Stonehaven Traffic Capacity Study

Aberdeenshire Council

S-Paramics Model Development, Validation & Option Testing

TPATCSM/71625
July 2009

STONEHAVEN TRAFFIC CAPACITY STUDY

Description:	**Stonehaven Traffic Capacity Study**
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1 INTRODUCTION

1.1.1 As part of the Aberdeenshire Framework agreement, Aberdeenshire Council (AC) has requested SIAS Limited (SIAS) undertake a capacity assessment on the Stonehaven area of the A90(T).

1.1.2 AC has advised that two options are to be tested, both comprising 2,000 houses and 10ha of employment land at two different locations:

- Toucks
- East Newtonleys

1.1.3 This document summarises the S-Paramics model development process and option testing results.

1.1.4 In addition, the accessibility of potential future development sites was appraised using Accession accessibility modelling software and the findings are provided in Appendix A.

1.2 Study Aims

1.2.1 The overall aim of the study is to assess the traffic impact upon the surrounding road network with either of these potential sites developed at the suggested levels.

1.2.2 It should be borne in mind that this study does not consider the impact these developments may have on Stonehaven Town Centre, as the assessment is restricted to the A90, A92 and A957.

1.3 Objectives

1.3.1 The principal objectives of the model build were defined as:

- To accurately construct the network description in an S-Paramics traffic model
- To develop base trip matrices using data collected as part of a comprehensive programme of traffic surveys
- To calibrate and validate the Base model
- To develop separate future year matrices that include the traffic flow impact with the introduction of the East Newtonleys or Toucks developments, which both include 2,000 houses and 10ha of employment
- To individually test the impacts of the East Newtonleys and Toucks developments

2 S-PARAMICS MODEL DEVELOPMENT

2.1 Base Year Road Network

2.1.1 Ordnance Survey data supplied by AC was used to construct the road network in S-Paramics. Additional road network information was extracted from in-car videos, recorded by SIAS on 25 and 26 November 2008, of the study area road network.

2.1.2 Public transport information was extracted from internet based timetable information on 20 February 2009 and coded into the S-Paramics model.

2.1.3 The study area and S-Paramics traffic assignment zone configuration is shown in Figure 2.1.

Figure 2.1 : Study Area and S-Paramics Zone Configuration

2.2 Base Year Trip Matrices

2.2.1 A matrix of travel demand was derived from the results of AM (06:30 – 09:30) and PM (16:00 – 19:00) peak classified junction turning counts undertaken by specialist survey contractor PMA Data Collection Ltd. The surveys, organised by SIAS, were undertaken on Tuesday 13 January 2009 and included turn count data for the A90/A92 and A92/A957 Junctions.

2.2.2 The A90 mainline flows were checked against Automatic Traffic Counter (ATC) data site JTC08330, and found to be representative of a typical weekday.

2.2.3 The resultant data was used to derive AM and PM peak classified matrices to represent traffic movements for the study area.

2.3 Base Model Validation

Traffic Flow Comparisons

2.3.1 S-Paramics is subject to minor variations in the assignment from one run to the next. This being the case it is normal in the use of an S-Paramics model to use the mean link flow values derived from a series of at least five S-Paramics runs for comparison against the observed flows.

2.3.2 The model results are collected over the AM and PM peak periods, guidance given in the *Design Manual for Roads and Bridges* (*DMRB*) (Highways Agency) Vol. 12 suggests comparisons with observed flows at peak hour level. In this case, the main criteria for comparison will be the relative peak hours for the AM and PM peak periods, 07:15 – 08:15 and 16:45 – 17:45. The comparisons of flow are also provided over the full model periods (06:30 – 09:30 and 16:00 – 19:00).

2.3.3 The model has been validated to observed flows using the *DMRB* acceptability guidelines based on the GEH statistic which takes account of both relative and absolute differences. The GEH statistic is defined as follows for the comparison of observed and assigned traffic flow:

$$GEH = \sqrt{\left(V_O - V_A\right)^2 / \left(0.5 \times \left(V_O + V_A\right)\right)}$$

Where Vo = observed traffic flow and V_A = assigned traffic flow. The reason for using the GEH statistic, rather than an absolute or relative flow difference, is that it can accommodate a wide range of traffic flows, whereas an absolute difference of 100 vehs/hr can be important in a flow of 200 vehs/hr it is largely irrelevant in a flow of several thousand vehs/hr.

2.3.4 *DMRB* Vol. 12 suggests individual link flows should have a GEH ≤ 5 in 85% of cases over a one hour interval.

2.3.5 The main component of any validation procedure is to compare the assigned link flows with independent observations.

2.3.6 Due to the low number of junctions modelled, turning count comparisons at all surveyed junctions were used for calibration in the AM and PM Peak periods.

2.3.7 The summary calibration GEH statistics for the turning count comparisons for the AM Period are displayed in Table 2.1

Table 2.1 : AM Validation Statistics

			Peak Hour 07:15 - 08:15				Peak Period 06:30 - 09:30			
Junction Description	**From**	**To**	**Observed**	**Modelled**	**Diff (mod - obs)**	**GEH**	**Observed**	**Modelled**	**Diff (mod - obs)**	**GEH**
Turning Counts										
A92 / Toucks	NBD Off Slip	A92	59	70	11	1.4	168	170	2	0.2
A92 / Toucks	NBD Off Slip	Toucks	3	4	1	0.5	8	10	2	0.7
A92 / Toucks	Toucks	NBD On Slip	3	3	0	0.0	9	10	1	0.3
A92 / Toucks	Toucks	A92	5	5	0	0.0	17	18	1	0.2
A92 / Toucks	A92	Toucks	2	4	2	1.2	9	10	1	0.3
A92 / Toucks	A92	NBD On Slip	419	378	-41	2.1	908	911	3	0.1
SBD Off Slip	A90	A92	57	65	8	1.0	187	187	0	0.0
SBD On Slip	A92 West	A92 East	122	139	17	1.5	378	375	-3	0.2
SBD On Slip	A92 West	SBD On Slip	4	0	-4	2.8	6	0	-6	3.5
SBD On Slip	Housing	A92 West	0	0	0	0.0	1	0	-1	1.4
SBD On Slip	Housing	A92 East	3	3	0	0.0	4	5	1	0.5
SBD On Slip	A92 East	SBD On Slip	76	80	4	0.5	194	195	1	0.1
SBD On Slip	A92 East	A92 West	420	383	-37	1.8	912	919	7	0.2
A92 / A957	A92 West	A957	71	77	6	0.7	205	204	-1	0.1
A92 / A957	A92 West	A92 East	54	64	10	1.3	177	176	-1	0.1
A92 / A957	A92 East	A92 West	397	369	-28	1.4	863	868	5	0.2
A92 / A957	A92 East	A957	73	102	29	3.1	240	239	-1	0.1
A92 / A957	A957	A92 East	38	37	-1	0.2	96	97	1	0.1
A92 / A957	A957	A92 West	99	95	-4	0.4	243	245	2	0.1
Link Counts										
A90 NBD			1886	1907	21	0.5	4668	4675	7	0.1
A90 SBD			462	465	3	0.1	1355	1364	9	0.2
A90 NBD Off-Slip			62	73	11	1.3	176	177	1	0.1
A90 NBD On-Slip			422	381	-41	2.0	917	916	-1	0.0

2.3.8 It can be seen in Table 2.1 that 100% of turn and link counts return a GEH statistic of less than or equal to 5, indicating that the model satisfactorily reflects observed link counts and turning movements at the key junctions.

2.3.9 The calibration GEH statistics for the turning count comparisons for the PM Period are displayed in Table 2.2.

Table 2.2 : PM Validation Statistics

Junction Description	From	To	Peak Hour 16:45 - 17:45 Observed	Modelled	Diff (mod - obs)	GEH	Peak Period 16:00 - 19:00 Observed	Modelled	Diff (mod - obs)	GEH
Turning Counts										
A92 / Toucks	NBD Off Slip	A92	63	54	-9	1.2	141	143	2	0.2
A92 / Toucks	NBD Off Slip	Toucks	1	1	0	0.0	3	3	0	0.0
A92 / Toucks	Toucks	NBD On Slip	3	3	0	0.0	7	8	1	0.4
A92 / Toucks	Toucks	A92	3	7	4	1.8	15	16	1	0.3
A92 / Toucks	A92	Toucks	5	9	4	1.5	24	22	-2	0.4
A92 / Toucks	A92	NBD On Slip	91	89	-2	0.2	229	225	-4	0.3
SBD Off Slip	A90	A92	307	317	10	0.6	810	813	3	0.1
SBD On Slip	A92 West	A92 East	365	376	11	0.6	941	968	27	0.9
SBD On Slip	A92 West	SBD On Slip	6	0	-6	3.5	12	0	-12	4.9
SBD On Slip	Housing	A92 West	2	1	-1	0.8	2	2	0	0.0
SBD On Slip	Housing	A92 East	0	0	0	0.0	3	3	0	0.0
SBD On Slip	A92 East	SBD On Slip	195	178	-17	1.2	448	450	2	0.1
SBD On Slip	A92 East	A92 West	92	98	6	0.6	238	247	9	0.6
A92 / A957	A92 West	A957	70	76	6	0.7	189	196	7	0.5
A92 / A957	A92 West	A92 East	295	301	6	0.3	755	777	22	0.8
A92 / A957	A92 East	A92 West	89	84	-5	0.5	218	226	8	0.5
A92 / A957	A92 East	A957	41	47	6	0.9	126	127	1	0.1
A92 / A957	A957	A92 East	149	149	0	0.0	367	367	0	0.0
A92 / A957	A957	A92 West	198	191	-7	0.5	468	472	4	0.2
Link Counts										
A90 NBD			627	620	-7	0.3	1582	1586	4	0.1
A90 SBD			1568	1593	25	0.6	4071	4079	8	0.1
A90 NBD Off-Slip			64	54	-10	1.3	144	143	-1	0.1
A90 NBD On-Slip			94	93	-1	0.1	236	232	-4	0.3

2.3.10 The results in Table 2.2 clearly show that over 100% of turn and link counts return a GEH statistic of less than or equal to 5 indicating that the model satisfactorily reflects observed link counts and turning movements at the key junctions

Traffic Queue Comparisons

2.3.11 As part of the traffic survey programme, traffic queue data was collected at the A92/A957 Junction on Tuesday 13 January 2009.

2.3.12 Minimal traffic queueing was observed and modelled during both survey periods at the A92/A957 junction.

2.3.13 Full queue data is presented in Appendix B.

Summary

2.3.14 The Stonehaven S-Paramics Capacity Study model was developed to be employed in the junction capacity assessment of two proposed developments, East Newtonleys and Toucks. A network description was developed from OS mapping data provided by Aberdeenshire Council.

2.3.15 Base year trip matrices were derived using classified turning counts collected by PMA Data Collection Ltd. The turning count data was checked against ATC site JTC08330, and found to be representative of a typical weekday.

2.3.16 Validation against observed flows and queue data indicated that the model was sufficiently robust to be taken forward and used in the Stonehaven Capacity Study.

3 S-PARAMICS MODEL CAPACITY TESTS

3.1 Introduction

3.1.1 Once the Base model was completed, AC requested Future Year scenarios be tested in order to gauge the impact of two developments: East Newtonleys (Scenario 2) and Toucks (Scenario 1) for the year 2016. A 2012 Reference Base Scenario was also developed, reflecting National Road Traffic Forecast (NRTF) growth. The NRTF growth applied for each scenario is illustrated in Table 3.1.

Table 3.1 : NRTF Growth Percentages

Road	NRTF	NRTF Road Class	NRTF % Growth			
			2012 Lights	2012 Heavies	2016 Lights	2016 Heavies
A90(T)	HIGH	Rural General	1.086	1.042	1.181	1.088
A92	MEDIUM	Rural General	1.074	1.030	1.153	1.063
A957	LOW	Rural Local	1.057	1.015	N/A	N/A

3.1.2 This chapter summarises the assumptions and the results of the 2012 Reference Case, 2016 Do-Nothing, 2016 Scenario 2, and then 2016 Scenario 1 which was a sensitivity test based on Scenario 2.

3.2 Assumptions

3.2.1 As the area to be modelled was only two junctions, rather than interrogating the Structure Plan and Local Plan it was considered that the application of NRTF growth, as detailed in Table 3.1, was more suitable.

3.2.2 The 2008 survey data was used to extract turning proportions at the A92/A957 junctions, as illustrated in Figure 3.1, and it was assumed that the same distribution would be applied to the development traffic.

3.2.3 The distribution of north/south development trips leaving the East Newtonleys site was taken from *Proposed Supermarket – With New A957*, East Newtonley, Bancon Developments (January 2009), which is a Transport Assessment written by Faber Maunsel. This distribution is also shown in Figure 3.1.

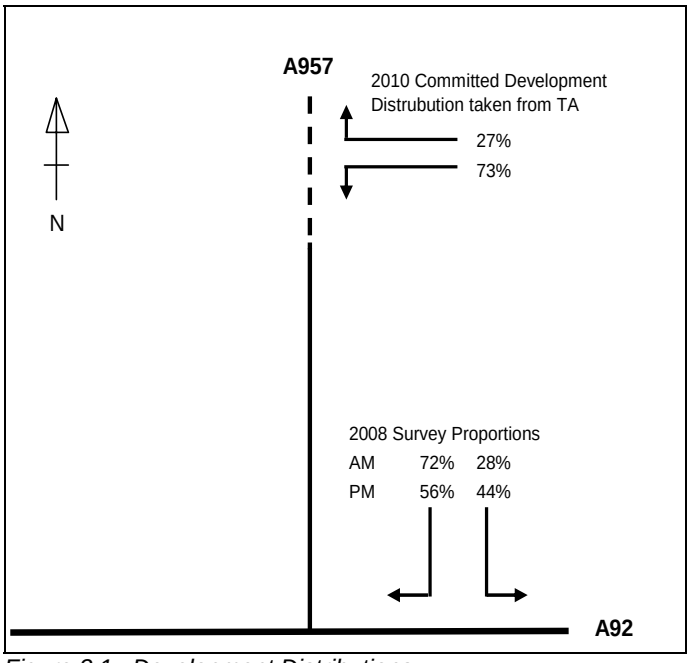

Figure 3.1 : Development Distributions

3.3 2012 Reference Case

3.3.1 AC requested construction of a 2012 Reference Case model in order to provide a benchmark for scenario testing.

3.3.2 The network description used in the 2012 Reference Case scenario was identical to that of the validated base.

3.3.3 The NRTF Traffic growth detailed in Table 3.1 was applied. With the application of NRTF growth, no significant queueing or congestion was shown in the AM or PM period in the 2012 Reference Case.

3.4 Future Year Development 2016

Development content

3.4.1 AC has provided the aspirational development proposals for Stonehaven in 2016. Figure 3.2 illustrates the approximate locations of Toucks (Scenario 1) and East Newtonleys (Scenario 2) developments in the study area.

3.4.2 The main analysis has been carried out on Scenario 2 (East Newtonleys), as this directly impacts upon the study area shown in Figure 3.2, so the results of Scenario 2 have been presented first, with Scenario 1 run as a sensitivity test later in the Report.

Figure 3.2 : Stonehaven Development Locations

3.4.3 As proposed by AC, both developments assume the development of:

- 2,000 houses
- 10Ha of employment
  - Class 4 - 25% at a build density of 3000m2 GFA/Ha
  - Class 5 – 25% at a build density of 3000m2 GFA/Ha
  - Class 6 – 50% at a build density of 6500m2 GFA/Ha

3.4.4 The TRICS database was used in order to calculate trip rates for each of the developments. The trip rates are summarised in Table 3.2.

Table 3.2 : Trip Rates

Development Type	AM Peak (06:30-09:30)		PM Peak (16:00 - 19:00)	
	In	Out	In	Out
Housing (per Household)	0.410	0.976	1.087	0.728
Warehouse (Commercial) (GFA 100M^2)	0.901	0.444	0.450	0.892
Business (GFA 100M^2)	3.247	0.732	0.917	2.897

3.4.5 The trip rates above were then used to generate the number of trips, to and from each development. The trip totals generated are shown in Table 3.3.

Table 3.3 : 2016 Trip Generation

Development Type	AM Peak (06:30 - 09:30)		PM Peak (16:00 - 19:00)	
	In	Out	In	Out
Housing (trips)	820	1952	2174	1456
Warehouse (Commercial) (trips)	214	105	107	212
Business (GFA) (trips)	771	174	218	688
Total	1,805	2,231	2,499	2,356

3.5 2016 Do-Nothing

3.5.1 A 2016 Do-Nothing test was run which assumed the Scenario 2 development trips (see Section 3.5), but with the existing infrastructure. Running the model quickly showed that the existing infrastructure was unable to cope with the proposed development flows, as indicated in the journey time graphs and queue comparison graphs.

3.6 2016 Scenario 2 Testing

3.6.1 As proposed by Aberdeenshire Council, Scenario 2 assumes the development of 2,000 houses and 10ha of employment at East Newtonleys. The potential new infrastructure proposed as part of this test is a slight realignment of the A957 and a new roundabout at the junction of the A957/A92. An initial conceptual layout was modelled, with no detailed design work on the proposed infrastructure. The proposed A92/A957 roundabout layout is shown in Figure 3.3.

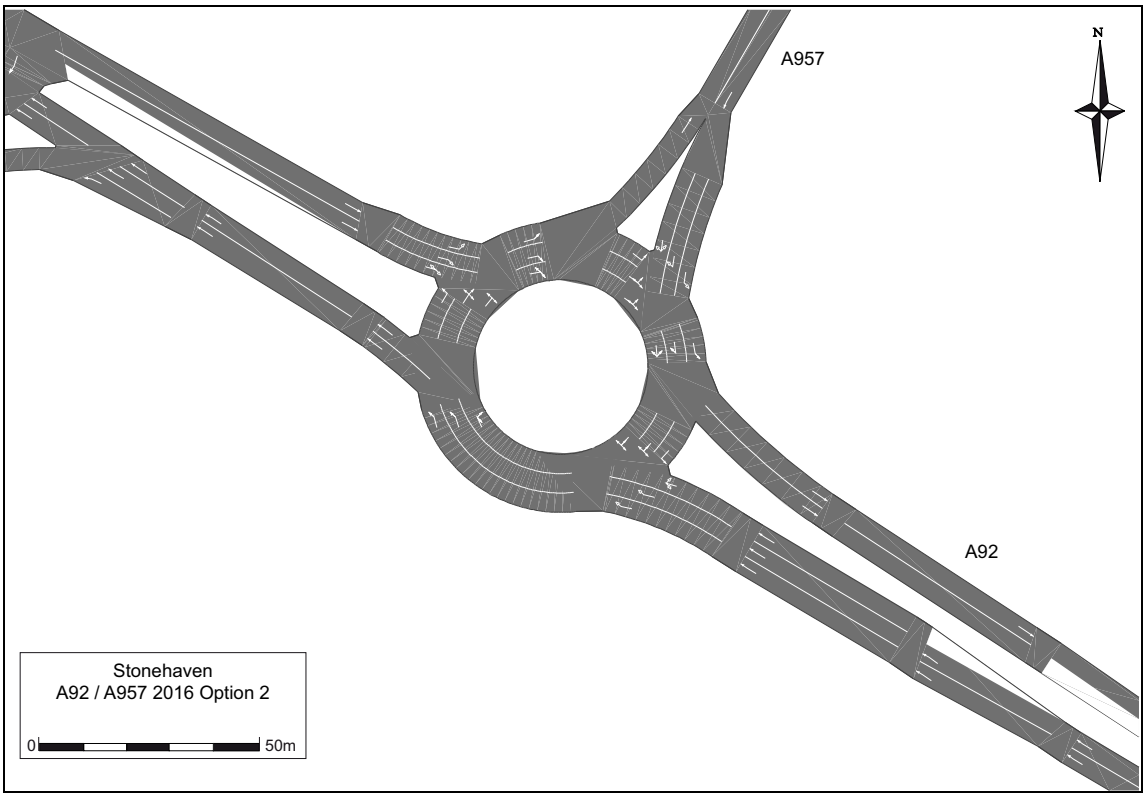

Figure 3.3 : Proposed A92/A957 Roundabout

3.6.2 Cost estimates for this proposed roundabout were based on a similar design at Badentoy Road, Portlethen. The provisional scheme cost estimate of £569,726 was calculated by Mouchel for a 40m ICD Roundabout. This cost included Optimism Bias (44%), Contingencies (20%), a Utilities Allowance (10%) and Signing and Lining (3%).

3.6.3 In Scenario 2, and as agreed with AC, NRTF high growth was applied to the A90(T) and medium to the A92 as per Table 3.1. Due to the inclusion of development related trips, NRTF low growth was not applied to A957 in this scenario.

3.6.4 Figure 3.1 shows that 73% of development traffic is predicted to travel southbound, this distribution was used in the future year development matrices. The final trip generation entering the model for Scenario 2 is summarised in Table 3.4.

Table 3.4 : Scenario 2 Trip Generation

Development Type	AM Peak (06:30 - 09:30)		PM Peak (16:00 - 19:00)	
	In	Out	In	Out
Housing (trips)	599	1425	1587	1063
Warehouse (Commercial) (trips)	156	77	78	155
Business (GFA) (trips)	563	127	159	502
Total	1,318	1,629	1,824	1,720

3.7 2016 Sensitivity Test Scenario 1

3.7.1 As proposed by AC, Scenario 1 assumes the same magnitude of development as East Newtonleys. The proposed Toucks site is situated west of Glaslaw Interchange and the proposed infrastructure is a new road bridge across the A90 to the Mill of Forest area.

3.7.2 The survey data was analysed to assess the proportion of traffic heading out of Stonehaven at three junctions listed as follows:

- A90(T)/B979
- A90(T)/Kirkton Road
- A92/A957

3.7.3 Analysis of the survey data suggested that around 30% of the traffic around Stonehaven used the A92 junction to take access to the strategic road network. In order to provide a robust assessment in Scenario 1 it was assumed that 50% of Toucks development would use the A92 junction. The final trip generation used in Scenario 1 is summarised in Table 3.5.

Table 3.5 : Scenario 1 Trip Generation

Development Type	AM Peak (06:30 - 09:30)		PM Peak (16:00 - 19:00)	
	In	Out	In	Out
Housing (trips)	299	712	794	531
Warehouse (Commercial) (trips)	78	38	39	77
Business (GFA) (trips)	281	63	79	251
Total	659	814	912	860

3.7.4 In Scenario 1 NRTF high growth was applied to the A90(T) and medium to the A92 as per Table 3.1. Due to the inclusion of development related trips, NRTF low growth was not applied to A957 in this scenario.

4 RESULTS

4.1.1 Journey Times and Queue Length data was analysed based on five model runs for each of the following scenarios.

- 2008 Base
- 2012 Reference Case
- 2016 Do-Nothing
- 2016 Scenario 1
- 2016 Scenario 2

4.2 Journey Time Comparisons

4.2.1 Journey times were extracted between every Origin and Destination within each model. The AM journey times corresponding to the A92/A957 Junction are summarised in Figure 4.1.

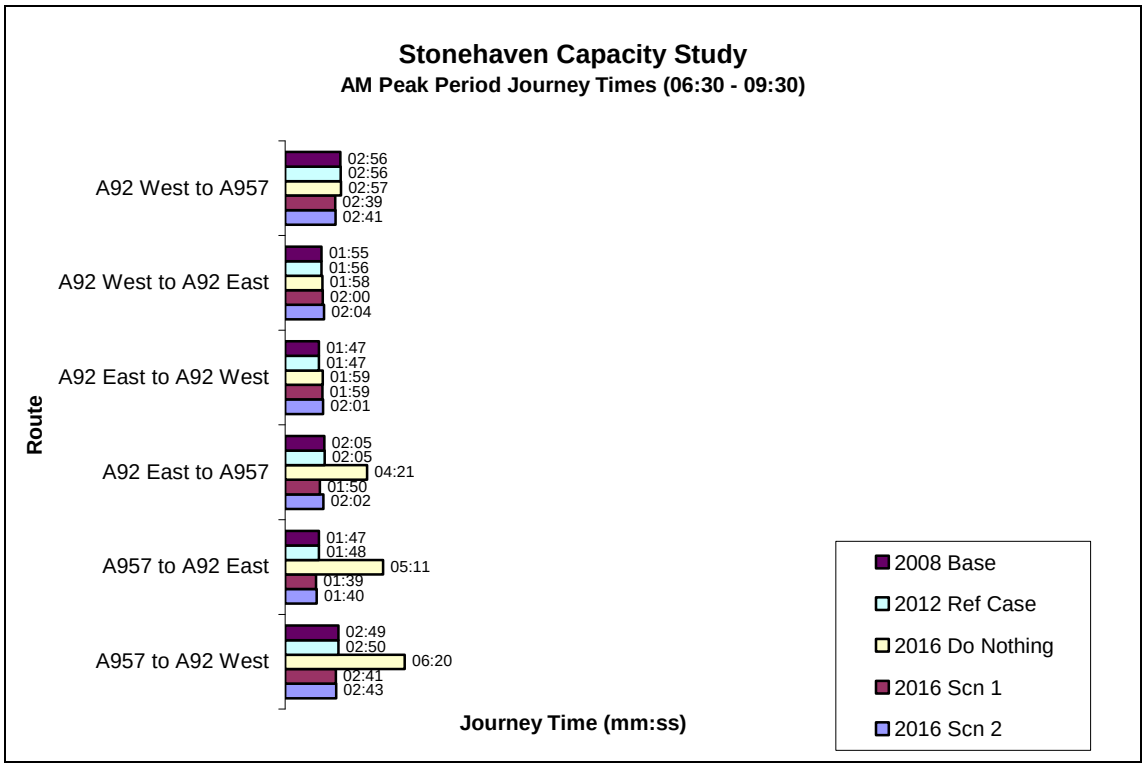

Figure 4.1 : AM Peak Journey times

4.2.2 It can be seen that in the AM period, journey times remain relatively constant between scenarios with the exception of the 2016 Do-Nothing scenario, where delays to/from the A957 range from 2min 57s to 6min 20s. The introduction of the proposed roundabout in Scenario 2 improves journey times in the AM Period by approximately 3min 30s from the A957 to the A92 West.

4.2.3 The PM Journey times corresponding to the A92/A957 Junction are summarised in Figure 4.2.

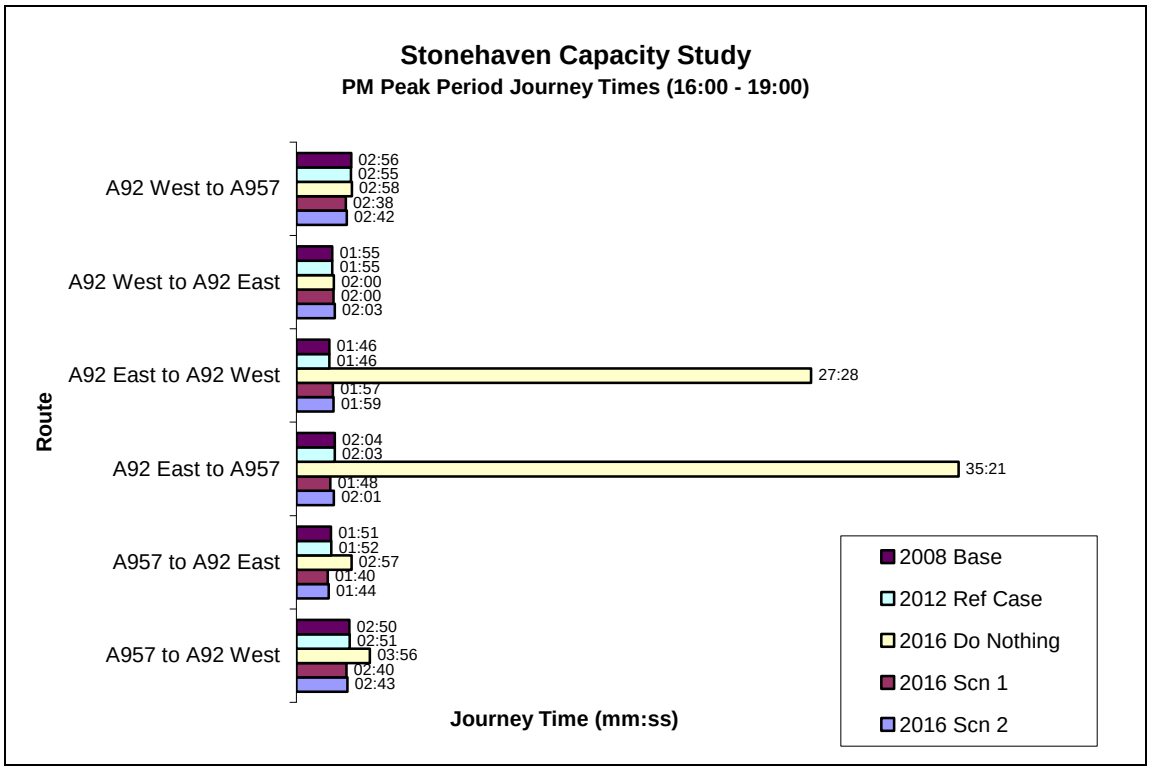

Figure 4.2 : PM Peak Journey times

4.2.4 It can be seen that in the PM period, journey times remain relatively constant between scenarios with the exception of the 2016 Do-Nothing scenario. In this scenario delays from the A92 east arm range from 27min 28s, to 35min 21s. This delay was attributed to right turning traffic unable to progress at the A92/A957 junction with the existing ghost island road layout. This delay was reduced significantly in scenarios with the proposed roundabout in place at this location in both the development scenarios.

4.3 Queue Length Comparisons

4.3.1 Maximum queue length data was extracted for the A957/A92 Junction. Figure 4.3 illustrates AM maximum queue lengths occurring on the A957.

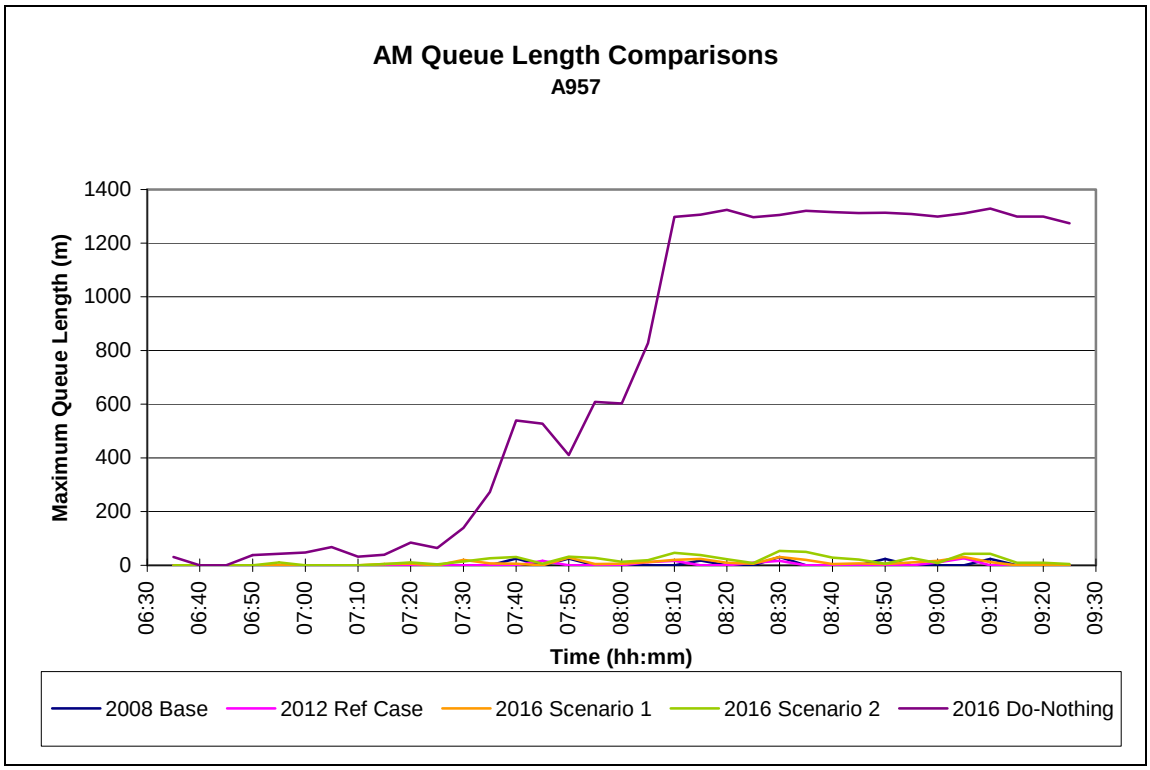

Figure 4.3 : AM Maximum Queue Length Comparisons, A957

4.3.2 In the 2016 AM Do-Nothing scenario, significant queueing occurred on approach to the A92 on the A957, reaching a maximum of around 1,300m. In all other scenarios, minimal queueing was observed.

4.3.3 From observation of the models, queueing on the A957 approaching the A92 can be attributed to traffic growth induced by the East Newtonleys Development, in conjunction with the existing road infrastructure in place. Figure 4.3 demonstrates that, with introduction of the proposed roundabout, queueing is reduced significantly.

4.3.4 Figure 4.4 illustrates AM maximum queue lengths occurring on the A92/A957 Junction east arm.

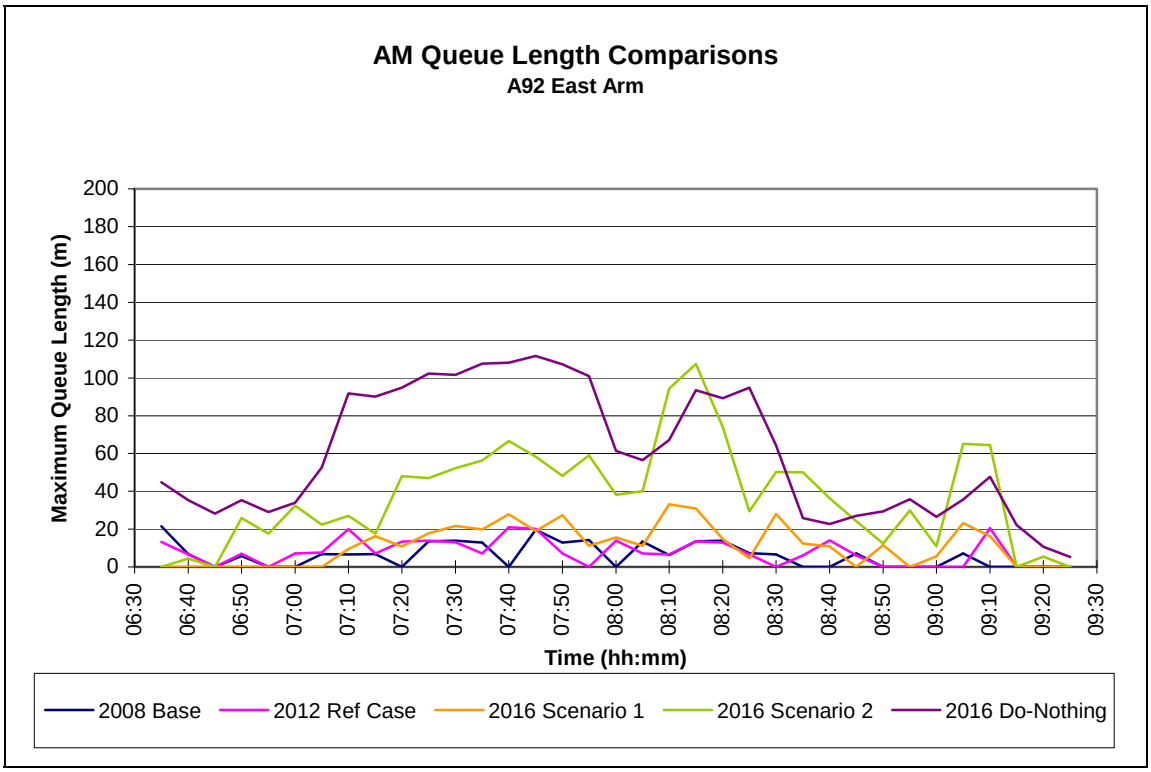

Figure 4.4 : AM Maximum Queue Length Comparisons, A92/A957 East Arm

4.3.5 Figure 4.5 illustrates AM maximum queue lengths occurring on the A92/A957 Junction west arm.

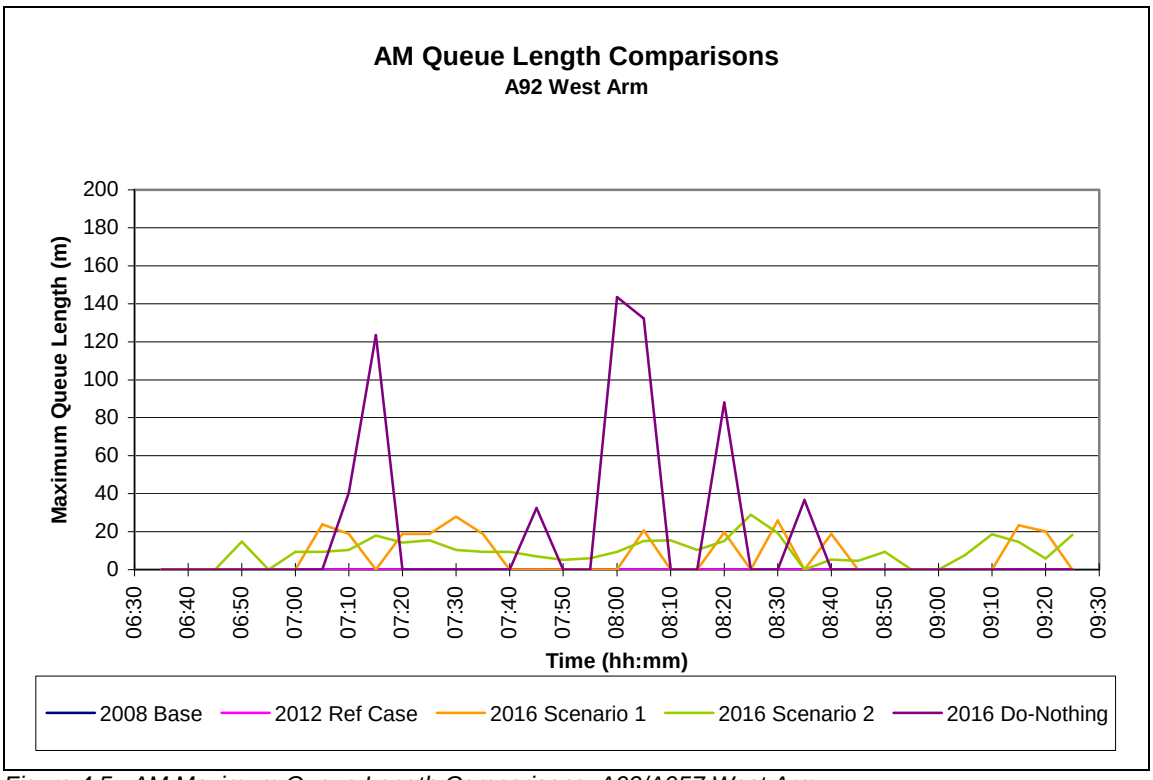

Figure 4.5 : AM Maximum Queue Length Comparisons, A92/A957 West Arm

4.3.6 Figure 4.4 and Figure 4.5 show that minimal queueing was observed in all scenarios at the east and west arms of the A92/A957 junction; with the exception of the 2016 Do-Nothing model in both cases and in Scenario 2 on the A92 East arm, when a maximum of around 100m was reached at around 08:20.

Figure 4.6 illustrates PM maximum queue lengths occurring on the A957.

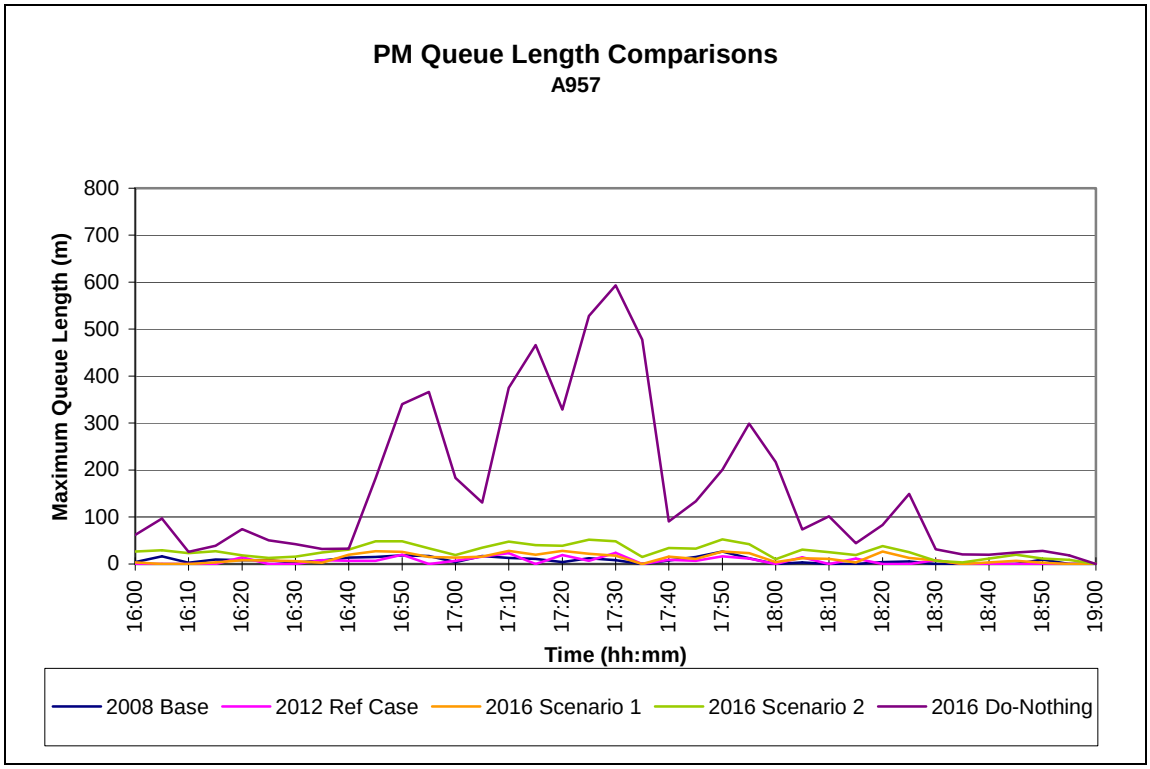

Figure 4.6 : PM Maximum Queue Length Comparisons, A957

4.3.7 In the 2016 PM Do-Nothing scenario, significant queueing occurred on approach to the A92 on the A957, reaching a maximum of around 600m. In all other scenarios, minimal queueing was observed.

4.3.8 From observation of the models, queueing on the A957 approaching the A92 can be attributed to traffic growth from the East Newtonleys Development with the existing road infrastructure in place.

4.3.9 Figure 4.7 illustrates PM maximum queue lengths occurring on the A92 east arm.

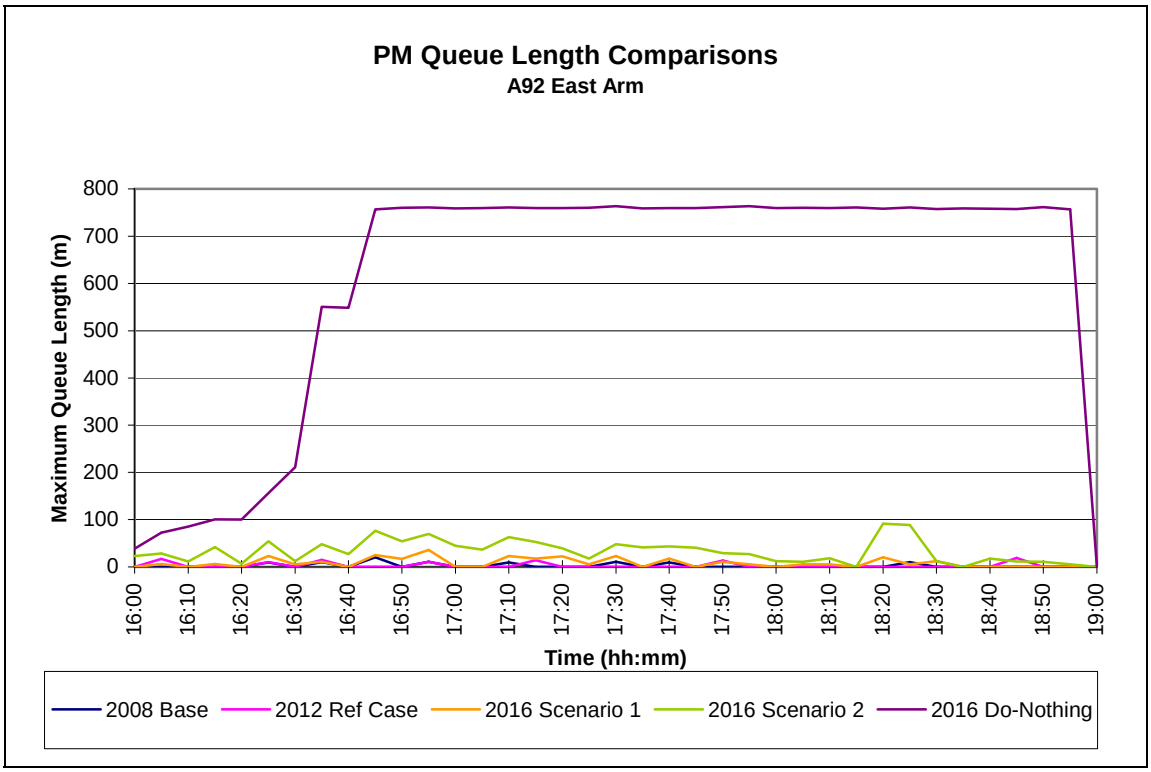

Figure 4.7 : PM Maximum Queue Length Comparisons, A92/A957 East Arm

4.3.10 Figure 4.7 shows a queue on the A92 East arm in the PM Peak, which is attributed to the increase in traffic generated by the East Newtonleys development, and the existing ghost island road layout not accommodating the right turning traffic as efficiently as the proposed roundabout design.

4.3.11 Figure 4.8 illustrates PM maximum queue lengths occurring on the A92 west arm.

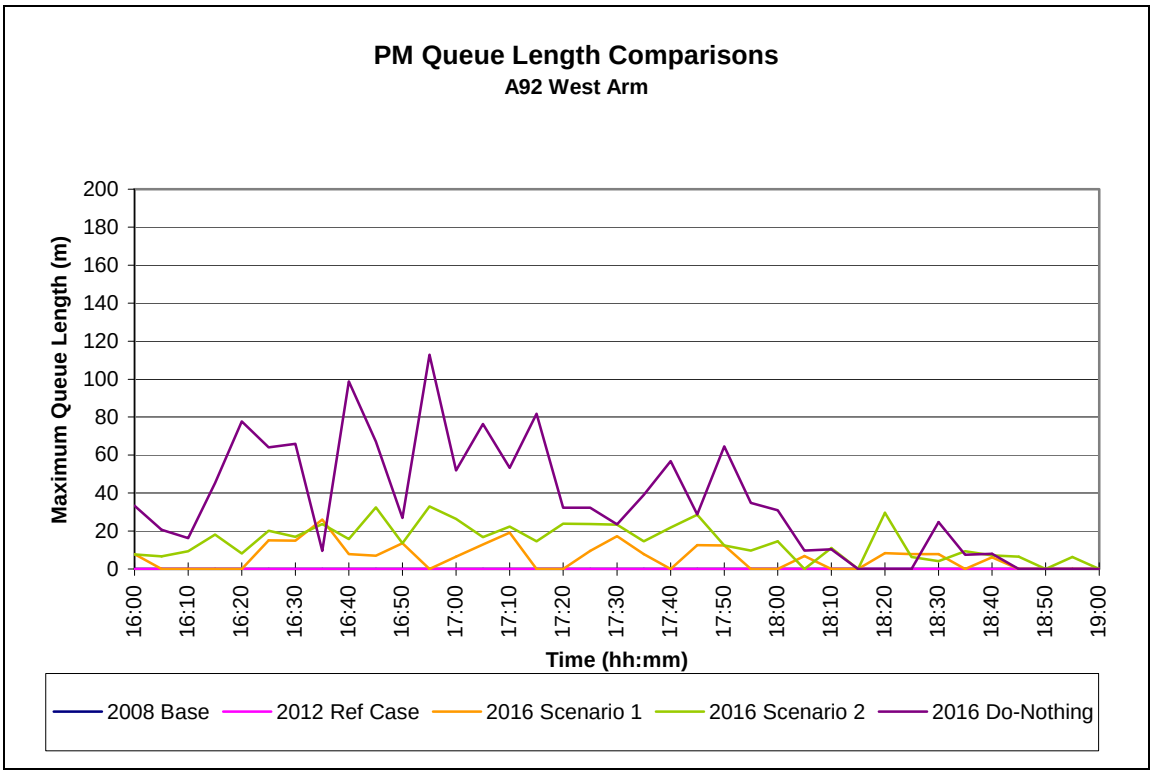

Figure 4.8 : PM Maximum Queue Length Comparisons, A92/A957 West Arm

4.3.12 Figure 4.8 shows that minimal queueing was observed in all scenarios at the west arm of the A92/A957 junction in the PM period; with the exception of the 2016 Do-Nothing which showed a slightly extended queue.

5 SUMMARY AND CONCLUSIONS

5.1.1 An S-Paramics model was developed for Aberdeenshire Council in order to test the capacity of the Stonehaven area of the A90(T).

5.1.2 The principal objectives of the model build were defined and completed:

- To accurately construct the network description in S-Paramics
- To develop base trip matrices using data collected as part of a comprehensive programme of traffic surveys
- To calibrate and validate the Base model
- To develop future year matrices that include the traffic flow impact with the introduction of either the East Newtonleys or Toucks developments, which both include 2,000 houses and 10ha of employment

5.1.3 In order to develop, calibrate and validate the S-Paramics model, traffic surveys were carried out on Tuesday 13 January 2009. Site observations showed no congestion and minimal queues.

5.1.4 The model was then used to test impacts on the surrounding road network with Toucks and East Newtonleys developments were included, particularly areas surrounding the A92/A957 junction were analysed.

5.1.5 The 2016 Do-Nothing scenario adopted the base network description. The 2016 Do-Nothing indicated capacity issues at the A92/A957 Junction with the East Newtonleys development included.

5.1.6 In 2016 both Scenario 1 (Toucks) and 2 (East Newtonleys) in the AM and PM period operate with no significant delays to any area of the study network with the conceptual roundabout implemented at the A92/A957.

5.1.7 Based on testing scenarios as agreed with Aberdeenshire Council, the East Newtonleys (Scenario 2) development could be implemented with additional infrastructure at the A92/A957 junction. No detailed design work at this location was carried out and a conceptual roundabout layout was used for testing.

5.1.8 It is assumed that the traffic impact as a result of the Toucks (Scenario 1) development would be less than the East Newtonleys development on the study area. A proportion of the development trips would take access to the network at the A92/A957 Junction. An identical roundabout design was used as the East Newtonleys development scenario.

5.1.9 This study does not consider the impact these developments may have on Stonehaven town centre, as the assessment is restricted to the A90, A92 and A957.

A STONEHAVEN ACCESSIBILITY APPRAISAL

Aberdeenshire Council
Aberdeenshire Towns - Stonehaven
Accessibility Appraisal

Date :	**23 July 2009**	*Distribution :*	
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1 INTRODUCTION

SIAS Limited (SIAS) has been commissioned by Aberdeenshire Council under the term commission to provide transport consultancy advice with regard to the development of the following Aberdeenshire towns:

- Inverurie
- Kintore
- Westhill
- Stonehaven

As part of these studies, S-Paramics is being used to assess the impact of future expansion on the existing and committed road network in the vicinity of the towns. In addition, the accessibility of potential future development sites is to be appraised using Accession accessibility modelling software.

The accessibility appraisal has been based on existing bus service details and has not investigated the accessibility of the sites in terms of rail travel due to the local nature of the studies. It is, however, suggested that this should be undertaken as part of the detailed appraisal of the potential development sites.

In addition, the impact of committed or potential future infrastructure improvements (including new Park & Ride sites and rail service improvements) could be appraised with regard to the potential development sites, however, this has not been included in this study.

This Technical Note summarises the results of the accessibility appraisal for Stonehaven.

2 POTENTIAL DEVELOPMENT SITES

2.1 Introduction

Stonehaven has a population of around 10,000 and is located 24km to the south of Aberdeen. Direct bus and rail services provide connection between the town and Aberdeen City Centre, with the A90(T) providing access to the city.

The trunk road forms the western boundary of Stonehaven and the town centre is located on the eastern edge of the town adjacent to the North Sea.

Aberdeenshire Council has confirmed that Stonehaven has two potential development sites at Toucks and East Newtonleys on the southern edge of the town.

2.2 Potential Development Sites

The Toucks site is located to the west of the A90(T), which is of dual carriageway standard in the vicinity of the town, and the A90(T)/A92 interchange. Other than the underpass, which is provided as part of the interchange, there are currently no connections provided between the site and Stonehaven. The A90(T) provides an effective barrier to movement between the site and the town, however, it is suggested that this severance issue could be minimised through the revision of the A90(T)/A92 interchange, which is likely to be required to support development of the Toucks site.

The East Newtonleys site is located to the north of the A92 and to the east of the A957. Footpaths link the site with the nearby residential area of Braehead, with onward connection provided into the centre of Stonehaven. Other than a lack of facilities for pedestrians and cyclists, it is considered that there are no significant barriers to movement between the site and the town centre.

While express and local bus services route past the potential development sites on the A90(T) and A92, the nearest bus stops are located at Braehead on the A957 and at Dunnotter Mains on the A92. The bus stops are outwith the distance which is considered convenient (400m) to access local bus services. The location of the sites is shown in Figure 2.1.

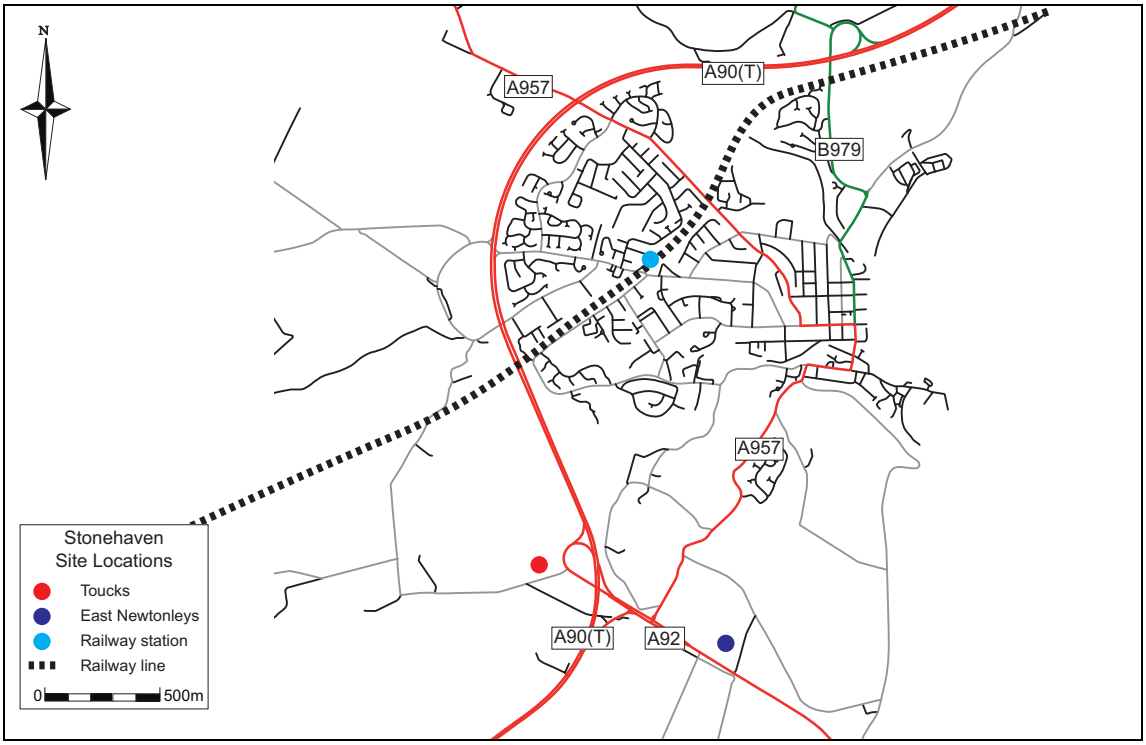

Figure 2.1 : Site Locations

3 ACCESSIBILITY APPRAISAL

3.1 Accession Modelling

Accession is a software package which was developed on behalf of the Department for Transport as a joint venture between MVA and Citilabs. The software enables the accessibility of an area to be appraised and has been approved by the Government for use in accessibility planning.

The software operates as a Geographical Information System (GIS) which brings together a number of data sources (including road network and public transport service information) to enable the accessibility of a potential development site or area to be appraised. ATCO Cif public transport service data (exported 11 February 2009) has been supplied by Aberdeenshire Council for use in the Aberdeenshire town studies.

Accessibility analysis calculations are generally based on travel time and results can be displayed graphically as contours or presented in a tabular format.

Accession can be used to undertake 'Local Accessibility' calculations which enable the accessibility of public transport services to be appraised for a particular area. 'Network Accessibility' calculations enable the accessibility of a destination to be determined from a user defined area. This study has made use of both local and network accessibility calculations.

The accessibility of the potential development sites have been appraised in terms of their proximity to local bus services in the morning peak (07:00 – 09:00) and off-peak (12:00 – 14:00) weekday periods. While it is acknowledged that the future developments will be supported by improvements to the public transport network to ensure they comply with national and local planning policy, in the first instance, the use of existing service information will enable an appraisal of the sites accessibility to be undertaken.

The parameters which have been used to inform the local accessibility analysis are as follows:

- Average walk speed – 4.8km/h
- Straight line walk distance factor – 1.2
- Maximum walk distance – 10min

The analysis has been undertaken to appraise the accessibility of the sites to 1, 2 and 4 buses per hour in the weekday peak and off-peak periods. A 60min service frequency would represent a minimum standard and a 15min frequency is considered to represent a high level of service frequency.

Network accessibility calculations have been undertaken to determine the accessibility of the potential development sites on foot, cycle and by bus. The parameters which have been used to inform the network accessibility analysis are as follows:

- Average walk speed – 4.8km/h
- Average cycle speed – 16km/h
- Straight line walk distance factor – 1.2
- Maximum connection distance – 1.0km
- Minimum time calculation undertaken
- All wait time included

For the purpose of this study it has been assumed that pedestrians and cyclists would be prepared to travel a maximum of 20min to access the development site or to access local amenities from the site.

In addition, the accessibility of the town to the centre of Aberdeen, has been appraised in the peak and off-peak periods. A maximum journey time of 50min has been assumed for the purpose of this study to provide an additional parameter against which to assess the accessibility of the potential development sites.

Census population data has been applied to the network accessibility appraisal to determine the magnitude of existing (based on 2001 data) residents living within a 20min walk or cycle of the sites to provide an additional indicator of the site's accessibility.

3.2 Accessibility Appraisal – Local Accessibility

3.2.1 Public Transport Accessibility – Weekday Peak

Figures 3.1 and 3.2 confirm the availability of bus services in the morning weekday peak period, which has been assumed to be 07:00 – 09:00 for the purpose of this appraisal. National planning policy guidance suggests that 400m (equivalent to a 5min walk) represents a convenient distance which residents would be prepared to walk to access a bus service, however, given the rural nature of a number of the development sites, this appraisal has set a maximum journey time of 10min or 800m.

Figure 3.1 shows the proportion of Stonehaven which is accessible to a bus service which operates with a minimum of a 60min frequency in the morning peak. The location of the Toucks and East Newtonleys development sites are outwith a 10min walk of the bus service, however, the East Newtonleys site may have the potential to be served by the services which currently serve the Braehead or Dunnotter Mains bus stops.

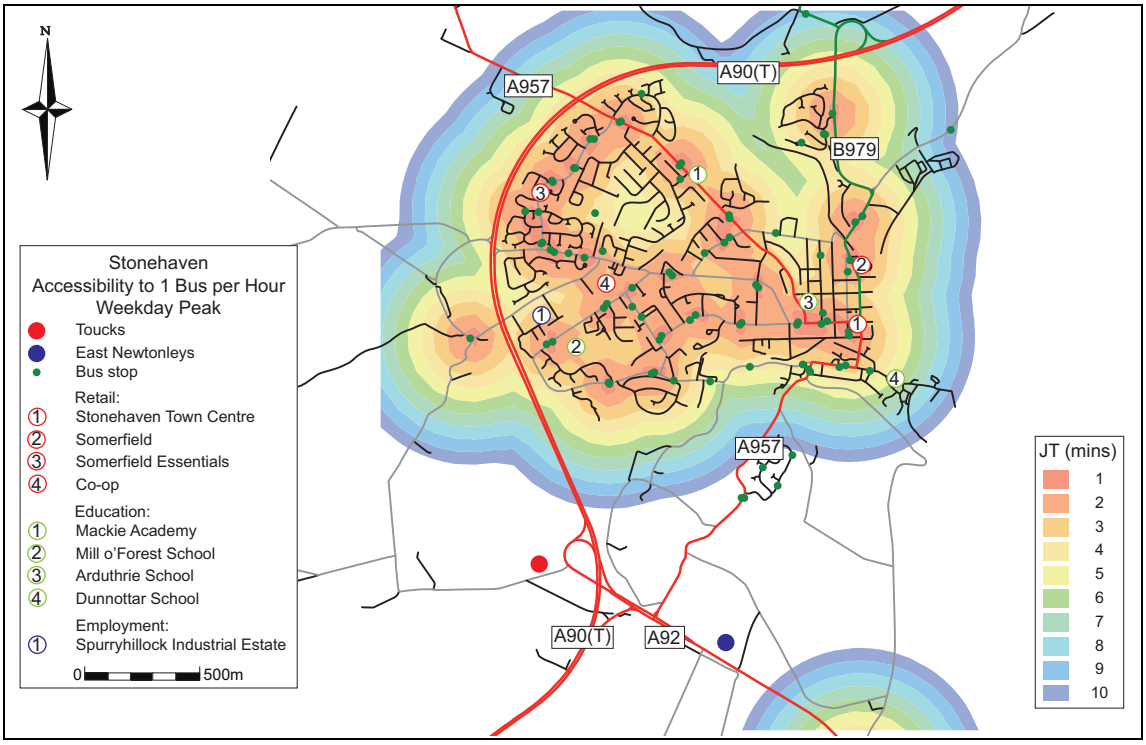

Figure 3.1 : Weekday Peak Accessibility to a 60min bus service

Figure 3.2 shows the proportion of Stonehaven which is accessible to a bus service which operates with a minimum of a 30min frequency in the morning peak. As can be seen, only a few bus stops are served by a 30min service frequency between 07:00 – 09:00. Both sites are located relatively remote from the bus stops which are served by anything more than a 60min frequency bus service.

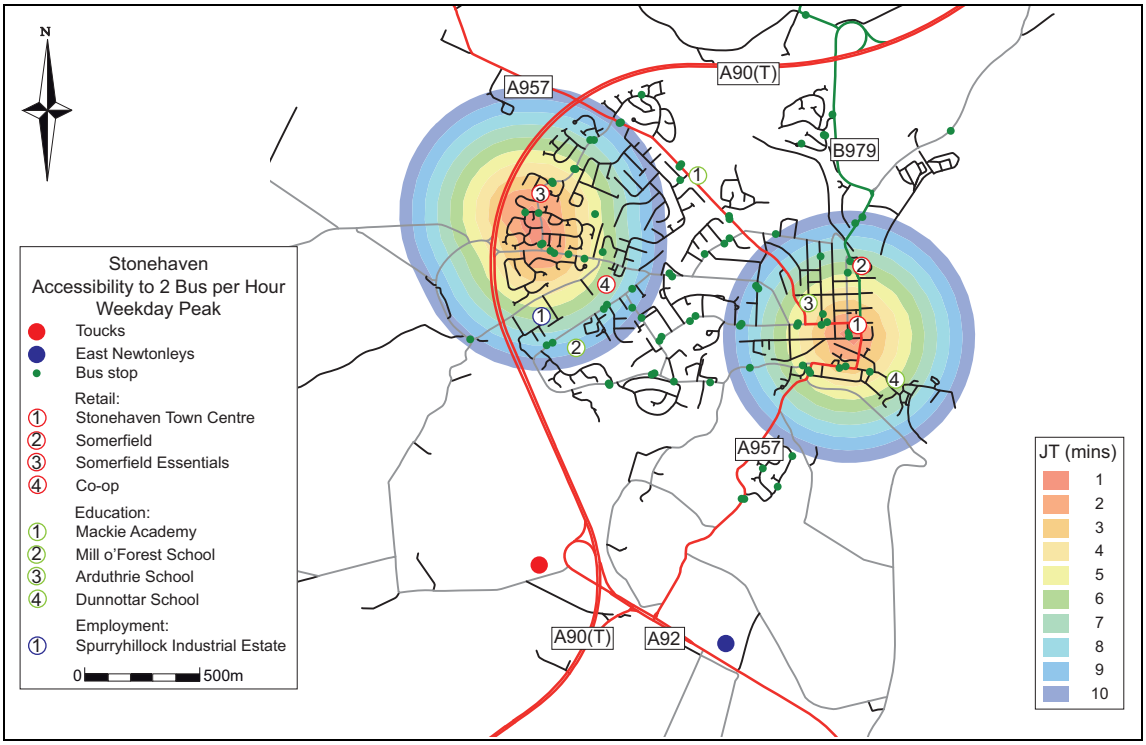

Figure 3.2 : Weekday Peak Accessibility to a 30min bus service

No Stonehaven bus stops are served by a four bus per hour service in the morning peak.

3.2.2 Public Transport Accessibility – Weekday Off-Peak

Figures 3.3 – 3.5 show the availability of bus services outwith the peak (12:00 – 14:00).

Figure 3.3 shows the proportion of Stonehaven which is accessible to a bus service which operates with a minimum of a 60min frequency in the weekday off-peak. The majority of Stonehaven is shown to be located within a 10min walk of a 60min frequency bus service. A greater proportion of the town has access to a 60min service frequency in the off-peak when compared to the morning peak period. For example, Braehead is shown to be served by a 60min service outwith the peak, but no service in the morning peak. As can be seen from the Accession output, a large proportion of the East Newtonleys site is located within a 10min walk of bus stops which provide access to a 60min service frequency. The Toucks site is shown to be in a relatively remote location in relation to existing public transport service provision.

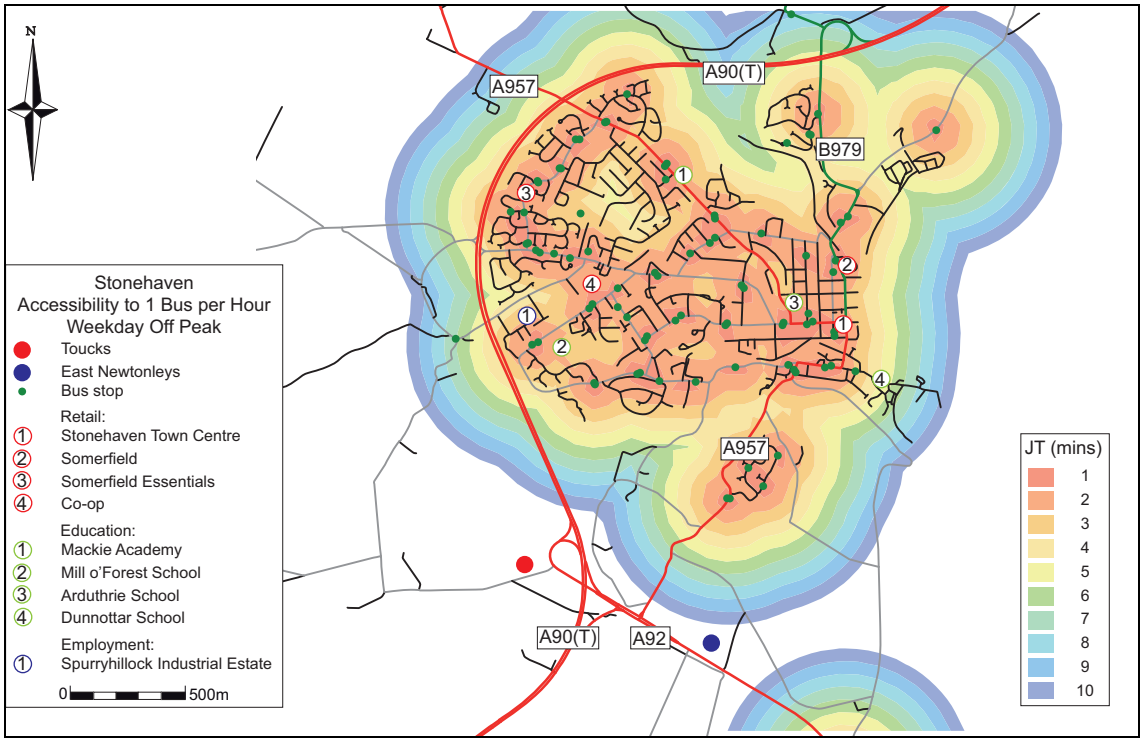

Figure 3.3 : Weekday Off-Peak Accessibility to a 60min bus service

Figure 3.4 shows the proportion of Stonehaven which is accessible to a bus service which operates with a minimum of a 30min frequency in the weekday off-peak. As with the previous appraisal of a 60min service frequency, the residential area at Braehead is served by a 30min service (the Stonehaven town bus service) between 12:00 – 14:00. This results in a proportion of the East Newtonleys site being located within a 10min walk of existing services which can be accessed from Braehead bus stops. This proportion is, however, reduced from that which is within a 10min walk of a 60min service frequency. The Toucks site is again relatively remote from the existing bus service provision.

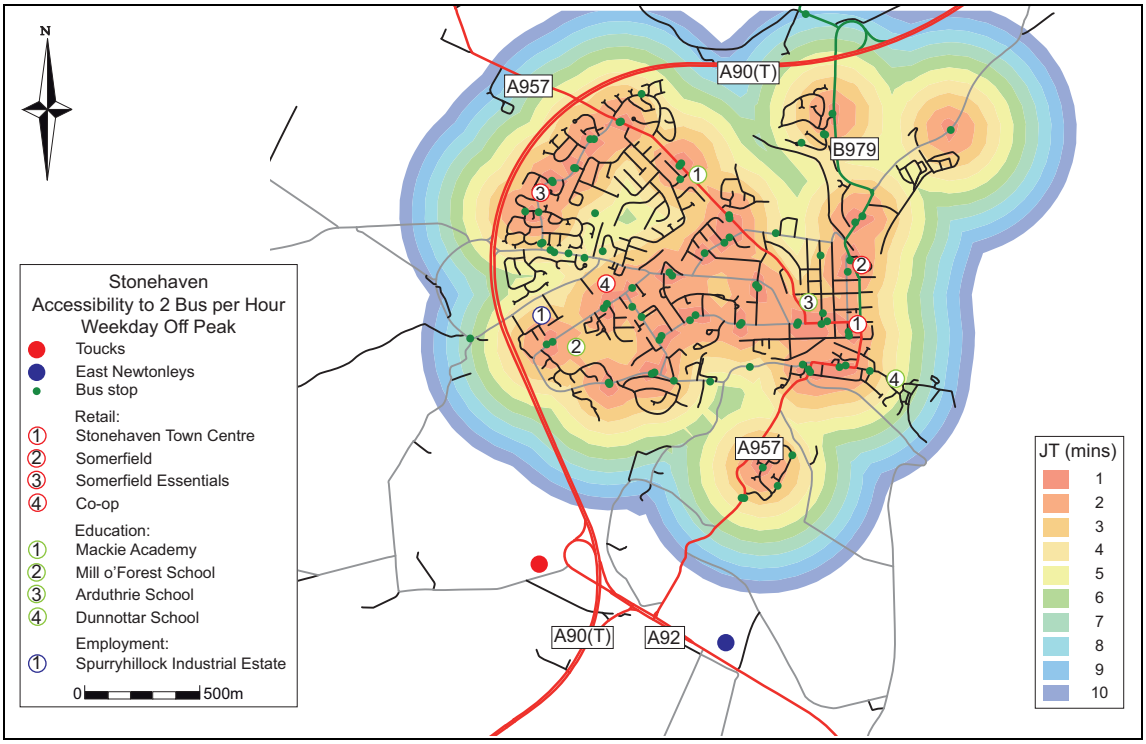

Figure 3.4 : Weekday Off-Peak Accessibility to a 30min bus service

Figure 3.5 shows the proportion of Stonehaven which is accessible to a bus service which operates with a minimum of a 15min frequency in the weekday off-peak. The output confirms that only a small proportion of Stonehaven has access to a 15min service frequency.

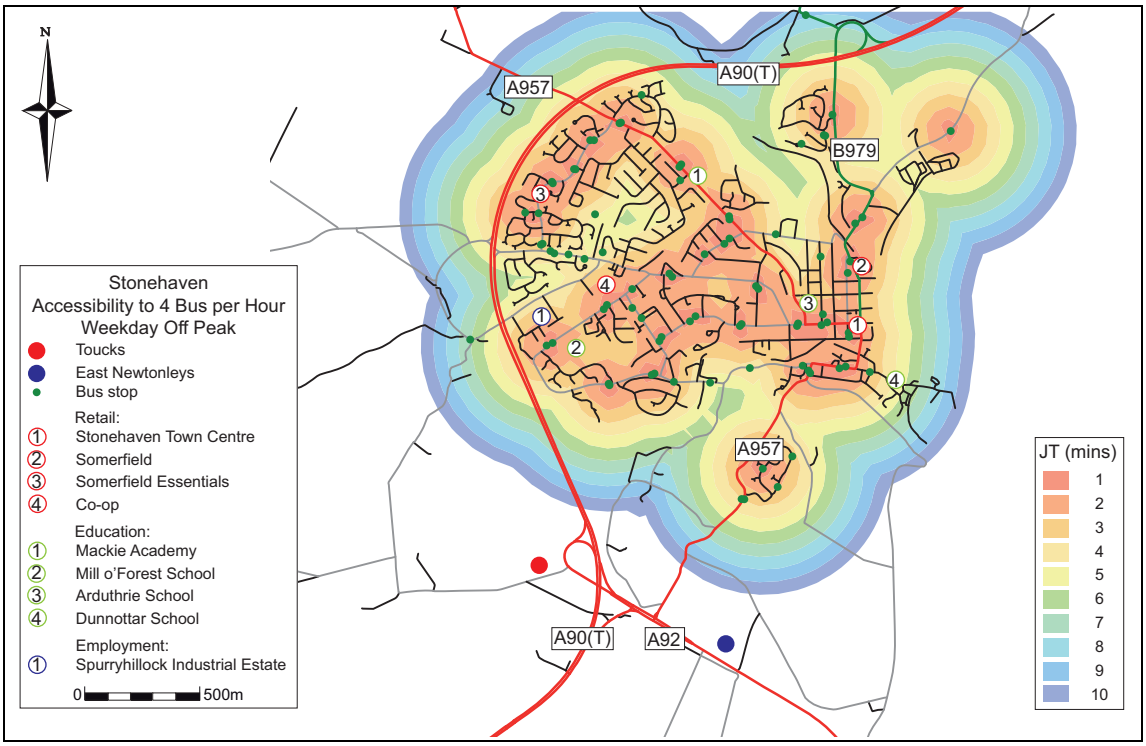

Figure 3.5 : Weekday Off-Peak Accessibility to a 15min bus service

3.3 Accessibility Appraisal – Network Accessibility

3.3.1 Pedestrian and Cycle Accessibility

Figures 3.6 – 3.9 show the accessibility to local amenities on foot and by cycle, of the Toucks and East Newtonleys sites. For the purpose of this study, the approximate location of the sites was assumed. Given the expected size of a number of the development sites, the location of the centre of the site could vary from that which has been assumed. It is, however, expected that the assumed site centroid locations will enable a robust comparison to be made between accessibility of the two sites.

Figures 3.6 and 3.7 show the predicted accessibility of the two potential development sites on foot. It is considered that Accession has underestimated the severance issues generated by the A90(T) and has potentially overestimated the accessibility of the Toucks site. Even with the potential impact on the robustness of the appraisal, no amenities are shown to be within a 20min walk of the Toucks site. While this is also true for the East Newtonleys site, the edge of Stonehaven town centre is shown to be only marginally further than a 20min walk of the site. Stonehaven rail station is located outwith a 20min walk of both sites.

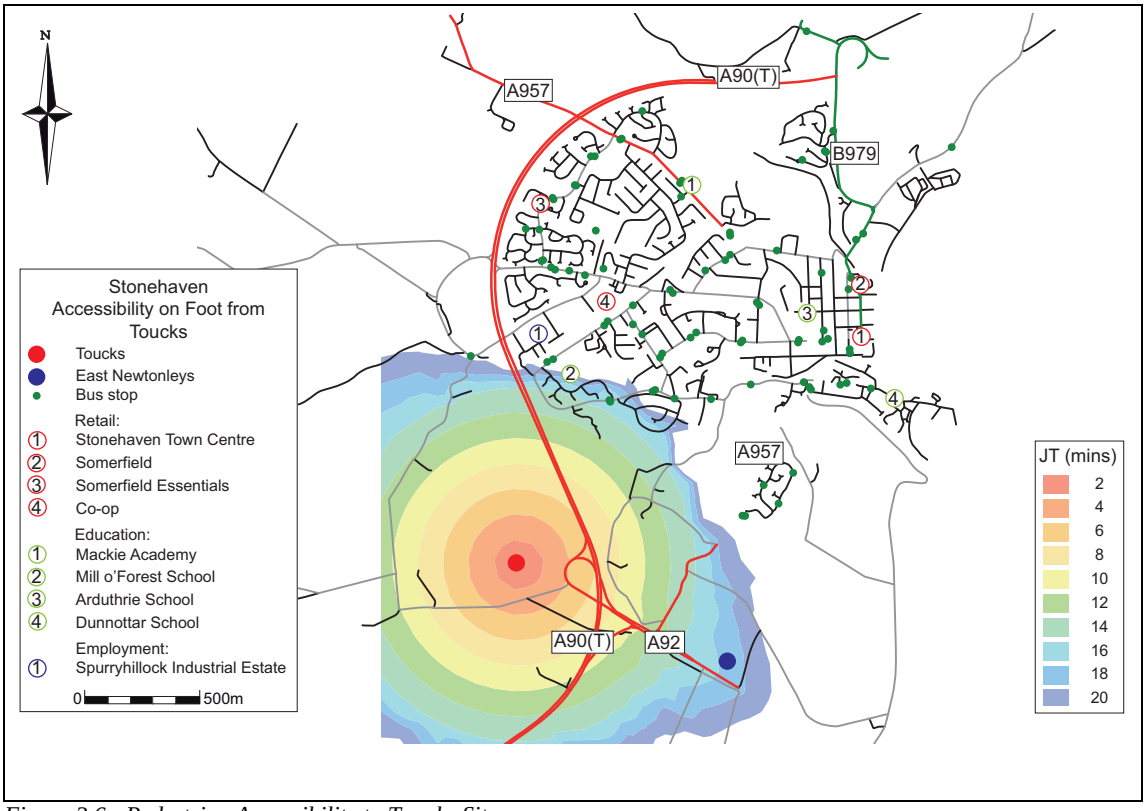

Figure 3.6 : Pedestrian Accessibility to Toucks Site

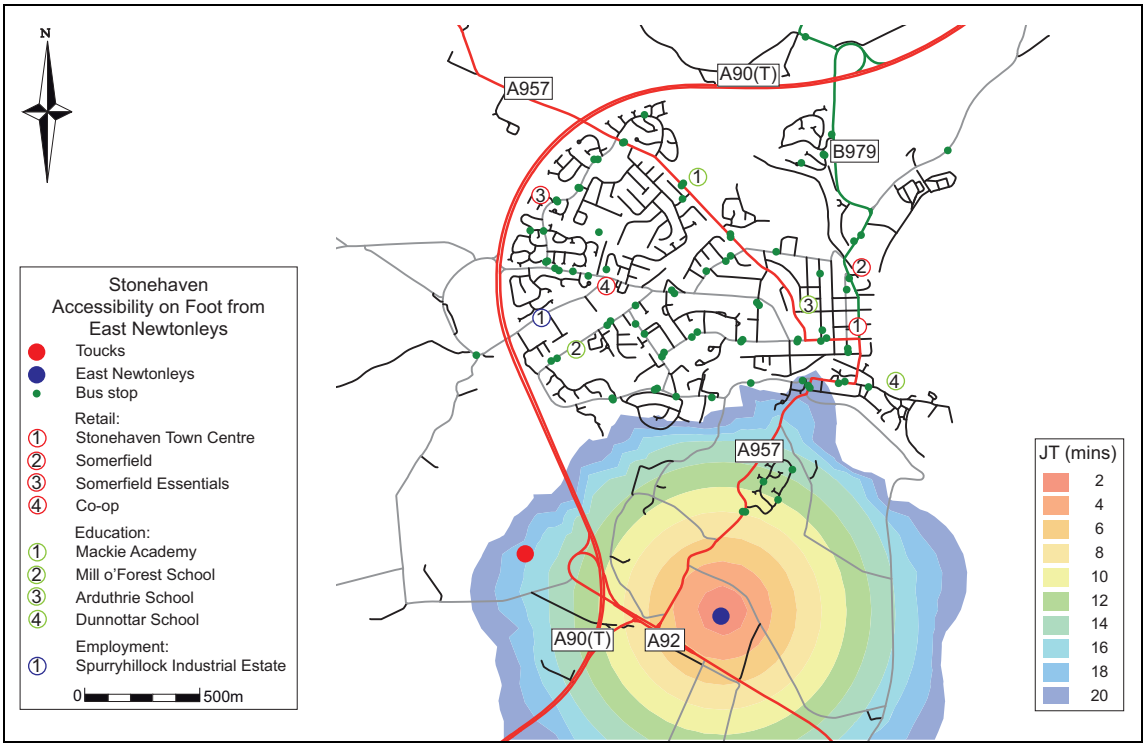

Figure 3.7 : Pedestrian Accessibility to East Newtonleys Site

Figures 3.8 and 3.9 show the predicted accessibility of the two potential development sites by cycle. The compact nature of Stonehaven results in both sites being located within a 20min cycle of the whole town. East Newtonleys is located within a 10min cycle of Stonehaven town centre, whereas it is over 10min from Toucks. Both sites are located around a 12min cycle from the Spurryhillock Industrial Estate and all Stonehaven schools are located within a 14min cycle of the East Newtonleys site and a 16min cycle of the Toucks site.

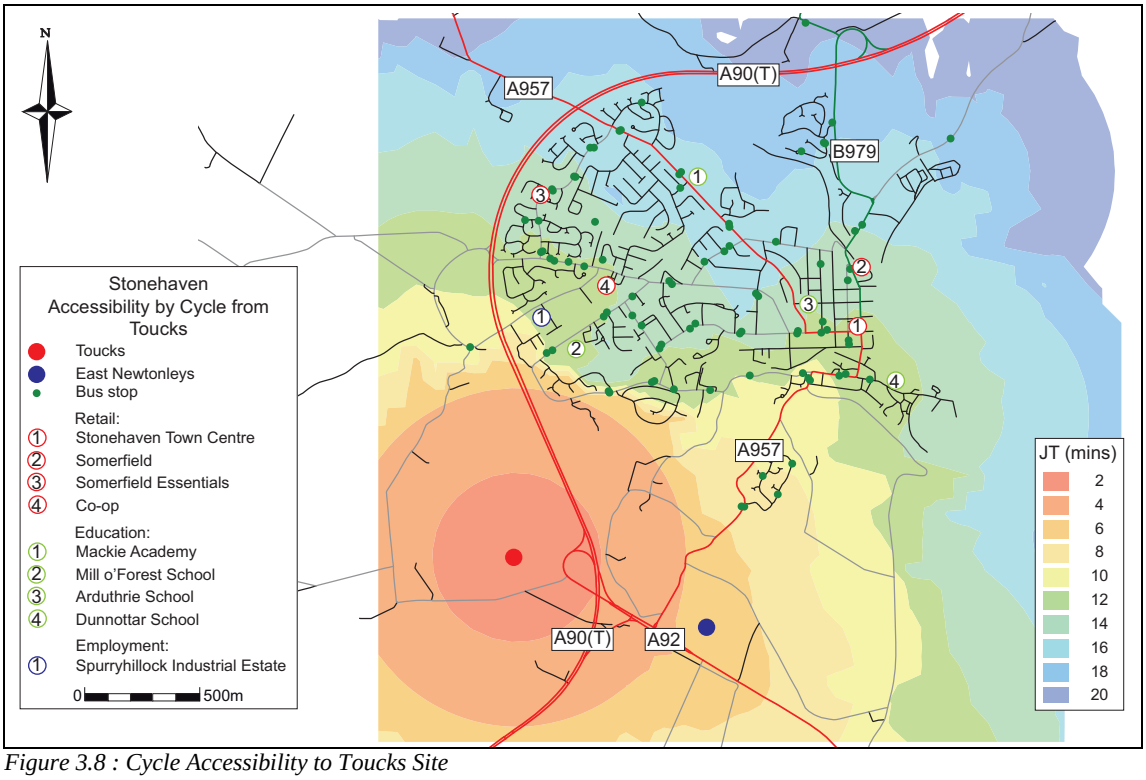

Figure 3.8 : Cycle Accessibility to Toucks Site

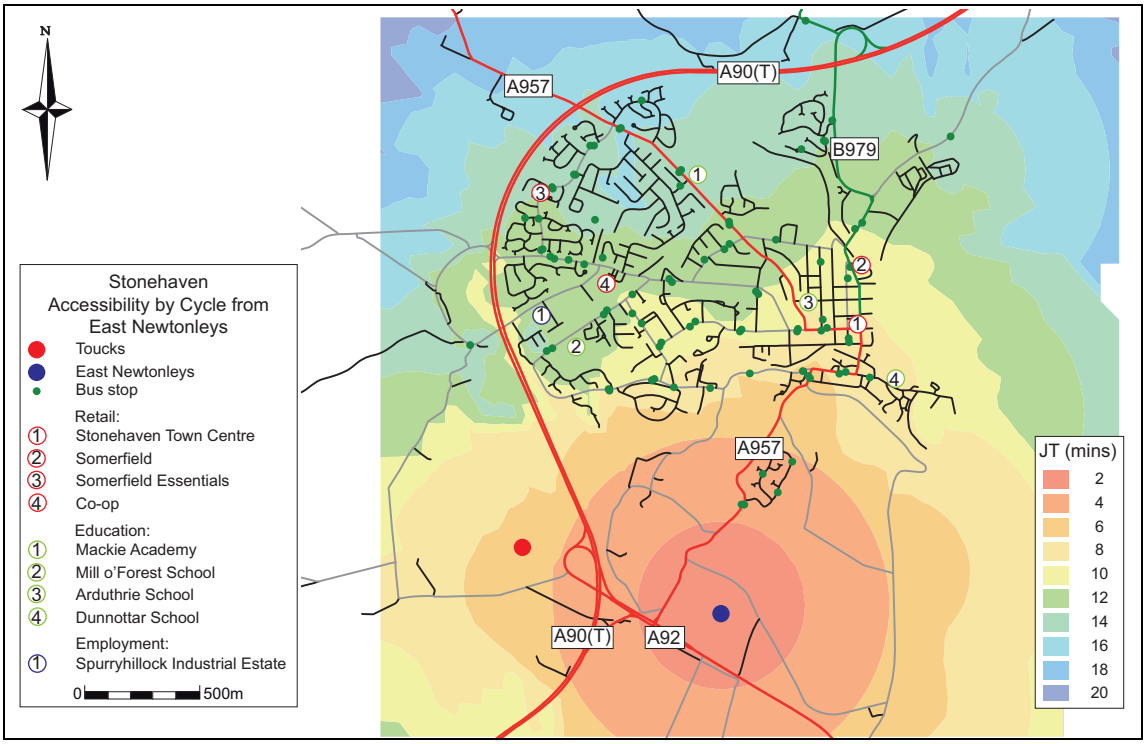

Figure 3.9 : Cycle Accessibility to East Newtonleys Site

3.3.2 Census Population Data Analysis

Tables 3.1 and 3.2 summarise the results of the accessibility appraisal with regard to the proximity of the sites to existing Stonehaven residents.

Table 3.1 : Accessibility to Toucks Site

Pedestrian Accessibility Journey Time (mins)	Population
14	210
16	189
18	144
Total	**399**

Cycle Accessibility Journey Time (mins)	Population
6	543
10	149
12	2,707
14	4,259
16	2,223
Total	**9,881**

Table 3.2 :Accessibility to East Newtonleys Site

Pedestrian Accessibility Journey Time (mins)	Population
18	144
20	149
Total	**293**

Cycle Accessibility Journey Time (mins)	Population
6	293
8	1,706
10	2,730
12	3,352
14	1,551
16	249
Total	**9,881**

The results in Tables 3.1 and 3.2 suggest that a greater number of Stonehaven residents live within a 20min walk of the Toucks site when compared to the East Newtonleys site. It is

suggested that the age of the Census data (2001) may have had an impact on the results of the appraisal.

It is expected that the age of the data has resulted in the omission of residents living in the recently constructed residential area at Braehead. As a result, the analysis predicts that only 293 residents live within a 20min walk of the East Newtonleys site, whereas 543 are predicted to live within a 20min walk of the Toucks site. Given the age of the Census data, it is suggested that these results be treated with caution.

The East Newtonleys site is shown to be more accessible than the Toucks site by cycle with a total population of 4,729 predicted to live within a 10min cycle of the site, which compares favourably with a population of 692 who live within a 10min cycle of the Toucks site.

3.4 Bus Accessibility to Aberdeen

The accessibility of the sites to the Aberdeen was appraised based on local bus services. Rail service information could also be included in the appraisal to enable a fuller appraisal of the town's accessibility to the centre of Aberdeen to be undertaken.

Figures 3.10 and 3.11 show the accessibility of Stonehaven to the centre of Aberdeen by bus with a maximum journey time of 50min displayed for the morning peak and off-peak scenarios. The results of the appraisal suggests that it would require a journey time of over 50min to access the centre of Aberdeen from both sites. A large proportion of Stonehaven is shown to be within a 50min journey of the city centre in the morning peak period with a reduced proportion of the town within a 50min journey of Aberdeen during the day.

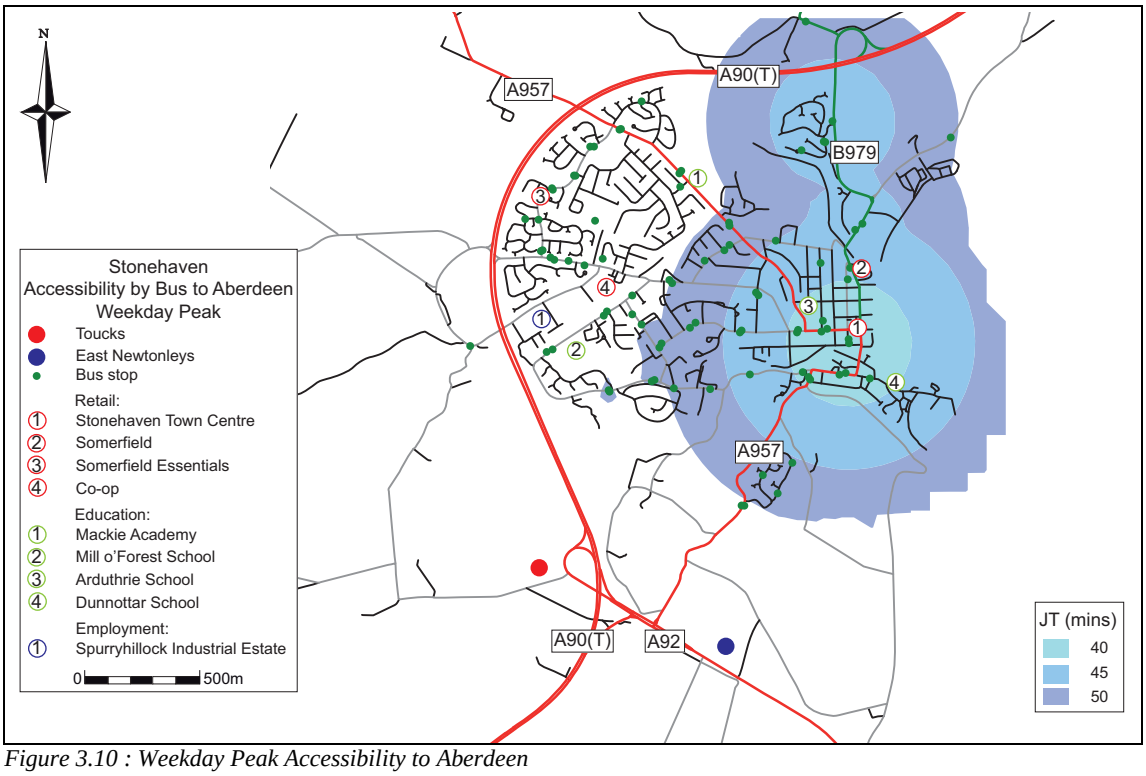

Figure 3.10 : Weekday Peak Accessibility to Aberdeen

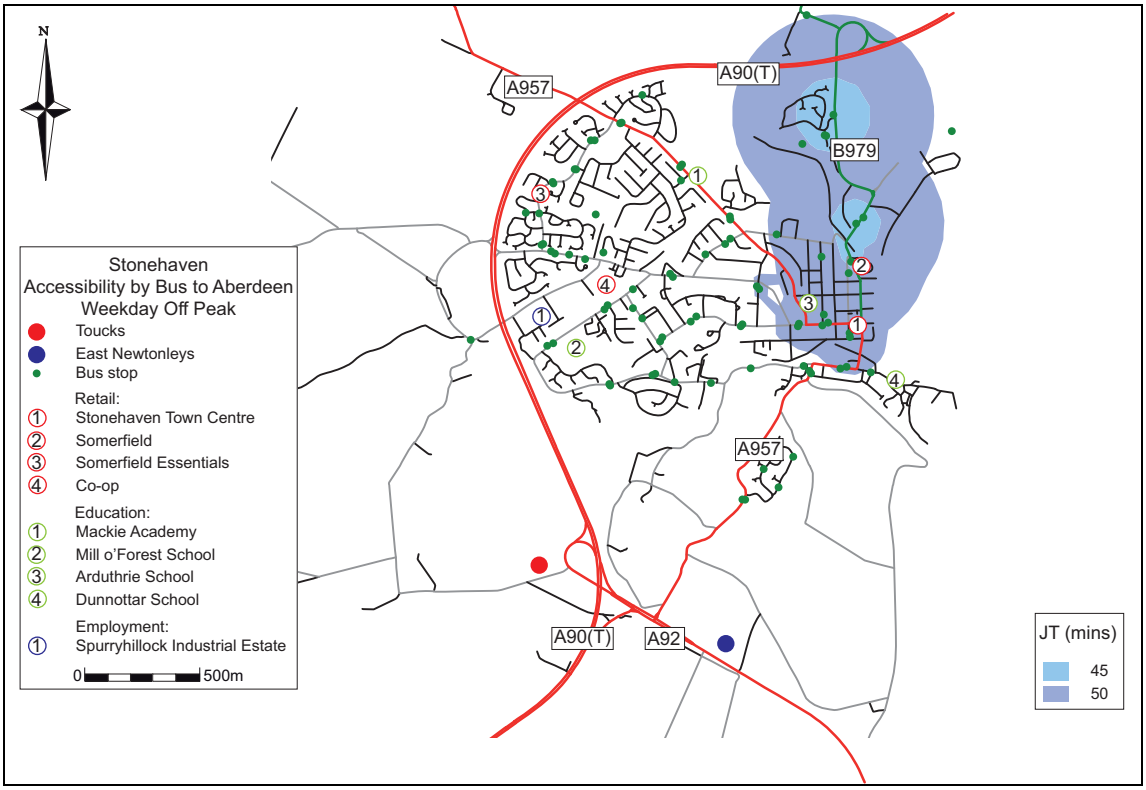

Figure 3.11 : Weekday Off-Peak Accessibility to Aberdeen

4 SUMMARY AND CONCLUSIONS

4.1 Summary

SIAS has been commissioned by Aberdeenshire Council under the term commission to provide consultancy advice with regard to the development of Stonehaven.

The accessibility of the following potential development sites has been appraised:

- Toucks
- East Newtonleys

Accession software has been used to appraise the accessibility of the above sites by bus, cycle and on foot. ATCO Cif public transport data which was exported 11 February 2009, and 2001 Census population data has been used to inform this appraisal.

4.2 Conclusions

Both potential development sites are located on the southern edge of Stonehaven. As a result, the majority of local amenities are situated outwith a 20min walk of the sites.

The Toucks site is located to the west of the A96(T) which provides a barrier to movement between the site and Stonehaven. It is suggested that development of this site will need to be supported by the provision of new pedestrian/cycle crossing facilities to minimise the impact of the A96(T) on movement to and from the site.

The East Newtonleys site is shown to be more accessible by bus, cycle and walk than the Toucks site, with the centre of Stonehaven shown to be around an 8min cycle from the town

centre and just over a 20min walk from the centre. This compares to the Toucks site, which is located around a 12min cycle and over a 30min walk from the town centre.

A large proportion of the East Newtonleys site is shown to be within a 10min walk of a 60min frequency off-peak bus service. It is expected that it will be relatively straightforward to integrate the East Newtonleys site into the existing bus service network ,whereas the Toucks site is relatively remote from existing local bus services.

It is considered that the East Newtonleys site is in a more accessible location than the Toucks site.

4.3 Further Work

It is suggested that the impact of future infrastructure and service improvements should be tested to provide a detailed appraisal of the accessibility of the development sites.

In addition to considering local travel by bus, it is suggested that rail services should be included in any detailed accessibility analysis to enable the accessibility of the potential development sites to be appraised on a wider network for all modes of travel

B TRAFFIC QUEUE LENGTH DATA

Table B.1 : A92/A957 Traffic Queue Length Data

Queue Length Survey - Stonehaven									13 January 2009		Junction 2		
	From Stonehaven on the A957				From A92 East - Right turn to A957				From A92 West (no queue)				
			Right Lane				Right Lane				Right Lane		
Time	Min	Maximum	Min	Maximum	Min	Maximum	Min	Maximum	Min	Maximum	Min	Maximum	Time
06:30				2				0					06:30
06:35				0				0					06:35
06:40				0				0					06:40
06:45				1				0					06:45
06:50				0				1					06:50
06:55				1				0					06:55
07:00				1				0					07:00
07:05				1				1					07:05
07:10				1				0					07:10
07:15				4				0					07:15
07:20				2				0					07:20
07:25				2				0					07:25
07:30				2				0					07:30
07:35				3				1					07:35
07:40				2				0					07:40
07:45				2				0					07:45
07:50				3				0					07:50
07:55				1				0					07:55
08:00				3				0					08:00
08:05				2				0					08:05
08:10				3				0					08:10
08:15				4				0					08:15
08:20				1				0					08:20
08:25				1				2					08:25
08:30				3				1					08:30
08:35				7				0					08:35
08:40				2				0					08:40
08:45				2				0					08:45
08:50				4				0					08:50
08:55				1				0					08:55
09:00				1				1					09:00
09:05				6				2					09:05
09:10				1				3					09:10
09:15				1				0					09:15
09:20				1				0					09:20
09:25				3				2					09:25
16:00				3				0					16:00
16:05				2				0					16:05
16:10				5				1					16:10
16:15				2				1					16:15
16:20				4				0					16:20
16:25				1				0					16:25
16:30				1				0					16:30
16:35				1				0					16:35
16:40				3				1					16:40
16:45				5				2					16:45
16:50				3				0					16:50
16:55				3				2					16:55
17:00				5				0					17:00
17:05				12				1					17:05
17:10				8				0					17:10
17:15				4				0					17:15
17:20				5				1					17:20
17:25				12				0					17:25
17:30				9				0					17:30
17:35				1				1					17:35
17:40				8				2					17:40
17:45				7				0					17:45
17:50				7				1					17:50
17:55				2				1					17:55
18:00				1				0					18:00
18:05				12				0					18:05
18:10				2				0					18:10
18:15				1				0					18:15
18:20				11				4					18:20
18:25				2				1					18:25
18:30				2				0					18:30
18:35				1				2					18:35
18:40				4				0					18:40
18:45				2				0					18:45
18:50				1				2					18:50
18:55				1				0					18:55

These queues were caused by HGV's crawling up the hill out of Stonehaven, not by the junction layout and traffic flows.