

# **Kintore Traffic Capacity Study**

**Aberdeenshire Council**

**S-Paramics Initial Testing Results**





## KINTORE TRAFFIC CAPACITY STUDY

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## **1 INTRODUCTION**

### **1.1 Introduction**

1.1.1 Aberdeenshire Council requested that SIAS Limited (SIAS) undertake an assessment of the traffic impact of proposed development sites in Kintore, using the Kintore S-Paramics traffic model originally developed in 2008.

1.1.2 On the advice of Aberdeenshire Council, the model considers committed and Local Plan content to 2012, then considers in isolation, each of the potential development areas outlined by Aberdeenshire Council to assess the impact on the road network of various 2016 forecast scenarios.

### **1.2 Objectives**

1.2.1 The primary purpose of this assessment is to aid and inform Aberdeenshire Council on the potential impact on the road network of various development scenarios.

1.2.2 The principal objectives of this study were to:

- Evaluate the road network impact of the potential development areas
- Evaluate the conceptual supporting infrastructure options proposed by Aberdeenshire Council
- Provide an initial assessment of accessibility opportunities for all modes, particularly public transport, pedestrians and cyclists (provided in Appendix B)

### **1.3 Kintore Model Background**

1.3.1 The Base Kintore S-Paramics model was completed in 2008 using observed data from 2007 and is representative of 2007 conditions.

1.3.2 The Kintore models represent the following AM and PM peak periods:

- AM Peak Period      07:00 – 10:00
- PM Peak Period      16:00 – 19:00

1.3.3 The peak hours for the Kintore model were calculated from the original 2007 survey data as:

- AM Peak Hour      07:15 – 08:15
- PM Peak Hour      16:45 – 17:45

1.3.4 Figure 1.1 shows the Kintore study area.



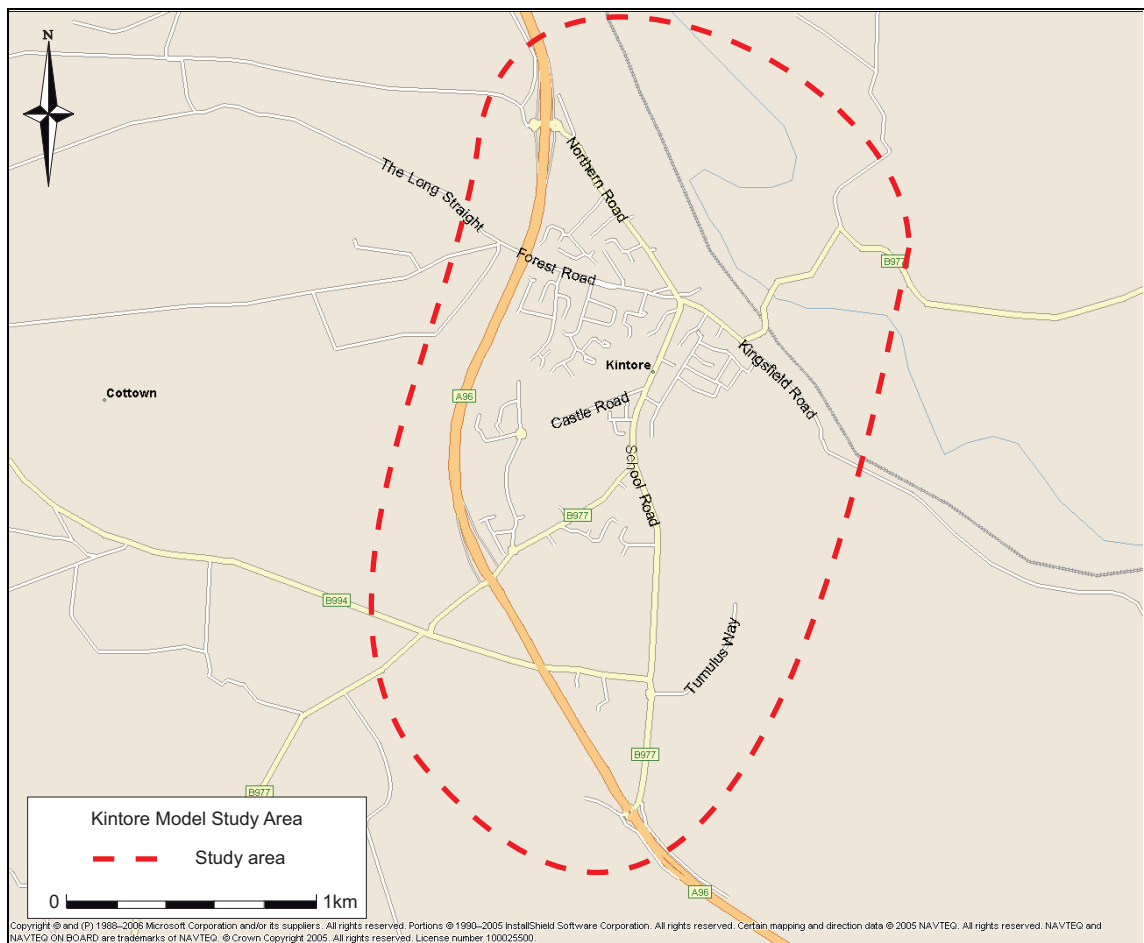


Figure 1.1 : Study Area

## 1.4 Test Scenarios

- 1.4.1 The scenarios requested by Aberdeenshire Council which have been tested as part of this study are detailed in Table 1.1.



Table 1.1 : Test Scenarios

Test	Model Content
2012 Do-Minimum	
2012 Test 1	B994/ B977/ Tumulus Way - new roundabout
2012 Test 2	B994/ B977/ Tumulus Way - new staggered signal controlled junction
2012 Test 3	New south facing slips B994 to A96
2012 Test 4	Test 3 plus closure of Broomhill Roundabout
2012 Test 5	New south facing slips B977 to A96
2016 Area A	2012 Do-Minimum & 2016 development (20Ha emp and 800 houses)
2016 Area A & Imp	Part time sigs at Broomhill B994/ B977/ Tumulus Way - new roundabout Segregated left turn slip from B977 to A96
2016 Area B	2012 Do-Minimum & 2016 development (20Ha emp and 800 houses)
2016 Area B & Imp	New south facing slips B994 to A96 Part time sigs at Broomhill Closure of A96 access to development Roundabout at B977 access to development B977/ B994 roundabout upgraded
2016 Area C	2012 Do-Minimum & 2016 development (20Ha emp and 800 houses)
2016 Area C & Imp	Segregated left turn slip from B977 to A96 Part time sigs at Broomhill
A96 Traffic Test 1	Area C & Imp, plus all traffic uplifted to match traffic leaving Inverurie
A96 Traffic Test 2	Area C & Imp, plus A96 traffic uplifted to match traffic leaving Inverurie

1.4.2 The first stage of testing provided the development of a 2012 Do-Minimum model, containing all committed development to 2012. Five infrastructure improvement tests were then carried out using the 2012 Do-Minimum model.

1.4.3 Testing then focused on 2016 with the inclusion of a 20Ha employment and 800 housing unit development. The 2016 development has been assessed at three possible locations, initially without any infrastructure improvements, then with improvements.

1.4.4 The test scenarios detailed in Table 1.1 have been evaluated using

- Model observations
- Traffic flow comparison at key junctions
- Average queue length comparisons
- Average journey time comparisons



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## 2 KINTORE 2012 DO-MINIMUM

### 2.1 Introduction

2.1.1 The Kintore 2012 Do-Minimum model has been developed from the 2007 Kintore Base model. NRTF central growth has been applied to traffic travelling on the A96, B977 and B994. The NRTF central growth factors applied, from 2007 to 2012 were:

- Lights: 1.077
- Heavies: 1.075

### 2.2 2012 Committed Developments

2.2.1 The 2012 committed development content was agreed with Aberdeenshire Council and is detailed in Table 2.1.

*Table 2.1 : 2012 Committed Developments*

Development	Type	Area
Braefarm	Employment	Midmill Call Centre
	Housing	50 Houses and 36 housing association flats
Woodside Croft	Housing	Approx 200 houses
Midmill South	Office	GFA 866 m2
	Workshop	GFA 3,322 m2
	Warehousing	GFA 10,113 m2
Retail Development	Retail	GFA 1,696 m2
	Petrol Filling Station	8 Pump
Midmill South East	Office	GFA 3,614 m2
	Light Industry	GFA 5,421 m2
	Warehousing (storage)	GFA 20,267 m2
	Warehousing (commercial)	GFA 4,045 m2
Midmill East	Office	GFA 2,550 m2
	Light Industry	GFA 515 m2

2.2.2 The 2012 committed development locations are shown in Figure 2.1.



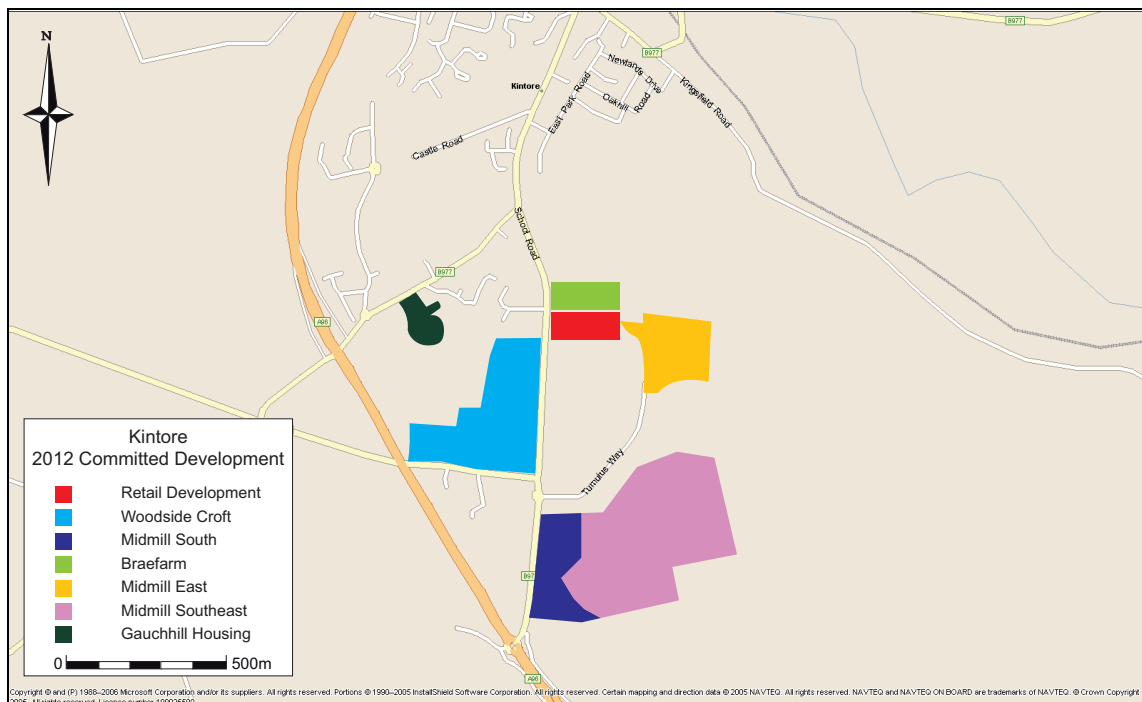


Figure 2.1 : 2012 Committed Development Locations

2.2.3 Access to the Braefarm development is via a new roundabout on the B977. The retail development is accessed by a new junction approximately 100m south of the Braefarm Roundabout. The Woodside Croft development has two access points on the B994; the Midmill developments are accessed via Tumulus Way.

**2.3 Committed Development Traffic Demand**

2.3.1 For the Midmill Call Centre element of the Braefarm development, peak hour trip totals and number of employees were provided by Aberdeenshire Council. The total number of proposed houses were also supplied by Aberdeenshire Council. Peak period trip totals were calculated using the trip rates shown in Table 2.2.

2.3.2 Peak hour trips were supplied by Aberdeenshire Council for the Woodside Croft housing development. Peak period trip expansion factors were calculated using the trip rates shown in Table 2.2.

2.3.3 For the Midmill South industrial estate, a transport statement was supplied by Aberdeenshire Council (*South Industrial Estate, Transport Statement*, Caledonian Logistics, July 2008) which detailed part of the development (warehousing) and provided peak period trips. Gross floor area dimensions were provided by Aberdeenshire Council for the workshop and office areas of the development and peak period trips were calculated from this, using trip rates extracted from TRICS 2008(b) v6.2.2.

2.3.4 A transport assessment was provided by Aberdeenshire Council for the retail development (*Proposed Retail Development, Kintore*, Colin Buchanan, September 2008). This provided peak period trip totals for the PM peak, and trip rates for the AM peak, for both the retail and petrol filling station elements of the development.



2.3.5 Gross floor area information was provided by Aberdeenshire Council for the Midmill east and southeast developments. Peak period trip totals were calculated using the trip rates shown in Table 2.2, extracted from TRICS 2008(b) v6.2.2.

2.3.6 Trip rates shown below were extracted from TRICS 2008(b) v6.2.2 and used to calculate trip totals where necessary. Trip rates were not required for the retail development in the PM peak as full trip information was provided within the transport assessment extracts provided by Aberdeenshire Council.

Table 2.2 : Committed Development Trip Rates

Development Type	07:00 - 10:00		16:00 - 19:00	
	In	Out	In	Out
Housing	0.410	0.976	1.087	0.728
Privately owned Flat	0.158	0.260	0.320	0.248
Office (100 sqm GFA)	3.247	0.732	0.732	2.799
Office (per employee)	0.820	0.178	0.157	0.699
Industrial Unit (100 sqm GFA)	0.671	0.534	0.259	0.792
Retail Unit (100 sqm GFA)	10.488	6.676	Not Required	
Petrol Filling Station (1 bay)	23.303	22.896	Not Required	
Warehouse Industrial (100 sqm GFA)	0.970	0.466	0.402	0.847
Warehouse Commercial (100 sqm GFA)	0.671	0.534	0.259	0.792

2.3.7 The total number of trips generated by the committed developments are shown in Table 2.3.

Table 2.3 : Peak Period Trip Totals

Development	AM	PM
Braefarm	303	314
Woodside Croft	261	432
Midmill South	117	122
Retail Development	614	914
Midmill East	120	105
Midmill South East	340	281

## 2.4 Committed Development Trip Distribution

2.4.1 Information regarding the distribution of trips was supplied by Aberdeenshire Council. For the Braefarm development, an extract from a Transport Assessment provided a distribution derived from a gravity model:

- 38.0% A96 North
- 46.5% A96 South
- 20.4% B994 West

2.4.2 As this distribution added to over 100% it was factored to total 100% as follows:

- 36.2% A96 South
- 44.3% A96 North
- 19.5% B994 West



- 2.4.3 The distribution for the Woodside Croft development was provided by Aberdeenshire Council as:
- 58% Aberdeen
  - 2% Dyce
  - 2% Blackburn
  - 4% Kemnay
  - 11% Inverurie
  - 22% Kintore
  - 1% Newmachar
- 2.4.4 The traffic distribution for the retail development was provided in the transport assessment as:
- 80% Kintore
  - 10% Kemnay
  - 10% Blackburn
- 2.4.5 No traffic distribution information was supplied for the Midmill South development. The trip distribution from Section 2.4.2 was applied to this development, as agreed with Aberdeenshire Council.
- 2.4.6 Aberdeenshire Council proposed to apply the trip distribution at the existing Tumulus Way/B994 roundabout to the Midmill East and Southeast developments. This location recently surveyed by Aberdeenshire Council and this data was used to verify the accuracy of the base model.



### 3 2012 TESTING

#### 3.1 Introduction

3.1.1 Five 2012 tests have been carried out using the 2012 Do-Minimum model. The 2012 tests are detailed in Table 3.1.

*Table 3.1 : 2012 Tests*

Test	Model Content
2012 Test 1	B994/ B977/ Tumulus Way - new roundabout
2012 Test 2	B994/ B977/ Tumulus Way - new staggered signal controlled junction
2012 Test 3	New south facing slips B994 to A96
2012 Test 4	Test 3 plus closure of Broomhill Roundabout
2012 Test 5	New south facing slips B977 to A96

#### 3.2 2012 Do-Minimum

3.2.1 Details of the 2012 Do-Minimum model development are provided in Chapter 2.

#### 3.3 2012 Do-Minimum Model Observations

3.3.1 In the AM peak, queueing is observed on the B977 southbound from Broomhill Roundabout, with the queue extending onto the B994 eastbound for approximately 350m at 08:15. Queueing is also observed on the A96 southbound, reaching approximately 400m at 08:00.

3.3.2 No significant queueing was observed in the PM peak.

#### 3.4 2012 Test 1

3.4.1 In Test 1 the B994 has been re-aligned to connect into the B977/ Tumulus Way roundabout, the existing roundabout at this location has been upgraded as shown in Figure 3.1.



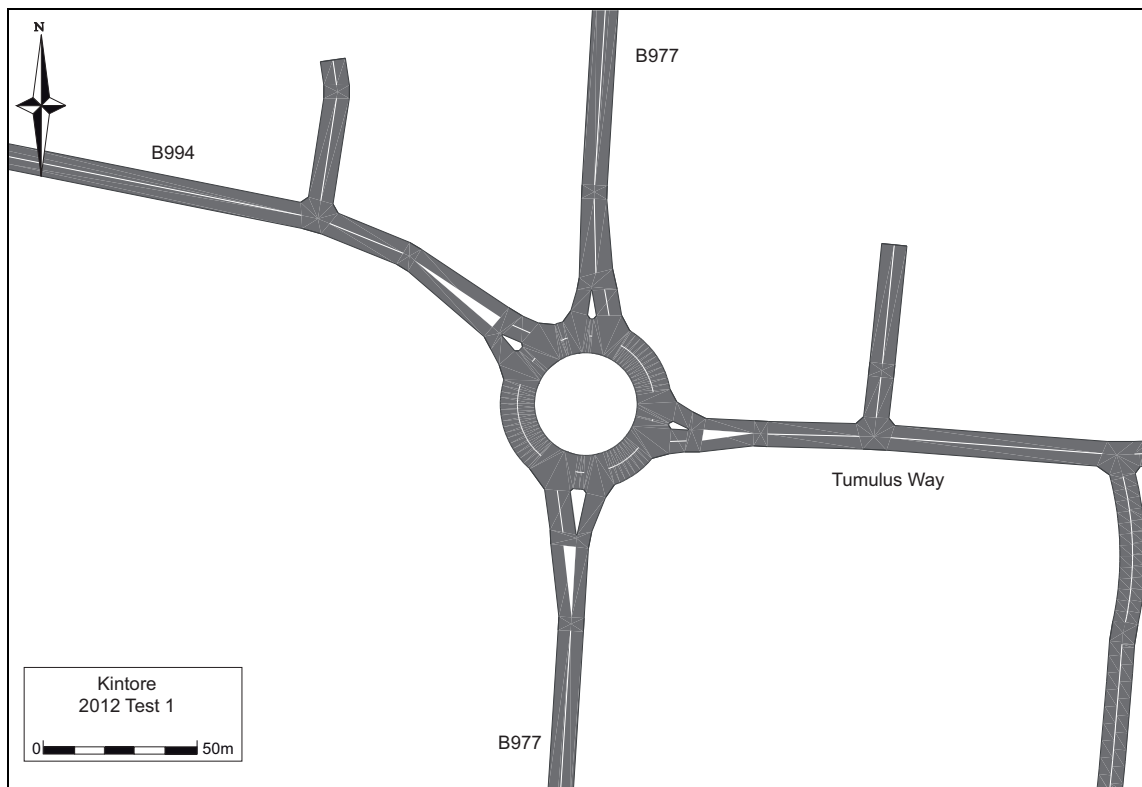


Figure 3.1 : 2012 Test 1

### 3.5 Test 1 Model Observations

- 3.5.1 In the AM peak, a queue forms on the B977 southbound from Broomhill Roundabout, reaching the new roundabout on the B977 by 07:30 and extending to approximately 150m past the roundabout by 08:15. Queueing is observed on the A96 southbound, reaching approximately 500m at 08:00.
- 3.5.2 No significant congestion is observed in the PM peak.

### 3.6 2012 Test 2

- 3.6.1 In Test 2 the roundabout at the B977/ Tumulus Way has been removed and replaced with a staggered signal controlled junction which also incorporates the B994/ B977 junction, as shown in Figure 3.2.



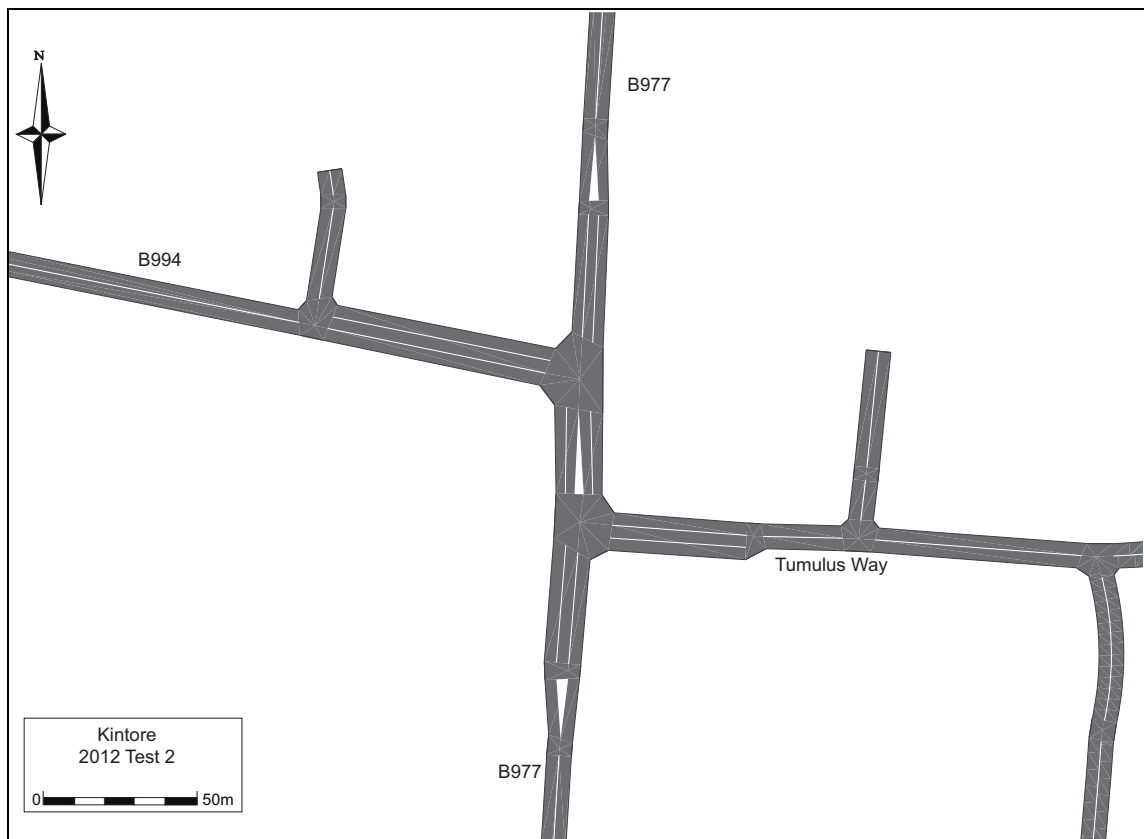


Figure 3.2 : 2012 Test 2

3.6.2 The signal stages and timings used are shown in Figure 3.2. A pedestrian stage is called every second cycle.



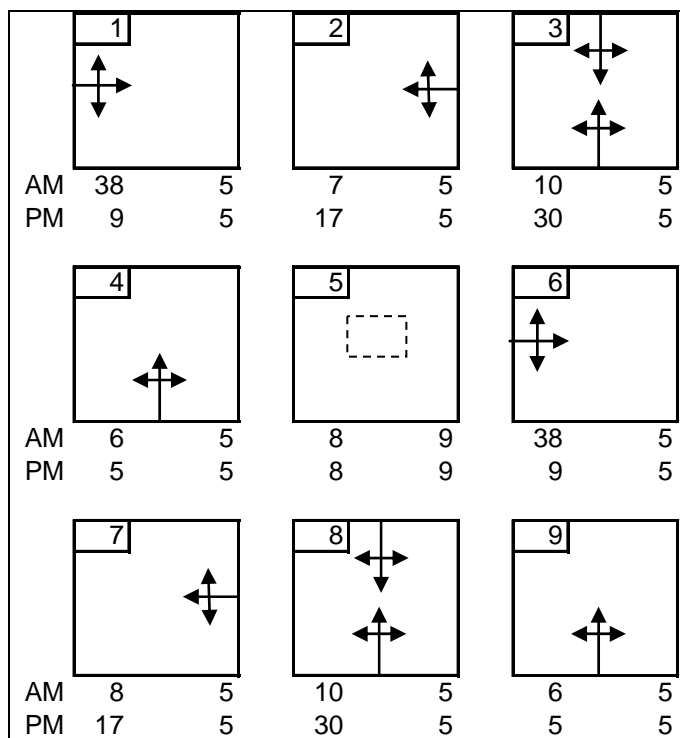


Figure 3.3 : Test 2 Signal Stages and Timings

**3.7 Test 2 Model Observations**

- 3.7.1 In the AM peak, queueing on the B977 southbound extends approximately 250m past the new signal junction by 08:15. The queue on the A96 southbound from Broomhill Roundabout is observed to be approximately 500m at 08:15.
- 3.7.2 No significant queueing is observed in the PM peak.

**3.8 2012 Test 3**

- 3.8.1 Test 3 is based on the 2012 Do-Minimum model and includes new south facing slip roads on the B994 (Kemnay Road) as it crosses the A96, as shown in Figure 3.4.

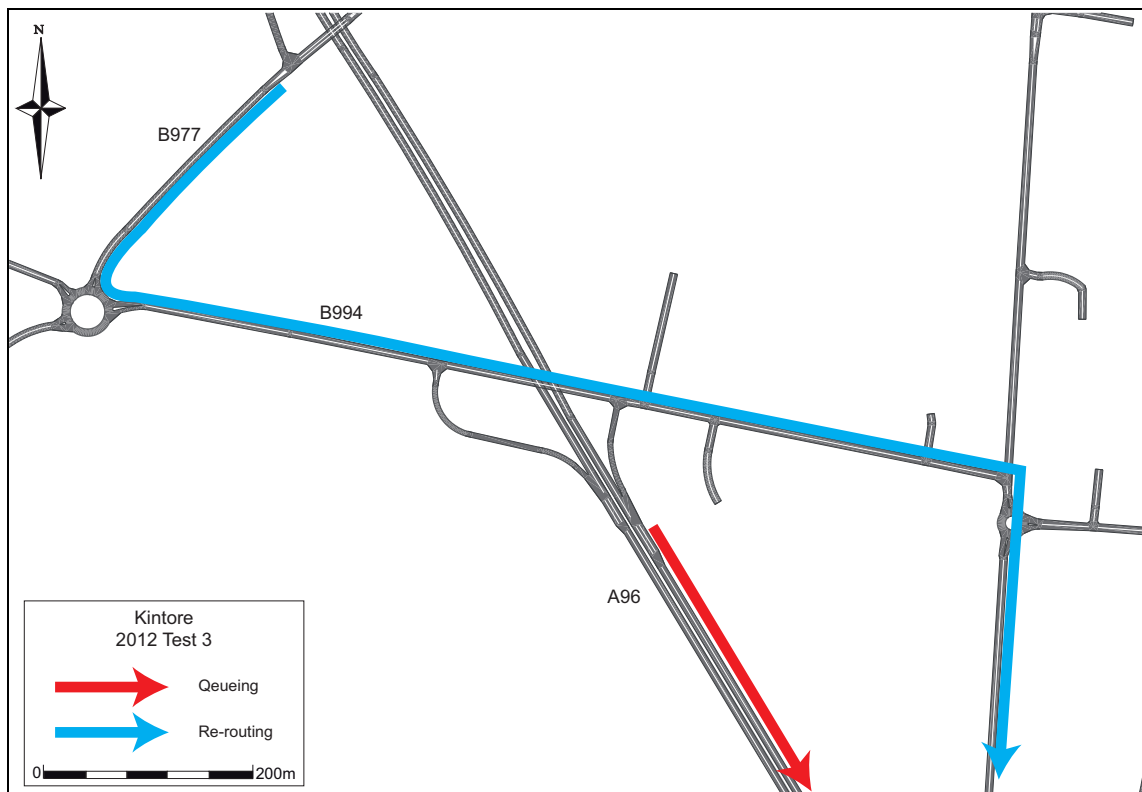


Figure 3.4 : 2012 Test 3

### 3.9 Test 3 Model Observations

- 3.9.1 The addition of the slip roads to and from the A96 provides southbound traffic a more direct route onto the A96. Queueing is observed on the A96 southbound from Broomhill Roundabout, with the queue reaching the slips by 07:35. With this section of road congested, southbound traffic reroutes via the B994 and B977. By 08:00 the queue from Broomhill Roundabout extends north on the B977 to the junction with the B994, then continues on the B994 for approximately 700m at 08:00. This congestion causes traffic to revert to using the southbound slips and the queue on the A96 southbound reaches approximately 650m at 08:20.
- 3.9.2 No significant queueing is observed in the PM peak.

### 3.10 2012 Test 4

- 3.10.1 Test 4 – as Test 3 but also includes the closure of Broomhill Roundabout.

### 3.11 Test 4 Model Observations

- 3.11.1 No significant queueing is observed in either the AM or PM peak, due to the removal of Broomhill Roundabout.

### 3.12 2012 Test 5

- 3.12.1 Test 5 – new south facing slip roads on the B977 (Gauchill Road) as it crosses the A96, creating a full grade separated junction as shown in Figure 3.5.

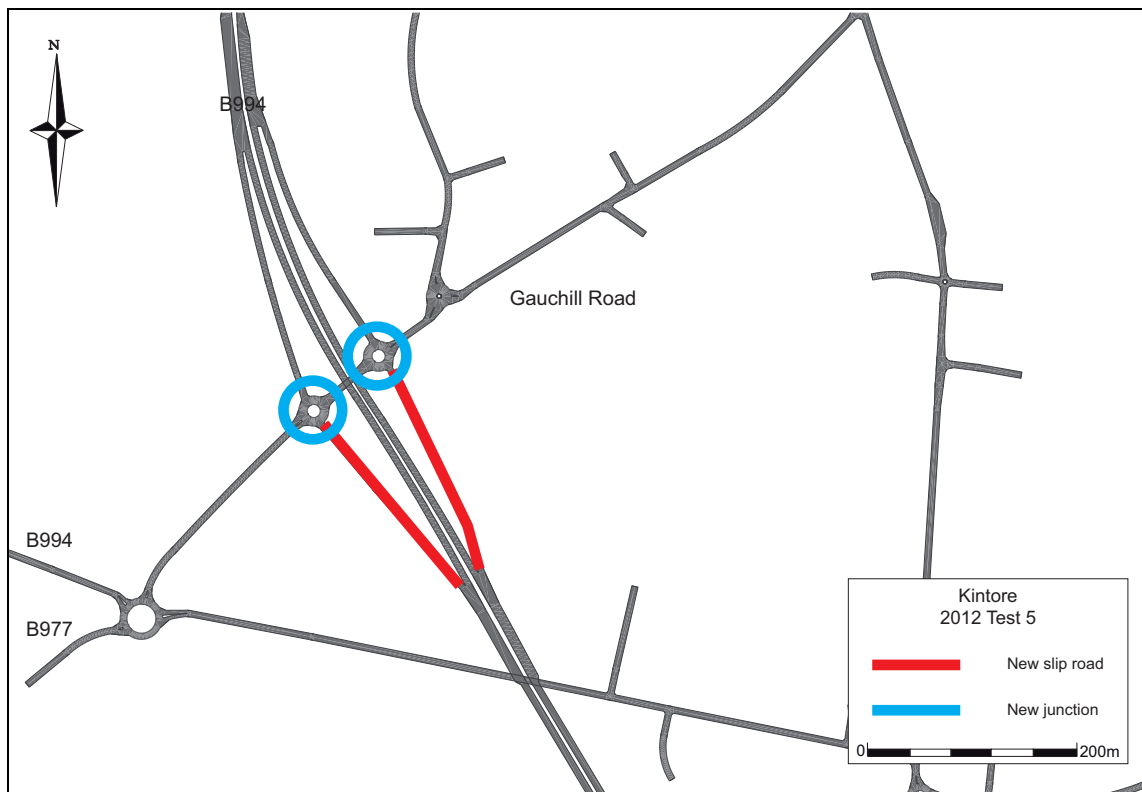


Figure 3.5 : 2012 Test 5

### 3.13 Test 5 Model Observations

3.13.1 Queueing on the B977 southbound from Broomhill Roundabout extends approximately 300m at 08:00. A queue is observed on the A96 southbound from Broomhill Roundabout, reaching approximately 700m by 08:20.

3.13.2 No significant queueing is observed in the PM peak.

### 3.14 2012 Traffic Flow Comparison at Key Junctions

3.14.1 Traffic flows (link counts) have been compared at six key locations in the model network:

- A96 South of Broomhill
- A96 North of Broomhill
- B977 North of Broomhill
- Tumulus Way
- B994
- B977 North of B994

3.14.2 Values are calculated as an average of five S-Paramics model runs and are shown as a difference to the 2007 Base. The link count locations are shown in Figure 3.5.



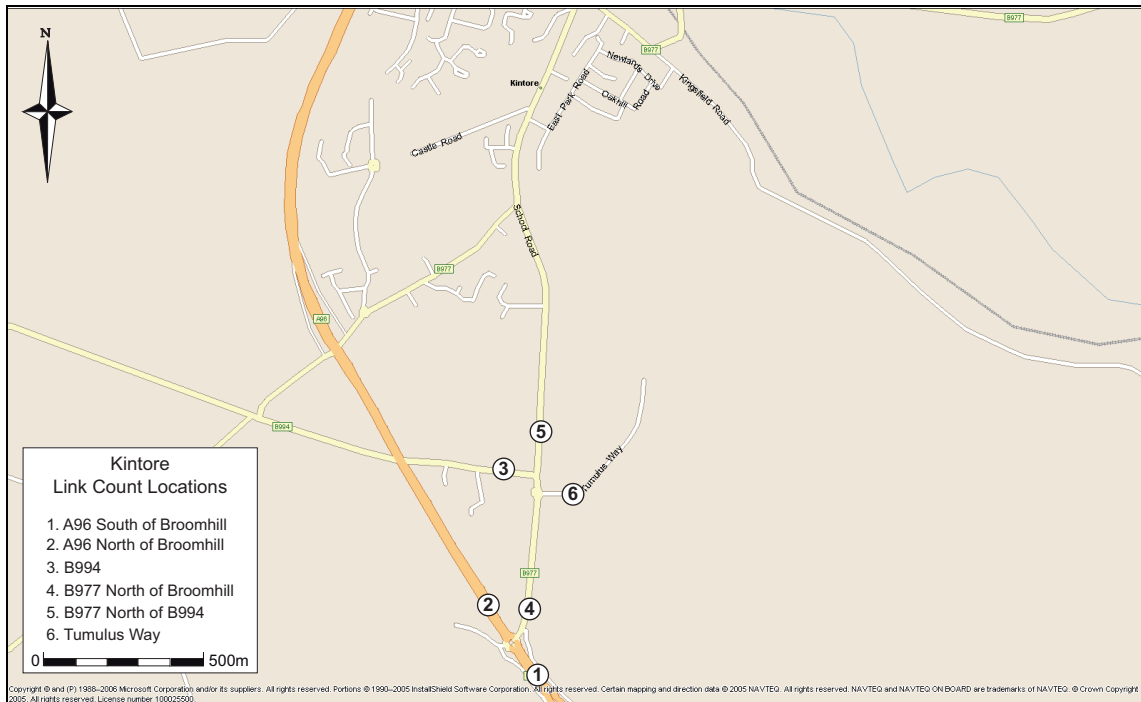


Figure 3.6 : Link Count Locations

3.14.3 Table 3.2 shows the link count comparison for the 2012 AM peak hour.

Table 3.2 : 2012 AM Peak Hour Link Count Comparison (07:15 – 08:15)

Ref	Location	2007 Base	2012 Do-Min	Change from 2012 Do-Min				
				Test 1	Test 2	Test 3	Test 4	Test 5
1	A96 NB south of Broomhill	522	646	-5	-3	-5	-5	-4
1	A96 SB south of Broomhill	1,922	2,010	-6	-1	-27	130	33
2	A96 NB north of Broomhill	408	443	-4	-2	62	196	69
2	A96 SB north of Broomhill	1,446	1,562	-7	11	76	578	99
4	B977 NB north of Broomhill	163	291	-39	-4	-88	-291	-61
4	B977 SB north of Broomhill	543	558	-50	-30	-138	-558	-67
6	Tumulus Way EB	178	317	41	2	-4	19	13
6	Tumulus Way WB	42	85	-5	1	9	7	7
3	B994 EB	464	553	121	55	-140	-84	-29
3	B994 WB	76	135	-6	-15	273	172	-55
5	B977 NB north of B994	76	140	90	21	10	0	17
5	B977 SB north of B994	209	253	-53	-63	76	-29	-17

3.14.4 Table 3.2 shows that in Test 1, the new roundabout at the B994/Tumulus Way improves traffic flow eastbound on the B994 in the AM peak hour. No significant changes in link counts are observed in Test 2.

3.14.5 In Test 3, the new south facing slips from the A96 to the B994 provide traffic a more direct route to and from the A96, resulting in a reduction in link counts on the B977 southbound and B994 eastbound. The link count on the B994 westbound is increased in Test 3 due to traffic from the B977 southbound rerouting along the B994 westbound to the new slips when the B977 southbound becomes congested.



3.14.6 Traffic flows in Test 4 show more variation due to the closure of Broomhill Roundabout. Test 5, with the new slips from the B977 to the A96 causes a reduction in traffic flow on the B977 northbound and southbound and an increase on the A96 as more traffic uses the new slips.

3.14.7 Table 3.3 shows the link count comparison for the 2012 PM peak hour.

Table 3.3 : 2012 PM Peak Hour Link Count Comparison (16:45 – 17:45)

Ref Location	2007 Base	2012 Do-Min	Change from 2012 Do-Min				
			Test 1	Test 2	Test 3	Test 4	Test 5
1 A96 NB south of Broomhill	2,111	2,366	-2	-11	2	-7	-1
1 A96 SB south of Broomhill	744	931	0	-11	4	3	-2
2 A96 NB north of Broomhill	1,493	1,676	10	4	453	682	464
2 A96 SB north of Broomhill	565	611	0	21	159	323	91
4 B977 NB north of Broomhill	665	809	-3	13	-417	-809	-404
4 B977 SB north of Broomhill	223	446	7	-14	-126	-446	-33
6 Tumulus Way EB	48	102	-4	-9	-1	-4	-3
6 Tumulus Way WB	93	277	0	2	-3	-3	0
3 B994 EB	96	203	0	-29	-136	140	-66
3 B994 WB	431	621	-16	-33	-405	-155	-409
5 B977 NB north of B994	294	359	-1	-9	-34	-95	-49
5 B977 SB north of B994	144	235	-6	-46	-7	-23	-16

3.14.8 Table 3.3 shows that the infrastructure improvements in Test 1 and Test 2 cause no significant changes to traffic flow, compared to the 2012 Do-Minimum.

3.14.9 Tests 3 and 5, with new A96 slips are both observed to increase traffic flow on the A96 northbound and decrease the flow on the B977 northbound and B994 westbound due to the alternative route now provided. Traffic flows in Test 4 are significantly different to the 2012 Do-Minimum due to the closure of Broomhill Roundabout.

### 3.15 2012 Testing Queue Length Comparison

3.15.1 Queue lengths were compared at key locations in the network where queueing was observed:

- A96 Southbound at Broomhill Roundabout
- B977 Southbound at Broomhill Roundabout
- B994 Eastbound at junction with B977

3.15.2 Queue information is provided as an average maximum queue length, which is the average of the maximum queue length recorded in each 15min period. A queue is recorded in the model when speed drops below 5mph and the gap in front of a vehicle drops below 10m.

3.15.3 All queue length statistics are calculated from an average of five S-Paramics model runs. Figures 3.7 to 3.9 show the AM peak queue results.



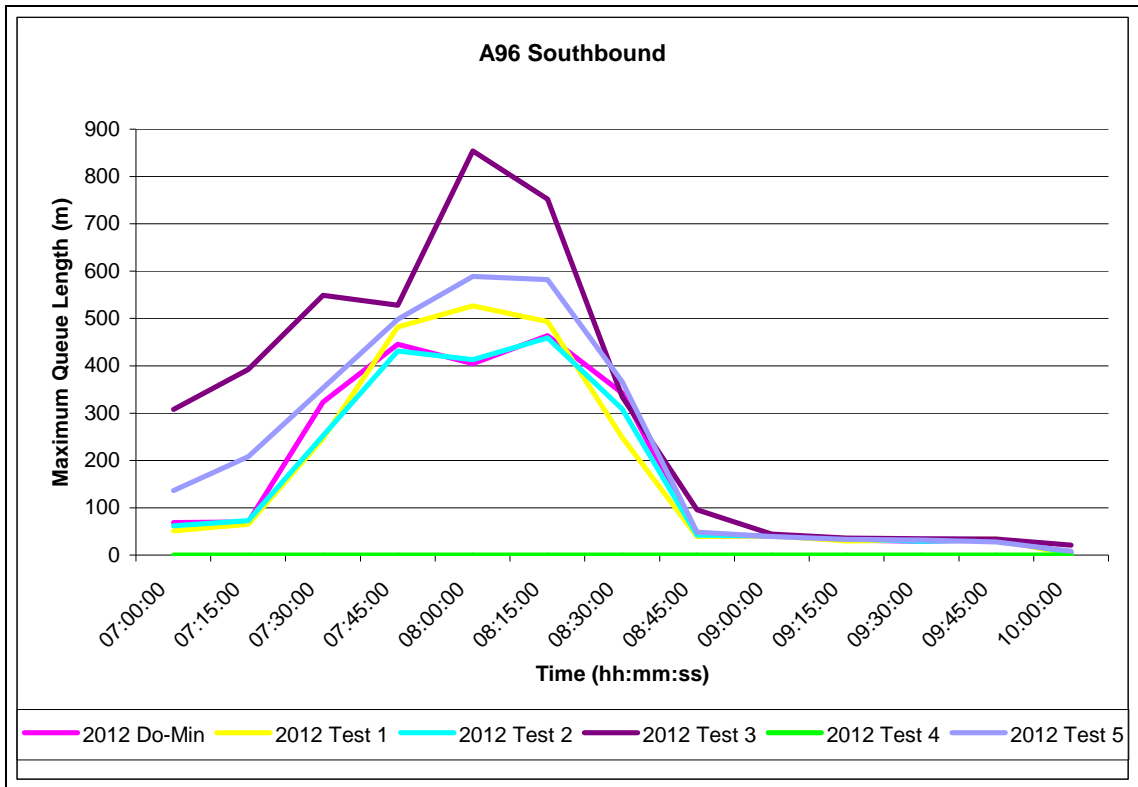


Figure 3.7 : 2012 AM Queueing – A96 Southbound towards Broomhill Roundabout

3.15.4 Figure 3.7 shows that on the A96 southbound in the AM peak, the 2012 Do-Minimum is observed to have an average maximum queue length of approximately 470m at 08:15. In Test 2, with the new signal controlled junction, queue lengths are similar to the 2012 Do-Minimum. Test 3 (new south facing slips on the B994) is observed to have the greatest queueing on the A96 southbound, reaching approximately 850m at 08:00. No queue is recorded in Test 4 due to the removal of Broomhill Roundabout.



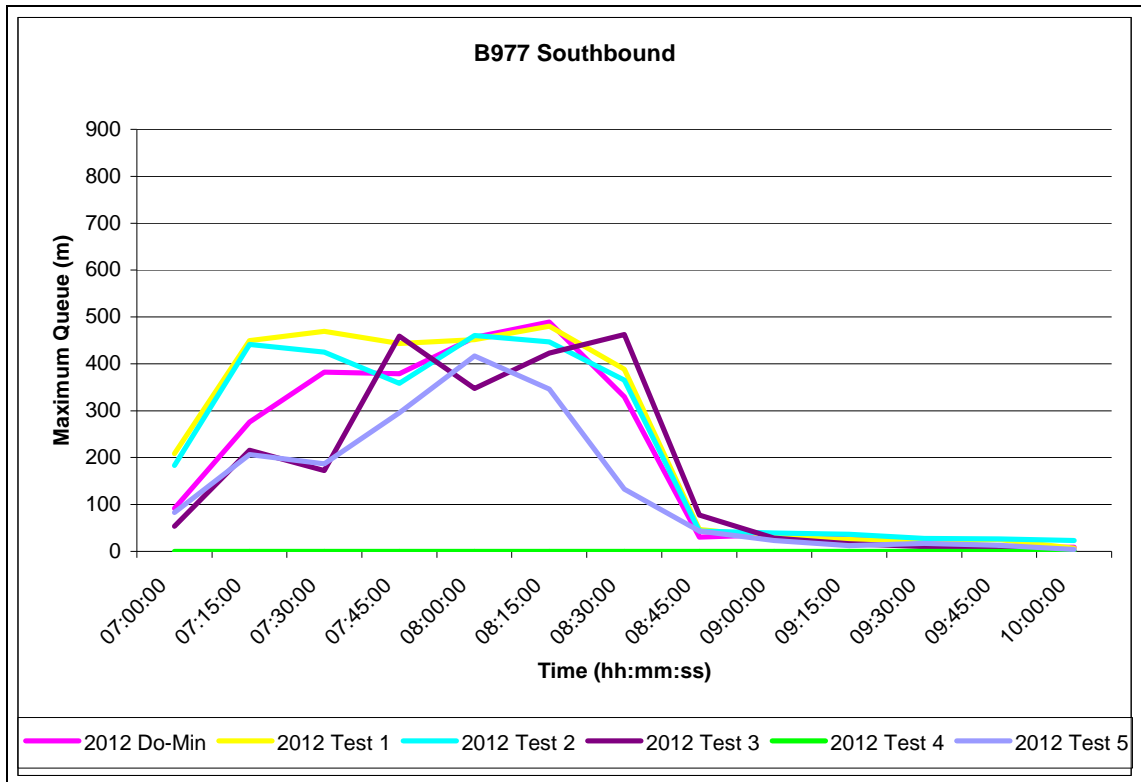


Figure 3.8 : 2012 AM Queueing – B977 Southbound towards Broomhill Roundabout

3.15.5 Figure 3.8 shows there is no significant difference in queueing on the B977 southbound between the 2012 tests. The maximum distance of approximately 500m is the distance from Broomhill Roundabout to the B994 junction, in most tests queueing continues onto the B994. No queueing is recorded in Test 4 as Broomhill Roundabout has been removed, removing the through route from the B977 to the A96.



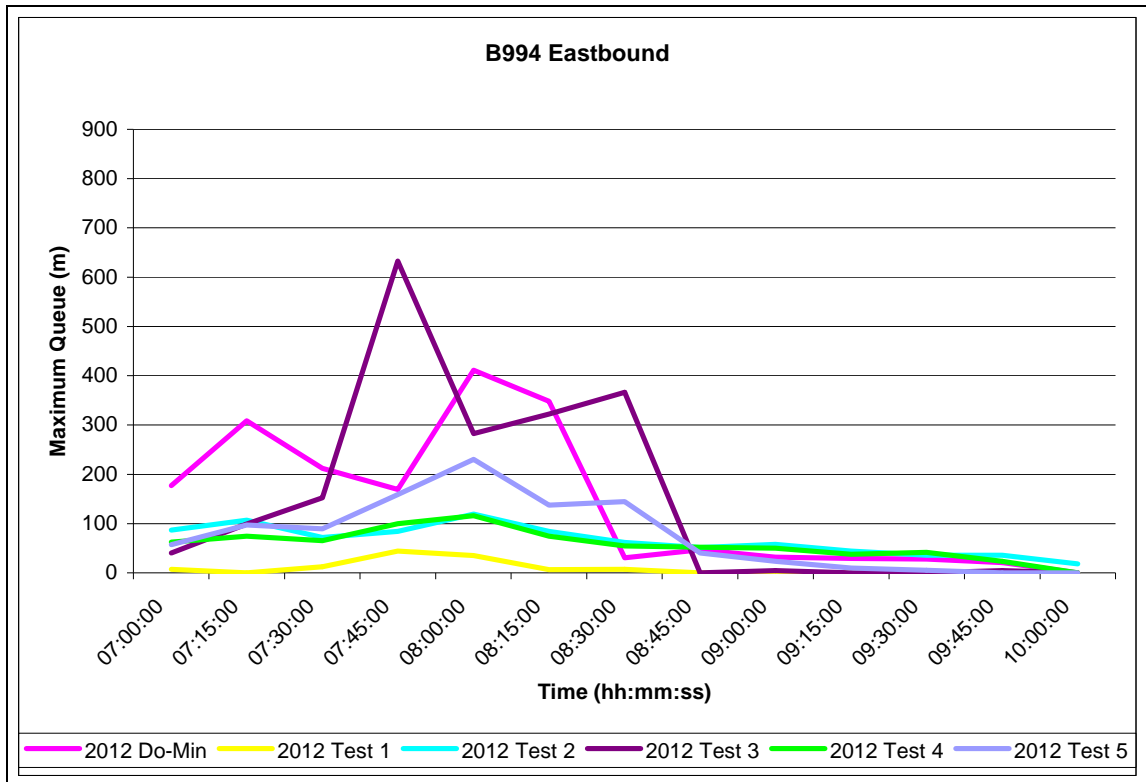


Figure 3.9 : 2012 AM Queueing – B994 Eastbound

3.15.6 Figure 3.9 shows that the eastbound queue on the B994 reaches approximately 400m in the 2012 Do-Minimum at 08:00. With the exception of Test 3 which increases to over 600m, queueing is reduced from the 2012 Do-Minimum level in all 2012 scenarios.

3.15.7 Figures 3.10 to 3.12 show the PM queue results.



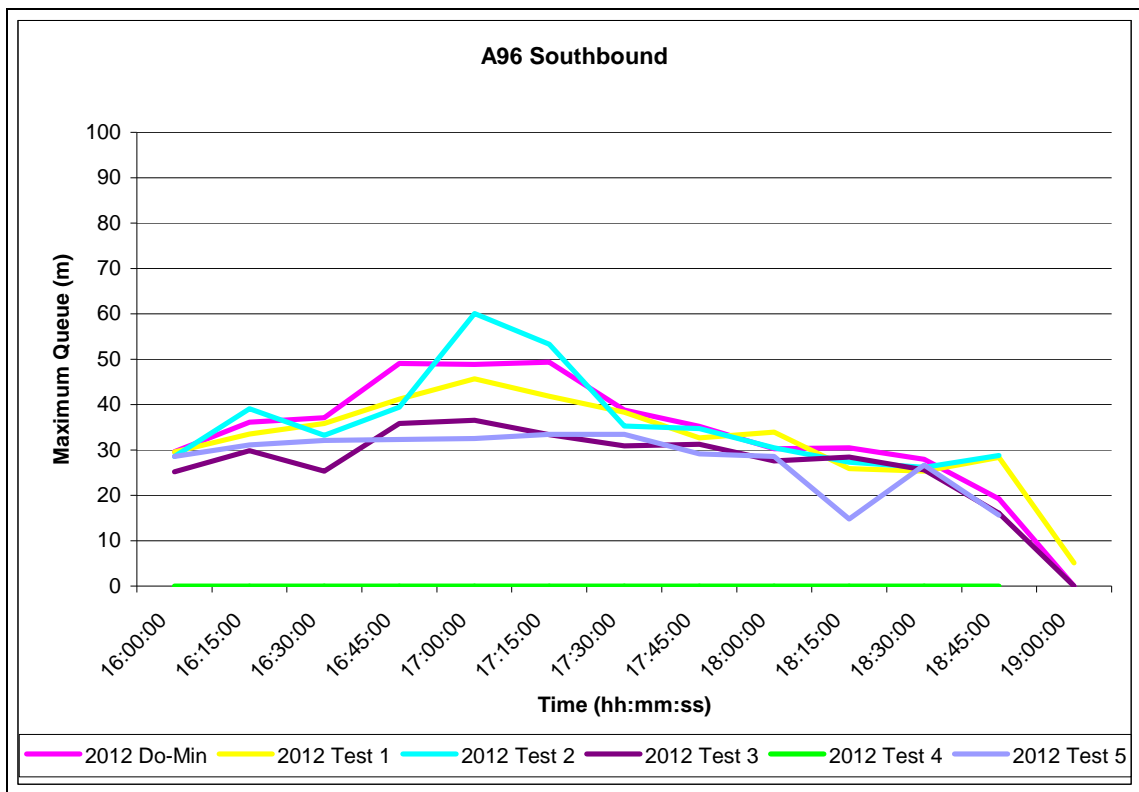


Figure 3.10 : 2012 PM Queueing – A96 Southbound towards Broomhill Roundabout

3.15.8 Figure 3.10 shows there is no significant queueing on the A96 southbound in any of the 2012 Tests, with all queue lengths observed to be less than 60m. No queueing was observed in Test 4 due to the removal of Broomhill Roundabout.



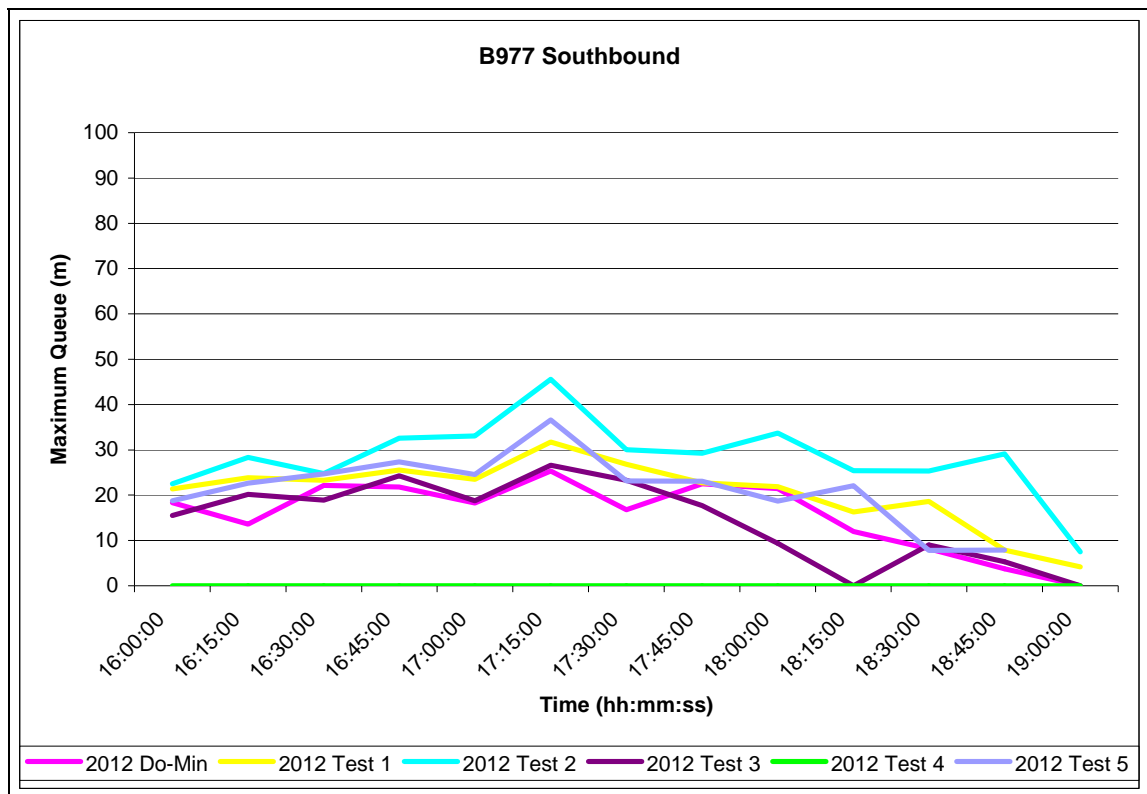


Figure 3.11 : 2012 PM Queueing – B977 Southbound towards Broomhill Roundabout

3.15.9 Figure 3.11 shows there is no significant queueing on the B977 southbound in any of the 2012 Tests, with all queue lengths observed to be less than 50m. No queueing was observed in Test 4 due to the removal of Broomhill Roundabout.



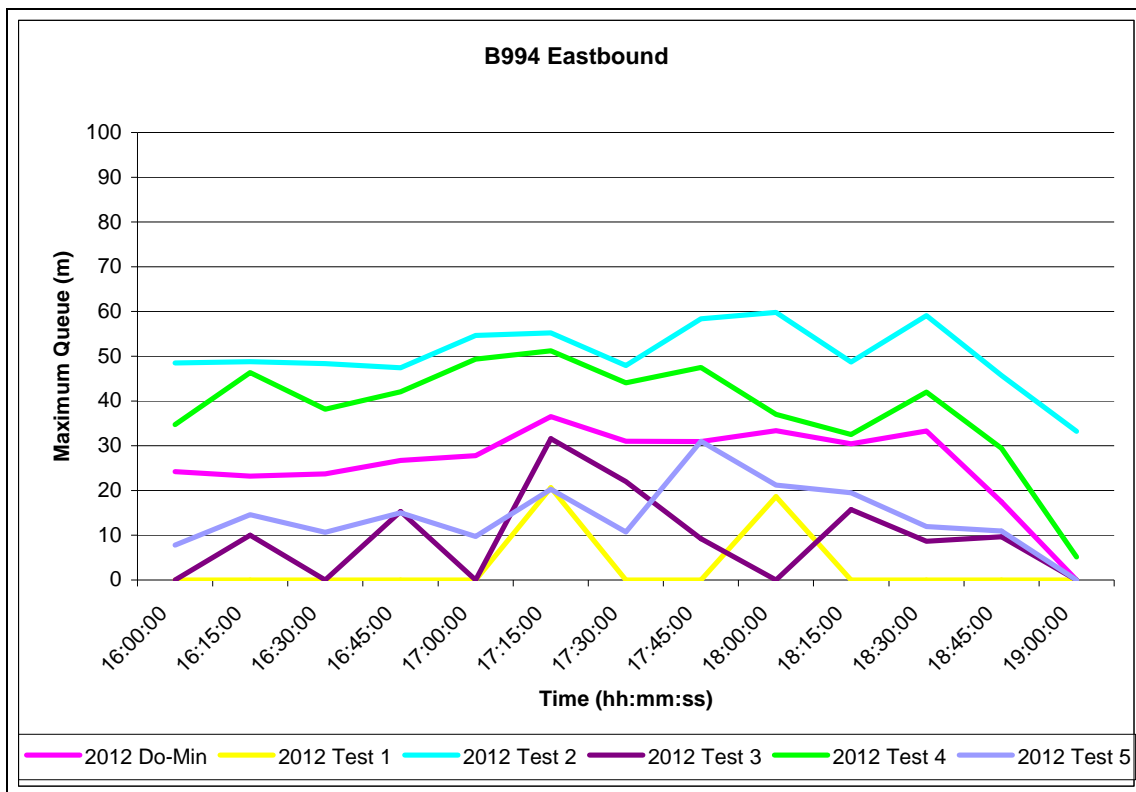


Figure 3.12 : 2012 PM Queueing – B994 Eastbound

3.15.10 Figure 3.12 shows that queueing in all scenarios on the B994 eastbound in the PM peak was less than 60m.

3.15.11 The PM peak results show that Tests 1, 3 and 5 perform better than the 2012 Do-Minimum on the B994 eastbound.

**3.16 2012 Testing Journey Time Comparison**

3.16.1 Average journey times were compared on three routes, in both directions. The routes compared were:

- A96 northbound and southbound – the length of the A96 in the model network
- B994 eastbound and westbound – from Gauchill roundabout to B994/B977 junction
- B977 northbound and southbound – from School Road/ Kingsfield Road junction to Broomfield Roundabout

3.16.2 All journey time statistics are calculated from an average of five S-Paramics model runs. Figure 3.13 shows the AM peak hour average journey times. No significant changes were observed to journey times on the B994 westbound in the AM or PM peaks, and as such it has been omitted from the comparisons at this stage.





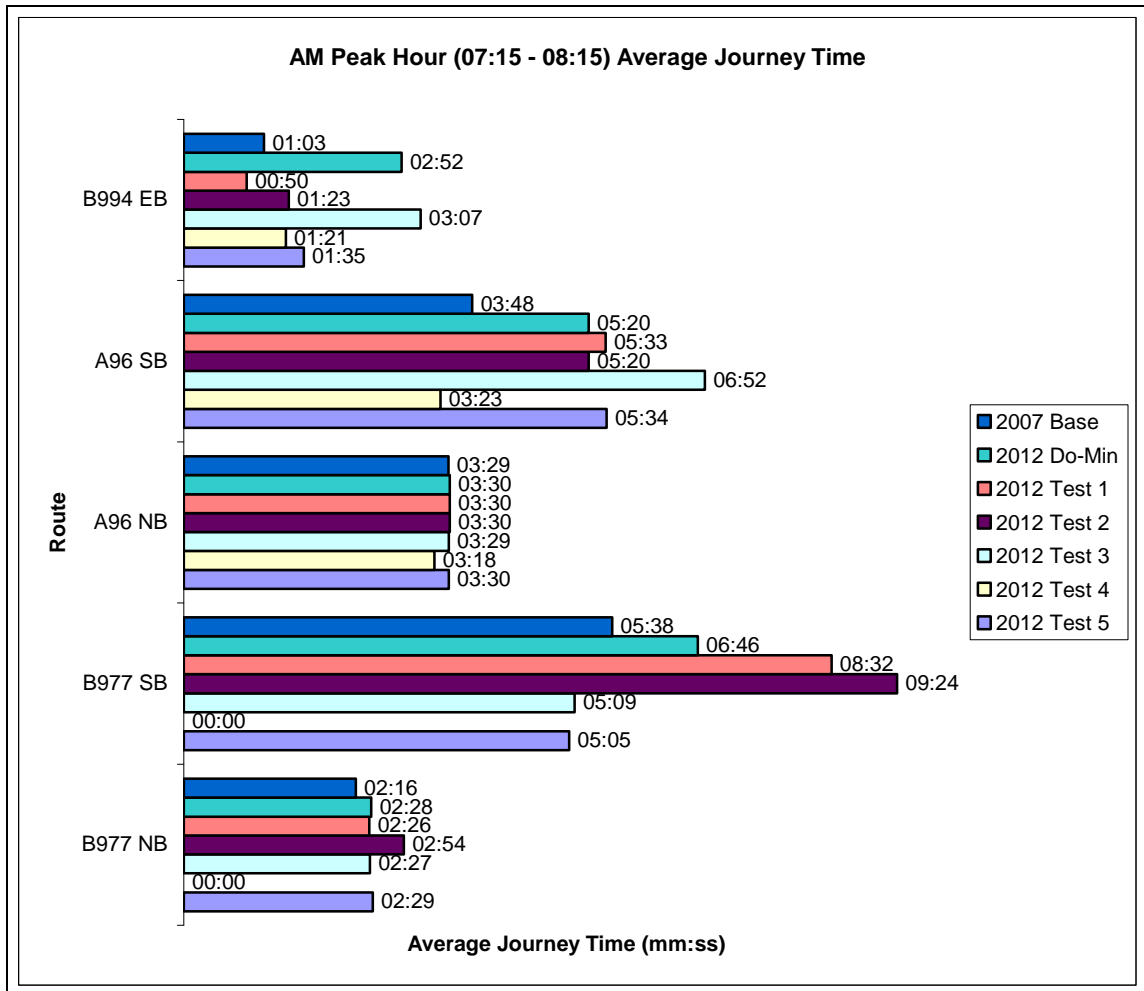


Figure 3.13 : AM Peak Hour Journey Times

- 3.16.3 Figure 3.13 shows that in the AM peak, the most significant changes in journey time were recorded on the B994 eastbound, the A96 southbound and the B977 southbound. This corresponds well with the variations in queue lengths observed at these locations.
- 3.16.4 No journey times were recorded on the B977 southbound and B977 northbound for Test 4 due to the removal of Broomhill Roundabout.
- 3.16.5 Figure 3.14 shows the PM peak hour average journey times.



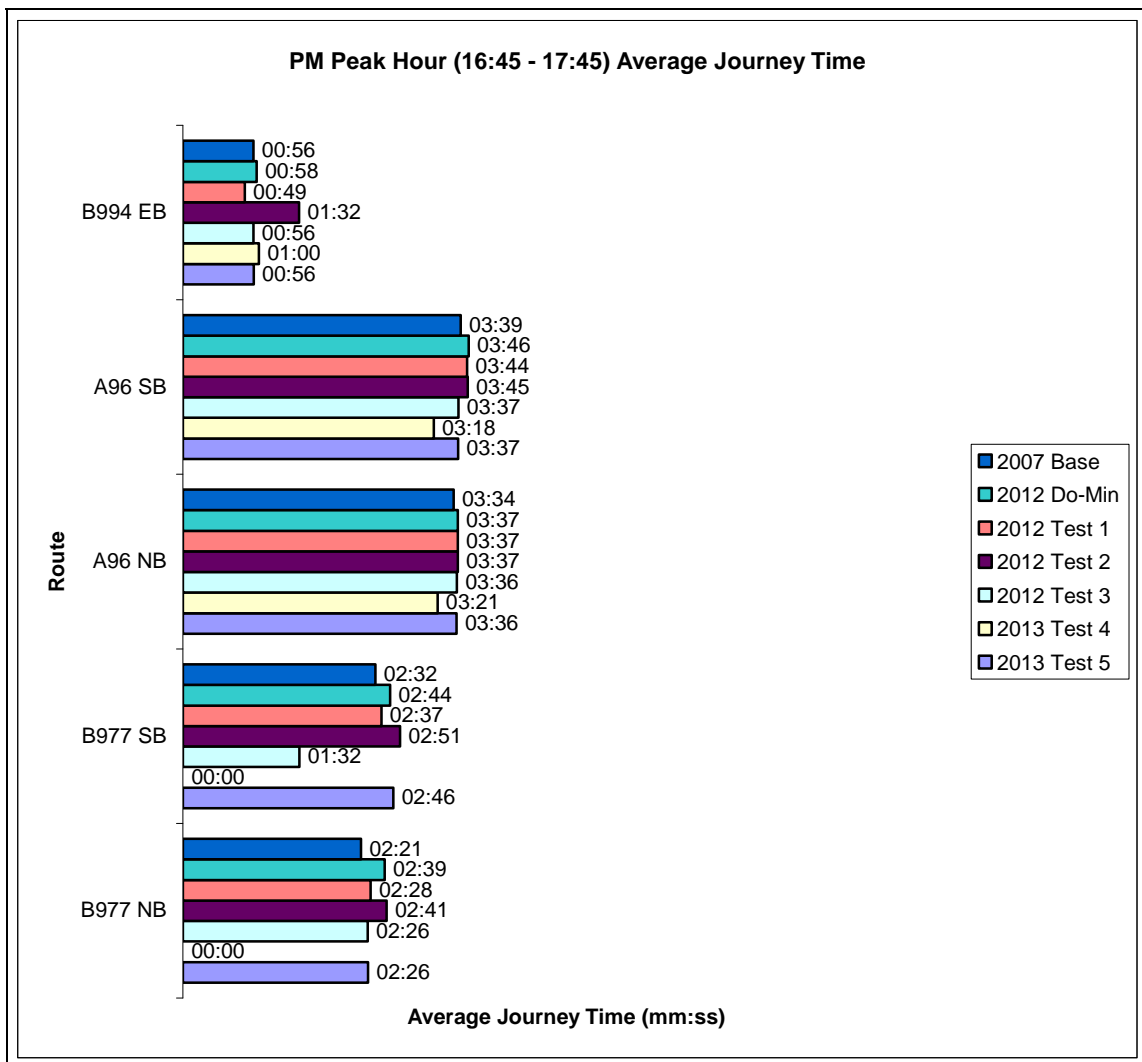


Figure 3.14 : PM Peak Hour Journey Times

3.16.6 Figure 3.14 shows that less variation occurs between journey times in the PM peak. Test 2 is observed to have a higher journey time on the B994 eastbound due to the additional delay associated with the new traffic signals. Test 3 shows a reduced journey time on the B977 southbound due to the reduction in traffic on this road as a result of the new A96 slips.

3.16.7 No journey times were recorded on the B977 southbound and B977 northbound for Test 4 due to the removal of Broomhill Roundabout

**3.17 2012 Testing Summary**

3.17.1 A 2012 Do-Minimum model has been developed from the Kintore 2007 Base model, which represents committed development and traffic growth to 2012.

3.17.2 At the request of Aberdeenshire Council, five test scenarios have been modelled in this 2012 Do-Minimum model.

3.17.3 Test 1: B994/ Tumulus Way new roundabout. Traffic flow comparisons indicated that the roundabout improved traffic flow on the B994 eastbound in the AM peak. As a result of this, queue lengths and journey times were reduced on the B994 eastbound, however this



improvement allowed the release of traffic through to the next junction (Broomhill Roundabout) quicker and journey times on the B977 southbound were observed to increase. No significant congestion was observed in the PM peak.

- 3.17.4 Test 2: B994/ Tumulus Way new signal controlled junction. The traffic signals were observed to reduce queue lengths on the B994 eastbound in the AM peak from approximately 400m in the 2012 Do-Minimum to less than 100m. Journey times on the B977 southbound were observed to increase. No significant congestion was observed in the PM peak.
- 3.17.5 Test 3: B994 to A96 slips. The south facing slips provide a more direct route to and from the A96 which resulted in a significant southbound queue at Broomhill Roundabout by 07:35. This caused traffic to reroute via the B994 eastbound and B977 southbound resulting in increased problems on the A96 approach to Broomhill Roundabout. Queue lengths reached approximately 850m on the A96 southbound and 600m on the B994 eastbound. Journey times on these routes were also increased compared to all other scenarios in the AM peak. No significant congestion was observed in the PM peak.
- 3.17.6 Test 4: Test 3 plus the closure of Broomhill Roundabout. Test 4 was observed to run through with no significant congestion in either the AM or PM peaks.
- 3.17.7 Test 5: B977 to A96 slips. Similarly to Test 3, the south facing slips provided a more direct route to and from the A96 which resulted in a significant southbound queue at Broomhill Roundabout and rerouteing of traffic via the B994 eastbound and B977 southbound. Journey times for Test 5 were similar to the 2012 Do-Minimum. No significant congestion was observed in the PM peak.





## 4 2016 TESTING

### 4.1 Introduction

4.1.1 All 2016 scenarios are based on the 2012 Do-Minimum model as a starting point. NRTF central growth has been applied to traffic travelling on the A96, B977 and B994. The NRTF central growth factors applied, from 2012 to 2016 were:

- Lights: 1.059
- Heavies: 1.064

### 4.2 2016 Development Content

4.2.1 At the request of Aberdeenshire Council, the 2016 development scenarios includes:

- Housing 800 units
- Employment 20Ha

4.2.2 The 2016 development content has been assessed at three potential locations as shown in Figure 4.1.

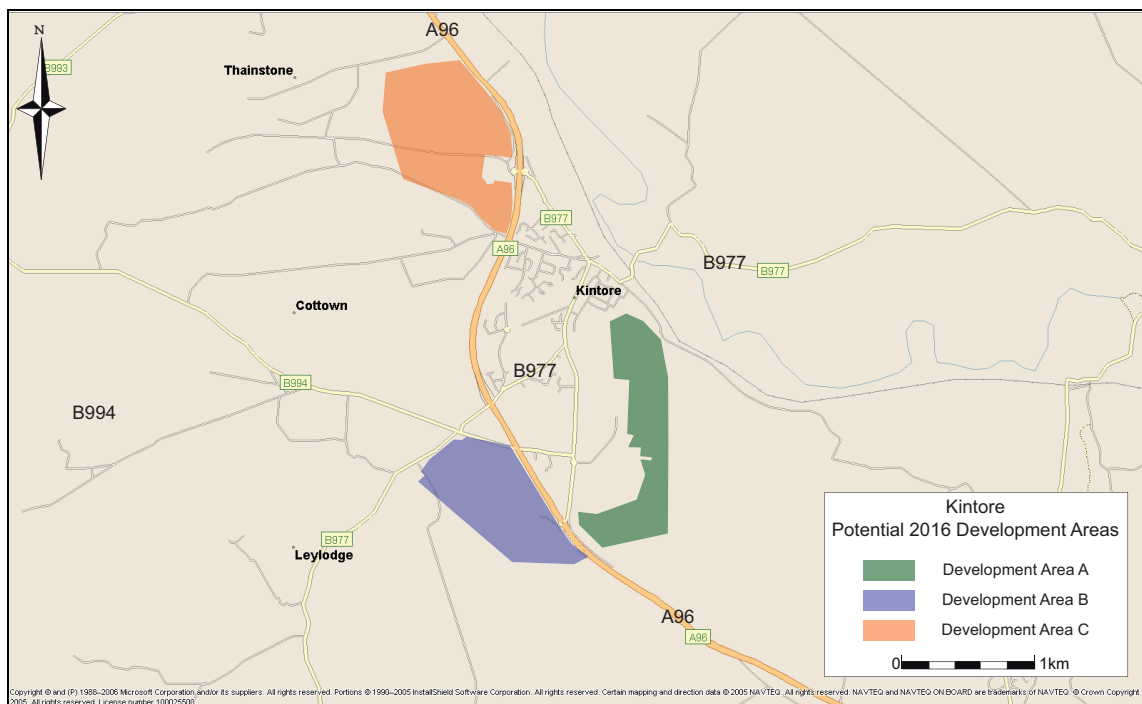


Figure 4.1 : Potential 2016 Development Locations

4.2.3 Aberdeenshire Council advised that the new employment development covers an area of 20Ha, with a build density of 50% at 6,500m<sup>2</sup> GFA per hectare of business use and warehousing and 50% at 3,000m<sup>2</sup> GFA per hectare business use and warehousing.

4.2.4 Trip rates were extracted from TRICS 2008(b) v6.2.2 and used to calculate trip totals where necessary. The trip rates used are shown in Table 4.1.



Table 4.1 : Trip rates

Development Type	07:00 - 10:00		16:00 - 19:00	
	In	Out	In	Out
Office (100 sqm GFA)	3.247	0.732	0.732	2.799
Warehouse (100 sqm GFA)	0.970	0.466	0.402	0.847
Housing	0.410	0.976	1.087	0.728

4.2.5 AM and PM trip totals for the 2016 testing are shown in Table 4.2.

Table 4.2 : 2016 Vehicle Trip Summary

2016	Development	AM	PM
2007 Base		9278	10480
2012 Do Min		11349	13006
	Growth to 2016	327	402
	Housing	1109	1452
	Employment	2572	2271
Total Developments		3681	3723
New Trips Added		3517	3553
<b>Total Matrix</b>		<b>15193</b>	<b>16962</b>
<b>Increase from 2007 Base</b>		<b>38%</b>	<b>34%</b>

4.2.6 Table 4.2 shows that the number of new vehicle trips added is less than the total new vehicle trips generated by the developments. The traffic demand matrix was adjusted to minimise double counting and allow internal trips to occur between the new housing and existing employment and vice versa.

4.2.7 No information has been provided regarding the distribution of trips for the 2016 development. In this instance, the distribution from a gravity model, provided by Aberdeenshire Council, was applied to the 2016 development:

- 36.2% A96 South
- 44.3% A96 North
- 19.5% B994 West

4.2.8 The average proportion of commuter traffic was calculated for existing housing and employment zones in the model and this proportion was applied to the proposed 2016 development. The commuter trips were distributed as per the gravity model.

### 4.3 2016 Area A

4.3.1 Area A is located to the east of Kintore, between the A96 and Kingsfield Road. Access to development area A is via Tumulus Way and the new access road at the Midmill Call Centre as shown in Figure 4.2.



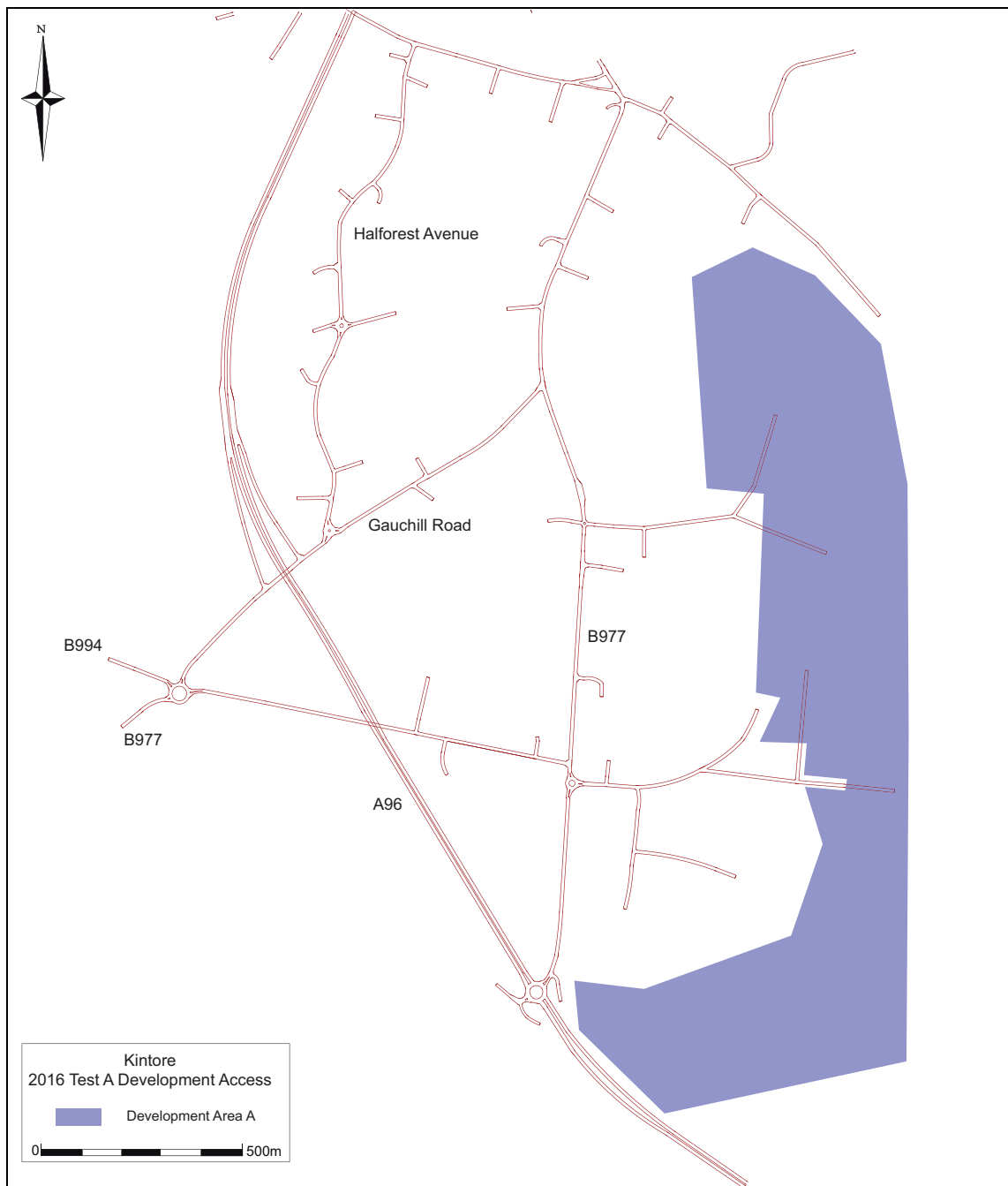


Figure 4.2 : 2016 Development Area A

4.3.2 At the request of Aberdeenshire Council, traffic has been distributed to the two accesses as follows:

- Housing – 50% Tumulus Way, 50% Kingsfield Road
- Employment- 75% Tumulus Way, 25% Kingsfield Road

**4.4 2016 Area A – Model Observations**

4.4.1 In the AM peak, the eastbound queue on the B994 from the junction with the B977 reaches the extents of the model by 07:30, with approximately 60 vehicles unable to join the model network



due to the congestion. The queue on the A96 southbound is approximately 450m at 07:30, and extends to approximately 2km by 08:30. By this time there are over 380 vehicles unable to join the model network on the B994 due to congestion. Significant congestion is observed throughout the model network for the remainder of the AM peak.

4.4.2 In the PM peak, a northbound queue forms on the B977 from the roundabout at Tumulus Way and the queue is approximately 300m by 17:00. By 17:30 traffic is queued into the development, and at 17:50 there are approximately 90 vehicles unable to join the model network due to congestion.

4.4.3 A queue of approximately 200m is observed on the A96 southbound at 17:30 and a queue of approximately 400m is observed on the B994 eastbound at 17:35.

#### **4.5 2016 Area A plus Improvements**

4.5.1 Due to the congestion observed on the B977 southbound from Broomhill Roundabout in the AM peak, a segregated left turn slip lane was introduced from the B977 to the A96 southbound as shown in Figure 4.3.

4.5.2 Improvements carried out in the 2016 Area A scenario were:

- Segregated left turn lane B977 to A96
- Part time signals at Broomhill Roundabout





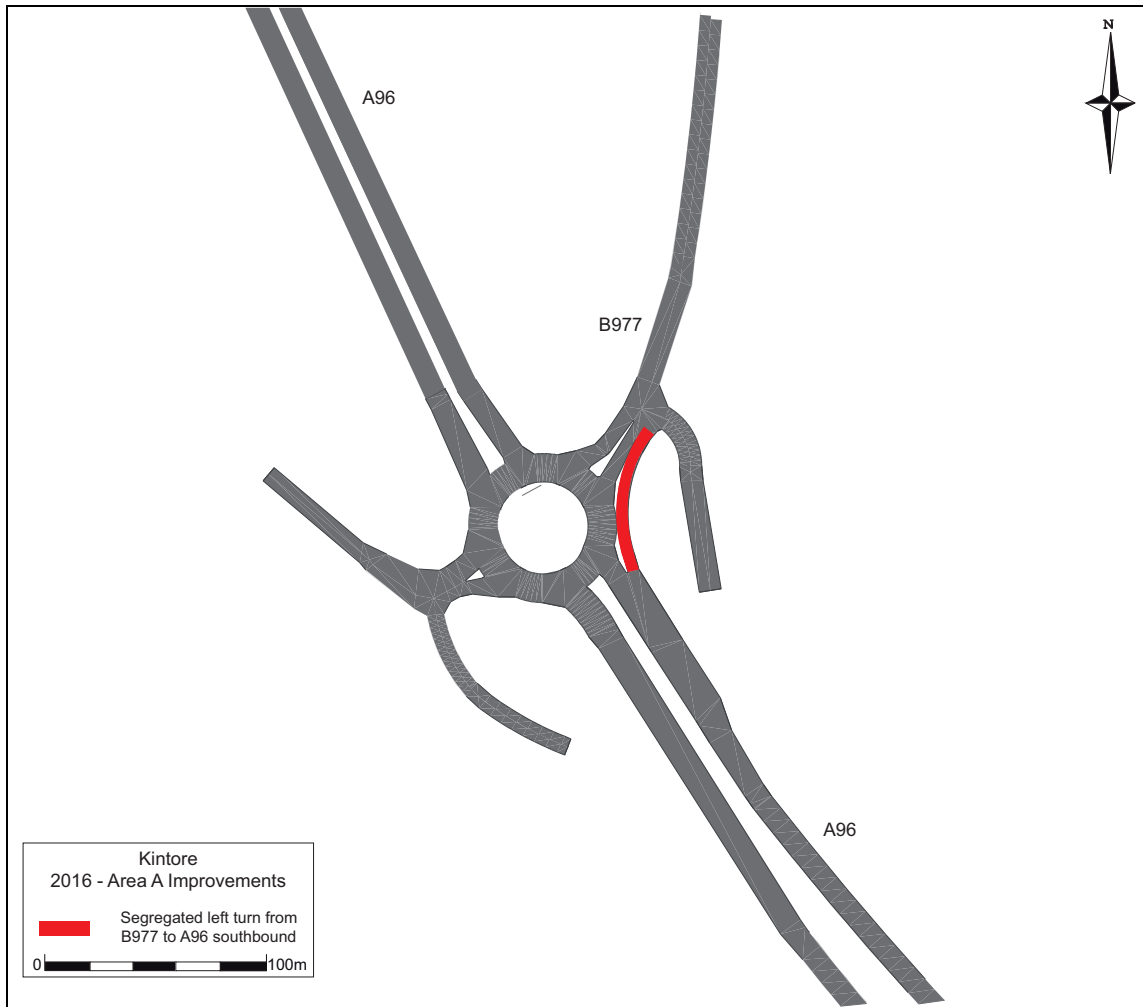


Figure 4.3 : B977 to A96 Segregated Left Turn lane

4.5.3 Significant queuing was observed on the A96 southbound due to the volume of northbound traffic turning right from the A96 Northbound onto the B977. Part time traffic signals were introduced on Broomhill Roundabout at the A96 southbound approach, in the AM peak only, in order to help reduce this southbound A96 queue. The signal timings used are shown in Figure 4.4.

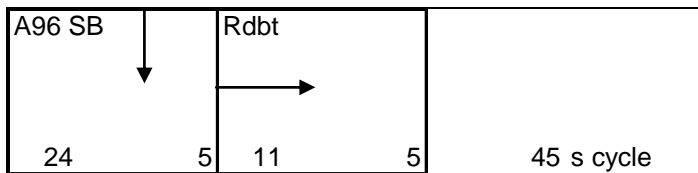


Figure 4.4 : Area A Broomhill Signals

**4.6 2016 Area A plus Improvements – Model Observations**

4.6.1 In the AM peak, a northbound queue forms on the B977 from the new roundabout at Tumulus Way extending to approximately 300m, however this queue is gone by 08:20. No other significant congestion is observed in the AM peak.

4.6.2 In the PM peak, a queue of approximately 400m is observed on the A96 northbound at 17:15. A northbound queue forms on the B977 from the roundabout at Tumulus Way and the queue extends as far as Broomhill Roundabout by 17:25.

**4.7 2016 Area B**

4.7.1 Area B is located to the south west of Kintore, between the A96 and the B977. Access to development area B is via a new link to Broomhill Roundabout to the east and the B977 to the west, as shown in Figure 4.5.

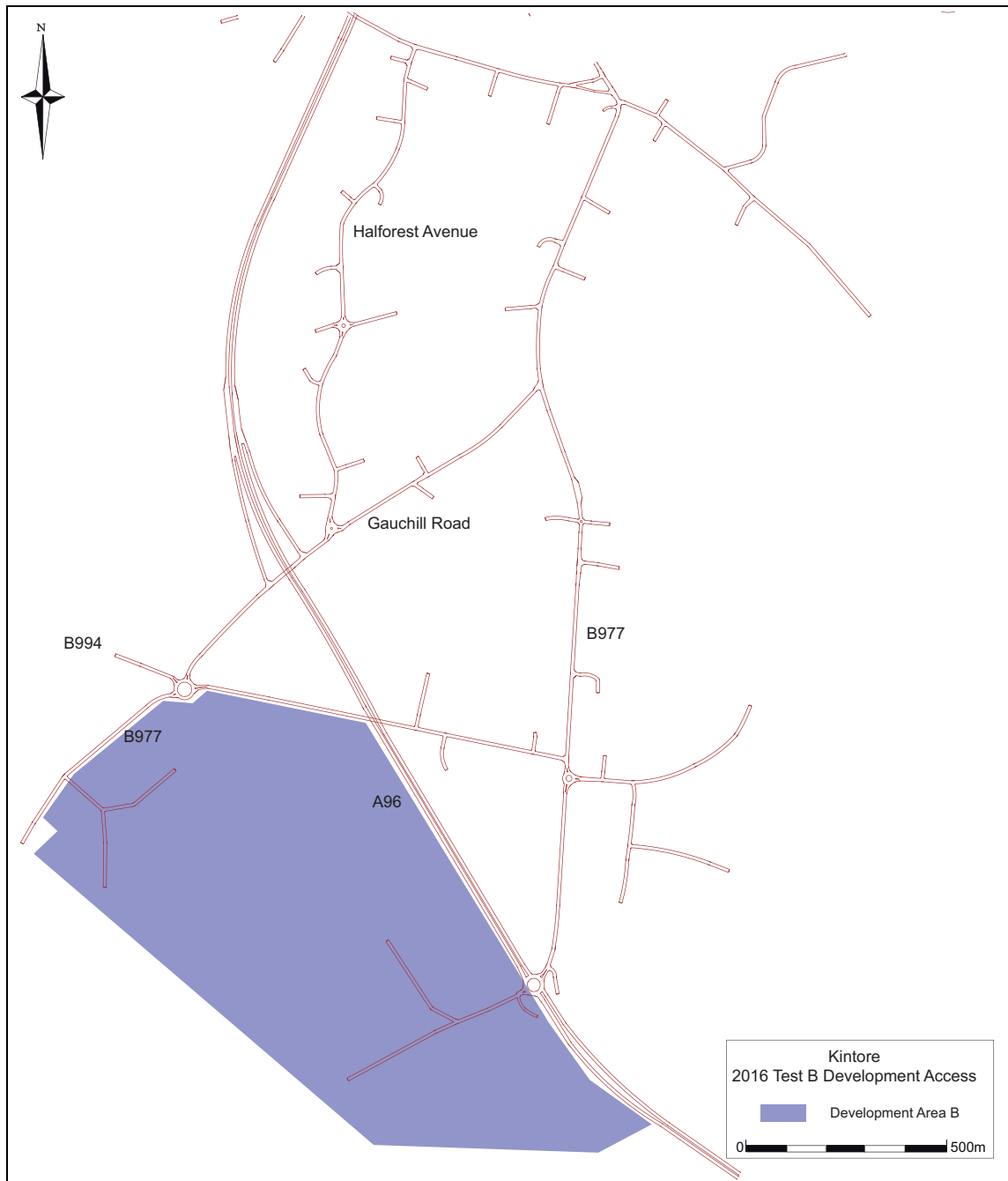


Figure 4.5 : 2016 Development Area B



4.7.2 At the request of Aberdeenshire Council, traffic has been distributed to the two accesses as follows:

- Housing – 25% B977, 75% A96 (Broomhill Roundabout)
- Employment- 25% B977, 75% A96 (Broomhill Roundabout)

**4.8 2016 Area B – Model Observations**

4.8.1 In the AM peak, queueing is observed from Broomhill Roundabout by 07:15, on the A96 southbound and B977. By 07:30 the queue on the A96 southbound is approximately 1km and the queue on the B977 has extended onto the B994, with 20 vehicles unable to join the model network due to congestion. The network becomes significantly congested in the AM peak and by 08:35 approximately 450 vehicles are unable to join the model network due to congestion.

4.8.2 In the PM peak, queueing is observed on the Broomhill access to the development by 16:35, with 22 vehicles unable to join the model network due to congestion by 17:00. This number of vehicles increases to a maximum of approximately 320 by 18:00. Queueing is also observed on the B977 northbound from the Tumulus Way roundabout between 16:40 and 18:00, reaching a maximum of approximately 350m at 17:00. Queueing is also observed on the A96 northbound from Broomhill Roundabout, from 16:50 to 17:35, reaching a maximum of approximately 400m at 17:25.

**4.9 2016 Area B plus Improvements**

4.9.1 At the request of Aberdeenshire Council, south facing slips were introduced between the B994 and the A96, as shown in Figure 4.6.

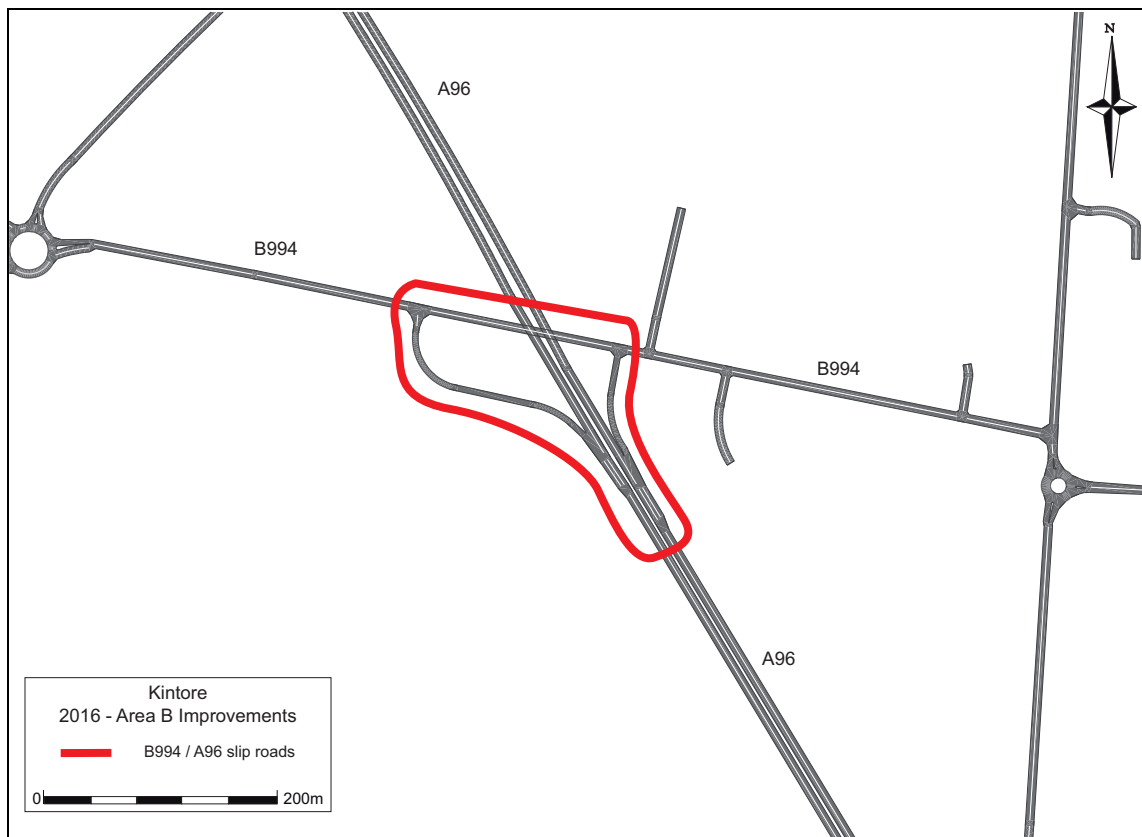


Figure 4.6 : B994/ A96 Slips



4.9.2 Part time traffic signals were introduced on Broomhill Roundabout at the A96 southbound approach, in the AM peak only, in order to help reduce the southbound A96 queue. The signal timings used are shown in Figure 4.7.

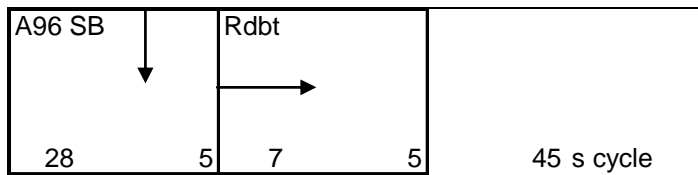


Figure 4.7 : Area B Broomhill Signals

4.9.3 With the slip lanes and traffic signals introduced, significant congestion was still observed, particularly around Broomhill Roundabout. In order to alleviate congestion in this area, all development traffic was assigned to the western access (B977). The development access on the B977 was upgraded to a roundabout. With this improvement in place, traffic could better access/ egress the development, but congestion was observed at the B977/ B994 roundabout. This roundabout was upgraded to provide two circulating lanes and two lane entries on all approaches.

4.9.4 The improvements introduced in the Area B plus Improvements scenario were:

- South facing slips B994 to A96
- Part time signals at Broomhill Roundabout
- All development traffic assigned to west (B977) access (no direct access from Broomhill)
- New roundabout at development access
- B977/ B994 roundabout upgraded

#### 4.10 2016 Area B plus Improvements – Model Observations

4.10.1 In the AM peak, some queueing is observed on the B977 westbound from Gauchill Roundabout between 07:15 and 08:25, and reaching a maximum of approximately 250m at 07:40. Between 07:40 and 08:30 some queueing is observed on the A96 southbound due to the traffic signals but this queue rarely exceeds 100m.

4.10.2 By 16:40 in the PM peak, queueing is observed on the B977 northbound from Gauchill Roundabout. By 17:00 the queue is back into the development and by 17:20 the queue on the B977 reaches the extents of the model network. At 18:00 there are 288 vehicles unable to join the model network due to congestion.

#### 4.11 2016 Area C

4.11.1 Area C is located to the north of Kintore, to the west of the A96. Access to development area C is via a new link connecting to the existing grade separated junction as shown in Figure 4.8.



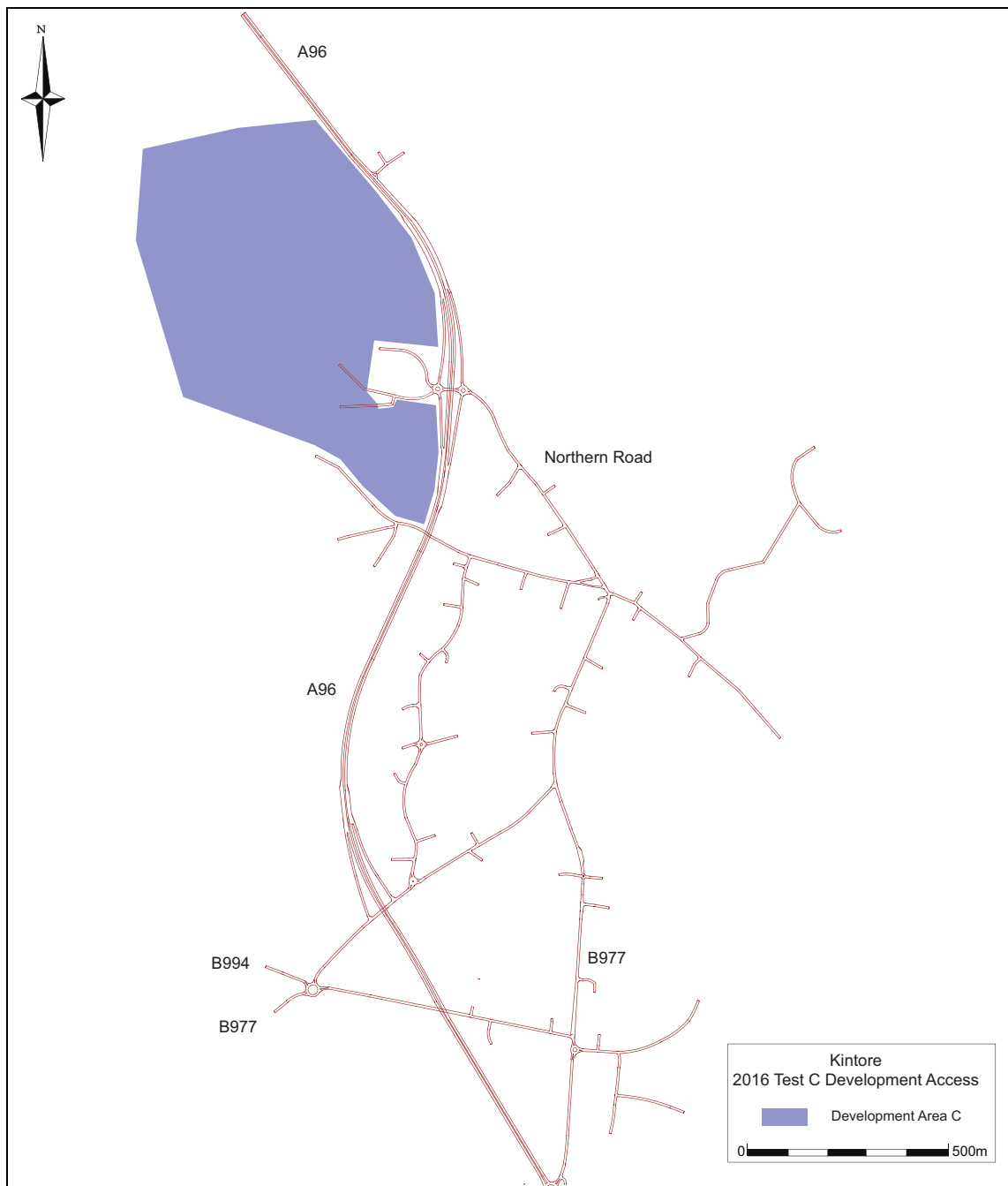


Figure 4.8 : 2016 Development Area C

**4.12 2016 Area C – Model Observations**

- 4.12.1 In the AM peak, a southbound queue is observed on the B977 southbound from Broomhill Roundabout by 07:10 and on the A96 southbound from Broomhill Roundabout by 07:20. By 08:30 the queue on the B977 southbound has extended onto the B994 as far as Gauchill Roundabout and the southbound queue on the A96 is approximately 1km.
- 4.12.2 No significant queuing is observed in the Area C model in the PM peak.



#### 4.13 2016 Area C plus Improvements

4.13.1 Due to the congestion observed on the B977 southbound from Broomhill Roundabout in the AM peak, a segregated left turn slip lane was introduced from the B977 to the A96 southbound as shown in Figure 4.3.

4.13.2 Part time traffic signals were introduced on Broomhill Roundabout at the A96 southbound approach in the AM peak only, in order to help reduce this southbound A96 queue. The signal timings used are shown in Figure 4.9.

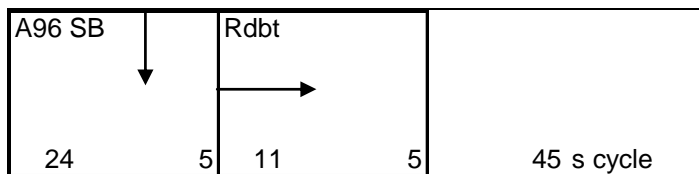


Figure 4.9 : Area C Broomhill Signals

4.13.3 Improvements carried out in the 2016 Area C scenario were:

- Segregated left turn lane B977 to A96
- Part time signals at Broomhill Roundabout

#### 4.14 2016 Area C plus Improvements – Model Observations

4.14.1 By 07:20 in the AM peak, an eastbound queue is observed on the B994 from the junction with the B977. This queue reaches a maximum of approximately 350m at 07:35 and is gone by 08:20.

4.14.2 No significant queuing is observed in the Area C plus improvements model in the PM peak.

#### 4.15 2016 Traffic Flow Comparison at Key Junctions

4.15.1 Traffic flows (link counts) have been compared at six key locations in the model network:

- A96 South of Broomhill
- A96 North of Broomhill
- B977 North of Broomhill
- Tumulus Way
- B994
- B977 North of B994

4.15.2 Values are calculated as an average of five S-Paramics model runs and are shown as a difference to the 2007 Base. The link count locations are shown in Figure 3.5.

4.15.3 Table 4.3 shows the link count comparison for the 2016 AM peak hour.



Table 4.3 : 2016 AM Peak Hour Link Count Comparison

Location	2007 Base	2012 Do-Min	Change from 2012 Do-Min					
			Area A	Area A + Imp	Area B	Area B + Imp	Area C	Area C + Imp
A96 NB south of Broomhill	522	646	245	246	243	248	248	248
A96 SB south of Broomhill	1,922	2,010	-129	177	-342	321	30	318
A96 NB north of Broomhill	408	443	77	130	121	332	239	274
A96 SB north of Broomhill	1,446	1,562	-162	87	-114	571	26	132
B977 NB north of Broomhill	163	291	283	322	122	-31	-5	43
B977 SB north of Broomhill	543	558	134	436	-13	-207	-22	242
Tumulus Way EB	178	317	398	635	-129	27	-29	-7
Tumulus Way WB	42	85	227	228	7	8	3	5
B994 EB	464	553	-285	645	-335	-286	-67	-83
B994 WB	76	135	196	35	146	-38	8	-17
B977 NB north of B994	76	140	94	190	-1	30	-1	-10
B977 SB north of B994	209	253	579	156	184	95	27	214

4.15.4 Table 4.3 shows that in the AM peak hour, the Area A and B development scenarios without improvements are observed to have a decrease in traffic flow on several routes, compared with the 2012 Do-Minimum. This is due to the severe congestion in the network. The Area B plus Improvements scenario is observed to reduce traffic flow on the B977 southbound and B994 eastbound and increase traffic flow on the A96 southbound, due to the introduction of slips from the B994 to the A96 as part of the improvements for that scenario. Other changes to traffic flows reflect the location of the development and the related impact on the road network.

4.15.5 Table 4.4 shows the link count comparison for the 2016 PM peak hour.

Table 4.4 : 2016 PM Peak Hour Link Count Comparison

Location	2007 Base	2012 Do-Min	Change from 2012 Do-Min					
			Area A	Area A + Imp	Area B	Area B + Imp	Area C	Area C + Imp
A96 NB south of Broomhill	2,111	2,366	243	240	241	241	242	239
A96 SB south of Broomhill	744	931	255	309	215	239	304	308
A96 NB north of Broomhill	1,493	1,676	376	396	314	662	244	238
A96 SB north of Broomhill	565	611	0	54	149	379	278	284
B977 NB north of Broomhill	665	809	72	121	85	-400	16	13
B977 SB north of Broomhill	223	446	462	524	217	-126	40	32
Tumulus Way EB	48	102	276	283	-3	-2	-3	-1
Tumulus Way WB	93	277	535	643	1	1	5	8
B994 EB	96	203	141	132	167	-127	25	20
B994 WB	431	621	127	166	113	-369	8	7
B977 NB north of B994	294	359	95	145	-34	-13	6	11
B977 SB north of B994	144	235	235	231	56	20	11	13

4.15.6 Table 4.4 shows that in the PM peak hour, the Area A development scenario results in an increase in traffic flow on Tumulus Way as this is an access point for the development area. The Area B development location with network improvements is observed to significantly reduce



traffic flow on the B977 northbound and B994 westbound and increase flow on the A96 northbound, due to the introduction of new slips from the A96 to the B994.

**4.16 2016 Testing Queue Length Comparison**

4.16.1 Queue lengths were compared at locations in the network where queueing was observed:

- A96 Southbound at Broomhill Roundabout
- B977 Southbound at Broomhill Roundabout
- B994 Eastbound at junction with B977

4.16.2 Figures 4.10 to 4.12 show the 2016 AM queue lengths.

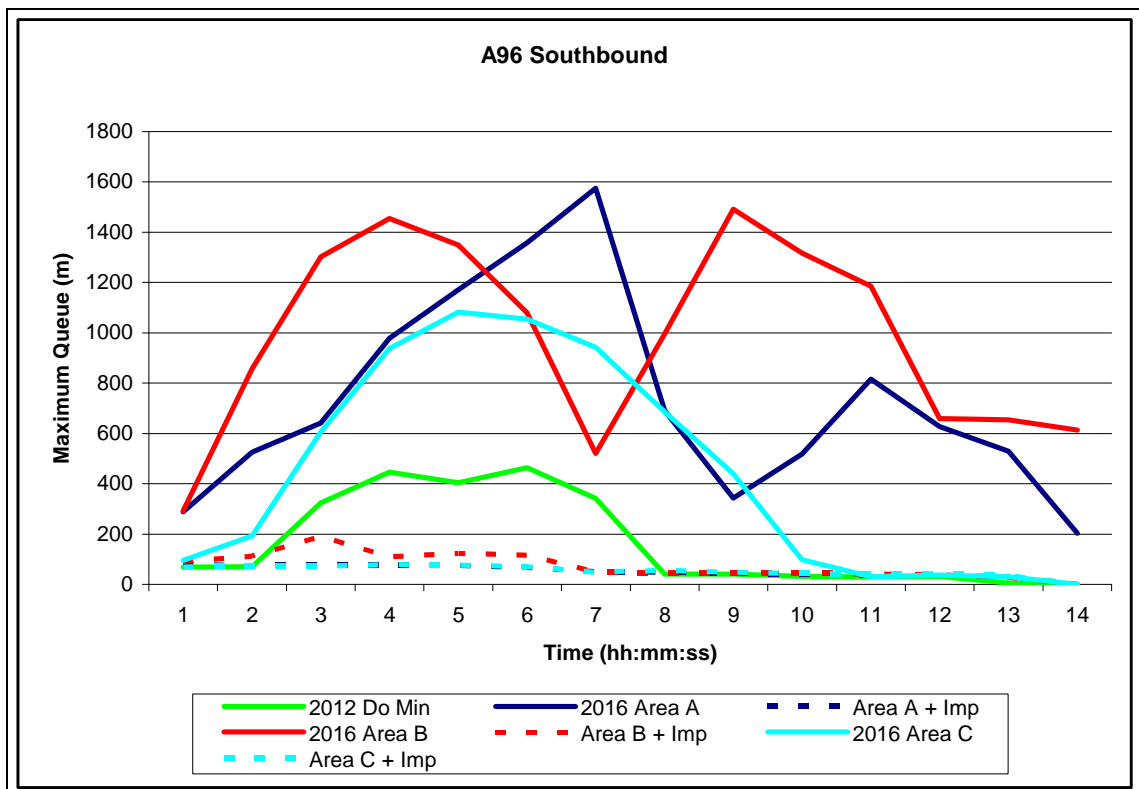


Figure 4.10 : 2016 AM Queueing – A96 Southbound

4.16.3 Figure 4.10 shows that on the A96 southbound, queue lengths in the Do-Minimum reach approximately 450m. When the development is included at sites A and B, queue lengths on the A96 are observed to increase to approximately 1500m. In Area C the queue length increases to approximately 1100m.

4.16.4 After improvements were made to the road network, queue lengths on the A96 southbound reduced to less than 200m in all scenarios.





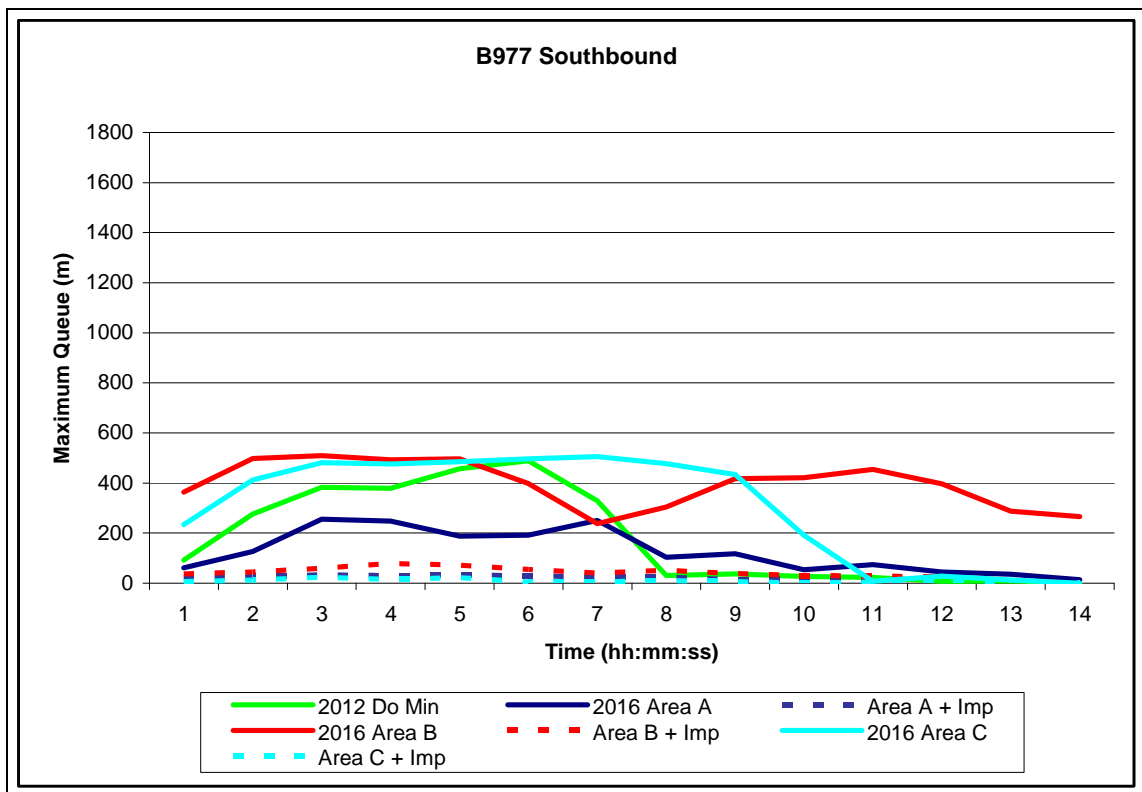


Figure 4.11 : 2016 AM Queueing – B977 Southbound

- 4.16.5 Figure 4.11 shows that in all three development locations, queueing on the B977 southbound extends from Broomhill Roundabout to the B994 junction (approximately 500m).
- 4.16.6 With improvements introduced to the road network, queueing in all three scenarios is reduced to less than 100m.



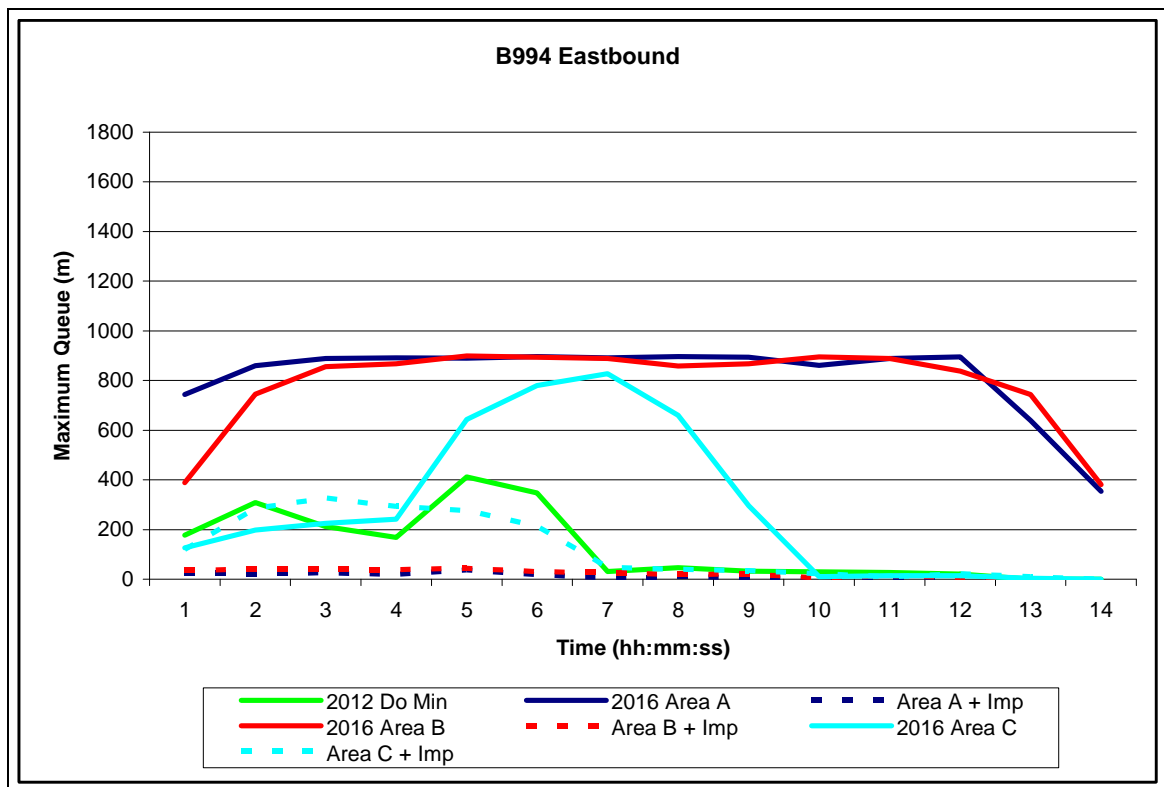


Figure 4.12 : 2016 AM Queueing – B994 Eastbound

- 4.16.7 Figure 4.12 shows that with the development located in Areas A and B, the queue on the B994 eastbound extends to the edge of the modelled network (approximately 900m) for most of the modelled peak.
- 4.16.8 With improvements to the model networks, queue lengths in the Area A and Area B scenarios are reduced to less than 50m. Queue lengths in area C with improvements reach approximately 300m.
- 4.16.9 Figures 4.13 to 4.14 show the PM peak queue length comparisons.



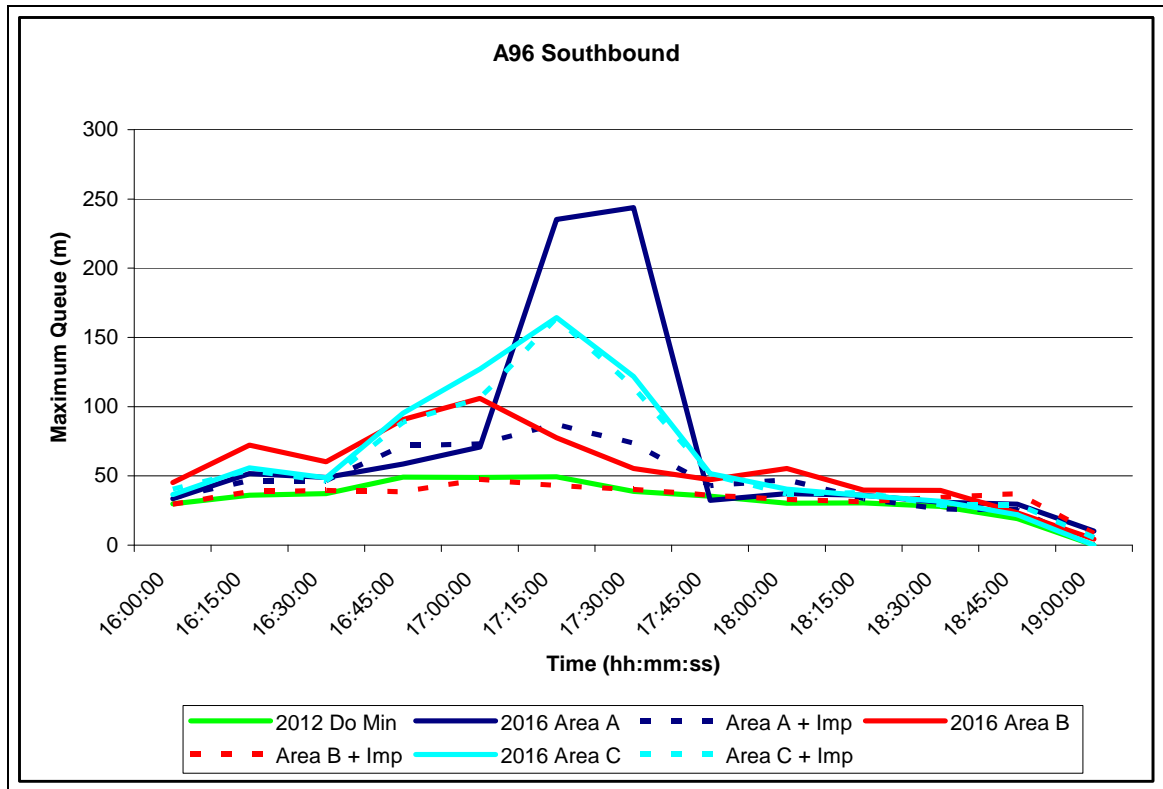


Figure 4.13 : 2016 PM Queueing – A96 Southbound

4.16.10 Figure 4.13 shows that in the PM peak, queue lengths in the Area A with no improvements scenario reach approximately 250m at 17:30. When improvements are introduced this queue reduces to less than 100m. Queue lengths in the Area C scenario reach approximately 160m with and without improvements. Area B is observed to have queue lengths of approximately 100m without improvements and 50m with improvements, similar to the 2012 Do-Minimum.



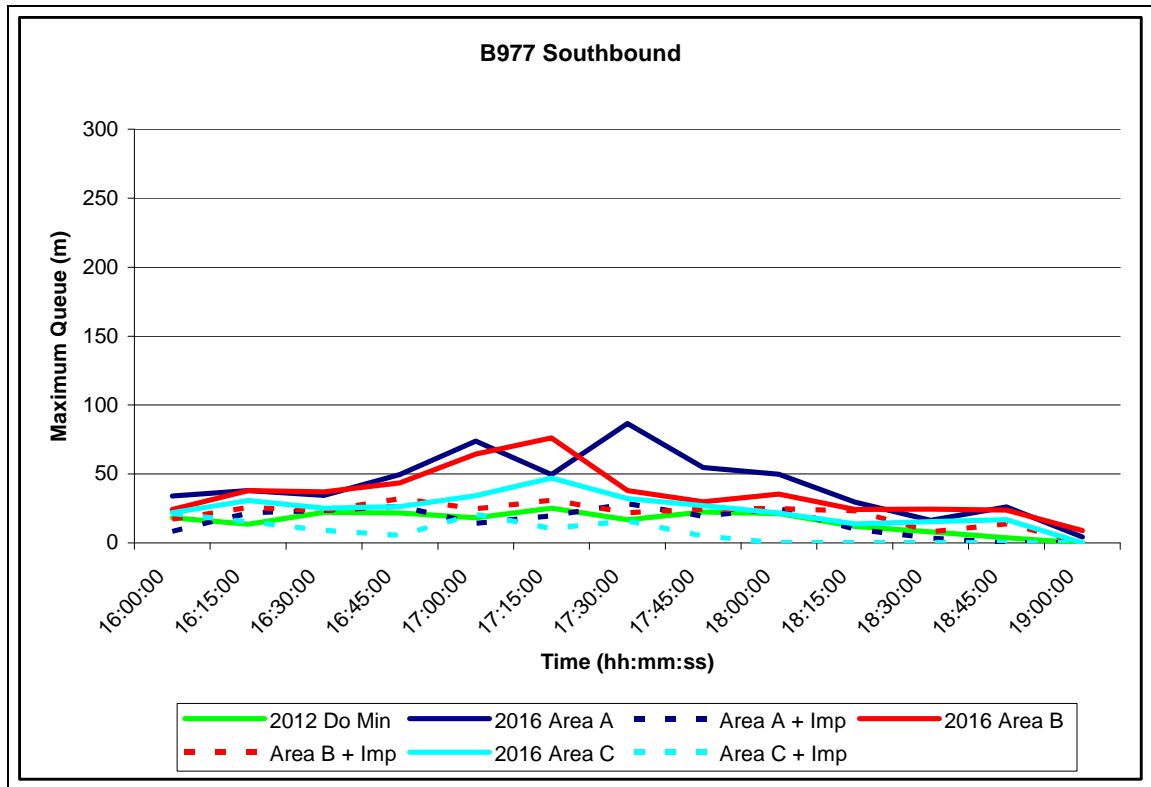


Figure 4.14 : 2016 PM Queueing – B977 Southbound

4.16.11 Figure 4.14 shows that there is no significant queueing on the B977 southbound in the PM peak.

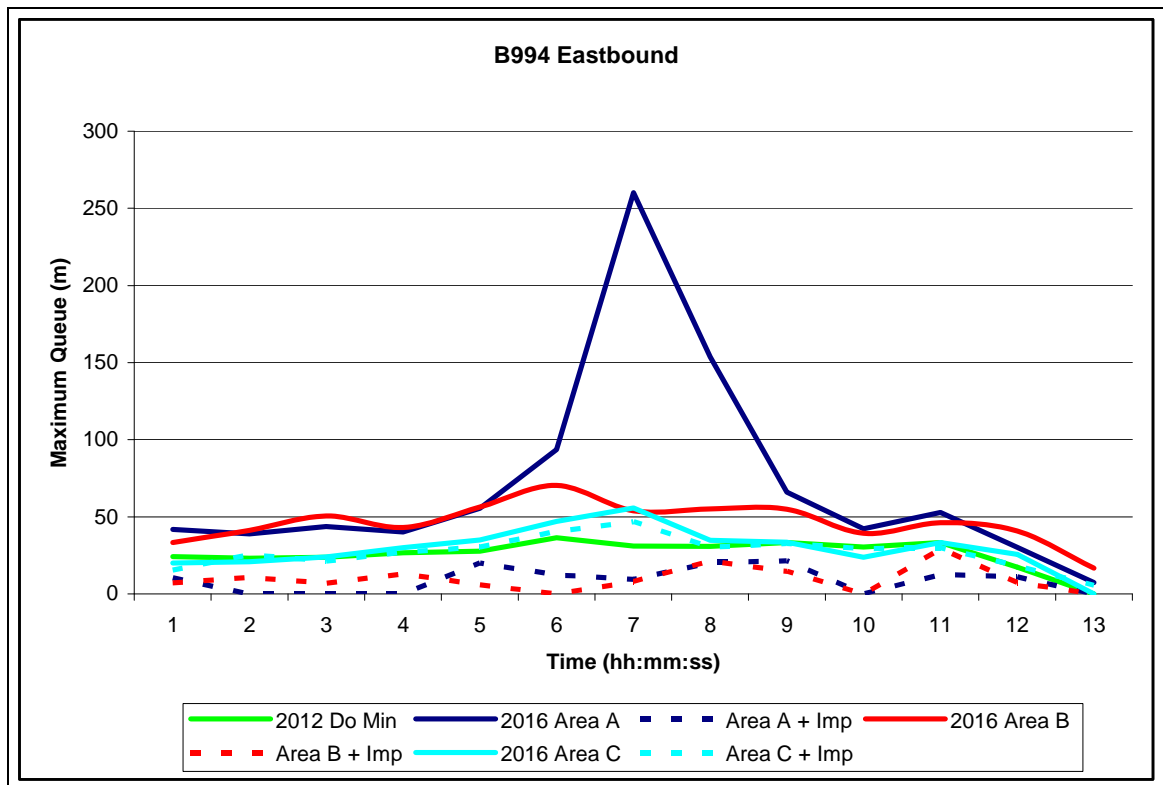


Figure 4.15 : 2016 PM Queueing – B994 Eastbound



4.16.12 Figure 4.15 shows that in the PM peak, the only scenario observed to have a significant queue on the B994 Eastbound is Area A with no improvements.

**4.17 2016 Testing Journey Time Comparison**

4.17.1 Average journey times were compared on four routes, in both directions. The routes compared were:

- B977 eastbound and westbound – from Gauchill roundabout to the School Rd junction
- A96 northbound and southbound – the length of the A96 in the model network
- B994 eastbound and westbound – from Gauchill roundabout to B994/B977 junction
- B977 northbound and southbound – from School Road/ Kingsfield Road junction to Broomfield Roundabout

4.17.2 Figure 4.16 shows the AM peak hour average journey times. No significant changes to journey times were observed on the B994 westbound, A96 northbound or B977 northbound in the AM peak, so these routes have been omitted from subsequent comparisons.

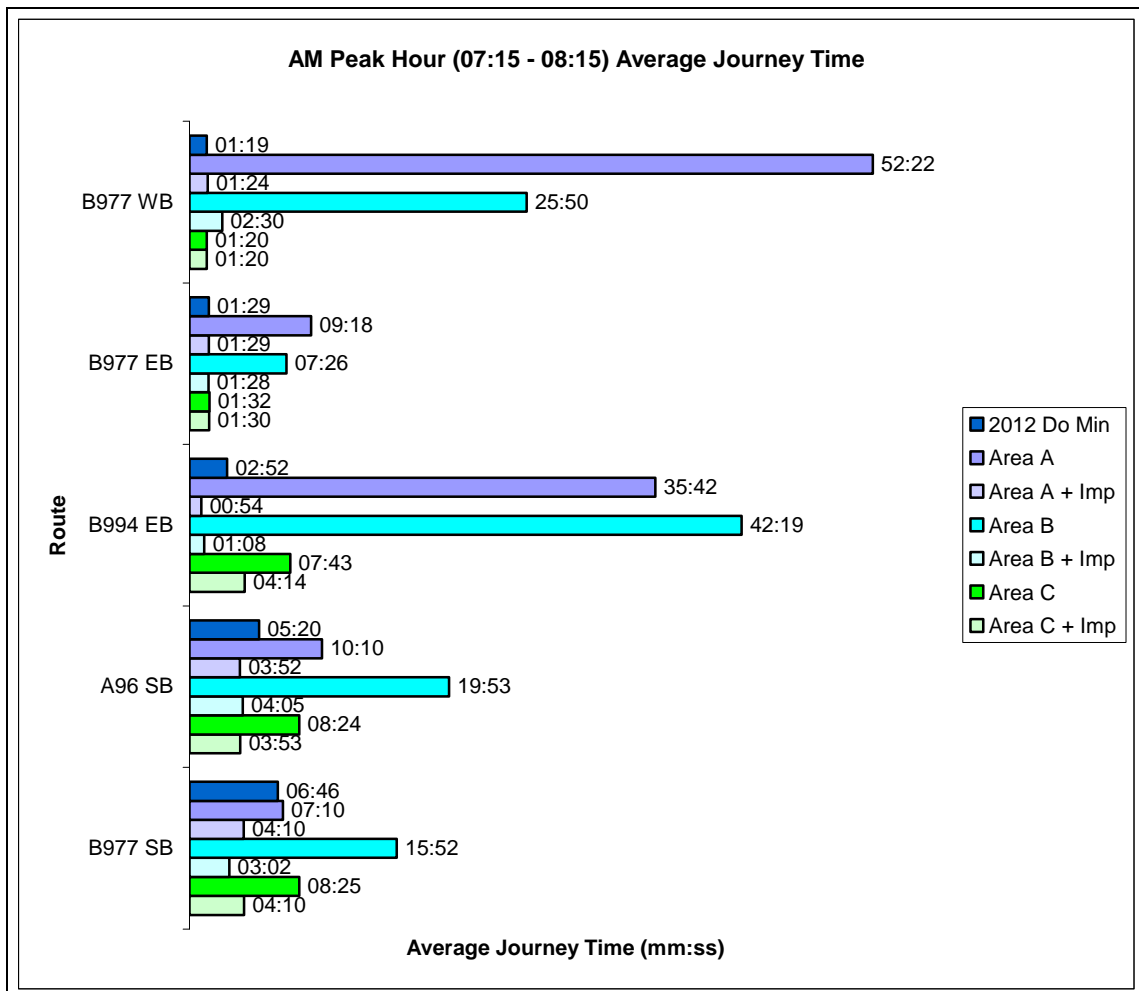


Figure 4.16 : 2016 AM Peak Hour Journey Times



- 4.17.3 Figure 4.16 shows that with no improvements in place, the journey times for Areas A and B are significantly longer than those for Area C on the B977 westbound and B994 Eastbound. This is due to the close proximity of the access points for Areas A and B to the existing areas of congestion in the network.
- 4.17.4 Figure 4.17 shows the PM average journey times. No significant changes to journey times were observed on the B977 eastbound or westbound or the B994 westbound in the PM peak, so these routes have been omitted from subsequent comparisons.

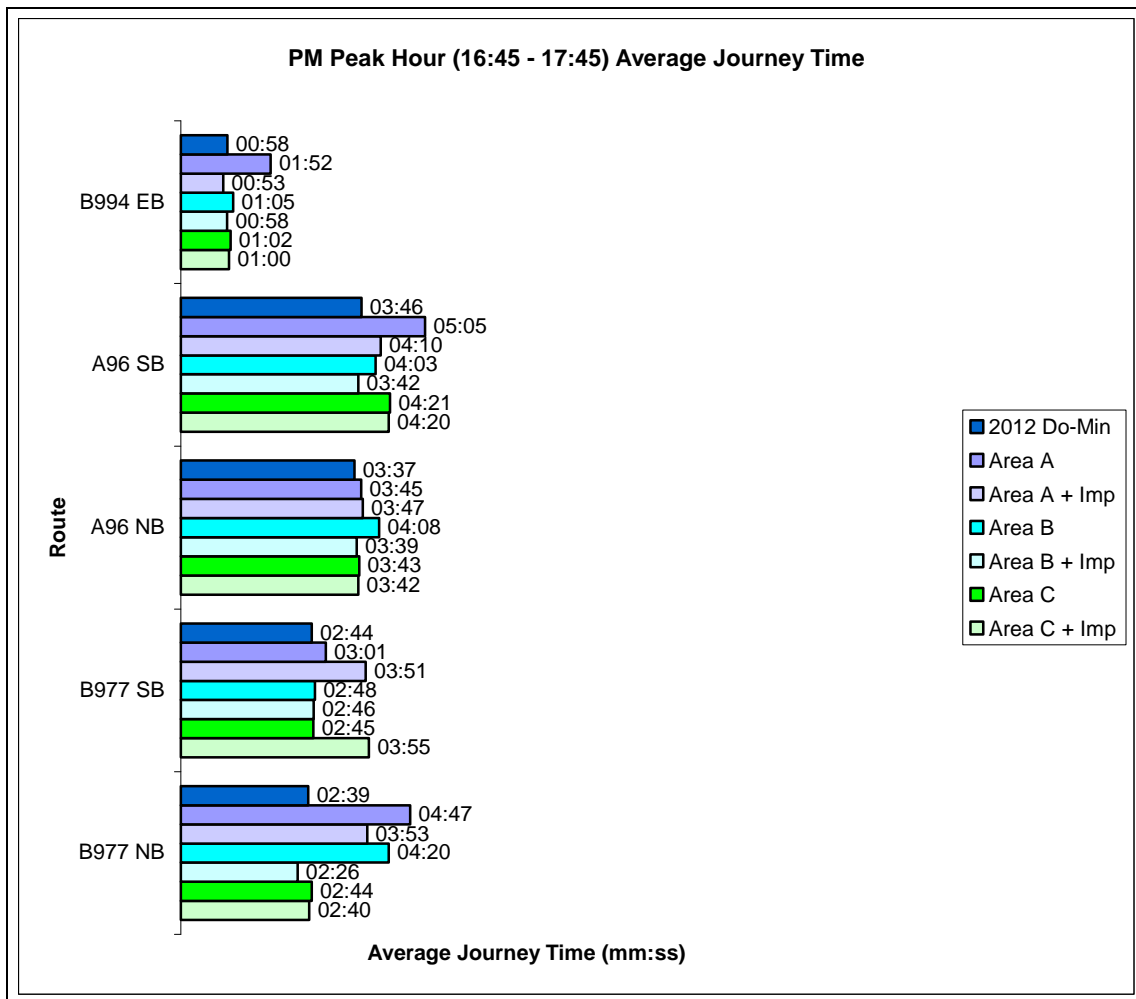


Figure 4.17 : 2016 PM Peak Hour Journey Times

- 4.17.5 Figure 4.17 shows that in the PM peak, the journey times are similar in all three scenarios.

**4.18 2016 Testing Summary**

- 4.18.1 A proposed development comprising of 800 housing units and 20ha of employment land has been tested at 2016, at three separate locations.
- 4.18.2 After initial assessment of the operation of the sites, improvements were carried out in the model networks to optimise the operation of each scenario.
- 4.18.3 Area A: located to the east of Kintore and accessed via Tumulus Way and the new roundabout at the Midmill Call Centre. In the AM peak, significant congestion was observed throughout the model network. In the PM peak, queuing was observed around the access to the development



on Tumulus Way and the B977 northbound and B994 eastbound. Queues were also observed on the A96 southbound.

- 4.18.4 Area A plus Improvements: A segregated left turn lane from the B977 to the A96 and part time signals on the A96 southbound arm of Broomhill Roundabout were introduced to aid operation of the junction. The improvements significantly reduce queueing and journey times in both peak periods, with the only queueing in the AM peak observed on the B977 northbound. In the PM peak, a queue of approximately 400m is observed on the A96 northbound and queueing was still present on the B977 northbound.
- 4.18.5 Area B: located to the south west of Kintore and accessed via a new link to Broomhill Roundabout to the east and the B977 to the west. In the AM peak, queueing began at Broomhill Roundabout, in particular the A96 southbound with queues of approximately 1km by 07:30. The network became significantly congested and by 08:35 approximately 450 vehicles were unable to join the model network due to congestion. In the PM peak, development traffic was unable to gain egress from the site at Broomhill Roundabout due to the cutting movement across the site access arm, and by 18:00 320 vehicles were unable to join the model network due to congestion.
- 4.18.6 Area B plus Improvements: Several infrastructure improvements were introduced including south facing slips from the B994 to the A96, part time signals at Broomhill Roundabout, a new roundabout at the B977 development access, and the B977/ B994 roundabout upgraded. In order to address the issue of egress at Broomhill in the PM peak, all development traffic was assigned to the B977 access. With all development traffic using the B977 access, queueing was observed around Gauchill Roundabout on the B977, westbound in the AM peak and northbound in the PM peak. Queueing extended back into the development in the PM peak with approximately 290 vehicles unable to join the model network due to congestion at 18:00.
- 4.18.7 Area C: located to the north of Kintore, to the west of the A96, and accessed via a new link connecting to the existing grade separated junction. Area C was observed to have the lowest levels of congestion of the three sites without improvements. In the AM peak, queueing was observed on the B977 southbound, A96 southbound (1100m) and B994 as far as Gauchill Roundabout. No significant queueing was observed in the Area C model in the PM peak.
- 4.18.8 Area C plus Improvements: A segregated left turn lane from the B977 to the A96 and part time signals on the A96 southbound arm of Broomhill Roundabout were introduced to enhance the operation of the model network. In the AM peak, an eastbound queue was observed on the B994 from the junction with the B977 reaching approximately 350m. No significant congestion was observed in the PM peak.







## 5 ADDITIONAL 2016 TESTING

### 5.1 Introduction

5.1.1 At the request of Aberdeenshire Council, two additional tests were carried out in the most successful 2016 scenario, Area C with Improvements. The tests involved adjusting A96 traffic in the Kintore model to make it consistent with traffic volumes entering and exiting the south of the 2016 Test 2 Inverurie model.

### 5.2 A96 Traffic Test 1

5.2.1 Traffic volumes exiting/entering the Inverurie model via the A96 to the south were assessed and used to derive an uplift factor, which was then applied to the traffic exiting/entering the Kintore model via the A96 to the north. The distribution in this instance applies the uplift factor to all trips throughout the Kintore network.

5.2.2 The uplift factors used were:

- AM - Traffic entering Kintore model from North: 1.027045
- AM – Traffic exiting Kintore model to North: 1.303284
- PM - Traffic entering Kintore model from North: 1.296156
- PM – Traffic exiting Kintore model to North: 1.121281

### 5.3 A96 Traffic Test 2

5.3.1 In Test 2 only A96 northbound and southbound traffic was increased by the uplift factor, compared to Test 1 which applied the increase to all trips throughout the Kintore network.

### 5.4 Test 1 Model Observations

5.4.1 In the AM peak a queue is observed on the B994 which extends to approximately 300m by 08:00.

5.4.2 In the PM peak, a southbound queue is observed on the A96 at Broomhill Roundabout by 16:55, which causes some southbound traffic to reroute on the B994 eastbound and B977 southbound. The southbound queue on the A96 reaches approximately 300m at 17:35.

### 5.5 Test 2 Model Observations

5.5.1 In the AM peak, a queue is observed on the B994 which extends to approximately 350m by 07:35.

5.5.2 In the PM peak, queues build on the A96 at Broomhill Roundabout by 16:45, which causes some southbound traffic to reroute on the B994 eastbound and B977 southbound. By 17:30 queues of approximately 450m are observed on the A96 southbound. Queues reaching approximately 350m are observed on the B994 eastbound.

### 5.6 Additional Testing Traffic Flow Comparison

5.6.1 Traffic flows (link counts) have been compared at six key locations in the model network:

- A96 South of Broomhill
- A96 North of Broomhill



- B977 North of Broomhill
- Tumulus Way
- B994
- B977 North of B994

5.6.2 Values are calculated as an average of five S-Paramics model runs and are shown as a difference to the Area C plus Improvements model. The link count locations are shown in Figure 3.5.

5.6.3 Table 5.1 shows the link count comparison for the 2016 additional testing AM peak hour.

*Table 5.1 : Additional Testing AM Peak Hour Link Count Comparison*

Location	Area C + Imp	Difference to Area C	
		Test 1	Test 2
A96 NB south of Broomhill	894	135	269
A96 SB south of Broomhill	2,328	37	62
A96 NB north of Broomhill	717	144	265
A96 SB north of Broomhill	1,694	37	56
B977 NB north of Broomhill	334	8	2
B977 SB north of Broomhill	800	15	5
Tumulus Way EB	310	7	4
Tumulus Way WB	90	11	11
B994 EB	470	7	4
B994 WB	118	1	1
B977 NB north of B994	130	3	-1
B977 SB north of B994	467	-1	-3

5.6.4 Table 5.1 shows that in Test 1 there is an increase in traffic flow on the A96 and also other roads throughout the network. Traffic flows in Test 2 show a higher increase on the A96 north and south movement as this was the sole location where an uplift was applied.

5.6.5 Table 5.2 shows the link count comparison for the 2016 additional testing PM peak hour.



Table 5.2 : Additional Testing PM Peak Hour Link Count Comparison

Location	Area C + Imp	Difference to Area C	
		Test 1	Test 2
A96 NB south of Broomhill	2,605	200	303
A96 SB south of Broomhill	1,239	151	327
A96 NB north of Broomhill	1,914	210	309
A96 SB north of Broomhill	895	27	69
B977 NB north of Broomhill	822	12	-6
B977 SB north of Broomhill	478	146	259
Tumululus Way EB	101	5	-8
Tumululus Way WB	285	2	-9
B994 EB	223	113	111
B994 WB	628	1	1
B977 NB north of B994	370	-5	-16
B977 SB north of B994	248	25	139

5.6.6 Table 5.2 shows a greater increase in traffic flow on the A96 and B977 in Test 2 compared to Test 1. Congestion on the A96 southbound causes traffic to reroute via the B994 eastbound and B977 southbound which increases traffic flows at these locations.

## 5.7 Additional Testing Queue Length Comparison

5.7.1 Queue lengths were compared at the following locations:

- A96 Southbound at Broomhill Roundabout
- B977 Southbound at Broomhill Roundabout
- B994 Eastbound at junction with B977

5.7.2 No significant queueing was observed on the B977 southbound in the AM or PM peak in Test 1 or 2. Figures 5.1 and 5.2 show the AM peak queue results.



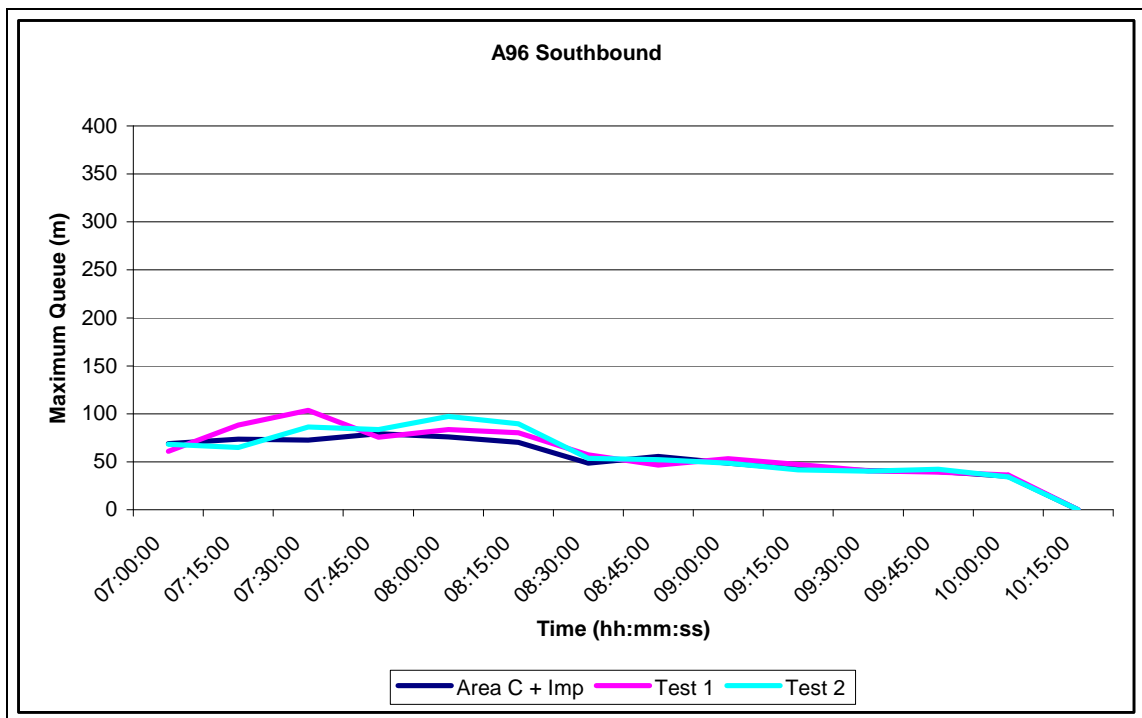


Figure 5.1 : Additional Testing- AM Queueing A96 Southbound

5.7.3 Figure 5.1 shows that there is no significant difference in queue lengths on the A96 southbound in the AM peak with the increased traffic in Test 1 and 2.

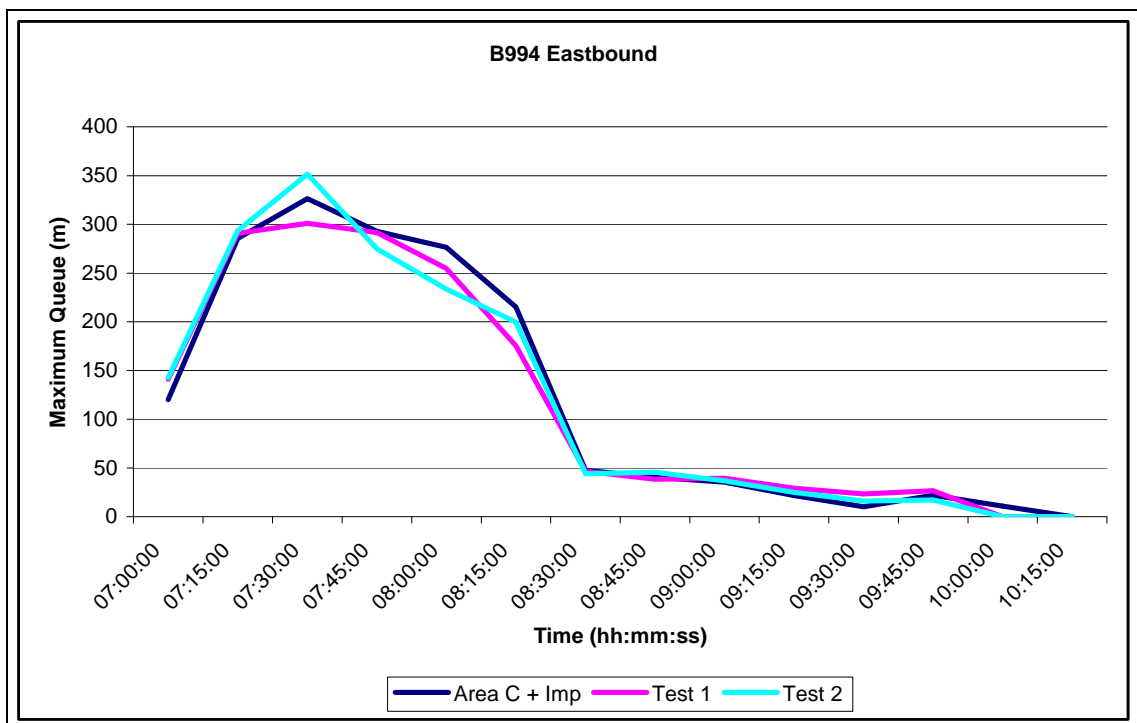


Figure 5.2 : Additional Testing- AM Queueing B994 Eastbound

5.7.4 Figure 5.2 shows that there is no significant impact on queue lengths on the B994 in the AM peak in Test 1 or Test 2.



5.7.5 Figures 5.3 and 5.4 show the PM queue graphs for the A96 southbound and B994 eastbound.

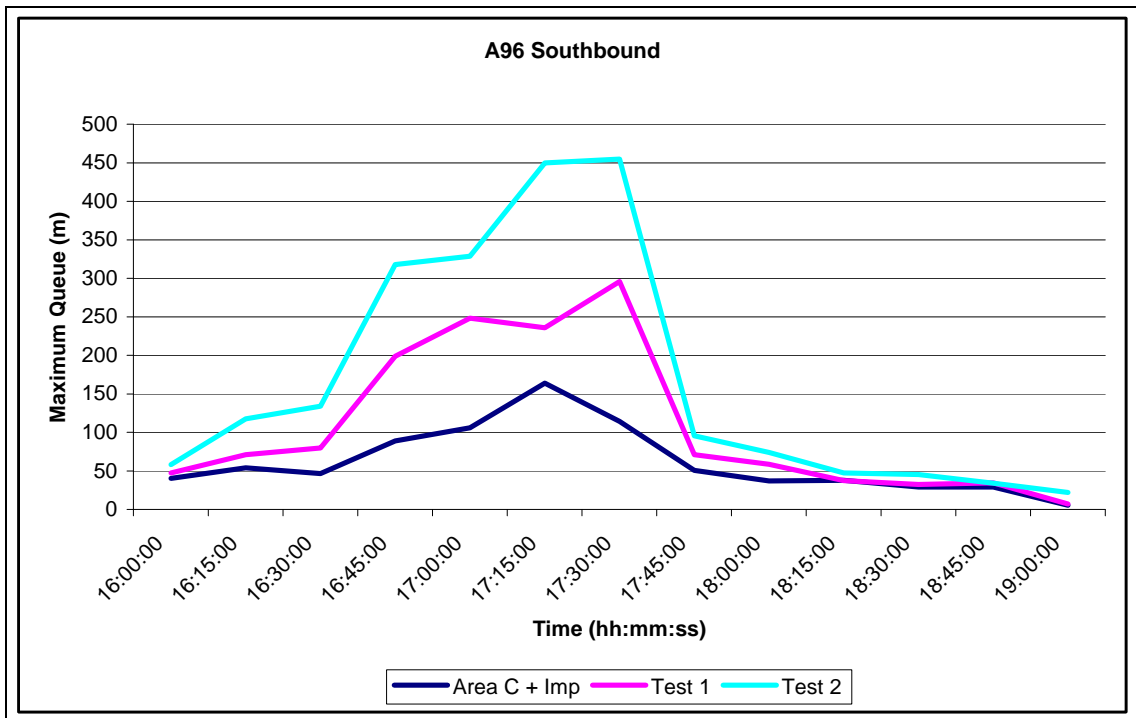


Figure 5.3 : Additional Testing- PM Queueing A96 Southbound

5.7.6 Figure 5.3 shows that in the PM peak, queue lengths on the A96 southbound increase by approximately 150m in Test 1 compared to the Area C + Improvements model from which it was developed. In Test 2 the queue length is observed to increase by 300m from the Area C + Improvements model.

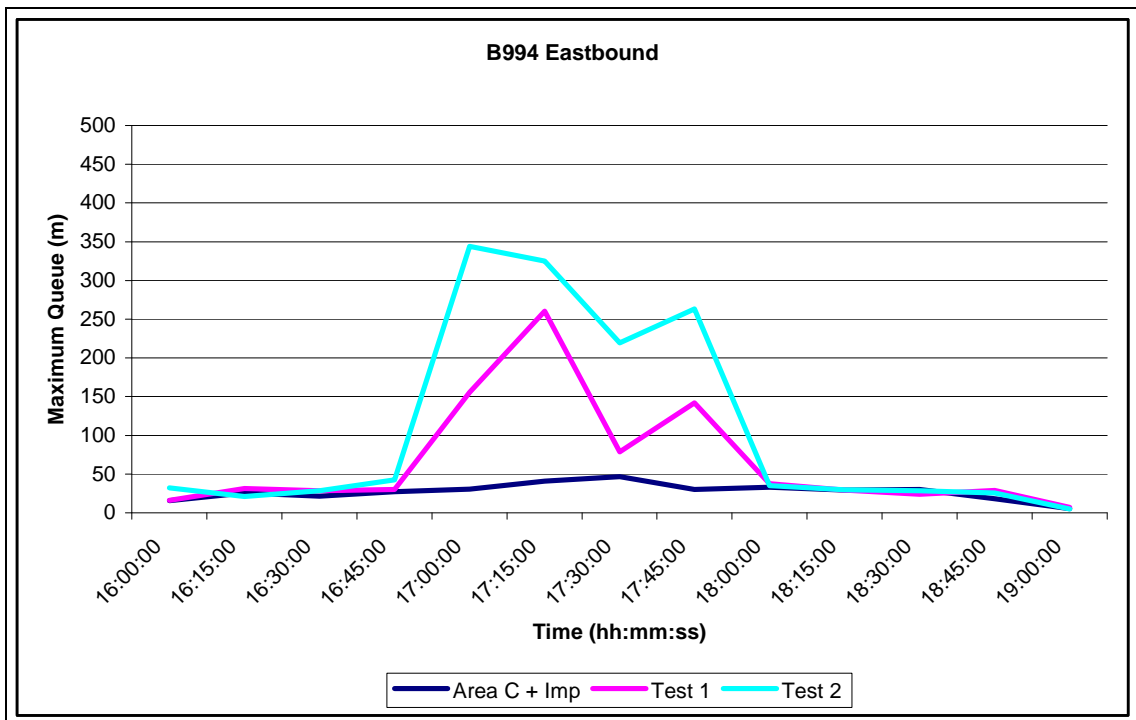


Figure 5.4 : Additional Testing- PM Queueing B994 Eastbound



5.7.7 Figure 5.4 shows that queue lengths on the B994 eastbound increase by approximately 200m in Test 1 and a further 100m in Test 2, compared to the Area C plus Improvements model.

**5.8 Additional Testing Journey Times**

5.8.1 Average journey times were compared on three routes, in both directions. The routes compared were:

- A96 northbound and southbound – the length of the A96 in the model network
- B994 eastbound and westbound – from Gauchill roundabout to B994/B977 junction
- B977 northbound and southbound – from School Road/ Kingsfield Road junction to Broomfield Roundabout

5.8.2 All journey time statistics are calculated from an average of five S-Paramics model runs. Figure 5.5 shows the AM peak hour average journey times.

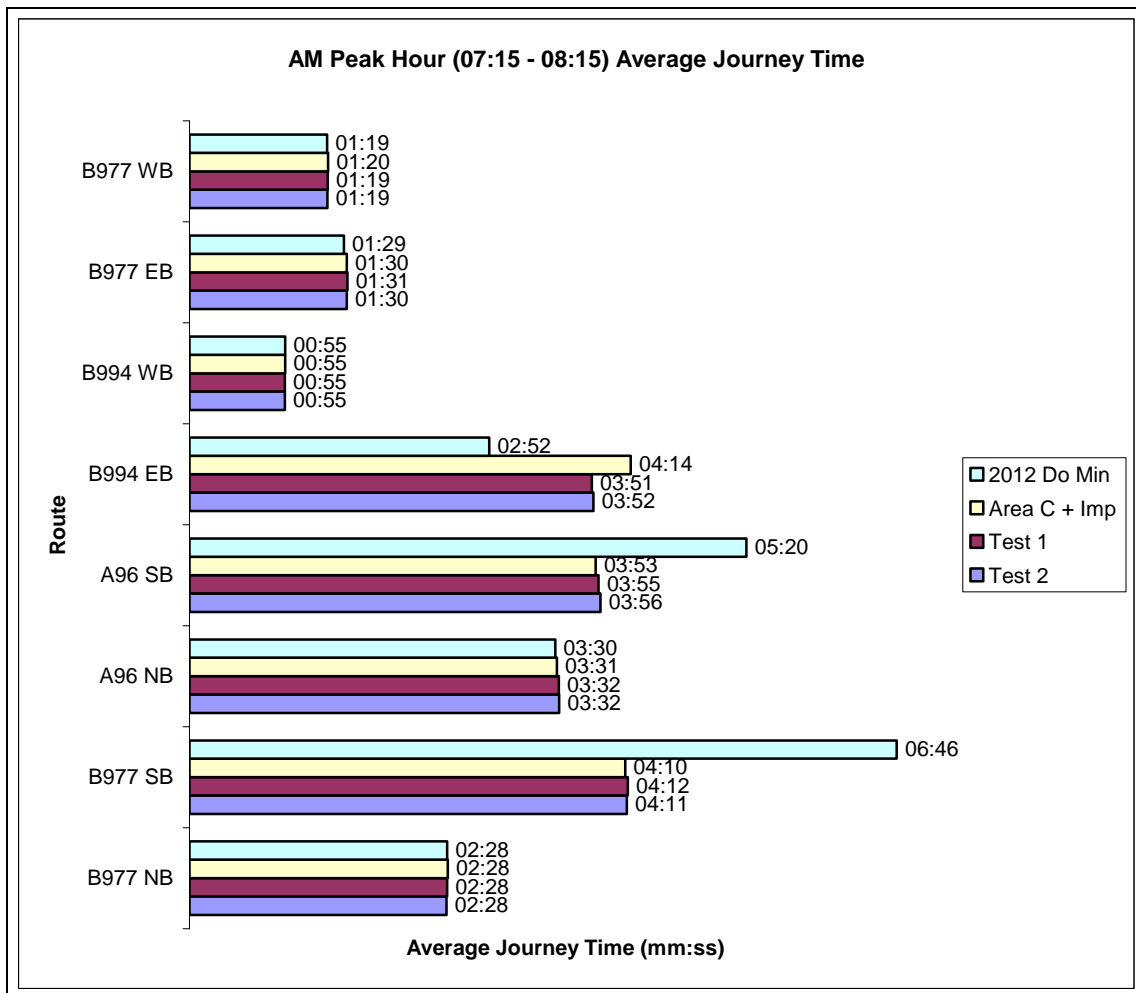


Figure 5.5 : Additional Testing AM Journey Times

5.8.3 Figure 5.5 indicates that the additional traffic in Tests 1 and 2 has no significant impact on journey times in the AM peak. Journey times on the key routes of the B977 southbound and A96 southbound remain the same as the Area A +Improvements scenario.

5.8.4 Figure 5.3 shows the PM peak hour average journey times.



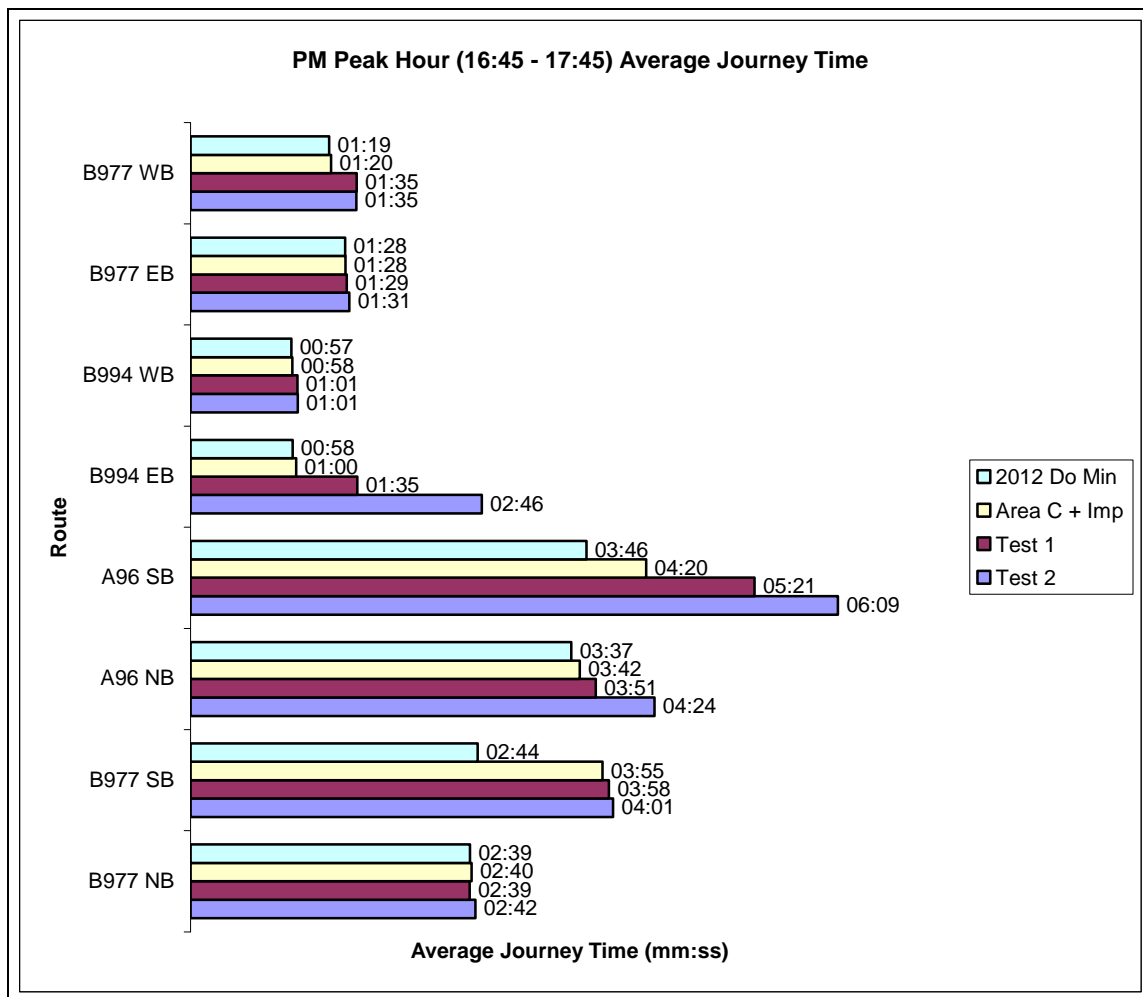


Figure 5.6 : Additional Testing PM Journey Times

5.8.5 Figure 5.3 shows that in the PM peak hour, average journey times are increased from the Area C plus Improvements scenario in Test 1 and increased further in Test 2 on the B994 eastbound and A96 southbound in particular, due to the additional traffic.

**5.9 Additional Testing Summary**

5.9.1 At the request of Aberdeenshire Council, two additional tests were carried out in the most successful 2016 scenario, Area C plus Improvements.

5.9.2 Test 1: All trips in Kintore network factored to match traffic volumes exiting/entering the Inverurie model via the A96 to the south.

5.9.3 Test 2: A96 northbound and southbound traffic factored to match traffic volumes exiting/entering the Inverurie model via the A96 to the south.

5.9.4 The additional traffic has no significant impact on queueing or journey times in the AM peak. In the PM peak, queueing and journey times on the A96 southbound and B994 eastbound are increased in Test 1 and increased further in Test 2 from the Area C plus improvements model on which these tests were based.







## 6 PROVISIONAL SCHEME COSTS

### 6.1 Introduction

6.1.1 Provisional cost estimates were carried out by Mouchel for the following infrastructure improvements:

- A96/ B994 slips
- Access directly into existing 'all ways' grade separated junction at north end of Kintore (for Area C)

### 6.2 Summary Costs

6.2.1 Mouchel have developed all costings using SPON's 2009, and considering:

- Optimism Bias 44% (DMRB Stage 2)
- Contingencies Allowance 20%
- Utilities Allowance 10%

6.2.2 The summary costs provided in Table 6.1 are given as indicative general costs.

*Table 6.1 : Kintore Provisional Scheme Costs*

Infrastructure	Indicative Cost Estimate	
B944 On-Off Slips to A96	£	616,536.00
Access to Development Area C from existing grade separated junction	£	536,709.00
Broomhill Roundabout Improvements (SIAS Est)	£	616,536.00
<b>Total</b>	<b>£</b>	<b>1,769,781.00</b>

6.2.3 A full detailed breakdown of all costs is provided in Appendix A.





## 7 SUMMARY

- 7.1.1 Model testing has been carried out as an initial appraisal of the Kintore road network operation, under agreement with Aberdeenshire Council.
- 7.1.2 A 2012 Do-Minimum model has been developed from the Kintore 2007 Base model, which represents committed development and traffic growth to 2012.
- 7.1.3 Five test scenarios have been modelled in the 2012 Do-Minimum model:
- Test 1: B994/ Tumulus Way new roundabout
  - Test 2: B994/ Tumulus Way new signal controlled junction
  - Test 3: B994 to A96 slips
  - Test 4: Test 3 plus the closure of Broomhill Roundabout
  - Test 5: B977 to A96 slips
- 7.1.4 No significant congestion was observed in any Test in the PM peak. Tests 1 and 2 improved traffic flow on the B994 eastbound in the AM peak. The new slips in Tests 3 and 5 caused increased queueing on the A96 southbound and rerouting of traffic on the B994 and B977. No significant congestion was observed in the AM or PM peak in Test 4.
- 7.1.5 2016 testing included a proposed development comprising 800 housing units and 20ha of employment land. This development was tested at three separate locations:
- Area A: located to the east of Kintore
  - Area B: located to the south west of Kintore
  - Area C: located to the north of Kintore
- 7.1.6 After initial assessment of the operation of the sites, improvements were carried out to the model network to optimise the operation of each scenario.
- 7.1.7 Area A was observed to have significant congestion throughout the model network in the AM peak. In the PM peak, queueing was observed around the access to the development on Tumulus Way and the B977 northbound and B994 eastbound. Queues were also observed on the A96 southbound. The following improvements were made to the Area A scenario:
- Segregated left turn lane B977 to A96
  - Part time signals at Broomhill Roundabout
- 7.1.8 The Area A improvements significantly reduced queueing and journey times in both peak periods, with the only queueing in the AM peak observed on the B977 northbound. In the PM peak, a queue of approximately 400m was observed on the A96 northbound and queueing was still present on the B977 northbound.
- 7.1.9 In the Area B scenario, significant congestion was observed in the AM peak, approximately 450 vehicles were unable to join the model network due to congestion. In the PM peak, development traffic was unable to gain egress from the site at Broomhill Roundabout due to the cutting movement across the site access arm, and by 18:00, 320 vehicles were unable to join the model network due to congestion. The following improvements were made to the Area B scenario:
- South facing slips B994 to A96



- Part time signals at Broomhill Roundabout
  - All development traffic assigned to west (B977) access
  - New roundabout at development access
  - B977/ B994 roundabout upgraded
- 7.1.10 With all development traffic using the B977 access, queueing was observed around Gauchill Roundabout on the B977, westbound in the AM peak and northbound in the PM peak. Queueing extended back into the development in the PM peak with approximately 290 vehicles unable to join the model network due to congestion at 18:00.
- 7.1.11 Area C was observed to have the lowest levels of congestion of the three sites without improvements. In the AM peak, queueing was observed on the B977 southbound, A96 southbound (1100m) and B994 as far as Gauchill Roundabout. The following improvements were made to the Area C scenario:
- Segregated left turn lane B977 to A96
  - Part time signals at Broomhill Roundabout
- 7.1.12 With improvements in place the only significant queueing is on the B994 eastbound, reaching approximately 350m in the AM peak.
- 7.1.13 At the request of Aberdeenshire Council, two additional tests were carried out:
- Test 1: All trips in Kintore network factored to match traffic volumes exiting/entering the Inverurie model via the A96 to the south.
  - Test 2: A96 northbound and southbound traffic factored to match traffic volumes exiting/entering the Inverurie model via the A96 to the south.
- 7.1.14 The additional traffic had no significant impact on queueing or journey times in the AM peak. In the PM peak, queueing and journey times on the A96 southbound and B994 eastbound were increased in Test 1 and increased further in Test 2 compared to the Area C plus improvements model on which these tests are based.
- 7.1.15 No Kintore testing to date has included the influence of the Aberdeen Western Peripheral Route (AWPR), so no analysis has been undertaken in this study to determine what impact the AWPR could have on the local Kintore network.
- 7.1.16 Further work would be required to determine the details of any proposed junction improvements and infrastructure works to facilitate future development, which in any case would be subject to the usual planning procedures.



**A APPENDIX A**





**INDICATIVE COST ESTIMATE - NORTHERN KINTORE**  
Estimated as Local Distributor Road 6.5m wide

	Qty	Unit	Rate	Amount
<b>1. Preliminaries (10%)</b>				<b>10% of sub-total (See below)</b>
<b>2. Site Clearance</b>				
General	1	ha	£3,411.36	£3,411.36
Kerbing	100	lin.m	£6.15	£615.00
Gully cover & frame remove to store	2	nr	£4.76	£9.52
Lighting column remove to store	1	nr	£68.02	£68.02
Masonry boundary wall remove to store	20	m3	£62.00	£1,240.00
<b>TOTAL</b>				<b>£5,343.90</b>
<b>3. Earthworks</b>				
Excavation (bitu - U1)	663	m3	£2.87	£1,902.81
Extra over excavation in Hard material	100	m3	£9.00	£900.00
Disposal (bitu - U1)	663	m3	£31.24	£20,712.12
Excavation (excluding 5A)	284	m3	£2.87	£815.08
Disposal (excluding 5A)	284	m3	£31.24	£8,872.16
Excavation (5A)	279	m3	£2.87	£800.73
Deposition	279	m3	£0.84	£234.36
Topsoiling	2785	m2	£4.62	£12,866.70
Backfilling of gullies	2	nr	£14.02	£28.04
<b>TOTAL</b>				<b>£47,132.00</b>
<b>4. Pavements</b>				
Full Carriageway	1466	m2	£55.00	£80,630.00
Resurfacing	70	m2	£35.00	£2,450.00
Planed off for tie-in	70	m2	£5.28	£369.60
Kerbing	490	lin m	£12.43	£6,090.70
Footway	1420	m2	£20.50	£29,110.00
Edging kerb	900	lin m	£6.14	£5,526.00
Anti-skid	163	m2	£19.25	£3,137.75
<b>TOTAL</b>				<b>£127,314.05</b>
<b>5. Drainage</b>				
Gullies	12	nr	£271.71	£3,260.52
Pipework	400	lin.m	£61.58	£24,632.00
Chambers	2	nr	£1,182.07	£2,364.14
<b>TOTAL</b>				<b>£30,256.66</b>
<b>6. Streetlighting</b>				
Remove from store and reinstall column	1	nr	£150.07	£150.07
New columns	7	nr	£839.88	£5,879.16
Cut-outs	8	nr	£30.00	£240.00
Ducting	250	lin.m	£30.00	£7,500.00
<b>TOTAL</b>				<b>£13,769.23</b>
<b>7. Traffic Signs</b>				
ADS signs with 3 posts	1	nr	£1,200.00	£1,200.00
Directional signs 2 posts	2	nr	£350.00	£700.00
<b>TOTAL</b>				<b>£1,900.00</b>

	Qty	Unit	Rate	Amount
<b>8. Road Markings</b>				
Lines	140	lin.m	£1.00	£140.00
Arrows	1	nr	£31.83	£31.83
TOTAL				<b>£171.83</b>
<b>CONSTRUCTION COST</b>				<b>£225,887.67</b>
<b>PRELIMINARIES (10%)</b>				<b>£22,588.77</b>
<b>SUB - TOTAL</b>				<b>£248,476.44</b>
<b>PUBLIC UTILITIES (10%)</b>				<b>£24,847.64</b>
<b>TRAFFIC MANAGEMENT (15%)</b>				<b>£37,271.47</b>
<b>SUB - TOTAL</b>				<b>£310,595.55</b>
<b>CONTINGENCIES (20%)</b>				<b>£62,119.11</b>
<b>SUB - TOTAL</b>				<b>£372,714.66</b>
<b>OPTIMISM BIAS (44%)</b>				<b>£163,994.45</b>
<b>TOTAL</b>				<b>£536,709.10</b>

Prepared by: Kevin Chin

Date: 28/02/2009

Checked and Reviewed by: Louise Trayner

Date: 03/03/2009

Approved by: Ricky Laing

Date: 03/03/2009



**INDICATIVE COST ESTIMATE - KINTORE ON AND OFF SLIPS**

Estimated as per outline design provided by SIAS

	Qty	Unit	Rate	Amount
<b>1. Preliminaries (10%)</b>				<b>10% of sub-total (See below)</b>
<b>2. Site Clearance</b>				
General	1.9	ha	£3,411.36	£6,481.58
Kerbing	422	lin.m	£6.15	£2,595.30
Masonry boundary wall remove to store	35	m3	£62.00	£2,170.00
<b>TOTAL</b>				<b>£11,246.88</b>
<b>3. Earthworks</b>				
Excavation (bitu - U1)	90	m3	£2.87	£258.30
Extra over excavation in Hard material	90	m3	£9.00	£810.00
Disposal (bitu - U1)	90	m3	£31.24	£2,811.60
Excavation (excluding 5A)	474	m3	£2.87	£1,360.38
Disposal (excluding 5A)	474	m3	£31.24	£14,807.76
Excavation (5A)	119	m3	£2.87	£341.53
Deposition	119	m3	£0.84	£99.96
Topsoiling	1190	m2	£4.62	£5,497.80
<b>TOTAL</b>				<b>£25,987.33</b>
<b>4. Pavements</b>				
Full Carriageway	1465	m2	£50.00	£73,250.00
Resurfacing	1265	m2	£35.00	£44,275.00
Planned off for resurfacing & tie-in	1324	m2	£5.28	£6,990.72
Kerbing	790	lin m	£12.43	£9,819.70
<b>TOTAL</b>				<b>£134,335.42</b>
<b>5. Drainage</b>				
Gullies	30	nr	£271.71	£8,151.30
Pipework	800	lin.m	£61.58	£49,264.00
Chambers	6	nr	£1,182.07	£7,092.42
<b>TOTAL</b>				<b>£64,507.72</b>
<b>6. Traffic Signs</b>				
ADS signs with 3 posts	1	nr	£1,200.00	£1,200.00
Directional signs 2 posts	6	nr	£350.00	£2,100.00
<b>TOTAL</b>				<b>£3,300.00</b>
<b>7. Road Markings</b>				
Hatch	310	m2	£10.00	£3,100.00
Lines	1500	lin.m	£1.00	£1,500.00
Arrows	4	nr	£31.83	£127.32
<b>TOTAL</b>				<b>£4,727.32</b>
<b>8. Fencing</b>				
Fencing	500	lin m	£10.80	£5,400.00
<b>TOTAL</b>				<b>£5,400.00</b>

Qty	Unit	Rate	Amount
			<u>£249,504.67</u>
			<u>£249,504.67</u>
			<u>£274,455.14</u>
			<u>£27,445.51</u>
			<u>£54,891.03</u>
			<u>£356,791.68</u>
			<u>£71,358.34</u>
			<u>£428,150.02</u>
			<u>£188,386.01</u>
			<u>£616,536.03</u>

Prepared by: Kevin Chin

Date: 26/02/2009

Checked and Reviewed by: Louise Trayner

Date: 27/02/2009

Approved by: Ricky Laing

Date: 03/03/2009

**B APPENDIX B**





# Aberdeenshire Council Aberdeenshire Towns - Kintore Local Accessibility Appraisal

<i>Date :</i>	<b>13 May 2009</b>	<i>Distribution :</i>	
<i>Author :</i>	<b>Graeme Low</b>	<b>Peter MacCallum</b>	<b>Aberdeenshire Council</b>
<i>Reviewer:</i>	<b>Emma Gilmour</b>	<b>Mark Peters</b>	<b>Aberdeenshire Council</b>
<i>Reference :</i>	<b>TPATCKCS/71005</b>	<b>Bob Nicol</b>	<b>SIAS Limited</b>
		<b>Peter Stewart</b>	<b>SIAS Limited</b>

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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 of three potential development sites in Kintore.

## 2 POTENTIAL DEVELOPMENT SITES

### 2.1 Introduction

Kintore has a population of around 1,700 and is located 21km to the north-west of Aberdeen. Direct bus services provide connection between the town and Aberdeen City Centre, with the A96(T) providing access to the city.



The trunk road forms the western boundary of Kintore and the town centre is located in the north of the town.

Aberdeenshire Council has requested that the accessibility of three potential development sites/areas be appraised. The sites are located on the south-eastern edge of Kintore (Development Area A), to the south-west of Kintore (Development Area B) and to the north-west of the town (Development Area C). All three sites are assumed to include both employment and residential elements in accordance with Aberdeenshire Council’s aspirations for the area.

**2.2 Potential Development Sites**

Development Area A is located on the south-eastern edge of Kintore to the east of the B987, which provides access to the A96(T) via the Broomhill Roundabout. Bus stops are provided on the B987 in the vicinity of the development site.

Development Area B is located to the south-west of Kintore and to the west of the A96(T). Access is expected to be provided from the B994, which forms the northern boundary of the site. Access is provided into Kintore via either the B994 or the B977, which cross the trunk road in the vicinity of the site. Access is provided to and from Kintore via a grade separated interchange between the A96(T) and the B977. Those wishing to travel south towards Aberdeen are required to access the A96(T) at the Broomhill Roundabout via the B994 and B987. The trunk road is of dual carriageway standard in the vicinity of the potential development site. The nearest bus stops are located on the B987 in Kintore.

Development Area C is located to the north-west of Kintore, immediately to the west of the A96(T)/B977 Interchange. The trunk road is of dual carriageway standard in the vicinity of the site and provides convenient access to Aberdeen to the south, and Inverurie to the north. Access is provided into Kintore via the B977. The nearest bus stops are located on the B977 immediately to the east of the A96(T)/B977. The locations of the sites are shown in Figure 2.1.

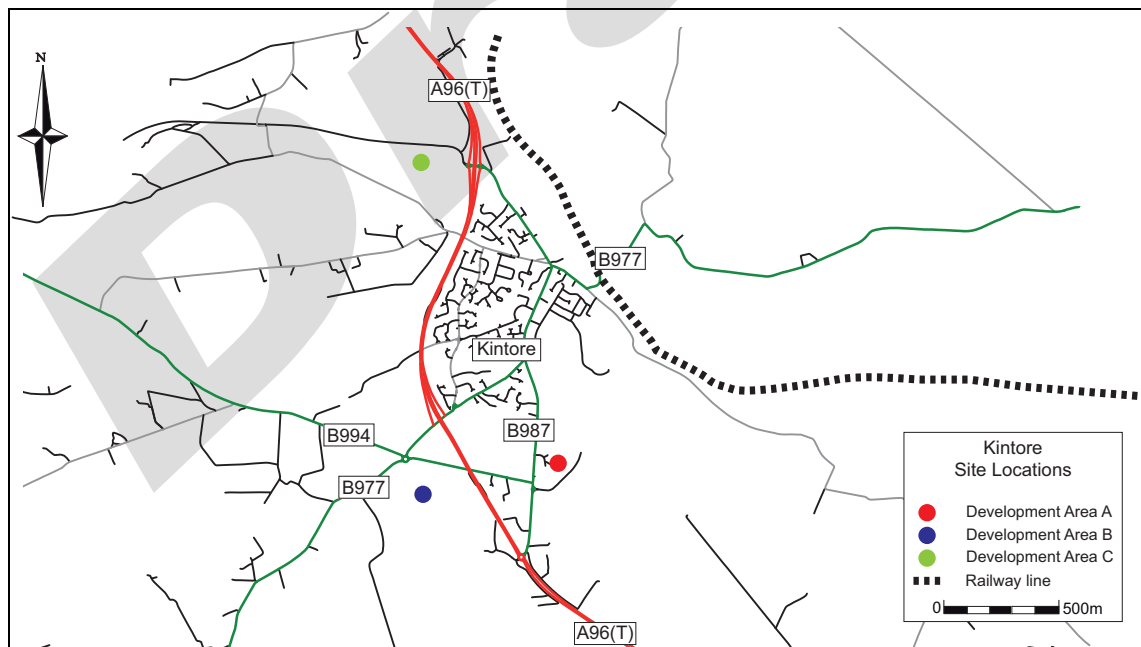


Figure 2.1 : Site Locations



### 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 – 3.3 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, this appraisal has set a maximum journey time of 10min or 800m.

Figure 3.1 shows the proportion of Kintore which is accessible to a bus service which operates with a minimum of a 60min frequency in the morning peak. All three potential development sites are shown to be within a 10min walk of existing bus services in the weekday peak. Development Area A is shown to be the most accessible, with the nearest bus stops located on the B987 within a 3min walk of the site. Development Area B is the next most accessible, as it is located within a 7min walk of the nearest bus stops; with Development Area C around a 10min walk of the nearest stops. A limited frequency local bus service currently routes along the B977 in the vicinity of the site. It is, however, considered that the frequency of the service will necessitate a new or diverted bus service to be introduced to serve the potential development site.

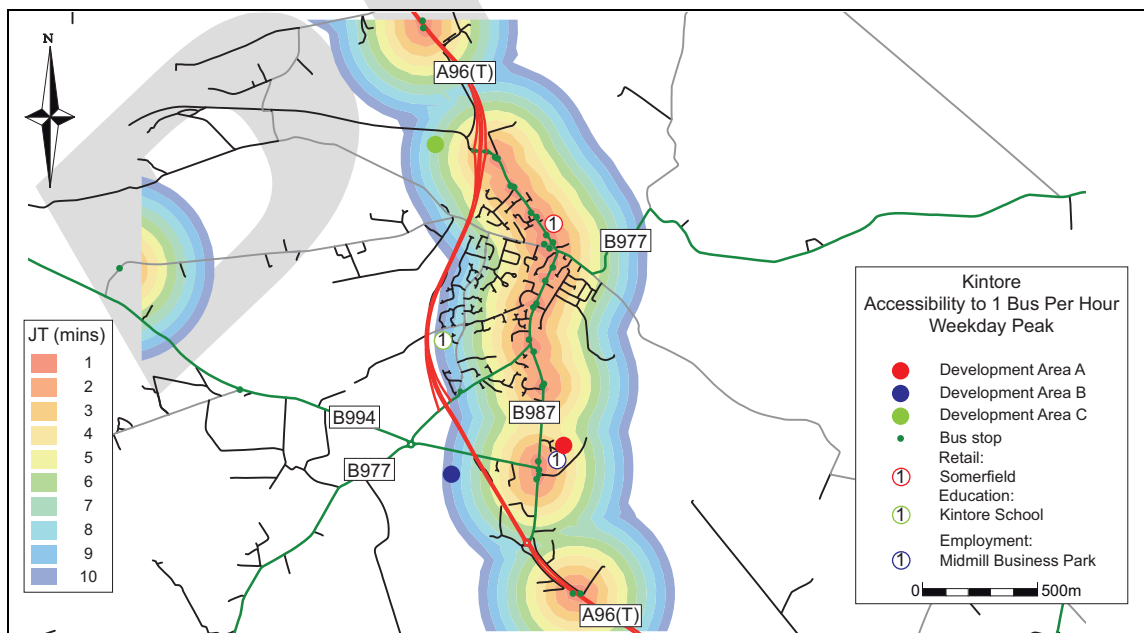


Figure 3.1 : Weekday Peak Accessibility to a 60min bus service





Figure 3.2 shows the proportion of Kintore which is accessible to a bus service which operates with a minimum of a 30min frequency in the morning peak. The contour plot is unchanged from the output which detailed the accessibility of Kintore to a 60min service frequency. Development Area B remains the least accessible of the three sites in terms of its proximity to existing bus stops.



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

Figure 3.3 shows the proportion of Kintore which is accessible to a 15min frequency in the morning peak. It can be seen that stops in the south of Kintore are not served by a 15min service in the weekday peak. This results in the accessibility of Development Areas A and B being reduced, whereas Development Area C retains an excellent level of accessibility. Development Area A is shown to be located within an 8min walk of a 15min frequency service, whereas Development Area B is located outwith a 10min walk of an equivalent service frequency.

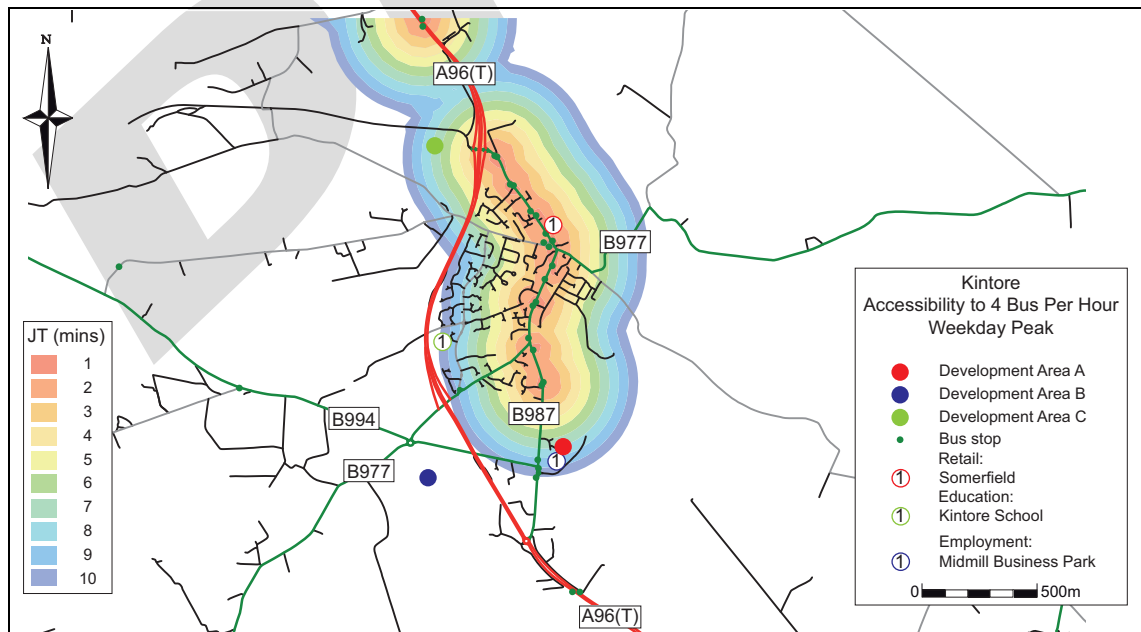


Figure 3.3 : Weekday Peak Accessibility to a 15min bus service



3.2.2 Public Transport Accessibility – Weekday Off-Peak

Figures 3.4 – 3.6 show the availability of bus services outwith the peak (12:00 – 14:00). The figures confirm that a similar level of service is provided in the off-peak period when compared to the peak.

Figure 3.4 shows the proportion of Kintore which is accessible to a bus service which operates with a minimum of a 60min frequency in the off-peak period. All three potential development sites are shown to be within a 10min walk of existing bus services outwith the weekday peak. Development Area A is shown to be the most accessible, with the nearest bus stops located on the B987 within a 3min walk of the site. Development Area B is the next most accessible site as it is located within a 7min walk of the nearest bus stops; with Development Area C around a 10min walk of the nearest stops.

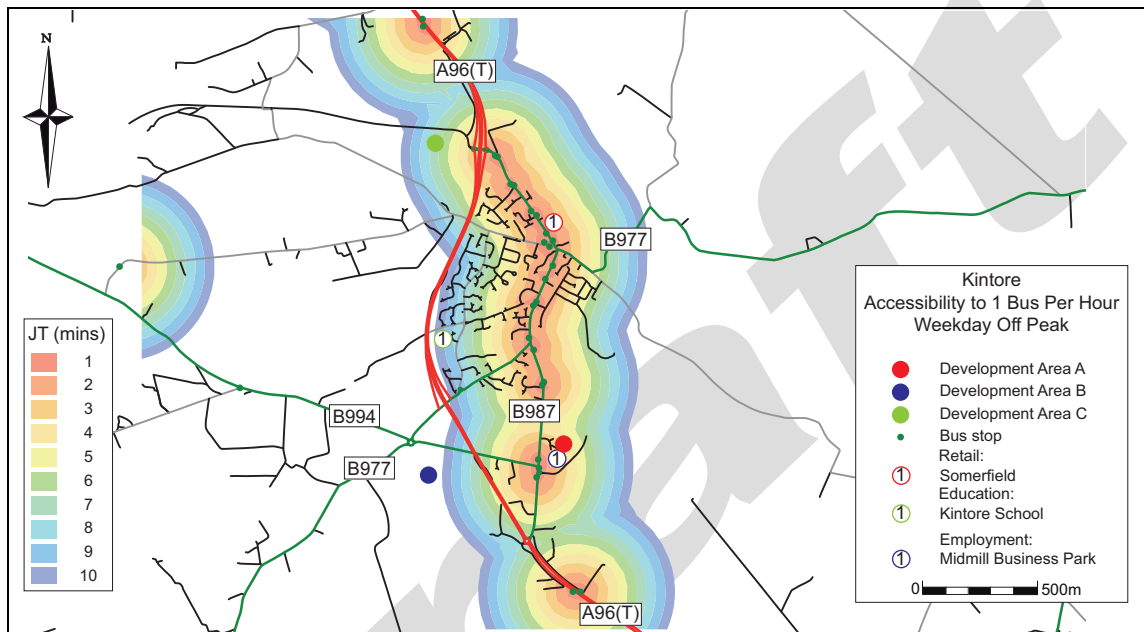


Figure 3.4 : Off-Peak Accessibility to a 60min bus service

Figure 3.5 shows the proportion of Kintore which is accessible to a bus service which operates with a minimum of a 30min frequency in the off-peak period. The contour plot is unchanged from the output which detailed the accessibility of Kintore to a 60min service frequency. Development Area B remains the least accessible of the three sites in terms of its proximity to existing bus stops.





Figure 3.5 : Off-Peak Accessibility to a 30min bus service

Figure 3.6 shows the proportion of Kintore which is accessible to a bus service which operates with a minimum of a 15min frequency in the off-peak period. The contour plot is unchanged from the output which detailed the accessibility of Kintore to a 30min service frequency. Development Area B remains the least accessible of the three sites in terms of its proximity to existing bus stops.



Figure 3.6 : Off-Peak Accessibility to a 15min bus service

### 3.3 Accessibility Appraisal – Network Accessibility

#### 3.3.1 Pedestrian and Cycle Accessibility

Figures 3.7 – 3.12 show the accessibility to local amenities on foot and by cycle, of the three development 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 appraisal of the accessibility of the sites to be made.

Figure 3.7 shows the predicted accessibility of Development Area A on foot. As can be seen from the output, over half of Kintore is shown to be within a 20min walk of the site. The site's location adjacent to the Midmill Business Park, ensures that the employment area is accessible on foot from the site. The centre of Kintore and Kintore School are shown to be around a 20min walk of the site. It is considered that the site will not require significant improvements to be introduced to the local pedestrian network to ensure it is accessible on foot.

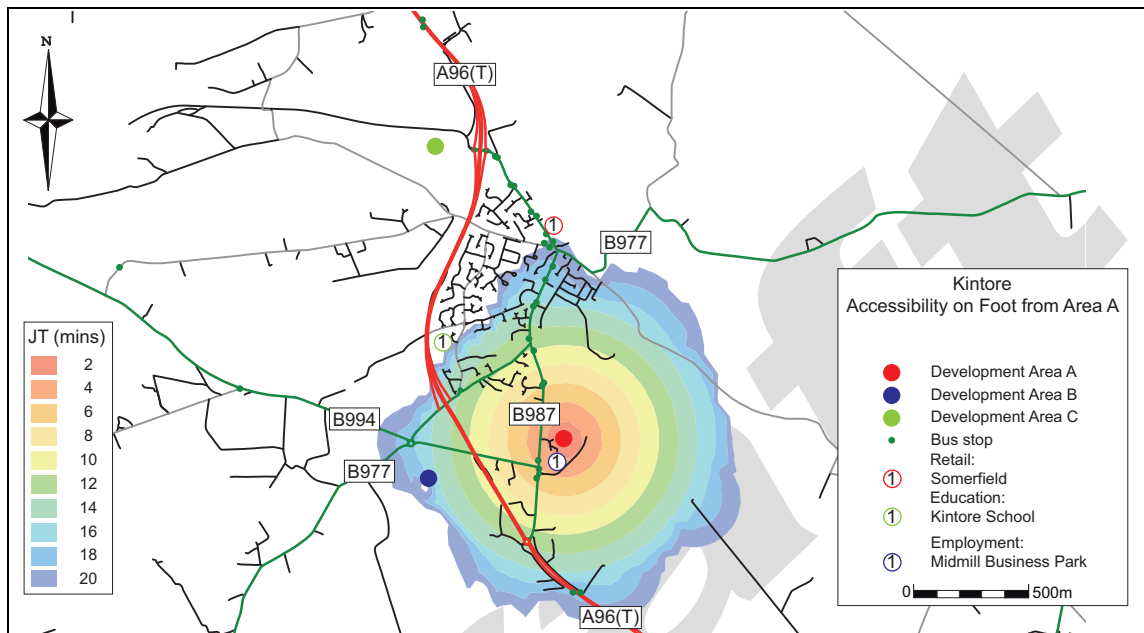


Figure 3.7 : Pedestrian Accessibility from Development Area A

The accessibility of Development Area B on foot is shown in Figure 3.8. Around half of Kintore, including Kintore School and the Midmill Business Park, are shown to be within a 20min walk of the site. While there are two existing crossings of the A96(T), it is considered that the accessibility appraisal presents a slightly optimistic estimate of the accessibility of the site, as it takes no account of the severance issue created by the A96(T), however, the provision of additional crossings is unlikely to significantly improve the accessibility of the site.



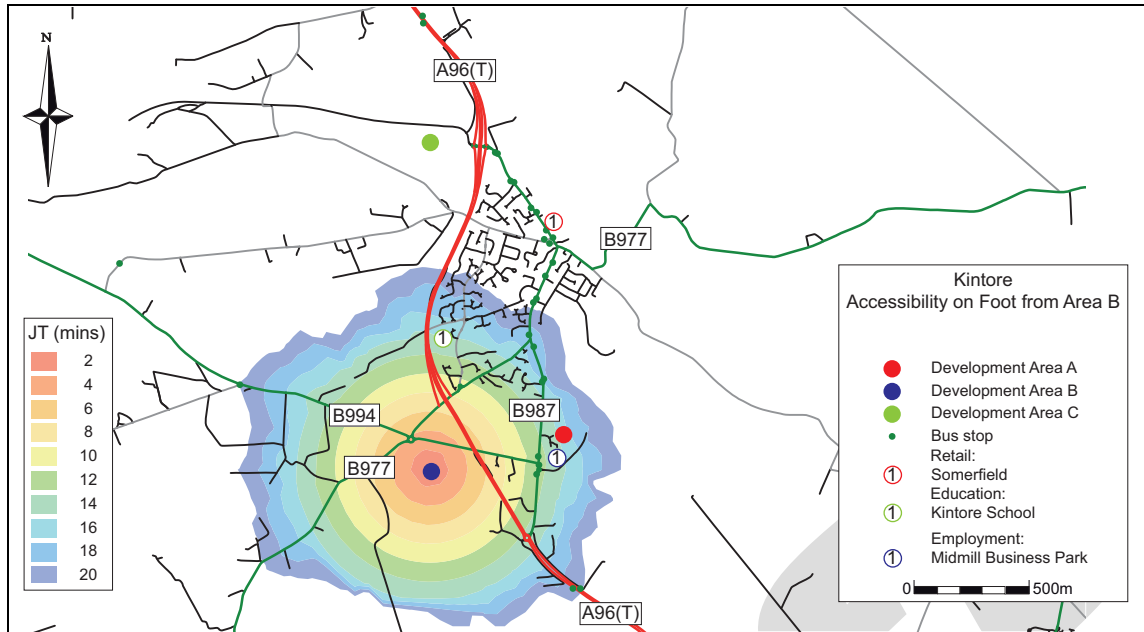


Figure 3.8 : Pedestrian Accessibility from Development Area B

Figure 3.9 shows the predicted accessibility of Development Area C on foot. The site location results in it being located within a 20min walk of the northern half of Kintore, including the town centre and Somersfield supermarket. Pedestrians are able to cross the A96(T) at the A96(T)/B977 interchange and it is considered that the introduction of additional crossings is unlikely to significantly improve the accessibility of the site for pedestrians.

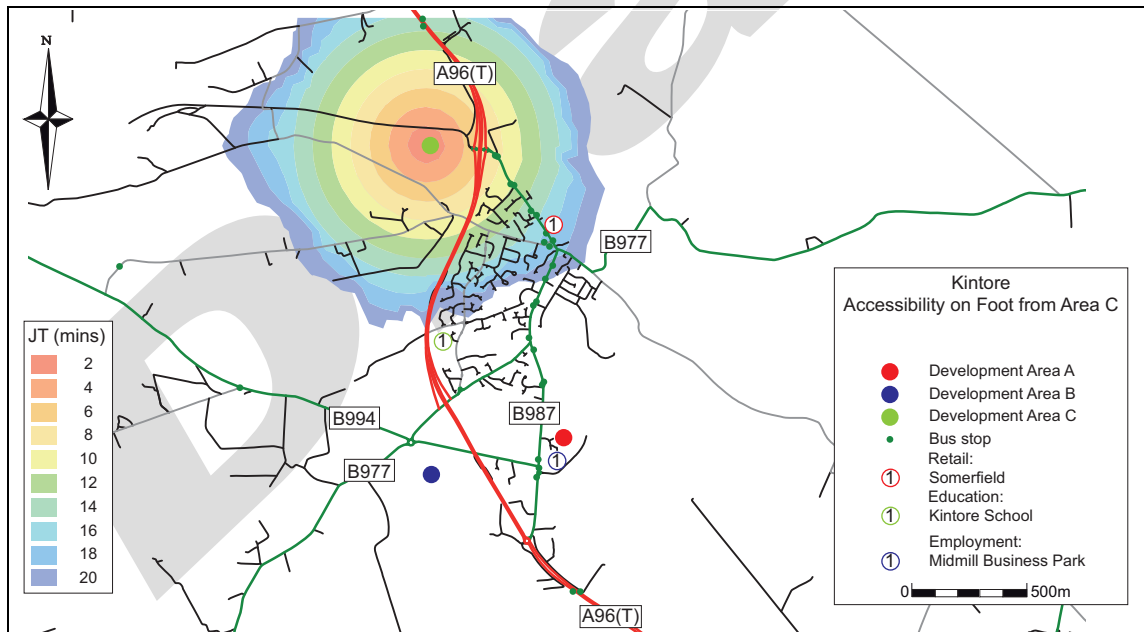


Figure 3.9 : Pedestrian Accessibility from Development Area C

Figure 3.10 predicts the accessibility of Development Area A by cycle with all Kintore residents shown to live within a 10min cycle of the site.



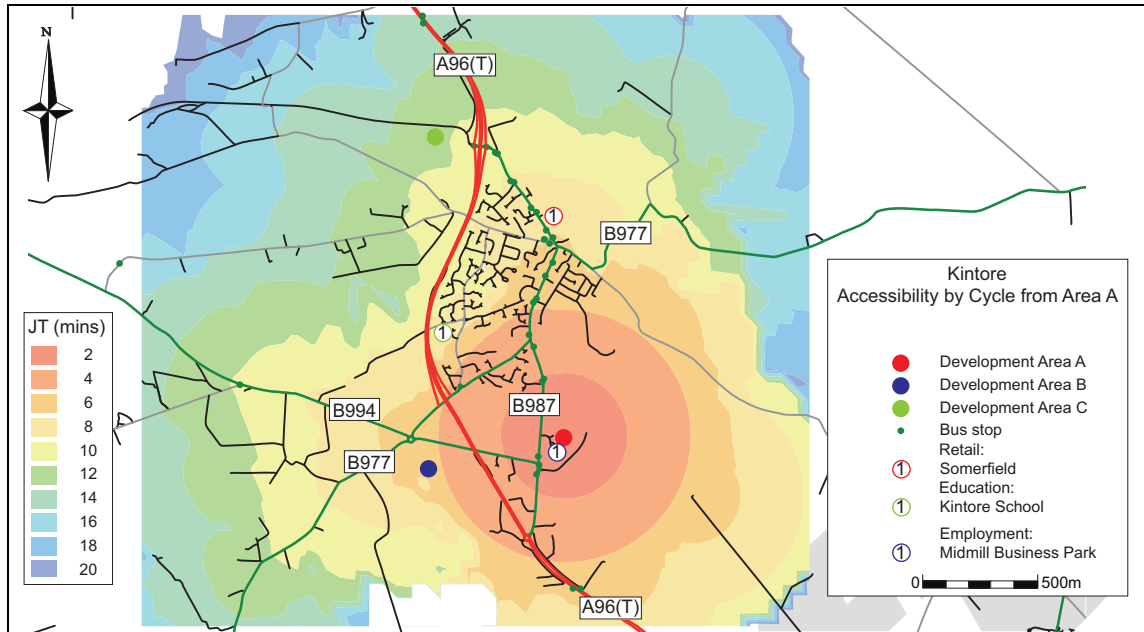


Figure 3.10 : Cycle Accessibility from Development Area A

The accessibility of Development Area B by cycle is shown in Figure 3.11. The small size of Kintore again results in the whole town being predicted to be within a 10min cycle of the site. The A96(T) is not expected to present a significant barrier to movement between the town and the site as there are existing crossings provided over the trunk road in the vicinity of the site.

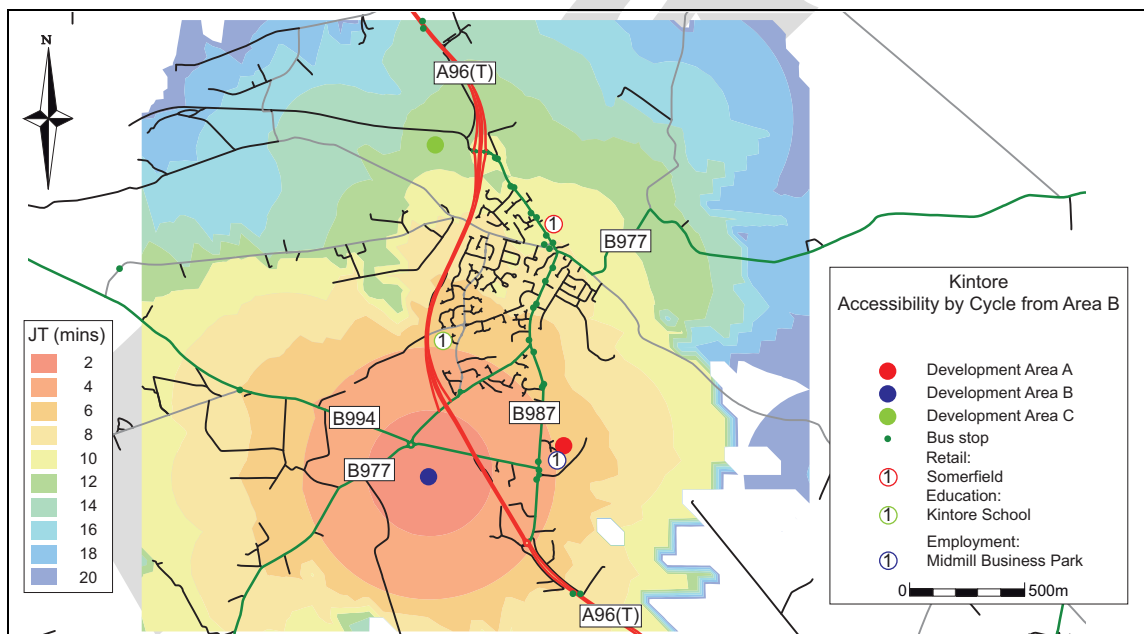


Figure 3.11 : Cycle Accessibility from Development Area B

Figure 3.12 shows the accessibility of Development Area C by cycle. As with the two alternative sites, the size of Kintore results in the whole town and its associated amenities, being located within a 10min cycle of the site. It is considered that infrastructure improvements will not significantly improve the accessibility of the site by cycle as there is currently a crossing point at the A96(T)/B977 interchange at which cyclists can cross the A96(T) to access Kintore.



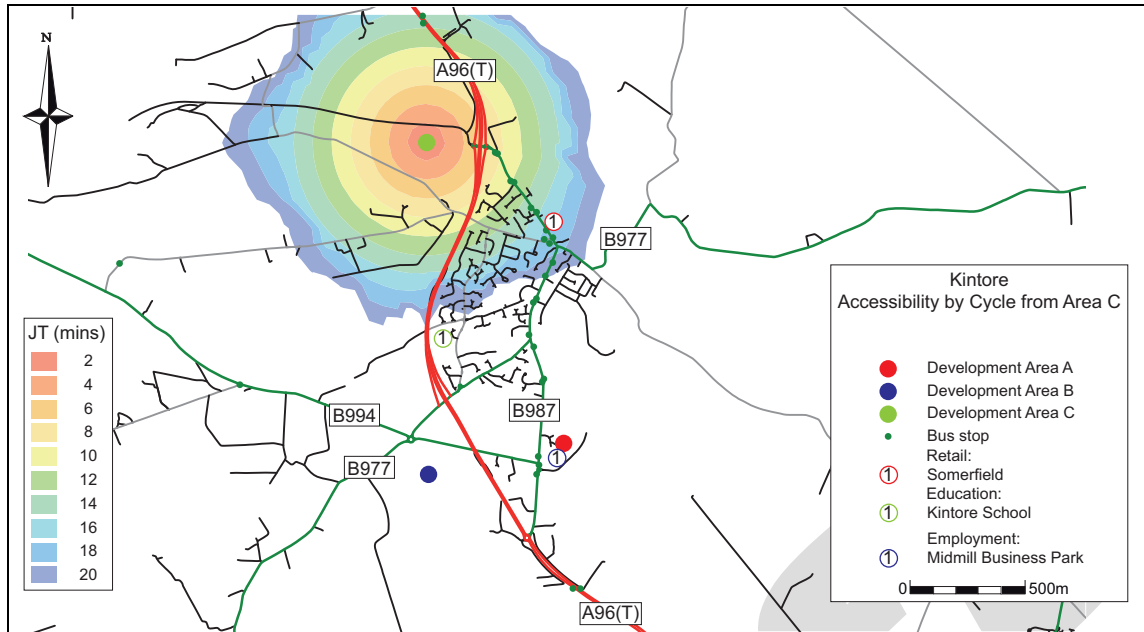


Figure 3.12 : Cycle Accessibility from Development Area C

### 3.3.2 Census Population Data Analysis

Tables 3.1 - 3.3 summarise the results of the accessibility appraisal with regard to the proximity of the sites to existing Kintore residents.

Table 3.1 : Accessibility to Development Site A

Pedestrian Accessibility		Cycle Accessibility	
Journey Time (mins)	Population	Journey Time (mins)	Population
4	87	2	87
14	274	4	89
16	442	6	1,109
18	245	8	944
20	237	10	170
<b>Total</b>	<b>1,285</b>	12	182
		16	155
		<b>Total</b>	<b>2,736</b>

Table 3.2 : Accessibility to Development Site B

Pedestrian Accessibility		Cycle Accessibility	
Journey Time (mins)	Population	Journey Time (mins)	Population
8	113	2	113
14	87	4	87
18	355	6	444
20	89	8	936
<b>Total</b>	<b>644</b>	10	819
		12	182
		16	155
		<b>Total</b>	<b>2,736</b>



Table 3.3 : Accessibility to Development Site C

Pedestrian Accessibility		Cycle Accessibility	
Journey Time (mins)	Population	Journey Time (mins)	Population
12	305	4	517
14	212	6	1,034
16	427	8	570
18	182	10	113
20	425	12	87
<b>Total</b>	<b>1,551</b>	16	355
		18	60
		<b>Total</b>	<b>2,736</b>

The above results suggest that the greatest number of Kintore residents (1,551) live within a 20min walk of Development Area C, with 1,285 residents living within a 20min walk of Development Area C. Development Area B is shown to be the least accessible on foot, with 644 residents living within a 20min walk of the site. It is, however suggested that the age of the Census data (2001) may have had an impact on the results of the appraisal given the amount of residential development which has been constructed in the town in recent years.

The size of Kintore results in the whole town being within a 10min cycle of all three potential development sites. A 6min cycle time has been used to provide a suitable comparison of the site's accessibility. Development Area C is shown to be the most accessible of the three sites by cycle with a total population of 1,551 predicted to live within a 6min cycle of the site. This compares favourably with a population of 1,285 who live within a 6min cycle of Development Area A, and 644 who live within a 6min cycle of Development Area B.

### 3.4 Bus Accessibility to Aberdeen

Figures 3.13 and 3.14 show the accessibility of Kintore 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 around 45min to access Aberdeen from Development Area A in the morning peak, with Development Areas B and C located around a 55min journey of the city centre. Outwith the peaks, the journey time is reduced to 40min from Development Area A and 50min from Development Areas B and C.





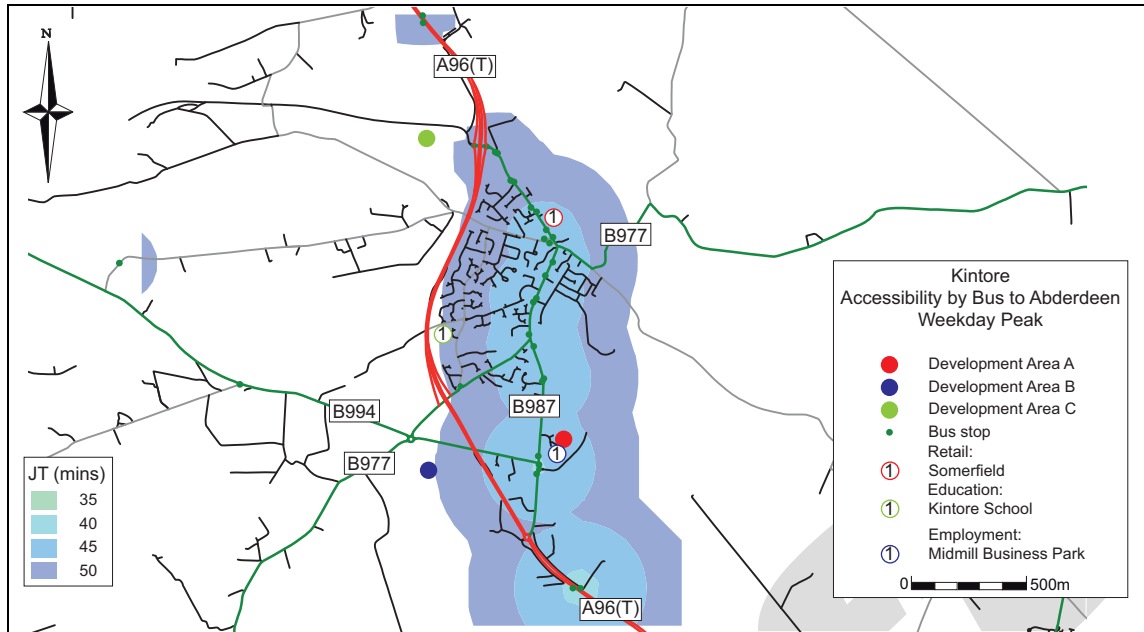


Figure 3.13 : Weekday Peak Accessibility to Aberdeen

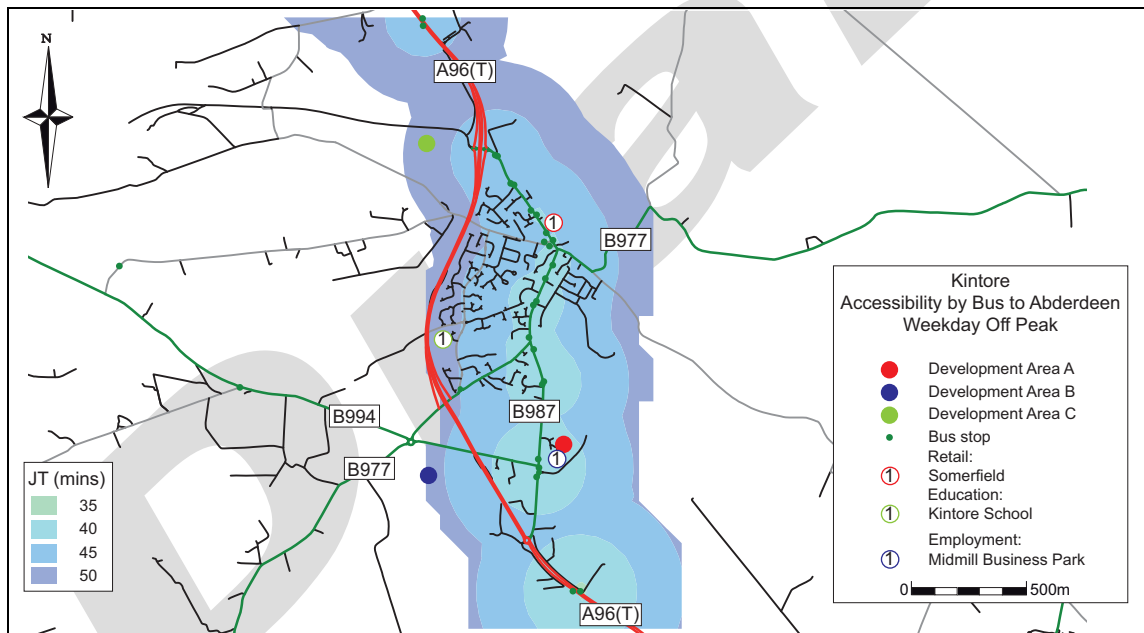


Figure 3.14 : Weekday Off-Peak Accessibility to Aberdeen

## 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 Kintore.

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

- Development Site A
- Development Site B



- Development Site C

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

Development Area A is shown to be accessible on foot and by cycle for existing Kintore residents and is located close to existing bus services which provide convenient access into the centre of Aberdeen.

Development Area B is shown to be the least accessible of the three sites, as it is located in a relatively remote location in relation to Kintore residents and bus stops. An existing bus service (No. 221) routes along the B977 in the vicinity of the site providing connection between Kintore, Inverurie and Kemnay. The service is a local service which operates one bus per day service between Kintore and Kemnay. It is considered that a new bus service will be required to ensure that the site is accessible by bus.

Development Area C is shown to be the most accessible for existing Kintore residents to access on foot or by cycle. The site is also well located to existing bus services and the A96(T).

## 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

