound as per Fig 8.2)

Figure 8.11 shows very little difference between the car and the bus journey times in the PM Peak. Figure 8.12 shows the results for Scenario 4 during the PM peak.

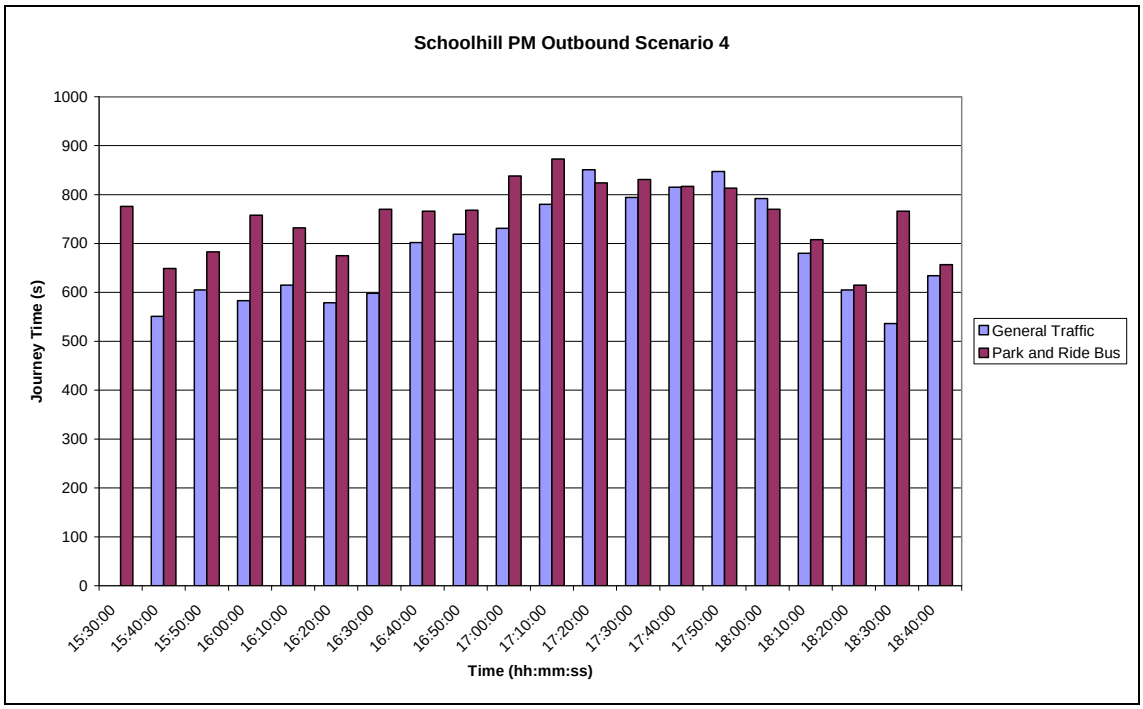

Figure 8.12 : Schoolhill Park and Ride PM Peak Scenario 4 (Existing Lane Southbound as per Fig 8.2)

Figure 8.12 again shows very little difference between the car and the bus journey times during the PM Peak.

Figure 8.13 shows the results for Scenario 5 during the PM peak.

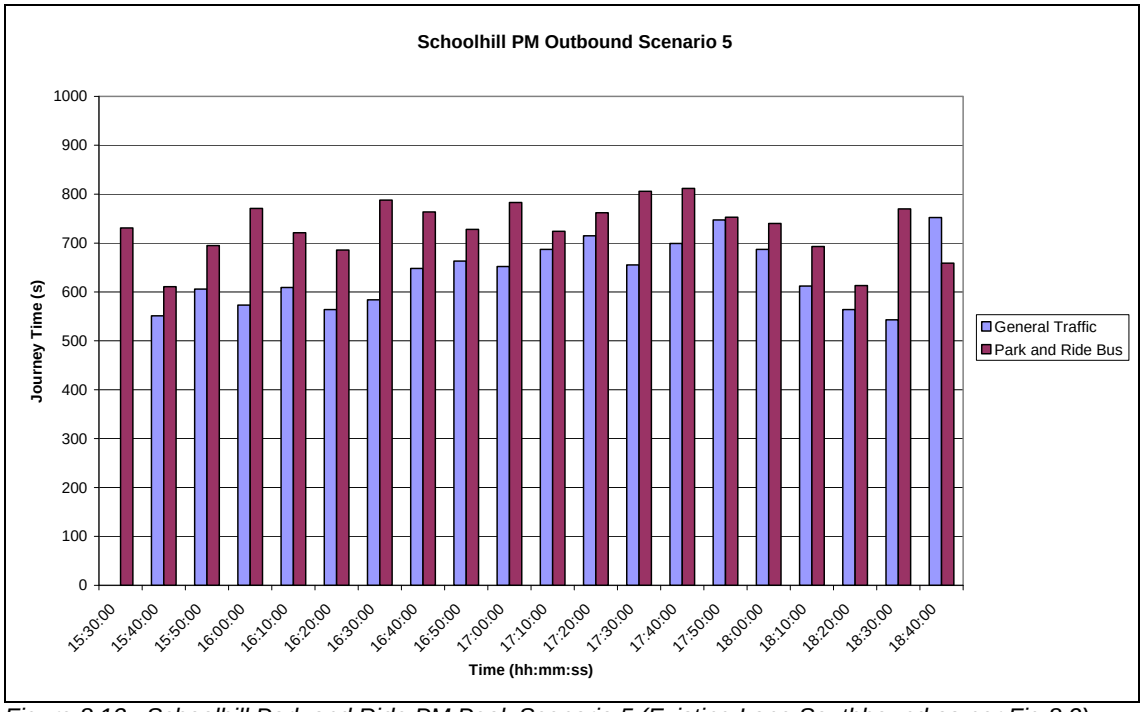

Figure 8.13 : Schoolhill Park and Ride PM Peak Scenario 5 (Existing Lane Southbound as per Fig 8.2)

Figure 8.13 shows the bus takes longer than the car in the PM Peak. Figure 8.14 shows the results when a new lane is added where possible.

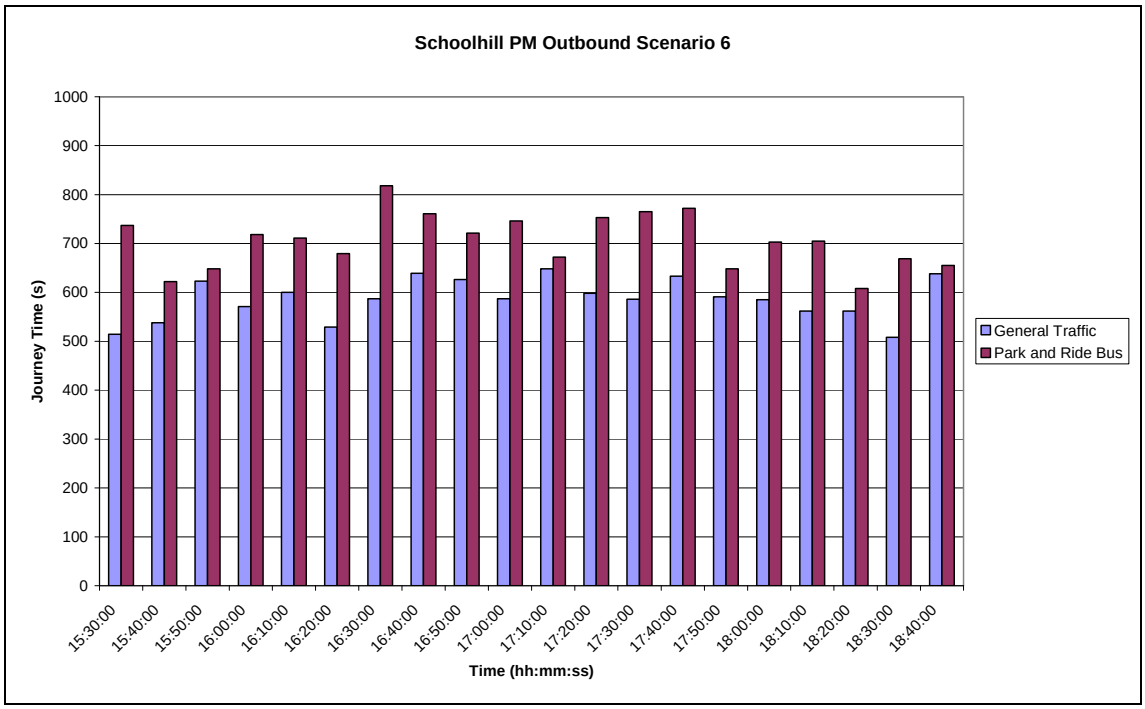

Figure 8.14 : Schoolhill Park and Ride PM Peak Scenario 6(New Lane Southbound as per Fig 8.2)

Figure 8.14 shows that when a new lane is provided southbound, the bus takes longer than the car during the PM Peak.

8.5 Findings from Park and Ride Testing

Charleston Interchange is perceived by drivers as the start of the congested route and the Park and Ride site should be beyond this location. Not with standing this, the attraction of traffic to the Park and Ride site could draw additional traffic through the Charleston Interchange should the service be attractive to drivers currently using the A90 Stonehaven Road to access the city.

SIAS believes there is more likelihood of intercepting traffic already on Wellington Road and the A90 South rather than trying to position the Park and Ride to intercept some from the A90 South, some from the AWPR and some from Wellington Road. It is anticipated that traffic for the city centre from locations to the west of Aberdeen will be intercepted at other Park and Ride sites to the West of Aberdeen. It is unlikely that a significant volume of drivers would drive southeast to a Park and Ride site in the South using the AWPR.

The preferred Park and Ride site based on traffic operational assessments using the S-Paramics model is Schoolhill.

While it is outwith the scope of this study to undertake a full re-appraisal of the Park and Ride sites, the findings do identify Schoolhill as the preferred site in traffic operational terms and meets the key success factors such as:

- Serves a urban city centre area
- Costs of Parking (at destination compared to that at Park and Ride site)
- Lack of Parking at destination
- High frequency of service
- Security
- Facilities at Park and Ride site
- Congestion on route served with bus priority measures
- Park and Ride site located beyond the normal congestion point

Much of the previous assessment work undertaken by Halcrow Group in 2002 will still be relevant for this location and more recent development proposals for Schoolhill will lend further support to a public transport interchange at this location. It is recommended that any subsequent detailed investigation of this site refreshes the original Halcrow Group findings for:

- Planning context and land value
- Environmental Effects, including effects upon:
  - Humans
  - Buildings
  - Man-made Features
  - Flora and Fauna
  - Geology
  - Topography
  - Water
  - Air/Climate
- Landscape Effects including:
  - Existing landscape character and pattern

    - Fit to topography
    - Visibility
    - Visual mitigation
- Engineering
- Operational capacity, detailed routeing of Park and Ride and number of buses required to meet the required frequency

In terms of bus priority, the Park and Ride testing regime has shown that, if possible, the provision of an extra lane for buses will allow the most reliable operation of the Park and Ride service. While not tested within the S-Paramics model, it can be assumed that the installation of demand management techniques will ensure a competitive journey time for Park and Ride services through inducing delay to private car trips.

The sections of Wellington Road between Charleston and Souterhead Road and Souterhead Road and Hareness Road offer the most likely opportunities for this bus priority and associated demand and queue management measures.

9 HIGH OCCUPANCY VEHICLE LANES (HOVS)

9.1 Introduction

The following sections detail the methodology and findings for assessing the provision of High Occupancy Vehicle (HOV) lanes on the A90 between Charleston and Bridge of Dee.

9.2 Methodology

The methodology to assess the potential use of High Occupancy Vehicles has been undertaken as a sensitivity test based on the provision of complimentary transportation options around Aberdeen. If HOVs are to be encouraged, measures would be required to support and cause a change in existing driver behaviour.

Existing national statistics suggest an average car occupancy of 1.2 persons which equates to approximately 80% of vehicles having a single occupancy.

The measures considered within this study are for an HOV lane on the A90 in a northbound direction between Charleston and finishing 100m south of Bridge of Dee to allow for weaving traffic before the bridge. This measure would compliment the provision of the Park and Ride via Wellington Road by providing incentives and alternatives for drivers with destinations in other parts of the city which are not directly served by Park and Ride.

The public perception of an HOV lane will only be positive where the proportion of HOVs is less than that of Single Occupancy Vehicles (SOV), it is not desirable to achieve the position of a 50/50 split between numbers of SOV and HOV vehicles on the A90 as the perceived delay incurred would be similar regardless of the HOV lane.

To that end, SIAS has undertaken sensitivity testing and assumed that the HOV lane would encourage, through travel time savings a shift of an additional 5%, 10%, 15% and 20% from SOV to HOV in addition to the existing 20% of HOVs on the road network. Testing has been undertaken in the AM peak only.

Assuming that SOVs become 2 occupants to make them HOVs, the maximum tested 20% would remove approximately 120 cars from the A90 corridor over the AM period.

For simplicity in evaluating HOV through the use of the S-Paramics model, it has been assumed that the HOV lane will change the travel choices of any origin south of Schoolhill and any destination west of South College Street.

Also for simplicity of traffic model testing, it has been assumed that this shift in HOV is made up through drivers taking advantage of parking at the Park and Ride site which would then also function as a Park and Choose site and changing over to car share from the Park Ride site to their final destination. This provides a worst case estimate for the impact on the capacity of the Park and Ride car park and its associated access junctions.

It is likely that a proportion of SOVs encouraged to change to HOV would make this change at their point of origin. In any future detailed study into the application of HOV lanes a literature review should be undertaken.

It is logical to assume that any SOV unable to make their change to HOV at point of origin would desire a fast and efficient interchange closer to their destination. The Park and Ride car park has been assumed to provide that interchange. Schoolhill has been used as the baseline Park and Ride site to assess the varying proportions of HOV vehicles on the A90 corridor.

The perception of using the Loch Inch and Charleston Park and Ride locations, to an HOV driver would be poor due to the number of signalised junctions to negotiate inbound and outbound. Schoolhill would provide a more efficient change over point.

It should be borne in mind that a Park and Ride facility inside the A90 feeding directly from the A956 will pull more vehicles through the AWPR/Charleston interchange as they divert from the A90 whereas vehicles entering a site south of the interchange would give relief to the network at an earlier point.

It would not be possible to provide an HOV lane on Wellington Road if this is deemed as the most appropriate bus priority route.

The problem of an HOV lane is whether it gets some priority onto the Bridge of Dee or King George VI through some form of priority signal. It is likely that this would require improvements to the Bridge of Dee which will not form part of the medium term options.

Figure 9.1 shows the proposed HOV lane provision, the HOV lane would be adopted from the existing lane provision.

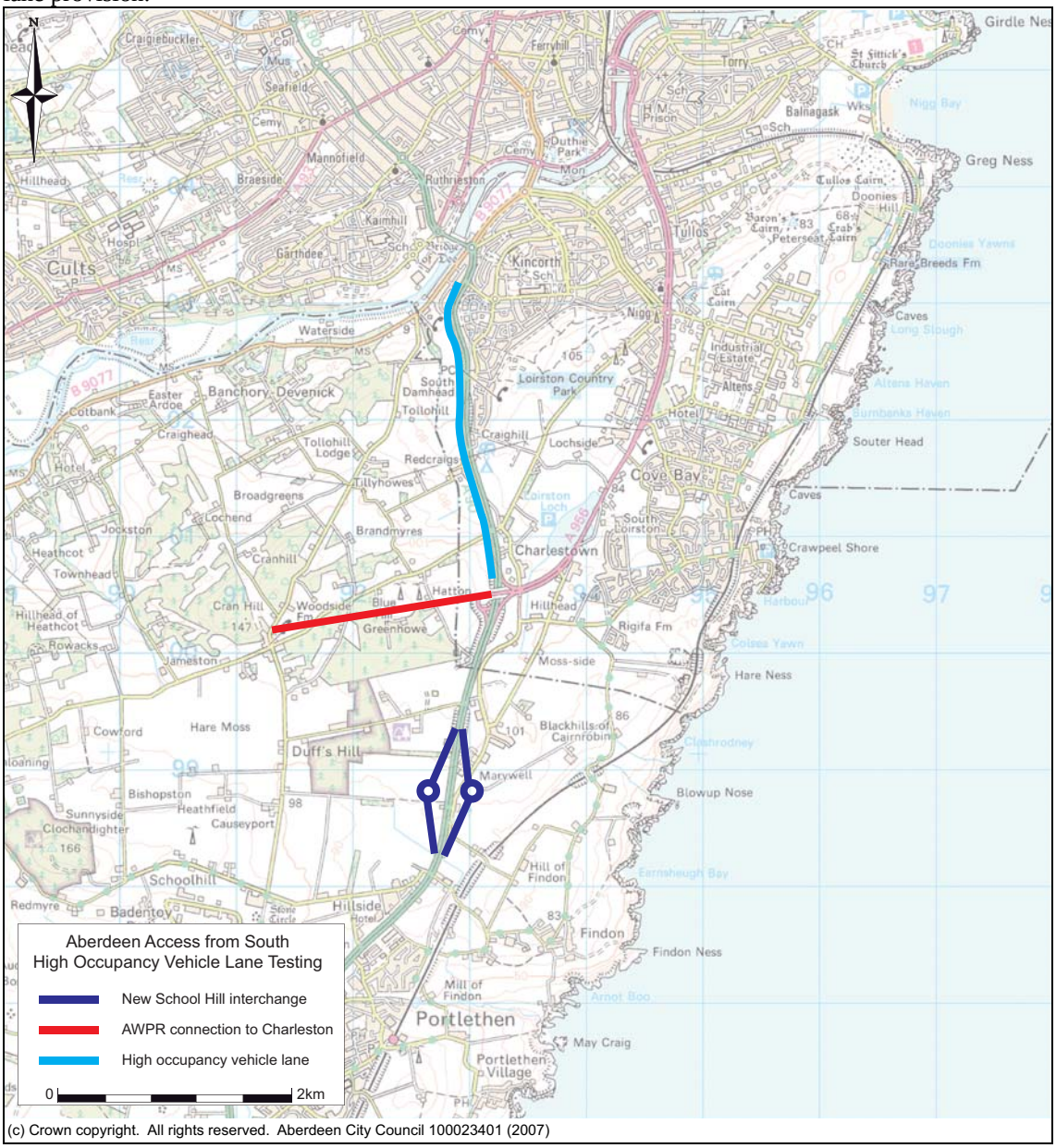

Figure 9.1 :HOV Lane Testing

9.3 Network Performance

Table 9.1 shows summary statistics for car travel times between the A90 (South) and the A90 (South Anderson Drive).

Table 9.1 : HOV Summary Mean Travel Time Statistics (A90(S) to A90(SAD))

	General Traffic	Existing HOV	P&R HOV
Base 04	09:18	09:18	-
2012 with Schoolhill PnR	08:55	08:55	-
HOV1 (75% / 25%)	09:11	08:45	10:34
HOV2 (70% / 30%)	09:10	08:47	10:26
HOV3 (65% / 35%)	09:12	08:49	10:23
HOV4 (60% - 40%)	09:10	08:47	10:30

Table 9.1 shows that for existing HOVs their travel times will be generally quicker than those of the remaining general traffic. Where the HOVs are deemed to require an interchange at the Park and Ride site at Schoolhill they suffer an interchange penalty of around 90 seconds.

Table 9.1 also shows that the traffic removed from the corridor as a result of the Park and Ride at Schoolhill also provide travel time benefits to the A90 corridor, the HOV lane and any subsequent removal of traffic afford further travel benefits to all users both HOV and general traffic.

10 HGV CRAWLER LANE

10.1 Introduction

The gradient of Wellington Road southbound is acknowledged to cause a problem for HGV traffic. This in turn causes difficulties for general traffic where both southbound lanes are occupied by HGVs particularly at traffic signal controlled junctions as the subsequent delays are imparted to all vehicles.

A recent study to identify potential areas where the benefits of the AWPR could be locked into the Aberdeen City road network has identified the possibility of providing an HGV crawler lane on Wellington Road southbound between Balnagask Road and Hareness Road. Figure 10.1 illustrates the proposal.

Figure 10.1 : HGV Crawler Lane

This is not a measure which can be tested within the existing S-Paramics model as gradient issues are not coded within the model description and no real benefits would be realised. A desktop study of the 2004 turning movements identified that of the total southbound HGV flow anywhere between 0% and 10% could seek to undertake a right turn at the junctions between Balnagask and Hareness. These indicate there is a need to allow accessibility to the industrial areas via the outside lane of Wellington Rd.

Some of the problems with assessing the performance and potential benefits of an HGV lane at this location are:

- Need for accurate data
  - Is it possible to assess the number of HGVs that are carrying a load which affects their progression?
  - Is it possible to assess the number of HGVs which are not carrying a significant load and are not unduly affected by the gradients and progression?
  - What range of speeds do HGVs currently travel at?

There is a need to assess these issues to understand better whether a very slow HGV at the front of the HGV crawler lane will actually cause more delays throughout the network as faster HGVs are unable to pass.

It is unrealistic to expect traffic signals to detect the approach of slow moving HGV traffic and allow extra time for them to proceed. SIAS believes this would be to the detriment of the wider network operation.

SIAS considers it likely that minimal improvements to general traffic would occur if HGVs were limited to the inside lane and that this would be to the detriment of the movement of freight and opportunities to introduce bus priority. Enforcement of an HGV lane would be extremely difficult.

11 SUMMARY AND CONCLUSIONS

11.1 Summary of Medium Term Testing

In order to undertake the medium term testing, a reference case model was developed:

- 2012 Do-Minimum = Short Term Do-Minimum model + Short Term improvements, also includes AWPR and new Charleston and Schoolhill interchanges

Six work packages were agreed by Aberdeen City Council and Nestrans and carried out in the 2012 Do-Minimum model. The work packages were:

- Package 1 – Signalise Bridge of Dee and King George VI Bridge
- Package 2 - Remove footway on BOD, Signalise Hareness Rd/ Wellington Rd junction
- Package 3 – One way gyratory using BOD and KGVI Bridge
- Package 4 – Replace Souterhead roundabout with signal controlled junction
- Package 5 – Park and Ride options
- Package 6 - HOV options

The traffic growth applied to the 2004 base model, using ASAM3b forecasts to form the 2012 future year model matrices (with Aberdeen Western Peripheral Route), can be summarised as follows for the AM and PM peak periods:

- AM Peak 2004 Base 31475 vehicles growth of 3.9% (1212 vehs) to 2012 giving 32687 vehicles in 2012 in the AM peak period
- PM peak 2004 base 40496 vehicles with growth of 4.6% (1873 vehs) to 2012 giving 42369 vehicles in 2012 in the PM peak period

11.2 Summary of Results

In Package 1 the terminal junctions of the Bridge of Dee and King George VI Bridge were signalised in different combinations but no scenario tested showed any benefits over the existing roundabouts. This was mostly due to land restraint caused by bridge widths, parapets and abutments.

Signalisation of the Hareness Rd/ Wellington Rd junction in Package 2 did reduce queueing in the PM peak and would allow control of traffic for any future public transport initiatives. Equally provision of an alternative pedestrian footbridge over River Dee which also enables removal of footways and width restriction on Bridge of Dee was shown to improve HGV travel times.

Package 3, the one way gyratory using Bridge of Dee and King George VI Bridge, resulted in significant congestion in both the AM and PM peaks. Some PM travel times were approximately four times greater than the 2012 Do-Minimum.

Package 4 adopted Package 2 as its reference and the redesign of Souterhead roundabout as a signal controlled junction in Package 4 provided benefits for all road users, in particular pedestrians, cyclists and public transport. Package 4 was the preferred option from the modelling assessment.

With regards the Park and Ride sites, SIAS considered previous studies and undertook an assessment, in traffic operational terms on the Access from South S-Paramics model networks, for potential Park and Ride sites at either:

- Loch Inch
- Charleston (East)
- Schoolhill (Duff's Hill)

The model testing adopted Package 4 as the reference and found Schoolhill to be the most suitable site which confirmed the findings of previous studies.

Package 6 included the preferred measures from Packages 2, 4 and 5 and tested high occupancy vehicle lanes. Results found that there could be benefits for HOVs over general traffic through providing these lanes and though disbenefits to other users could be low.

The final area of assessment was for HGV crawler lanes on Wellington Road Southbound. Investigation of these proposals found a need to assess the issues around Wellington Road in more detail to better understand whether a very slow HGV at the front of the HGV crawler lane will actually cause more delays throughout the network as faster HGVs are unable to pass. This should be done as part of a separate study taking cognisance of specific survey data for HGVs which is beyond the scope of this study.

11.3 Additional Medium Term Measures not Modelled

Some of the options raised at the stakeholder workshops, while not suitable for traffic modelling, were certainly worthy of consideration within the medium term time frame. These measures could assist in meeting the key objectives and provide solutions to access to Aberdeen from the South. Measures raised by stakeholders which were not suitable for modelling or incorporation into this appraisal are listed below, they have been scored against key planning objectives and details can be found in Appendix B:

- Strengthening of quality bus partnerships with bus operators
- Introduction of quality bus partnership to improve services to Stonehaven and Portlethen
- Parking review and restrictions where required in Aberdeen City Centre
- Shuttle buses travelling around Aberdeen South and linking to rail
- Integrated bus services to station and integrated ticketing
- Linkage to industrial estates from Schoolhill Park and Ride via Cairnrobin and provide infrastructure to give link to Altens
- Underpass/priority measures to get buses to/from Park and Ride
- Provide a link for public transport between Stonehaven Road and Wellington Road

Some of these additional suggestions are reflective of other elements within the Regional and Local Transport Strategies and the delivery of these strategies can provide additional benefit.

11.4 Findings

The medium term measures which through traffic modelling have shown a positive impact when tested are:

- pedestrian footbridge over River Dee which also enables removal of footways and width restriction on Bridge of Dee
- replace Wellington Road/Hareness Roundabout with signalised junction incorporating pedestrian and cyclist facilities
- Abbotwell Crescent existing access to West Tullos Road to retain left in/left out with access created further west from Abbotswell Crescent to West Tullos Road for public transport with potential traffic signal control.
- replace Souterhead Roundabout with signalised junction incorporating pedestrian and cyclist facilities
- Park and Ride located at Schoolhill subject to future detailed investigation

- new bus lane on Wellington Road between Charleston and Hareness Road increasing northbound lane provision to three lanes
- consideration of High Occupancy Vehicles (HOV) lane on the A90 northbound between Charleston and 100 metres south of Bridge of Dee, linked to Park and Ride site

These measures would provide significant benefits to pedestrians, cyclists and public transport while also aiding the movement of freight around the Altens and Tullos industrial areas. It will be important to ensure that land is available to facilitate conceptual designs and that a thorough consultation exercise is carried out.

A PACKAGE 2 QUEUE LENGTH GRAPHS

Figure A.1 shows the average maximum queue data for Wellington Road Southbound.

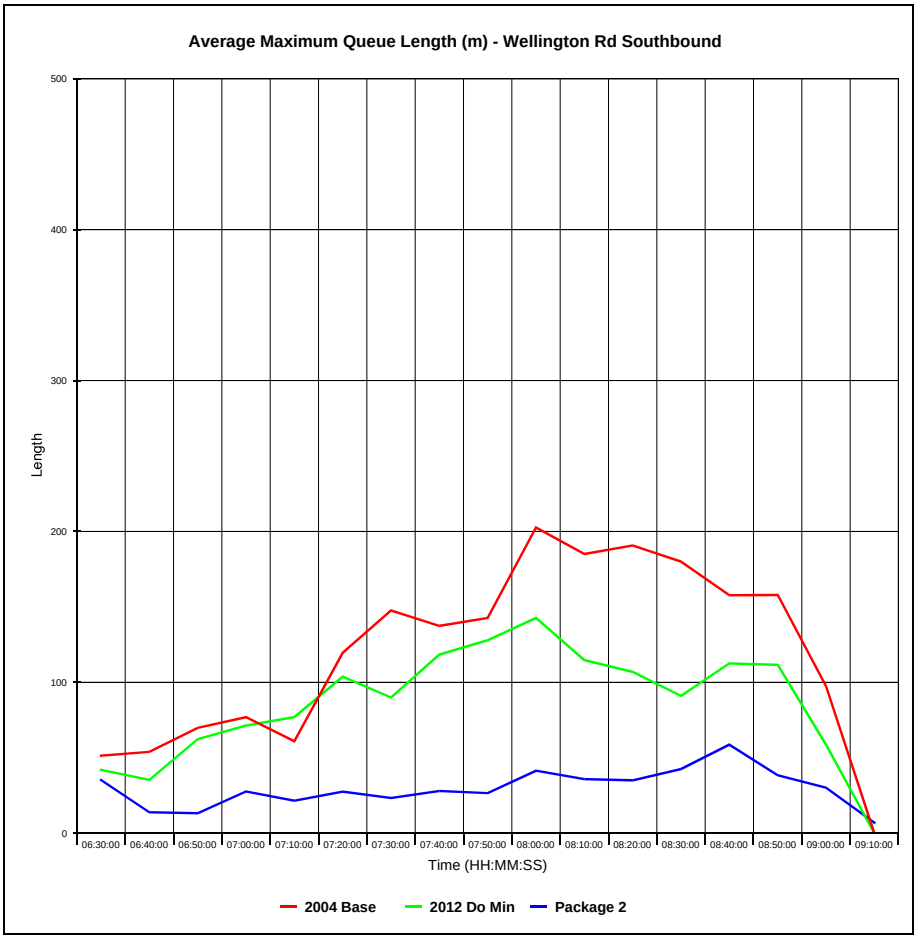

Figure A.1 : Queue Comparison (Wellington Road Southbound) – AM Peak

Figure A.1 demonstrates that with the introduction of the traffic signals at Hareness Rd, there is an improvement in the queue length from a maximum of approximately 200m in the 2004 base to approximately 50m in package 2 on Wellington Road Southbound.

Figure A.2 shows the data for Hareness Road.

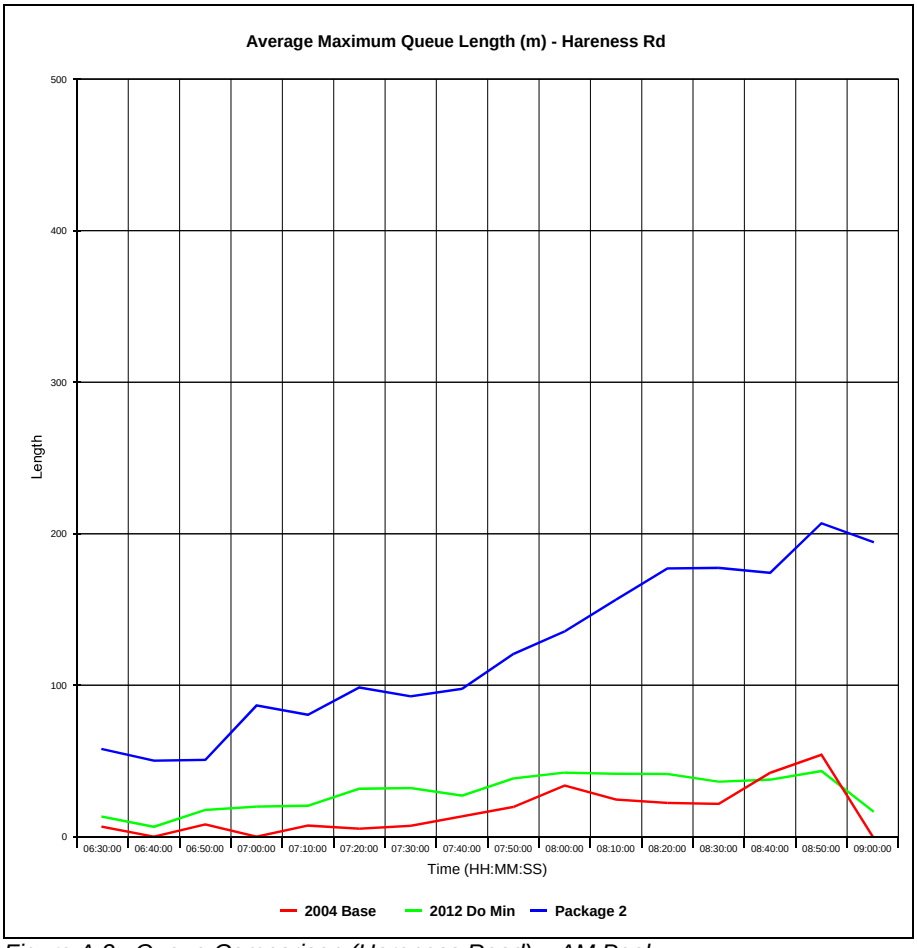

Figure A.2 : Queue Comparison (Hareness Road) – AM Peak

Figure A.2 shows that the queue increases slightly in the AM Peak dues to the balancing of the queues with the introduction of the traffic signals.

The data for Wellington Road Northbound is shown in Figure A.3.

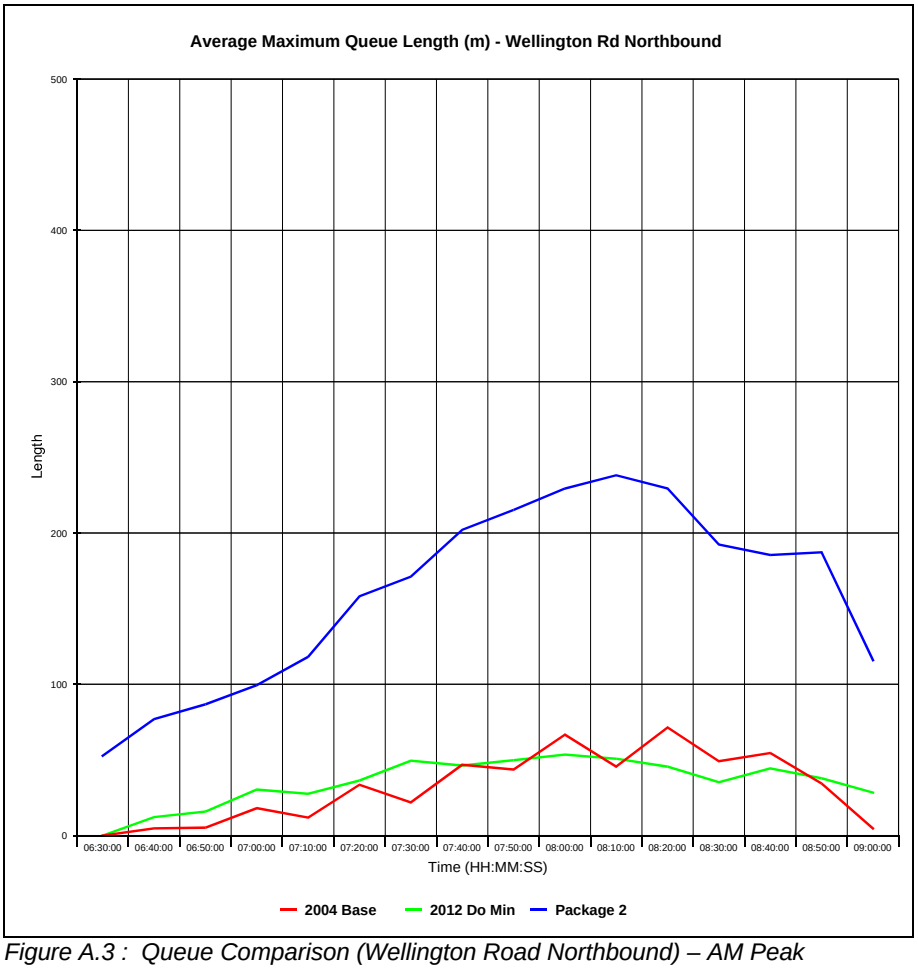

Figure A.3 : Queue Comparison (Wellington Road Northbound) – AM Peak

Figure A.3 shows that with the introduction of traffic signals the queues are longer, due to the delay introduced by the traffic signals. It should be borne in mind that there is the benefit of the safe operation of the junction and improved pedestrian and cyclist facilities.

The data for West Tullos Road is in Figure A.4.

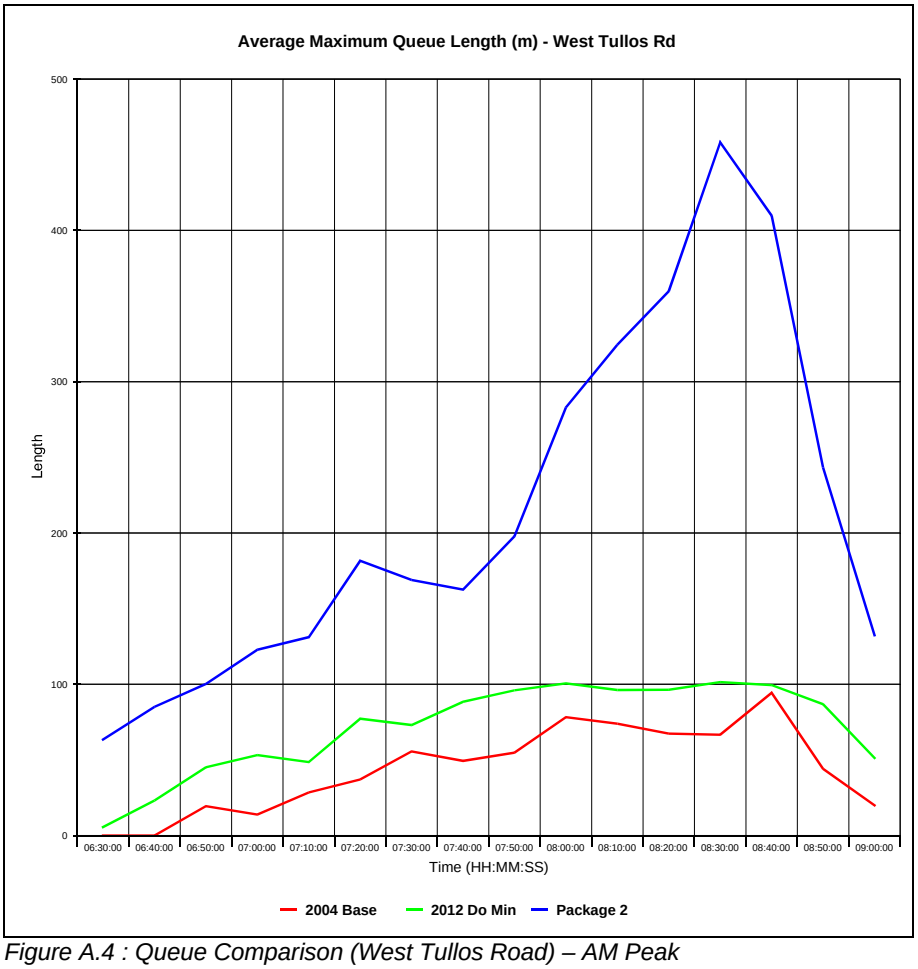

Figure A.4 : Queue Comparison (West Tullos Road) – AM Peak

Figure A.4 again shows increased queuing with the traffic signals, mainly concentrated within the AM Peak Hour.

It should be borne in mind that Table 4.3 and 4.5 showed little change in overall journey times in the area during either the AM or PM peaks.

Figure A.5 to Figure A.8 show the information for the PM Peak.

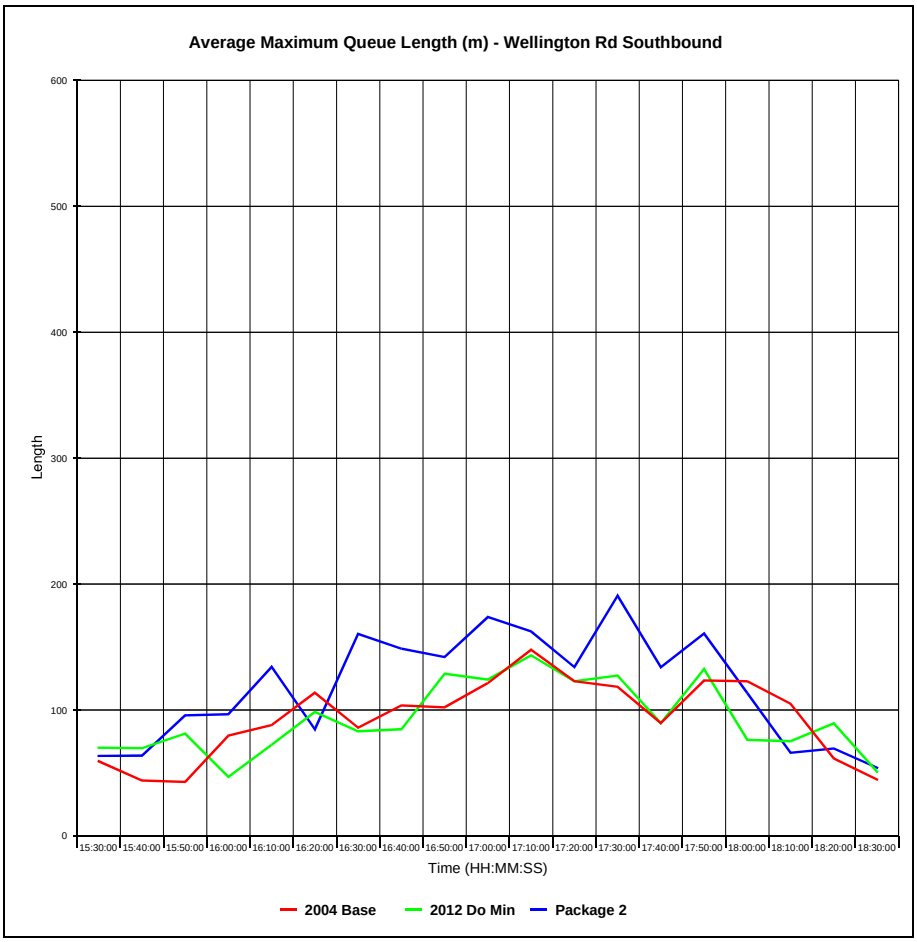

Figure A.5 : Queue Comparison (Wellington Road Southbound) – PM Peak

Figure A.5 shows that the queue lengths on Wellington Road Southbound are very similar to the 2004 Base and 2012 Do-Minimum with the introduction of the traffic signals.

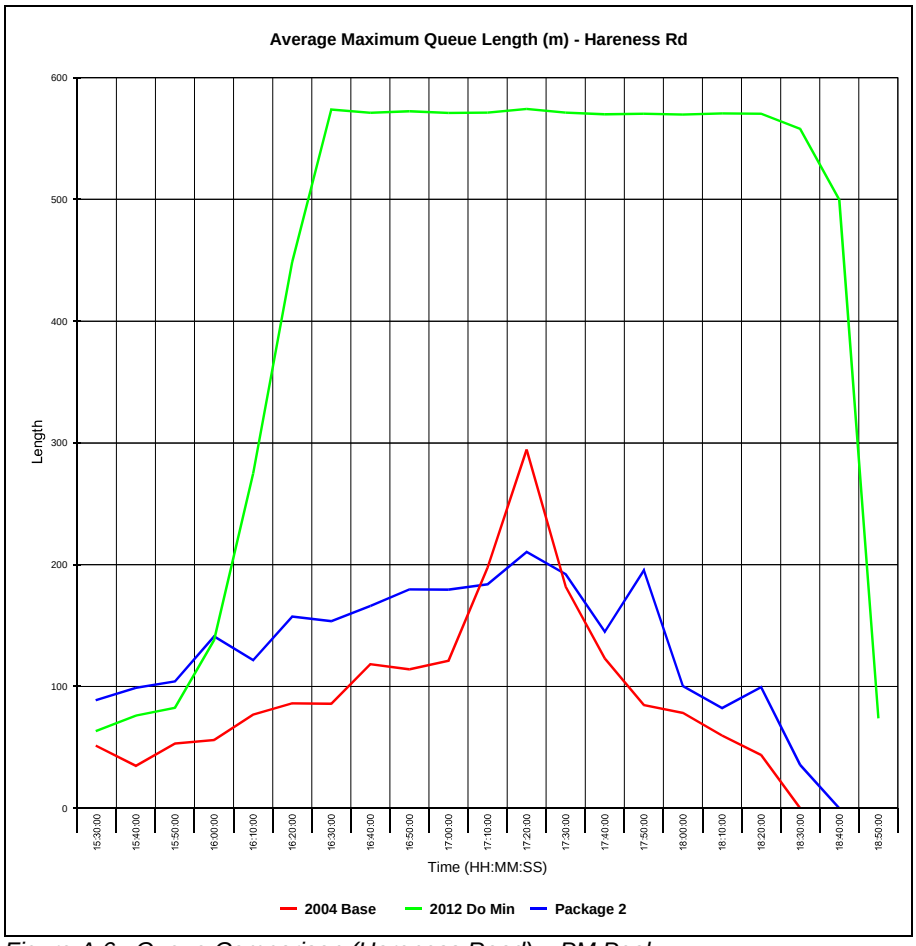

Figure A.6 : Queue Comparison (Hareness Road) – PM Peak

Figure A.6 shows that the maximum queue length is greatly reduced with the introduction of the traffic signals when compared against the 2012 Do-Minimum on Hareness Road in the PM Peak.

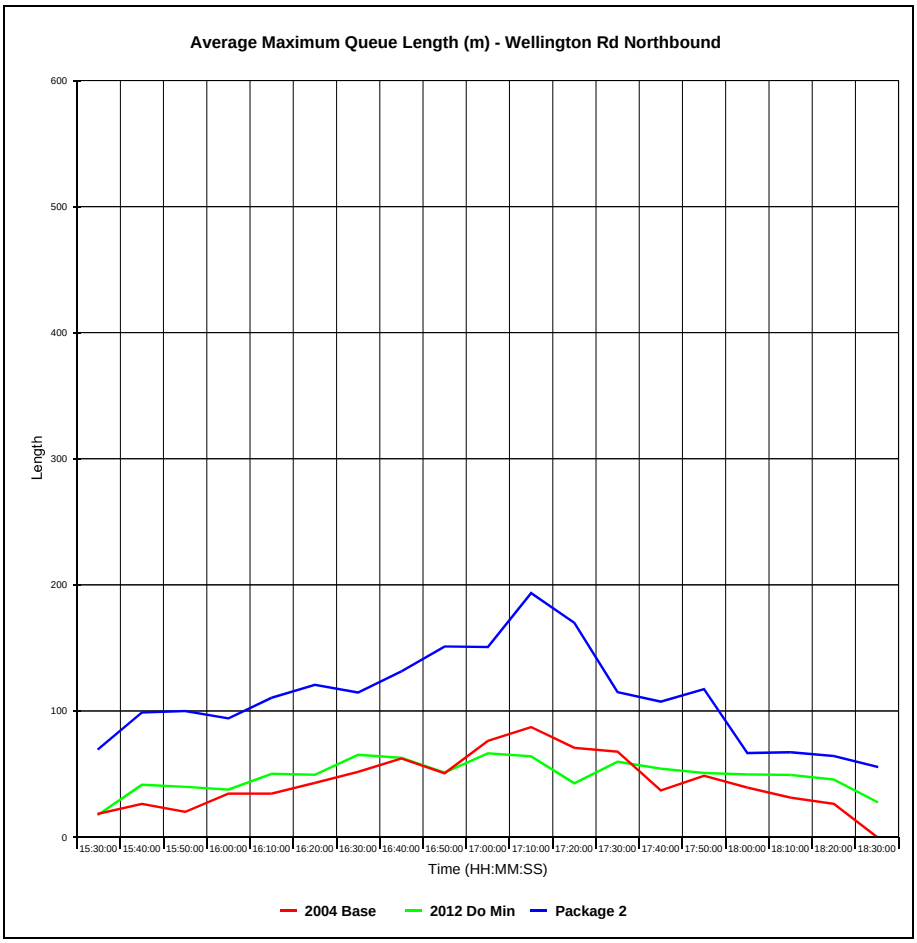

Figure A.7 : Queue Comparison (Wellington Road Northbound) – PM Peak

It can be seen from Figure A.7 that there is a slight increase in the northbound direction on Wellington Road with the introduction of the traffic signals. This is however, offset by the reduction in the queue from Hareness Road.

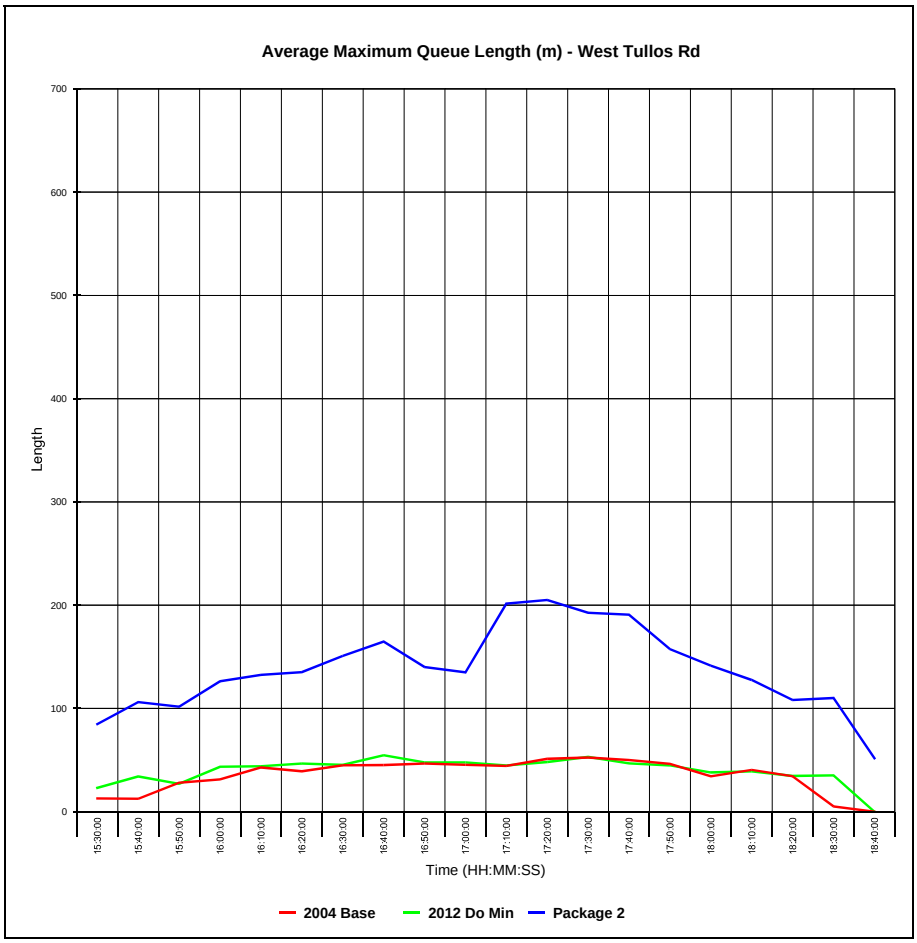

Figure A.8 : Queue Comparison (West Tullos Road) – PM Peak

Figure A.8 shows that the queuing on West Tullos Road has remained fairly consistent between the different scenarios. There is only a slight increase with the introduction of the signals.

B PACKAGE 4 QUEUE LENGTH COMPARISONS AT SOUTERHEAD JUNCTION

Figure B.1 shows the queue at the new Souterhead junction on the Wellington Road southbound approach.

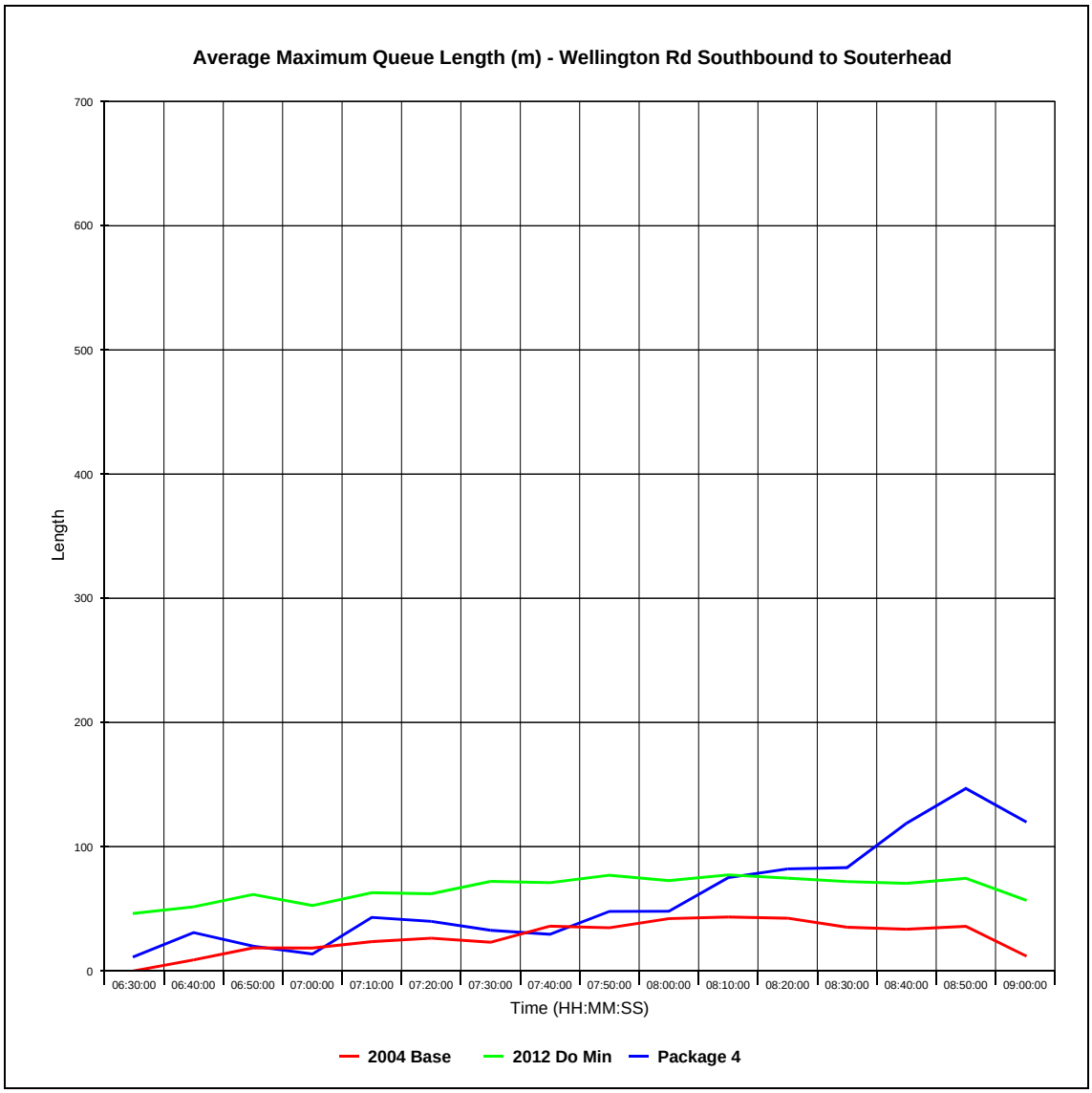

Figure B.1 : Queue Comparison Souterhead (Wellington Road Southbound) – AM Peak

Figure B.1 shows that with the introduction of the traffic signals the southbound queue remains consistent with when the roundabout was in place.

Figure B.2 shows the results for Wellington Road northbound.

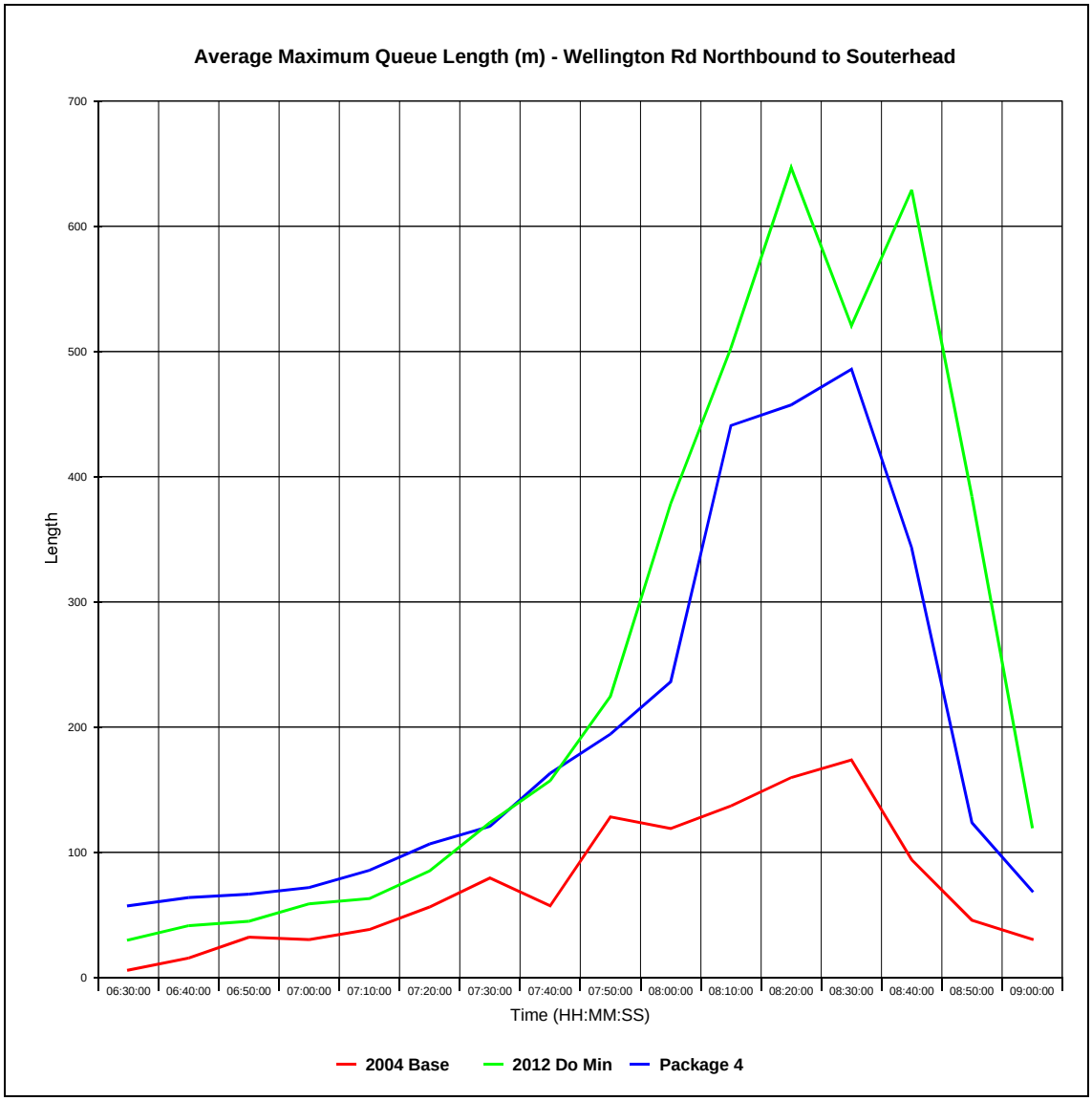

Figure B.2 : Queue Comparison Souterhead (Wellington Road Northbound) – AM Peak

Figure B.2 shows that with the introduction of the traffic signals, there is an improvement over the queue length in the 2012 Do-Minimum.

Figure B.3 shows the graph for the Souterhead Road approach.

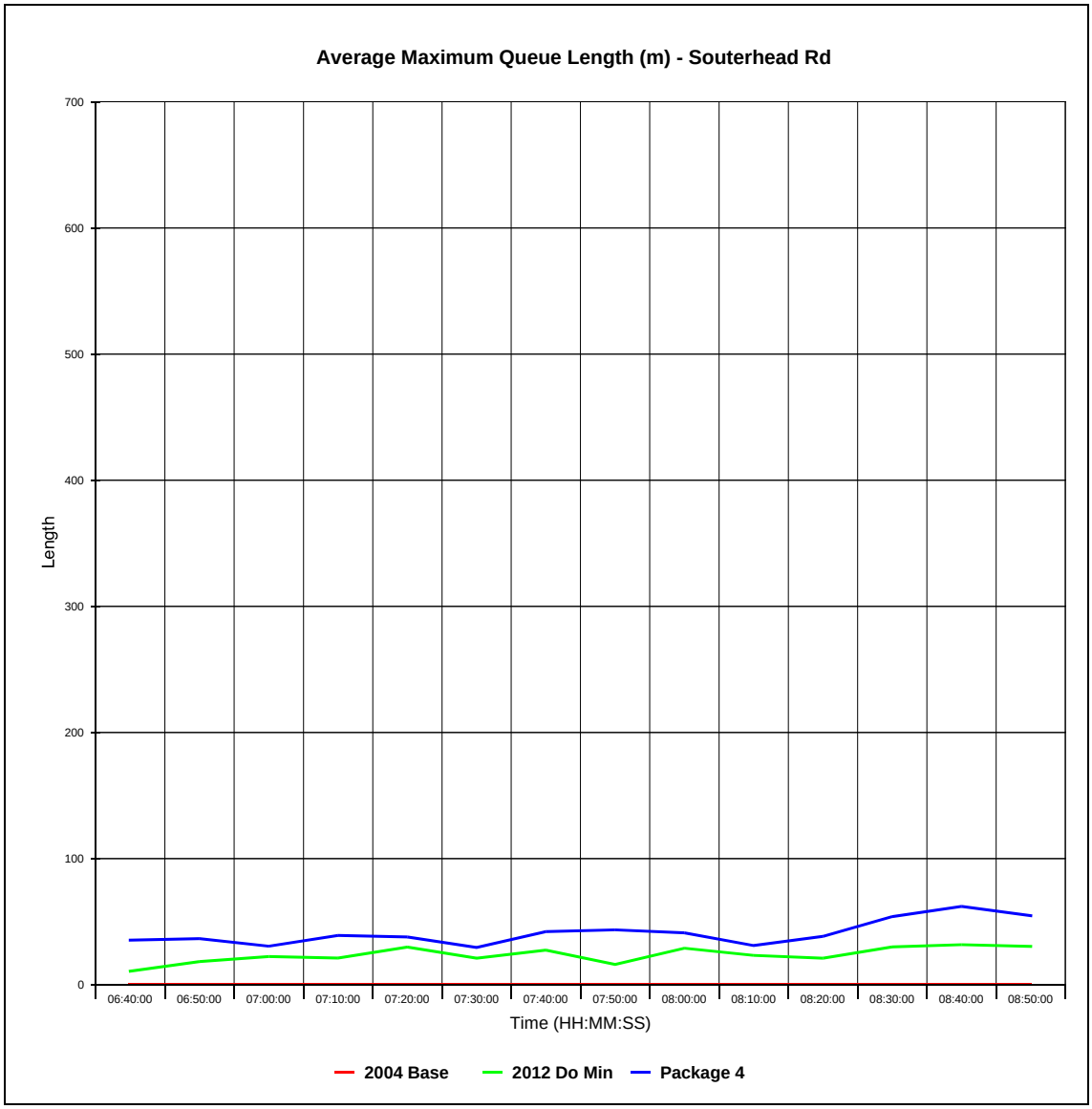

Figure B.3 : Queue Comparison Souterhead (Souterhead Road) – AM Peak

Figure B.3 shows that the results from the 2012 Do-Minimum and 2012 package 4 are very similar, both showing queues of less than 50m.

Figure B.4 shows the results for Langdykes Road.

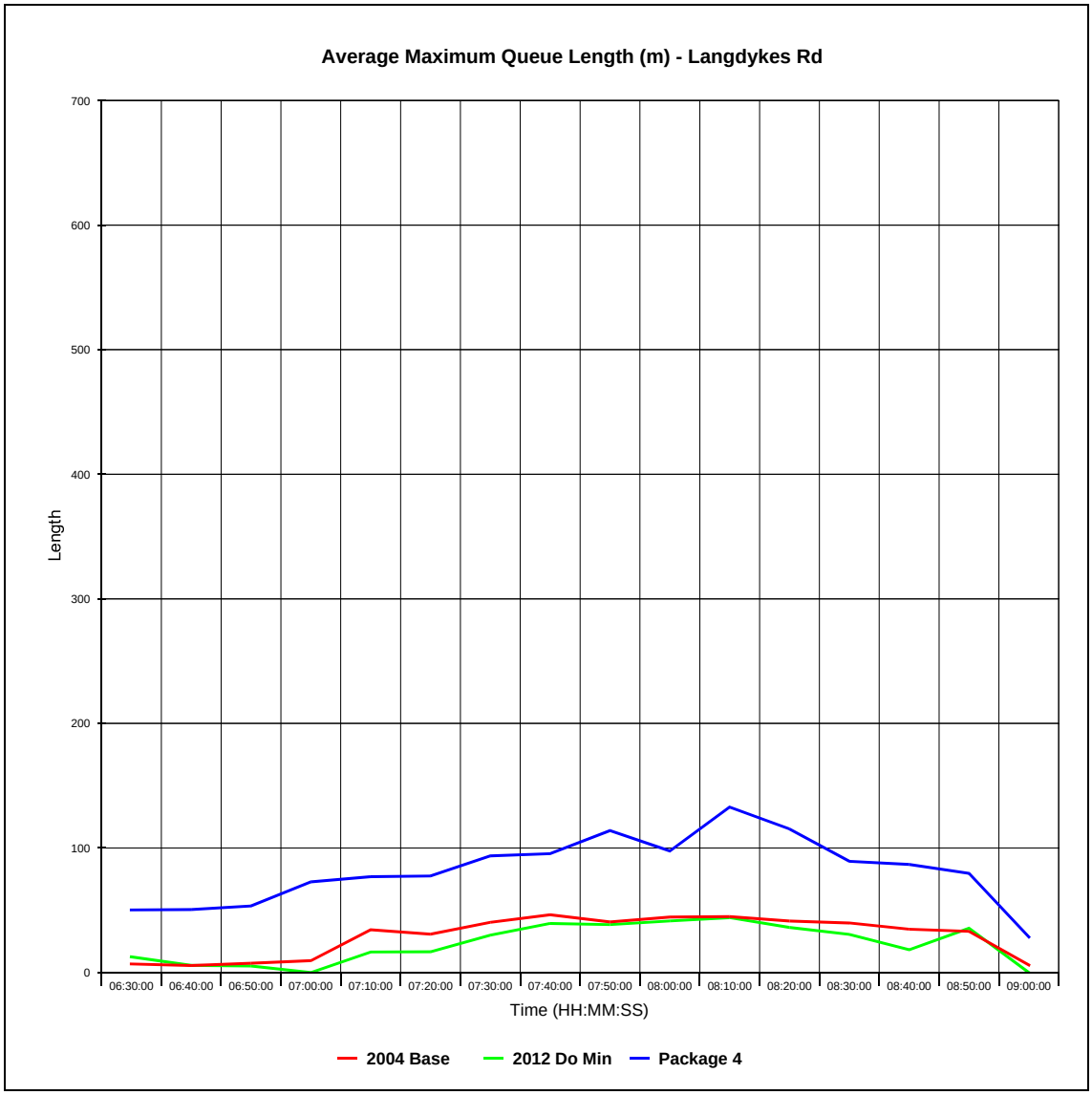

Figure B.4 : Queue Comparison Souterhead (Langdykes Road) – AM Peak

Figure B.4 shows that there is a slight increase in the queue length on Langdykes Road, however, the maximum queue is still only around 100m.

Figure B.5 shows the results for Wellington Road Southbound in the PM Peak.

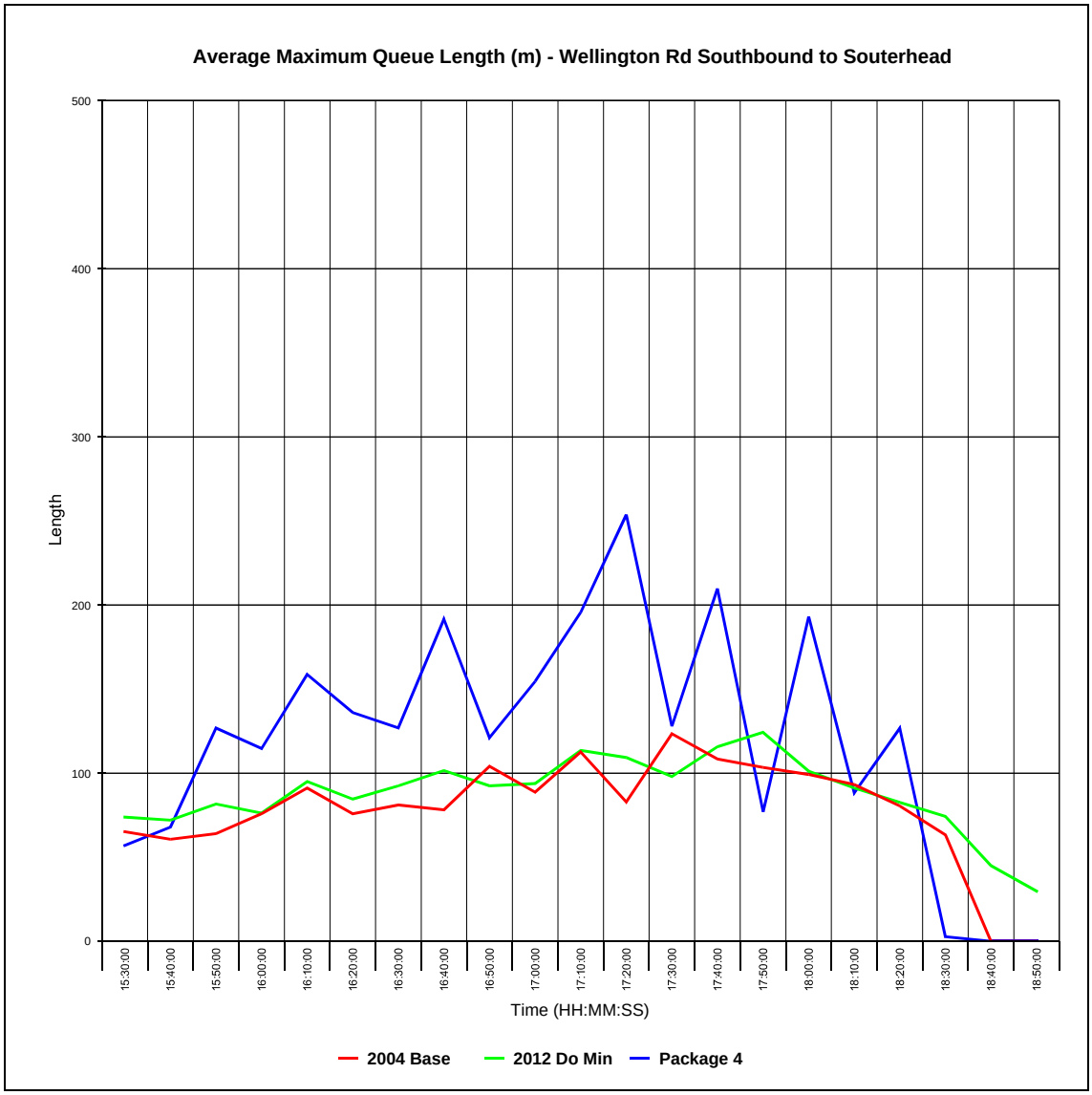

Figure B.5 : Queue Comparison Souterhead (Wellington Road Southbound) – PM Peak

Figure B.5 shows a slight increase in the queue length with the introduction of the traffic signals.

Figure B.6 shows the results for Wellington Road southbound.

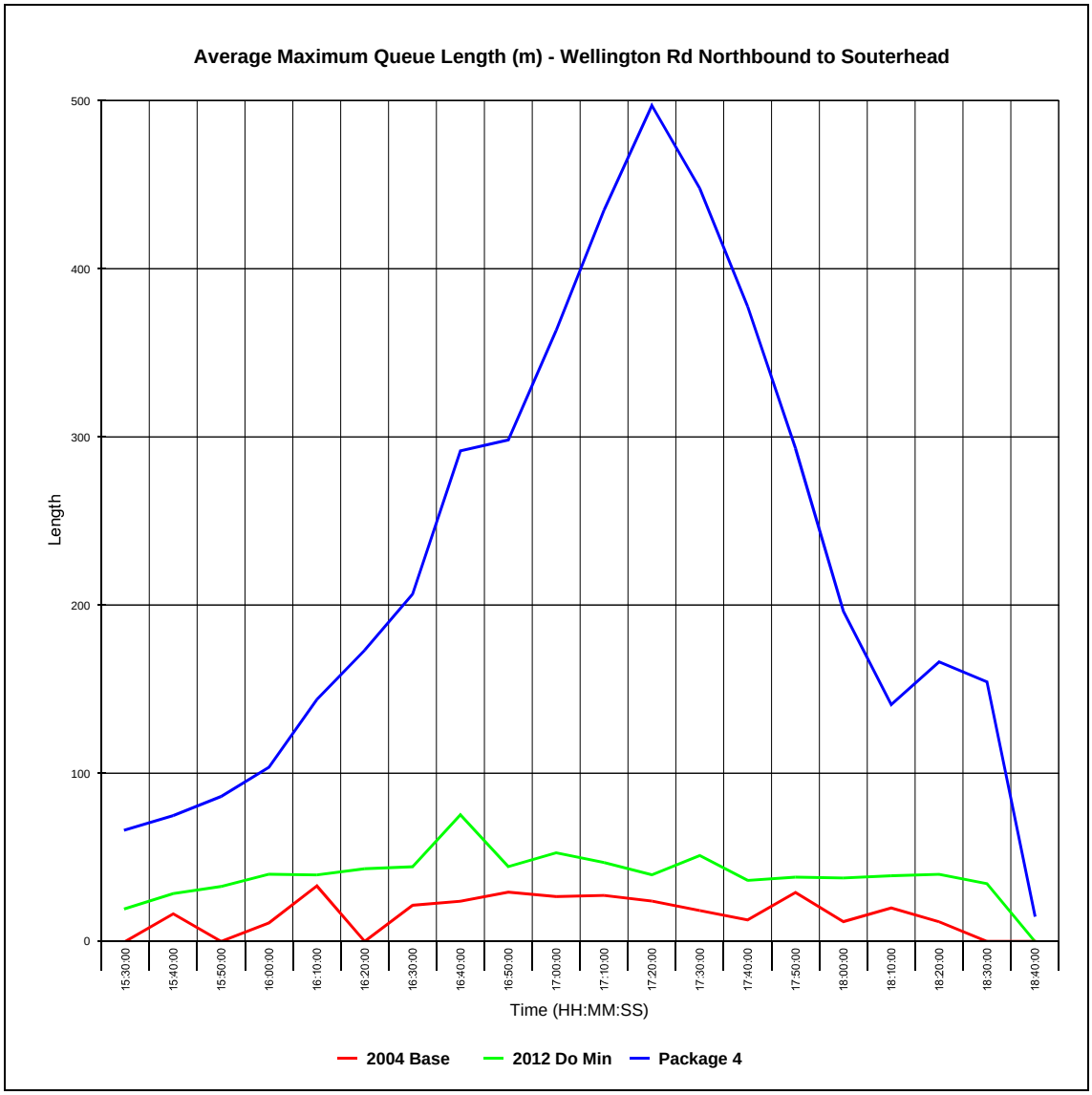

Figure B.6 : Queue Comparison Souterhead (Wellington Road Northbound) – PM Peak

It can be seen in Figure B.6 that there is an increase in the northbound queue, due to the delays at the new signals.

Figure B.7 shows the results for Souterhead Road.

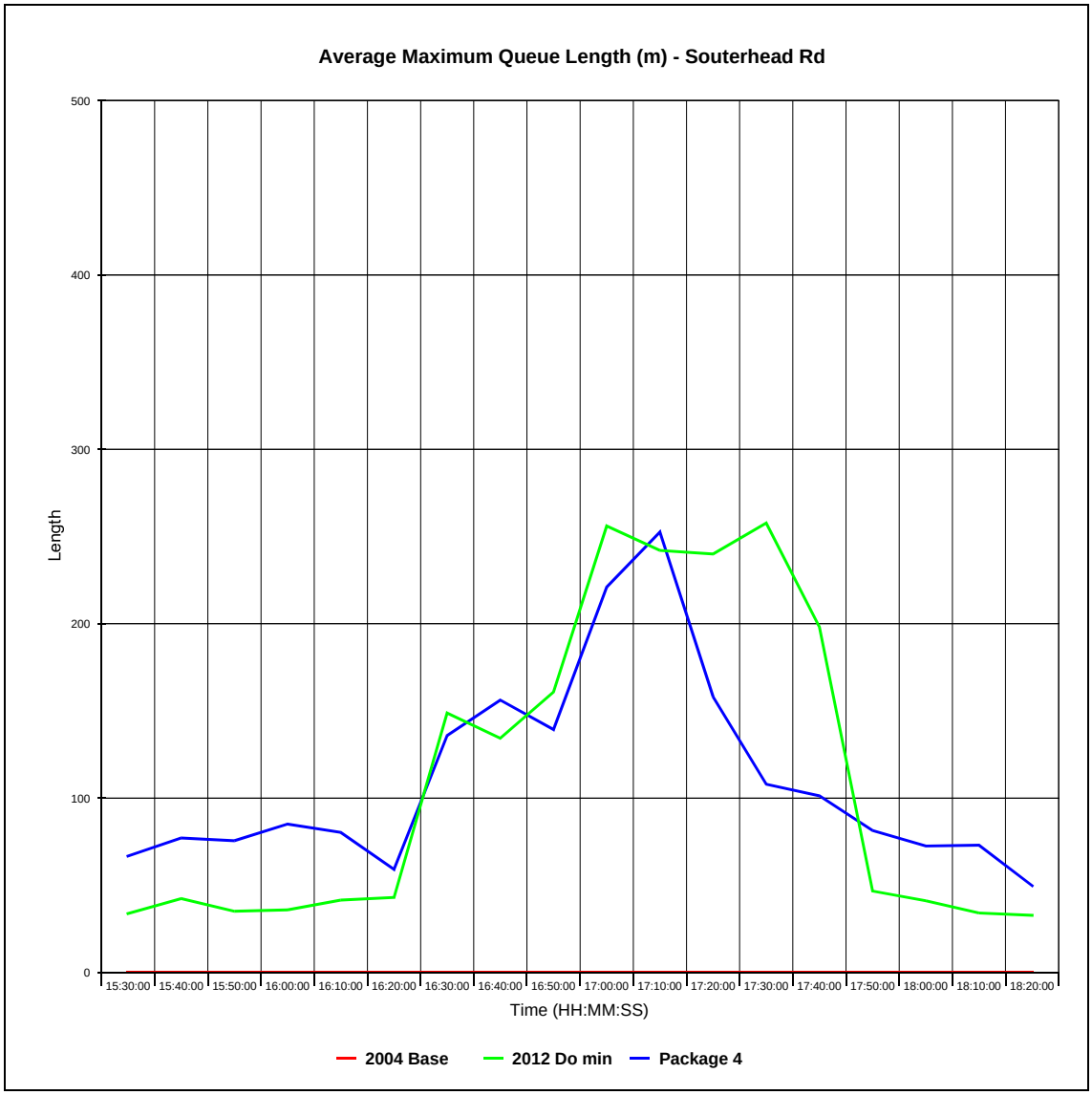

Figure B.7 : Queue Comparison Souterhead (Souterhead Road) – PM Peak

Figure B.7 shows the queue levels on Souterhead Road with the traffic signals are very similar to those in the 2012 Do-Minimum.

The results for Langdykes Road are shown in Figure B.8.

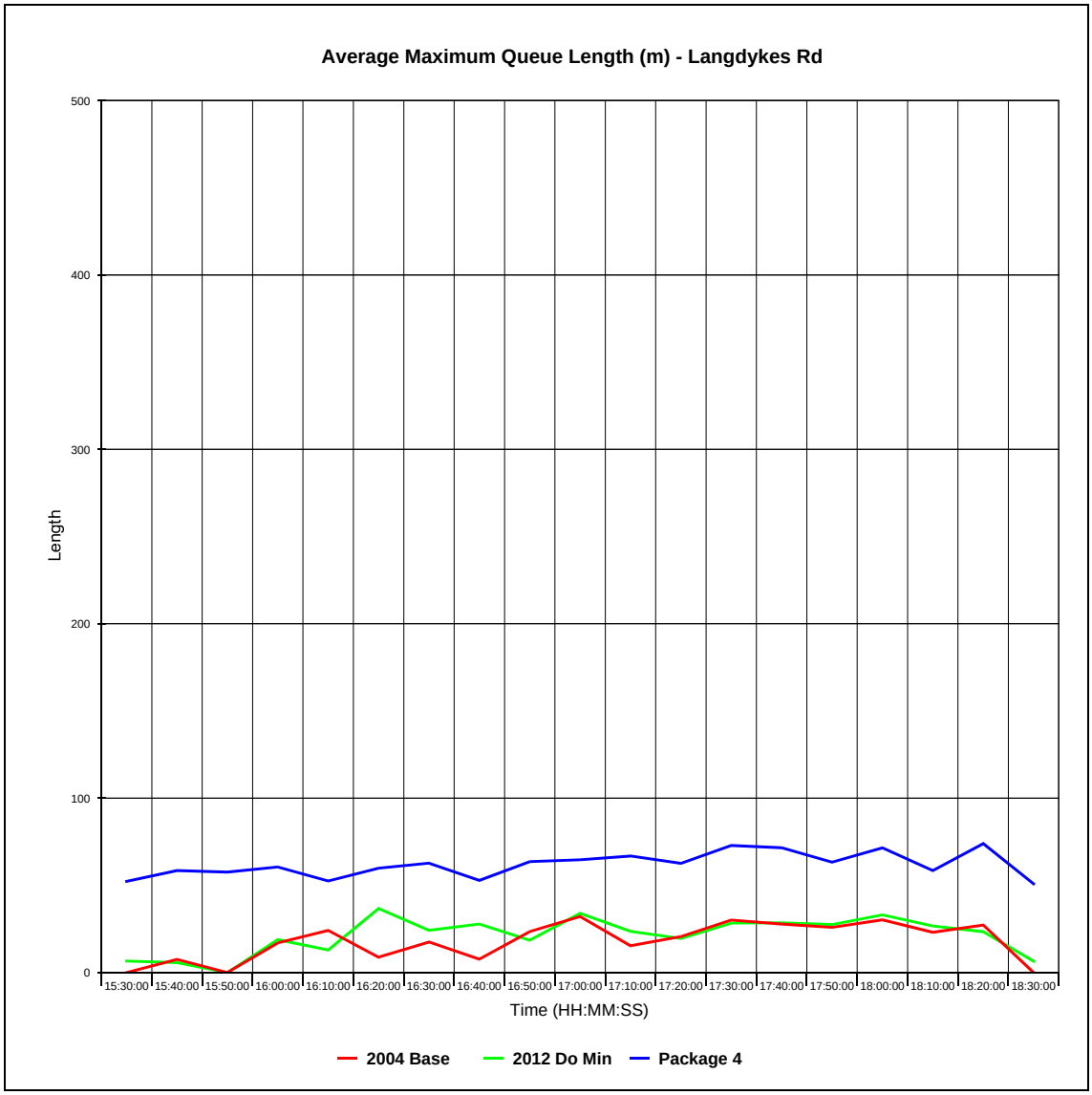

Figure B.8 : Queue Comparison Souterhead (Langdykes Road) – PM Peak

Figure B.8 shows that although there is a slight increase in the queue length with the introduction of the signals, the maximum length is still less than 100m.