A APPENDIX A – ASAM4 STRATEGIC TRANSPORT MODELLING

Information Note

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Executive Summary

To assist the preparation of the Aberdeenshire Local Development Plan, this study examined the strategic transport impacts associated with various development proposals in the A90 South Corridor.

The study reflected the vision of the finalised Aberdeen City and Shire Structure Plan, which aims to substantially increase the population and economic activity across the North East. More specifically, the study examined four alternative development scenarios within the A90 South Corridor, including:

- Scenario 1 – Banchory Leggart & Schoolhill;
- Scenario 2 – Banchory Leggart & Portlethen;
- Scenario 3 – Elsick; and
- Scenario 4 – Stonehaven

Each scenario reflected the full allocation or 'build-out' of development outlined in the Structure Plan for the A90 South corridor to the 2023 horizon - representing an extra 5,600 households, 9,200 population and 3,400 jobs situated at alternative locations in the Stonehaven - Portlethen corridor. The impacts associated with several proposed transport interventions, including the AWPR were also represented.

At the region wide level, the development of all scenarios is predicted to substantially increase the overall distance travelled by motorists (vehicle kilometres) and level of Carbon emissions associated with road-traffic. Each scenario is also likely to produce a slight increase in travel time lost due to congestion, suggesting that the overall growth in road traffic associated with the Structure Plan time would constrain many of the benefits associated with proposed transport interventions.

The figure below provides 'headline' results in terms of the impacts of each of the tests relative to Scenario 1, Test 1 (S1 T1), for the *key aggregate indicators* of car trips, public transport trips, vehicle kilometres travelled, carbon emissions and congestion, all in 2023.

The figure shows the percentage change from S1 T1 in each case, and relates to the whole ASAM4 modelled area. If only the A90 South Corridor were considered, the % changes would be larger. So in overview:

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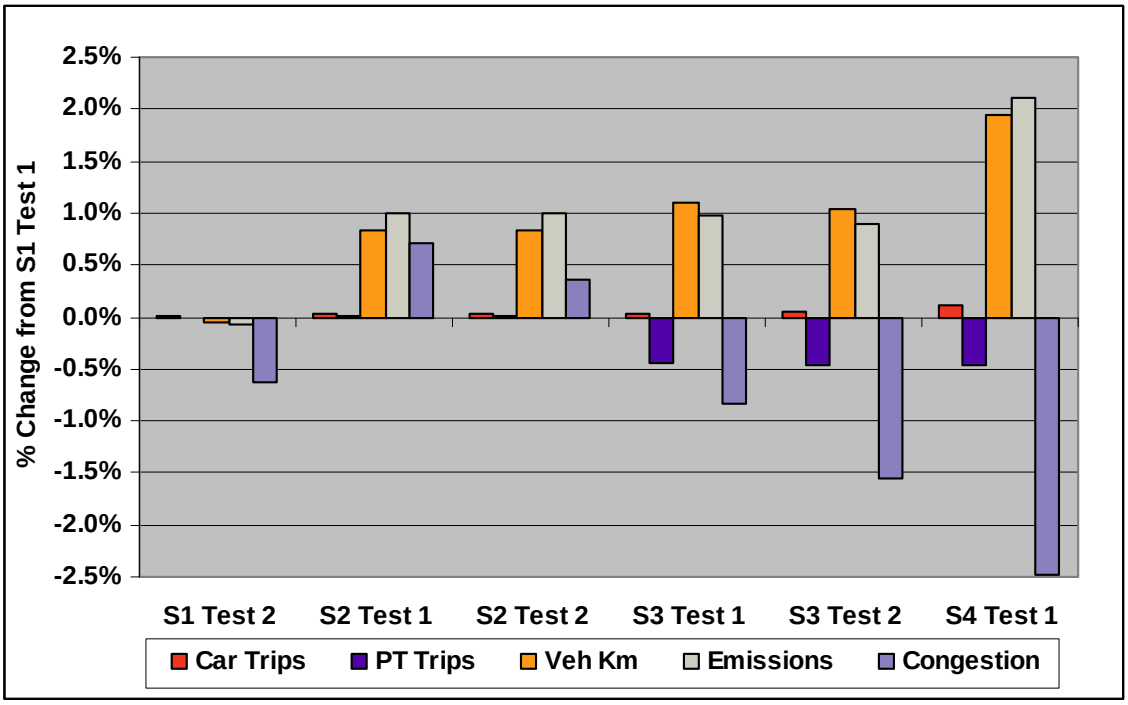


Figure - Key Performance Indicators

- the number of car trips generally *increases* from S1T1 to S4T1, although the changes are very small;
- the number of public transport trips generally *decreases* from S1T1 to S4T1, reducing markedly with S3 and S4;
- the number of vehicle kilometres travelled generally *increases* from S1T1 to S4T1, ie as the distance of the developments from Aberdeen increases;
- Emissions increase to a similar degree between S1T1 and S2T1-S3T2 then rise again to S4T1 – note that emissions reflect both distance travelled and vehicle speeds; and
- Congestion reduces in S1T2 (with the additional A90 junction access), increases in S2 then reduces with S3 and S4, with S4 seeing the lowest overall levels of congestion.

Note though that all these measures increase significantly in the ASAM4 modelled area between 2007 and 2023 (S1 T1) as follows, so the scale of the changes outlined above should be seen in this context.

- Car trips: +15%;
- Public transport trips: +5%;
- Vehicle kilometres: +25%;
- Emissions: +11%; and
- Congestion: +4%;

As all development proposals are located within the same strategic corridor and of a similar scale there are a number of common themes associated with each Scenario, these include:

- congestion in the Bridge of Dee area is likely to continue as this is a key pinch point;
- journey times from Findon to Charleston may continue to come under pressure at peak times;

- traffic levels using the AWPR Charleston and Stonehaven Interchanges are likely to be higher than previously predicted;
- the substantial growth in regional traffic levels is likely to increase the time to travel between South Aberdeenshire and Aberdeen city centre;
- the occupancy of rail services between Stonehaven and Aberdeen is forecast to remain close to or above seated capacity; and
- there are limited public transport options available for travelling between new developments and areas out with Aberdeen City Centre;

In addition to these common themes, the main impacts and benefits associated with each specific development Scenario include:

Scenario 1: Banchory Leggart and Schoolhill

- The relatively close proximity of these developments to Aberdeen would minimise the length of the vehicle journeys and produce the least Carbon emissions of the Scenario options;
- The close proximity of Banchory Leggart to the Bridge of Dee concentrates the development traffic in an already congested area and is likely to present the highest risk for delays to this area of the network compared to the other options. The introduction of a second A90 access junction helps to alleviate these impacts, but congestion in this area remains likely;
- The Schoolhill proposal creates less substantial access issues compared to other options, as Findon Interchange has the potential to provide access to the A90;
- Banchory Leggart has good potential for extending existing public transport services to serve the site, and is forecast to generate a slightly higher public transport mode share compared to other options; and
- Banchory Leggart has the poorest access to the rail network. However, accommodating additional population at Schoolhill (relatively close to Portlethen station) could support the desire for improved services to/from this area.

Scenario 2: Banchory Leggart and West Portlethen

- The impact of the Banchory Leggart development is similar to those discussed for Scenario 1;
- With the relative close proximity of these developments to Aberdeen, vehicle distance and Carbon emissions statistics also compare favourably compared to other options;
- Although, public transport mode share and passenger levels are also similar to that forecast for Scenario 1, the overall impact to travel time lost due to congestion is highest of all Scenarios;
- The West Portlethen site creates less substantive access issues, with the level of traffic to the West of Portlethen predicted to be slightly less than current levels;
- A new grade-separated interchange at Bruntland Road would improve access to the A90 – reducing delays and mitigating the risk of further road traffic accidents at this location; and
- The potential for public transport services to West Portlethen appears broadly similar to that for Schoolhill. Both developments could access and support new park and ride services at Findon and rail services at Portlethen Station.

Scenario 3: Elsick

- Situated further from Aberdeen, the Elsick development would generate slightly longer road journeys compared to Scenarios 1 and 2;
- With this rural location, Elsick also generates slightly less public transport mode share than for Scenarios 1 and 2. However, due to the larger scale of development, Elsick could be more self contained in nature, reducing the number of journeys made out with the settlement;
- Elsick-related traffic would access the A90 to the South of Charleston Interchange, which would increase traffic at this section of the A90 in excess of present day levels;
- The inclusion of direct access to the AWPR Fastlink reduces the impact of the Elsick development on the performance of the A90. However, the section of the A90 between Findon and Charleston would remain heavily trafficked;
- The Elsick development would provide a new grade-separated interchange at Bruntland Road, therefore reducing delays and mitigating the risk of road traffic accidents at this location; and
- The potential for public transport services to Elsick also reflects the opportunities discussed for both Schoolhill and West Portlethen. With the scale of development, Elsick may present better potential to support alterations to existing bus services and the development of new routes.

Scenario 4: Mill of Forest and Newtonleys

- Situated further south, Stonehaven-related developments would generate the longest vehicle journeys and the highest Carbon emissions of the options considered;
- The public transport mode share and increase in patronage levels associated with the Mill of Forest and Newtonleys developments are similar to that forecast for other developments;
- These developments, particularly Mill of Forest could be situated within walking distance of Stonehaven train station, potentially encouraging use of existing train services and supporting the introduction of improved service patterns; and
- Stonehaven developments are anticipated to increase traffic levels to the West of Stonehaven. However the A90 and AWPR Fastlink is anticipated to cope with this additional pressure without significantly affecting strategic journeys times – a point illustrated by the Stonehaven Scenario producing the least time lost due to congestion of all development options.

1 Introduction

1.1 During October 2009, Aberdeenshire Council commissioned MVA Consultancy to undertake a comparative appraisal of various development proposals in South Aberdeenshire. The study would examine various land use options and identify the strategic transport impacts associated with each development scenario.

1.2 This Note describes the methodology and assumptions applied to forecast changes in the level of traffic and public transport movements associated with different housing and employment proposals in the A90 South corridor. It also provides analysis of the predicted transport-related impacts associated with the different development scenarios, discussing the potential operational advantages and disadvantages of each scenario.

1.3 The modelling analysis was undertaken using the Strategic multi-modal transport model, ASAM4 (Aberdeen Sub Area Model 4).

1.4 The remainder of this note discusses the study further within the following sections:

- Background to the A90 South Development Proposals;
- Summary of the ASAM4 model;
- Assumptions used to forecast over time;
- Region-wide transport-related impacts;
- Strategic operational appraisal of development scenarios; and
- Summary of impacts and benefits.

2 A90 South Development Proposals

Background

2.1 The Aberdeen City and Shire Structure Plan (Finalised Plan August 2009) presents the vision and direction for future development of the North East. The Structure Plan lays out the aims and spatial strategy associated with housing requirements, employment allowances and demographic targets between 2007 and 2030.

2.2 Following the approval of the Structure Plan, Aberdeenshire and Aberdeen City Councils are currently preparing Local Development Plans, which aim to complement the Structure Plan by providing a long-term development strategy for each Local Authority. For Aberdeenshire, different development options are described in the Aberdeenshire Main Issues Report, May 2009, which identifies sites that may provide opportunities for development over time, including a number of locations in the A90 South Corridor.

2.3 The Structure Plan and Aberdeenshire Main Issues Report have been used to form the underlying land use and demographic assumptions applied in this study.

2.4 Additional information relating to the aims and objectives of this particular study are contained in the 'A90 South Development Options – Comparative Appraisal of Major Sites: Development Management Transport Appraisal Inception Report', SIAS, November 2009.

A90 South Corridor

2.5 The Aberdeen City and Shire Structure Plan recognises the requirement for a substantial level of additional housing and employment land to be provided within the A90 South Corridor, between Laurencekirk and the South edge of Aberdeen (which covers the Structure Plan development proposals associated with the Stonehaven to Portlethen and South of Drumlithie to Laurencekirk corridors).

2.6 Aberdeenshire Council has identified several sites that may accommodate the level of development anticipated. These development proposals have been combined into four different scenarios which would provide the level of residential development required for the Stonehaven to Portlethen corridor, including:

Scenario 1 – Preferred MIR Strategy

- K121 'Banchory Leggart' – 2,544 houses;
- K125 'Schoolhill' – 1,626 houses;

Scenario 2 – Banchory Leggart & Portlethen

- K121 'Banchory Leggart' – 2,544 houses;
- K90 'West Portlethen' – 1,626 houses;

Scenario 3 – Elsick

- K142 'Elsick' – 4,170 houses;

Scenario 4 – Stonehaven

- K89 'Mill of Forrest' - 2,085 houses;
- K101 'East Newtonleys' – 2,085 houses;

2.7 Each of these scenarios also includes some smaller scale residential development at:

- K73 'North Stonehaven' – 230 houses; and
- K122 'North Stonehaven' – 200 houses.

2.8 Each of these development scenarios would provide a total of **4,600 additional households** in the Portlethen to Stonehaven corridor.

2.9 In addition, each of the four development scenarios is anticipated to accommodate around half of the additional 52 Hectares of Employment land required across the Portlethen to Stonehaven corridor. With current development proposals at 'Cairnrobin' and 'Axcess Aberdeen' potentially providing the remaining proportion of employment land allowances.

2.10 For each Scenario, various types of transport plans are proposed, which describe potential road and public transport access options that could serve the developments. This information was used to develop an access strategy for each scenario, linking the new developments to the existing road and public transport networks.

2.11 One of the main aims of this study is to compare the transport-related impact of these A90 South development scenarios, between 2007 and 2023, assessing the impact associated with these scenarios in combination with housing and employment development proposals anticipated in other areas across the North East, and the introduction of several committed transport infrastructure schemes assumed to be in place by 2023.

2.12 The assumptions and methodology used to assess this combination of proposals are discussed further in Section 4.

3 Aberdeen Sub Area Model 4 (ASAM4)

3.1 ASAM4 is a Strategic multi-modal transport model covering the main road and public transport networks within Aberdeen and Aberdeenshire. The coverage of the full ASAM4 model is illustrated in Figure 3.1. Figure 3.2 illustrates the road and public transport network in the A90 South Corridor.

3.2 ASAM4 contains road and public transport assignment models and forecast year demand and trip end models which can be used to forecast the change in traffic and travel levels over time.

3.3 The ASAM4 'Base Year' is calibrated to reflect the transport system and road traffic and public transport passenger movements in 2007. The model uses anticipated changes in population, households and employment levels to forecast the level and distribution of vehicle and public transport trip making over time.

3.4 Changes in the demographic composition of the population (ie in terms of proportion of population at working age or retired) and local car ownership trends are also used to predict changes in trip making characteristics over time.

3.5 These changes in planning data were supplied by Aberdeenshire & Aberdeen City Councils with the overall region-wide growth in population and households, reflecting the vision laid out in the regional Structure Plan.

3.6 ASAM4 also takes account of the impacts associated with major committed transport infrastructure schemes anticipated to be delivered across the North East. These schemes are coded into the network modelling and their impact can be assessed on a corridor or road-by-road basis.

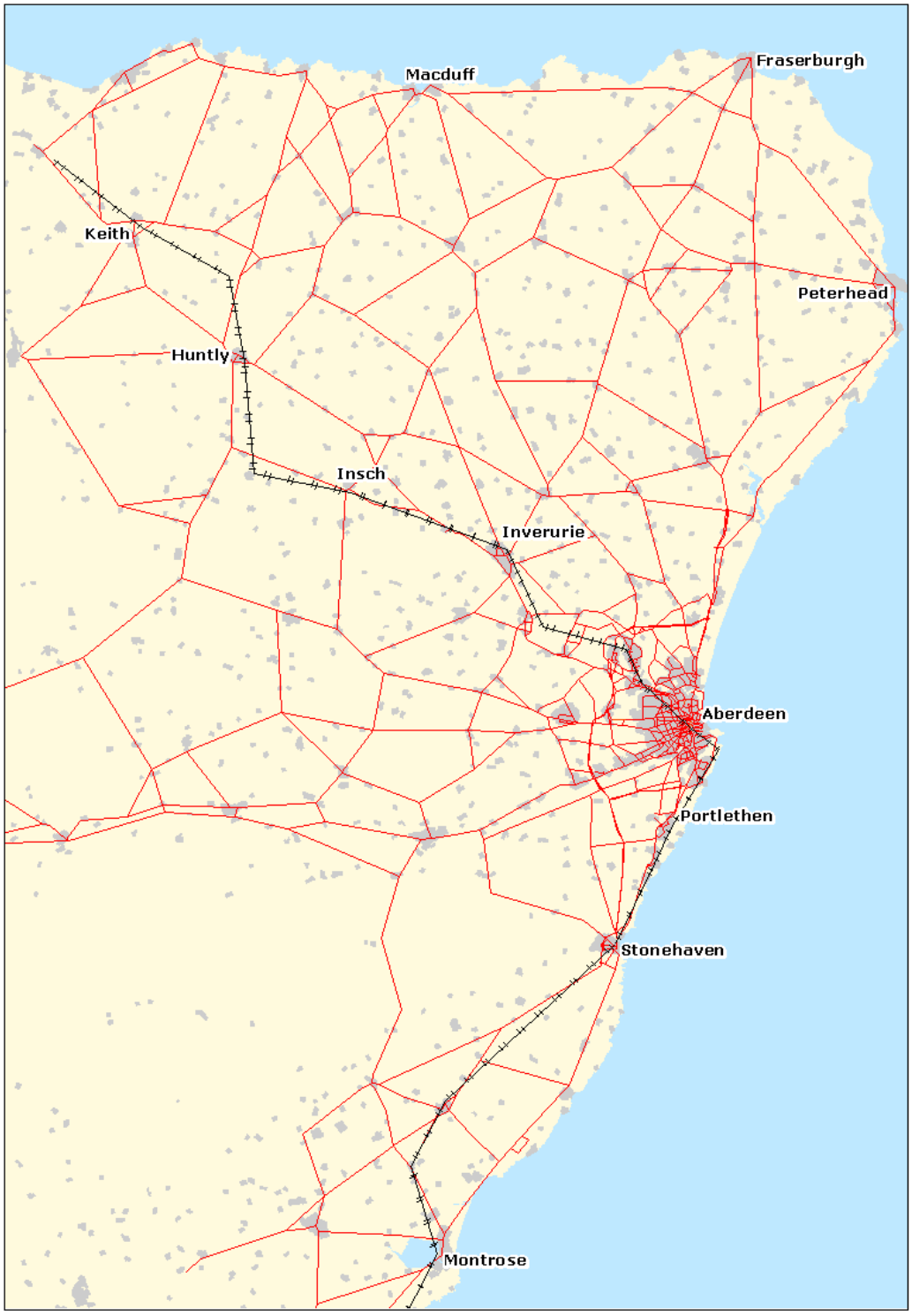


Figure 3.1 ASAM4 Coverage Area

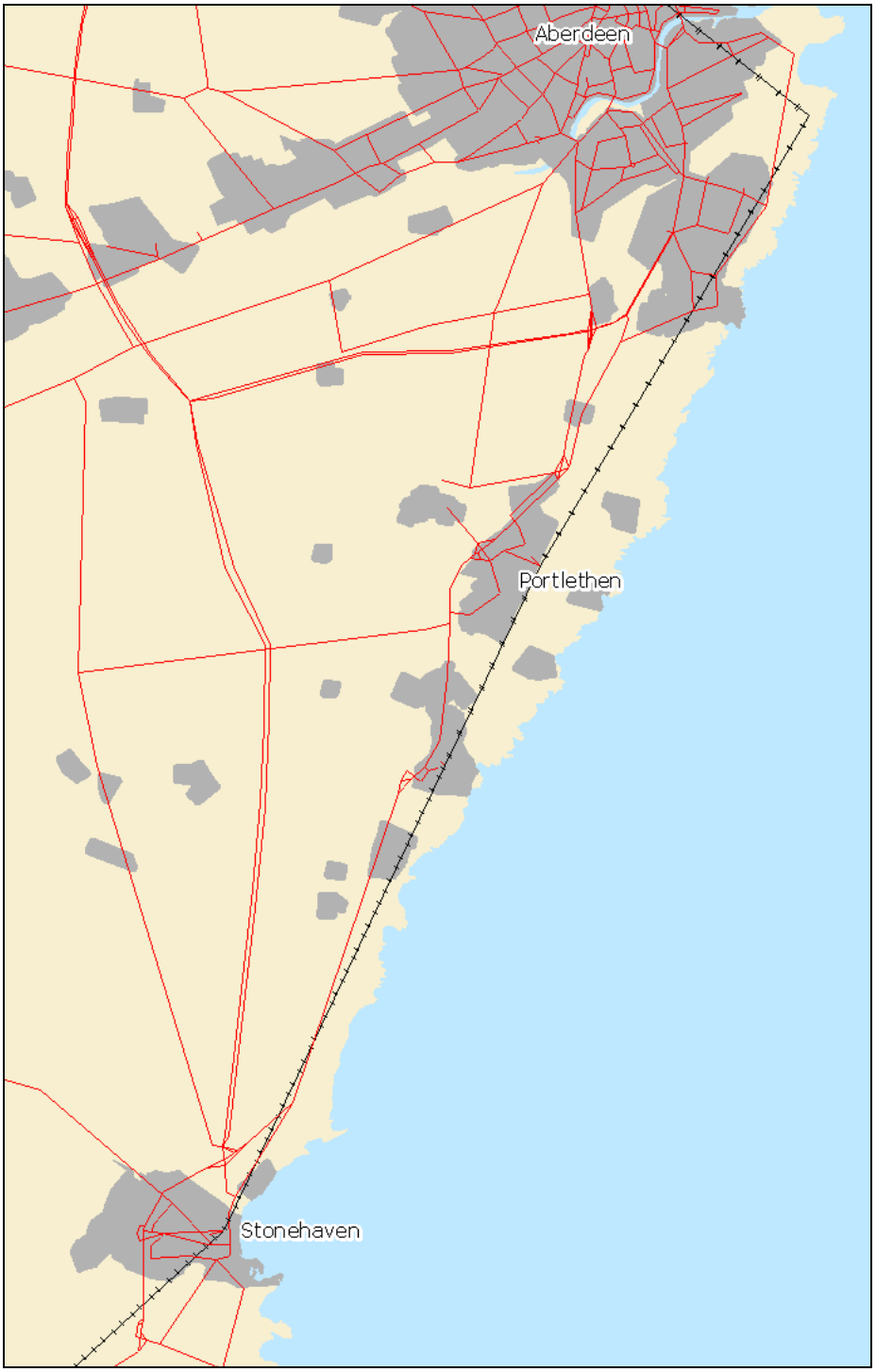


Figure 3.2 ASAM4 Network Coverage in the A90 South Corridor

3.7 The forecasts output from the full ASAM4 processes include road traffic flows and changes in vehicle speeds - which reflect the combined effects of both the introduction of transport schemes and the anticipated changes in the level and distribution of traffic and public transport movements over time. These outputs are interrogated to provide forecast changes in transport indicators, such as, traffic levels, congestion, journey time and Greenhouse Gas emissions.

3.8 Further information relating the ASAM4 model can be found in the relevant model development reports.

4 Forecasting Assumptions

4.1 As discussed, the ASAM4 modelling processes apply a range of transport infrastructure and planning and development information in the calculation of forecast future levels of traffic and travel. For this comparative study, these data and assumptions were combined to provide scenarios that represent a **2023 forecast year**.

Transport Network Infrastructure

4.2 The modelled 2023 future year '**Do Minimum**' transport network used in the A90 South corridor appraisal was based on the 2007 Base Year network with the addition of the following proposed transport infrastructure schemes:

- Strategic Rail (2008) - Improved Edinburgh-Aberdeen & Aberdeen-Inverurie Services;
- Laurencekirk rail station & rail service changes;
- Grade separation on the A90 at Schoolhill;
- A956 dual carriageway upgrade;
- Union Street pedestrianisation and traffic management schemes;
- an A96-to-Aberdeen Airport Link Road;
- A90 Balmedie to Tipperty dualling;
- Aberdeen Western Peripheral Route;
- Park and Ride sites at Chapelbrae, Parkhill & Schoolhill, and associated bus services; and
- Haudagain Roundabout Improvements.

4.3 The introduction of these transport schemes was applied consistently for each A90 South development scenario.

Development Access Strategy

4.4 For each development site, an access strategy was developed to reflect a reasonable level of road and public transport opportunities for travel to and from the various developments. These strategies included the following assumed changes to the road network and bus services:

Development Scenario 1: Banchory Leggart & Schoolhill - Test 1

- A new access road from the B9077 South Deeside Road to Banchory Leggart, linking with an at grade roundabout on the A90 (Bus Gate on Leggart Terrace and on Nigg Way);
- Link road access between the Banchory Leggart and Schoolhill Sites and to Findon interchange;
- First Bus service 17 extended from Kincorth to serve Banchory Leggart;
- New Park and Ride services planned for A90 corridor extended to commence at Schoolhill then call at the Park & Ride site, providing 4 services per hour to Aberdeen; and
- A new local bus service connecting Banchory Leggart, Schoolhill and Portlethen.

Development Scenario 1: Banchory Leggart & Schoolhill - Test 2

- Consistent with Scenario 1, Test 1 but also includes an additional grade separated junction on the A90 connecting to the Banchory Leggart development.

Development Scenario 2: Banchory Leggart & Portlethen West - Test 1

- A new access road from the B9077 South Deeside Road to Banchory Leggart, linking with an at grade roundabout on the A90 (Bus Gate on Leggart Terrace);
- Link road access between Banchory Leggart and Portlethen West Site and to Findon interchange;
- Upgrade of A90 junction at Bruntland Road to a grade separated interchange;
- First Bus service 17 extended from Kincorth to serve Banchory Leggart;
- New Park and Ride services planned for A90 corridor extended to commence at Portlethen West then call at the Park & Ride site providing 4 services per hour to Aberdeen; and
- A new local bus service connecting Banchory Leggart, Portlethen West and Portlethen.

Development Scenario 2: Banchory Leggart & Portlethen West - Test 2

- Consistent with Scenario 2, Test 1 and also includes an additional grade-separated junction on the A90 connecting to the Banchory Leggart development.

Development Scenario 3: Elsick - Test 1

- Link road connecting Elsick to existing A90 Newtonhill intersection;
- Upgrade of A90 junction at Bruntland Road to a grade-separated interchange; and
- Bus services from Stonehaven to Aberdeen divert through new Elsick development and Portlethen. Additional bus service frequency between Stonehaven and Aberdeen included to off-set longer journey time.

Development Scenario 3: Elsick - Test 2

- Consistent with Scenario 3, Test 1 and includes a new always grade-separated junction connecting Elsick with the AWPR Fastlink.

Development Scenario 4: Stonehaven - Test 1

- Link road connecting Mill of Forrest with the A92 and new bridge across the A90 to link to Stonehaven;
- Link road connecting Newtonleys with the A92;
- Stonehaven to Aberdeen bus services extended to start at new developments then travel via Stonehaven; and
- Local Stonehaven bus service altered to connect new developments with Stonehaven.

4.5 For the two smaller developments located towards the North of Stonehaven, slight alterations were made to existing bus services to provide a reasonable level of accessibility associated with these sites. These specific assumptions were consistent for all development scenarios. A link road was included for the development site (K73) to provide access to the B979 and Slug Road.

4.6 The assumptions described above created future transport networks that represented reasonable access to the strategic road network and provided around four bus services per hour between these major new development sites and central Aberdeen. It also provided a local bus service to link with local services and overall reflected similar levels of accessibility as currently in place for existing areas of major population within the A90 South Corridor.

4.7 Note that these assumed changes or improvements to the road network and bus services are used as part of this modelling exercise and do not intend to imply that these service patterns would necessarily be altered if these developments are progressed. They do however represent potential options for access to and from new residential and employment areas.

Planning & Development Data

4.8 Land use and development data along with future changes in demographics and car ownership are input to ASAM4, as part of the process of forecasting changes to traffic and public transport trip making.

Region-wide Land use and Demographic Assumptions

4.9 Aberdeenshire and Aberdeen City Councils supplied data outlining anticipated areas of housing and employment developments, with the overall region-wide growth in population and households reflecting the vision laid out in the Structure Plan. Further information is contained in the 'Aberdeen City and Shire Structure Plan, Finalised Plan', August 2009.

4.10 The region-wide assumptions used within this appraisal (in terms of changes in population, households and employment levels) reflect the information described in Figure 8 and Schedule 1 of the Structure Plan document, which detail the anticipated or targeted increase in housing and population between 2007 and 2030.

4.11 Using this information along with assumptions agreed with Aberdeenshire Council, the following levels of region-wide growth were applied to generate future levels of population, households and employment across Aberdeen and Aberdeenshire.

- In terms of population levels, an **additional 40,000 people** (+9%) were assumed to live in the region by 2030 (from 2007);
- An **additional 56,304 households** were assumed to be built across the region, including a population transfer or local migration effect used to populate these households to reflect the average (future) population per household levels (ie transferring a proportion of population from existing residential areas to live in new proposed developments); and
- Future employment levels were calculated to reflect the overall future number of people living in the region and the anticipated extra housing developed - where 200 houses were assumed to support 1 Hectare of employment land with an average of 66 jobs per hectare, therefore assuming an **additional 18,580 jobs** across the region from 2007 and 2030.

4.12 The release of new development over time was modelled to reflect the phases described for the Structure Plan 'Housing Requirement', resulting in around **74%** of development released between 2007 and **2023**.

4.13 The general distribution of these developments followed the housing (corridor) 'allowances' (including the effective land supply) detailed in Schedule 1 of the Structure Plan, but with the total number of additional households **constrained** to match the total region-wide housing '**requirement**' of **56,304** houses (ie assuming that an additional 56,304 houses are required to support an additional 40,000 people living across the region, along with changes in the average population per household).

4.14 Employment-related developments were distributed to reflect employment land allocations described within both the Aberdeenshire and Aberdeen Main Issues Reports and were **constrained** to match the total region-wide additional number of **18,580 jobs**.

4.15 At the more detailed zonal level, these development assumptions were distributed in line the Structure Plan growth corridors and generally reflects a broad-brush or consistent distribution of extra people, households and jobs across the main Structure Plan corridors.

A90 South Land use and Demographic Assumptions

4.16 Different assumptions were used to reflect development proposals in the A90 South corridor. These were combined with region-wide plans to provide a more detailed methodology for allocating housing, people and employment within the study area.

4.17 The overall growth scenario used within the A90 South Corridor was designed to reflect the full allocation or 'build-out' of all housing land allowances in the **Stonehaven to Portlethen** and South of **Drumlithie to Laurencekirk** corridors - therefore, assuming that each development proposal in the A90 South corridor was **fully developed** and **fully occupied**, representing a **high-end** traffic and travel growth scenario for this area of Aberdeenshire.

4.18 The full allocation of current housing plans within the Stonehaven to Portlethen and South of Drumlithie to Laurencekirk corridors was assumed - representing the effective land supply of 982 (mainly located close to the new Findon Junction on the A90) and 235 houses in these two corridors respectively. It also assumed the development of 4,600 houses in each of the four scenarios. With the number of residents per household calculated to match the average population per household forecast in Aberdeenshire by 2023.

4.19 The scenario also included the full development and occupation of employment land allowances (reflecting 52 hectares) within the Stonehaven to Portlethen corridor. Where half of these new jobs were assumed to be located within the major new development sites and half were assumed to be associated with existing employment sites at Axcess Aberdeen and Cairnrobin.

4.20 Housing and employment plans (and subsequent population levels) associated with other parts of Aberdeenshire and Aberdeen were reduced on a pro-rata to basis to accommodate this level of growth whilst matching the region-wide aspirations described in the Structure Plan.

4.21 The change in the total number of households, employment and population assumed for this study between 2007 and 2023 are described in Table 4.1.

Table 4.1 Assumed Planning Data Changes by Corridor: 2007 to 2023

Area	HH's	Emp.	Popn.	Change			Change %		
				HH's	Emp.	Popn.	HH's	Emp.	Popn.
Brownfield	40,680	33,245	78,851	6,173	-	2,171	15%	0%	3%
Regeneration	18,827	8,550	38,441	-	145	-4,347	0%	2%	-11%
Greenfield	7,061	5,066	17,167	12,433	2,466	20,306	176%	49%	118%
Aberdeen	**102,195**	**134,522**	**209,260**	**18,605**	**5,367**	**9,672**	**18%**	**4%**	**5%**
Huntly-Pitcaple	5,651	3,658	13,042	687	511	-105	12%	14%	-1%
Inverurie-Blackburn	8,158	8,131	18,802	3,054	1,636	3,963	37%	20%	21%
Portlethen-Stonehaven	9,769	7,753	23,868	5,582	3,432	9,215	57%	44%	39%
Drumlithie-Laurencekirk	2,824	1,577	6,754	1,135	562	1,495	40%	36%	22%
Peterhead-Hatton	11,681	11,079	27,675	1,319	920	-506	11%	8%	-2%
Ellon-Blackdog	6,446	3,455	15,521	1,830	1,380	1,931	28%	40%	12%
Local Growth (AHMA)	19,325	11,622	48,348	3,046	-	596	16%	-	1%
Local Growth (RHMA)	34,240	22,628	80,261	6,583	-	4,018	19%	-	5%
Aberdeenshire	**100,191**	**71,405**	**239,160**	**23,237**	**8,441**	**20,054**	**23%**	**12%**	**8%**
Aberdeen & Aberdeenshire	**202,386**	**205,928**	**448,420**	**41,842**	**13,808**	**29,726**	**21%**	**7%**	**7%**

4.22 The total change in planning data assumed within Aberdeen and Aberdeenshire between 2007 and 2023 is therefore an additional 41,842 households, 13,808 jobs and 29,726 people (increases of 21%, 7% and 7% respectively).

4.23 These changes in planning data tend to reflect a significant growth in development around the periphery of Aberdeen and along the A90 and A96 corridors of Aberdeenshire. There is also a

considerable growth assumed in specific urban areas of Aberdeen where there are opportunities for brownfield housing development. To some extent, the considerable increase in housing and population in these corridors is offset by a reduction in population out with the main growth corridors. This trend is particularly relevant for the City of Aberdeen, where a decline in population in some existing residential areas is assumed (ie through lower average household occupancy levels).

4.24 For this specific study, regeneration-related housing allocations detailed in the Structure Plan are assumed to generate replacement housing rather than any overall net increase in housing within these areas of Aberdeen. Note that these housing allowances may in fact represent a proportion of 'additional' housing rather than just providing replacement housing in these areas. Therefore, depending how plans for regeneration progress, the reduction in population and trip making (applied here) in these areas may be over-estimated.

Major A90 South Development Site Scenarios

4.25 Overall, this scenario represented an additional 5,582 houses (+57%), 3,432 jobs (+44%) and 9,215 (+39%) people located within the Stonehaven to Portlethen corridor by 2023. These overall corridor-based changes in planning data were kept constant for each specific A90 South development scenario, with the location of the major developments altering between scenarios. The additional level of housing and employment assumed to be associated with each development site is described in Table 4.2.

Table 4.2 Development by Site in Stonehaven-Portlethen Corridor: 2007 to 2023

Scenario	Site	Households	Employment
S1 & S2	Banchory Leggart	2,544	840
S1	Schoolhill	1,626	537
S2	Portlethen West	1,626	537
S3	Elsick	4,170	1,376
S4	Mill of Forest	2,085	688
S4	Newtonleys	2,085	688
All	Stonehaven: Small Sites	430	142
All	Findon/Axcess Aberdeen	840	964
All	Cairnrobin	-	950
All	Other Locations	142	-

4.26 Overall, the development assumptions applied for this study reflect a considerable level of in-migration to the region along with a strong growth in the regional economy – particularly for parts of the A90 South corridor. The application of such a strong growth scenario should be borne in mind when interpreting the results presented here.

Demographic Profile & Car Availability

4.27 To calculate the change in the demographic profile of the population and the level of car availability, information was extracted from the Land use and Transport Integration in Scotland (LATIS) service. This service, which includes an integrated land use model, provided forecasts that estimate the change in the proportion of working and non-working population on a geographical basis. It also provides details of predicted changes in car availability (calculated by comparing the % of households that do not have access to a car).

4.28 These forecasts were used in this study to create changes to the population profile and level of car availability in Aberdeen and Aberdeenshire between 2007 and 2023 (described in Table 4.3).

Table 4.3 Assumed Change in Demographic Profile & Car Availability

Area	% Non-Working Population		% Non-Car Owning Households	
	2007	2023	2007	2023
Aberdeen	37.8%	39.2%	33%	25%
Aberdeenshire	32.9%	37.8%	20%	16%

4.29 The population profile forecasts shown in Table 4.3 suggest that the proportion of the population that does not work is forecast to increase over time across both Aberdeen and Aberdeenshire. This trend generally reflects an 'aging population', with a larger proportion of retired people living in the North East (with a particularly large increase in the proportion of non-working population indicated in Aberdeenshire).

4.30 The forecasts also suggest a reduction in the proportion of households that would not have access to a car between 2007 and 2023, particularly within Aberdeen. This trend reflects growth in the economy and increasing income levels resulting in cars becoming more affordable. It is also likely to reflect the location of new housing developments, where many developments are proposed for areas that tend to have higher car ownership levels.

4.31 These demographic changes may also have knock-on consequences for the transport system, whereby a smaller level of working population may tend to reduce the number of people travelling during the traditional commuting time periods. However, for the road network these effects could be offset if a greater number of people choose to travel by car - an opportunity regularly associated with higher levels of car availability.

5 Region-wide Impact of Committed Infrastructure and Development

5.1 The assumptions outlined in section 4 relating to committed infrastructure schemes and land use developments were input to ASAM4 to create four 2023 forecast year scenarios. The following section describes the impact of these scenarios, comparing the 'Region-wide' changes forecast across the transport system between 2007 and 2023.

Travel Volumes – Car

5.2 Table 5.1 describes the change in the number of car-borne trips between 2007 and 2023 for each scenario test. These figures reflect the total level of motorists (including car passengers) travelling across Aberdeen and Aberdeenshire within an average day.

Table 5.1 Daily Car-Borne Trips: 2007 Base Year to 2023 Scenarios (persons)

Scenario	Daily Person Trips	2007-2023	
		Change	% Change
2007 Base Year	443,945	64,489	15%
S1 Test 1	508,434	64,533	15%
S1 Test 2	508,478	64,605	15%
S2 Test 1	508,551	64,643	15%
S2 Test 2	508,588	64,654	15%
S3 Test 1	508,599	64,741	15%
S3 Test 2	508,686	65,060	15%
S4 Test 1	509,005	64,489	15%

5.3 The forecasts indicate a considerable rise in the number of car trips over time, with around a 15% increase across Aberdeen and Aberdeenshire from 2007 to 2023 in all cases. The predicted increase in region-wide vehicle trip making therefore is relatively consistent for each scenario, and reflects the increase in the level of population and employment across the North East along with the anticipated increase in the level of car ownership.

5.4 The anticipated growth in non-working population over time (as a higher proportion of the population move into the retirement age bracket) could result in a change in the choice of time of day to make a journey. As retirees are more likely to travel for non-work purposes during the inter peak, a potential decline in working population could limit the growth of commuters in the peak time periods.

5.5 Therefore, the overall growth in regional population combined with a substantial growth in non-work travel purposes could result in additional pressures during the inter peak periods and / or during weekends.

Travel Volumes - Public Transport

5.6 Table 5.2 describes the change in the number of public transport trips between 2007 and 2023 for each scenario test. These figures reflect the total level of travellers using public transport during an average day.

Table 5.2 Daily Public Transport Trips: 2007 Base Year to 2023 Scenarios

Scenario	Daily Person Trips	2007-2023	
		Change	% Change
2007 Base Year	58,342		
S1 Test 1	61,278	2,936	5.0%
S1 Test 2	61,272	2,930	5.0%
S2 Test 1	61,287	2,945	5.0%
S2 Test 2	61,283	2,941	5.0%
S3 Test 1	61,004	2,662	4.6%
S3 Test 2	61,000	2,658	4.6%
S4 Test 1	60,998	2,656	4.6%

5.7 The forecasts indicate a small but relatively consistent rise in the number of people using public transport across Aberdeen and Aberdeenshire between 2007 and 2023.

5.8 This trend is likely to reflect a number of interrelated factors, including:

- The overall **rise** in regional population would result in a proportion of new inhabitants choosing to use rail or bus services;
- New public transport services and interchange opportunities are likely to **attract** some existing motorists to travel by PT. For example, the recent opening of Laurencekirk rail station, improved rail services and park and ride sites would **encourage mode shift**;
- A **higher** proportion of inhabitants are anticipated to have **access to a car** in the future, and therefore a proportion of these travellers are likely to choose to use the car for some journeys, therefore **limiting** or off-setting the **growth in PT travel** associated with other factors;
- Many of new residential and business related development sites are planned to be located in areas where current levels of **accessibility by public transport are relatively low** (ie parts of Aberdeenshire and Greenfield sites around the periphery of Aberdeen).

Therefore, higher car ownership and usage is likely to be associated with many of these new development sites, which over time, may limit growth in public transport trips;

- As many planned developments would be located around the edges of Aberdeen, an increase in **orbital style movements** between peripheral residential and business areas are likely. Currently, existing and anticipated public transport services focus on travel to / from Aberdeen city centre and therefore for some travel movements, there is likely to be a **lack of suitable alternatives** to using the car to travel – again potentially limiting growth in PT travel; and
- Existing and new bus services operating within central Aberdeen are likely to benefit from the decongestion effects associated with committed transport infrastructure schemes such as the AWPR. However, with the targeted growth in regional population, for some locations delays and the impact of congestion are still likely to occur. The introduction of the AWPR is likely to provide benefits for many travellers, particularly in generating quicker journey times between areas which currently require a journey through the centre of Aberdeen. Travellers could potentially find it quicker to travel a much further distance around Aberdeen using the AWPR than travelling into the city centre. These considerable benefits created by the AWPR, along with the availability of additional housing and employment land would generate greater choices for travellers, who may decide to choose to live and/or work in a different location to take advantage of these benefits – if so, the likely mode of travel would tend towards car use (to use the AWPR) and therefore constrain growth in public transport movements.

5.9 Comparing the development options, scenarios 1 and 2 display slightly higher levels of public transport growth than for Scenarios 3 and 4. This is likely to reflect the position of these developments, which are located closer to Aberdeen and may provide relatively short travel times by public transport compared to other development options – where there are less viable alternatives to car travel available.

Vehicle Kilometres

5.10 Table 5.3 describes the forecast change in the number of vehicle kilometres travelled by cars and goods vehicles between 2007 and 2023 for each development scenario. The modelling consistently illustrates an increasing level of vehicle travel across the region, with the rate of growth associated with vehicle distance out stripping the predicted growth in trip making (described in Table 5.1).

5.11 This trend is likely to occur for two main reasons: that the introduction of the AWPR provides a quicker but longer distance route for some journeys; and that a considerable proportion of future housing and employment developments would be located at the edges of Aberdeen and within Aberdeenshire – where the average distance travelled to work and other services is higher than the regional average.

5.12 The modelling indicates a consistent rise in vehicle kilometres for each scenario, although there is slightly more vehicle-km associated with the scenarios where development is planned further away from Aberdeen. This trend again suggests that these more rural locations could create longer distance journeys, as the average distance to travel to work (etc) is higher than the regional average.

Table 5.3 Annual Vehicle Kilometres: 2007 to 2023 (millions)

Scenario	Vehicle Kilometres	2007-2023	
		Change	% Change
2007 Base Year	3,819		
S1 Test 1	4,778	960	25%
S1 Test 2	4,776	958	25%
S2 Test 1	4,818	999	26%
S2 Test 2	4,818	1,000	26%
S3 Test 1	4,831	1,012	27%
S3 Test 2	4,828	1,009	26%
S4 Test 1	4,871	1,052	28%

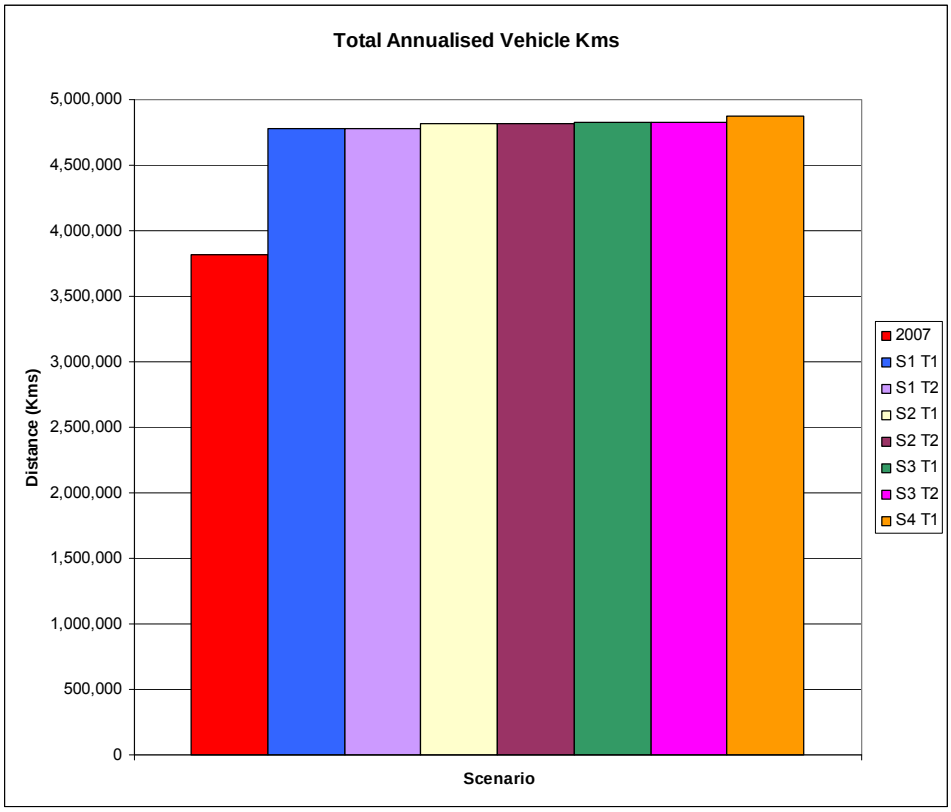


Figure 5.1 Annual Vehicle Kilometres: 2007 to 2023 (millions)

Greenhouse Gas Emissions

5.13 Table 5.4 describes the predicted change in road-related (exhaust pipe) Greenhouse Gas emissions between 2007 and 2023 (measured in Carbon Dioxide Equivalent).

Table 5.4 Annual Greenhouse Gas Emissions: 2007 to 2023 (Tonnes CO_2e)

Scenario	CO_2e	2007-2023	
		Change	% Change
2007 Base Year	804,491		
S1 Test 1	895,159	90,668	11%
S1 Test 2	894,531	90,040	11%
S2 Test 1	904,038	99,547	12%
S2 Test 2	904,160	99,668	12%
S3 Test 1	903,964	99,473	12%
S3 Test 2	903,142	98,650	12%
S4 Test 1	914,102	109,611	14%

Note that this analysis assumes no fuel and vehicle efficiency improvements after 2020

5.14 The forecasts indicate a consistent rise in Greenhouse Gas emissions associated with road traffic in Aberdeen and Aberdeenshire. This trend reflects the increase in the level of traffic predicted over time, whereby the increase in CO_2 from the rise in vehicle kilometres (and fuel burned) off-sets the assumed reductions in emissions over time associated with advances in technology and engine/fuel efficiency.

5.15 It should be noted that this forecast reflects current DfT assumptions on future vehicle fleet composition. Alternative scenarios are being developed at present to better reflect the Government's envisaged route to meeting their ambitious climate change targets, ie the widespread introduction of low or zero carbon vehicles.

5.16 Figure 5.2 illustrates the predicted level of road travel-related Carbon Emissions for each of the development scenarios in the 2023 forecast year.

5.17 The analysis demonstrates similar trends to those shown for the vehicle distance analysis, where scenarios that contain developments located further away from Aberdeen are predicted to produce the most road traffic-related Carbon Emissions. Therefore, the Banchory Leggart and Schoolhill developments are likely to produce around 19,000 tonnes less Carbon emissions per annum than the Stonehaven based scenario.

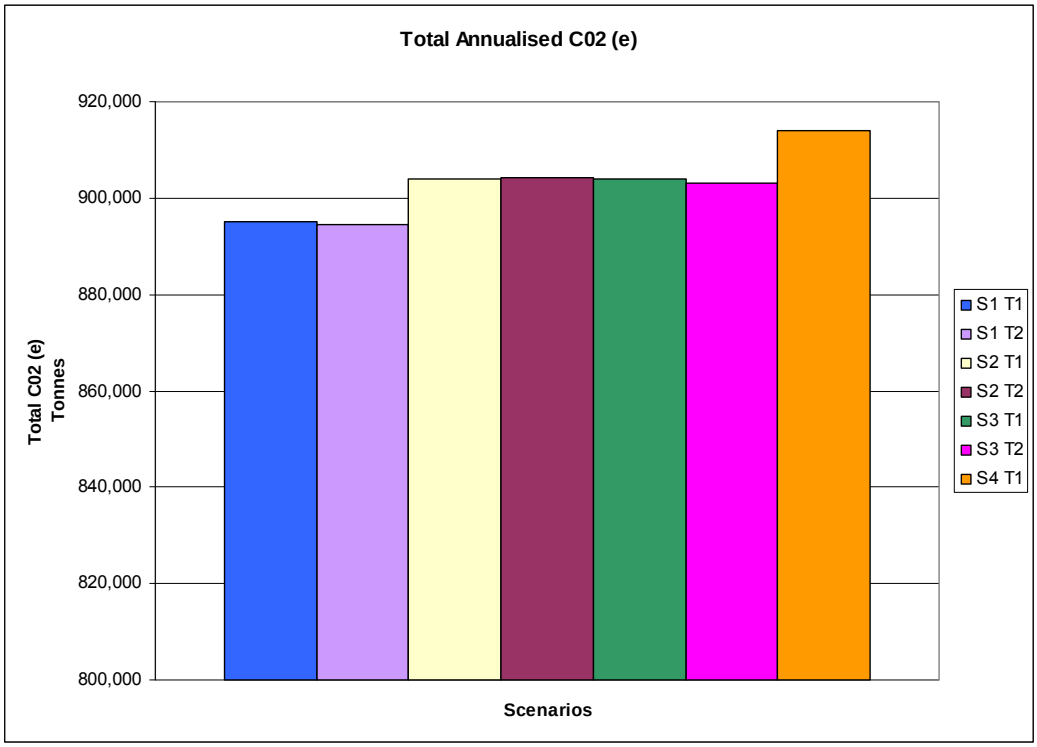


Figure 5.2 Annual Carbon Emissions for each Development Scenario: 2023 (Tonnes)

Time Lost due to Congestion

5.18 Table 5.5 describes the forecast change in the time lost due to congestion for cars and goods vehicles between 2007 and 2023 for each development scenario. This analysis measures the time lost between travelling unrestricted across the road network compared to that realised during an average hour in the morning and evening peak periods.

Table 5.5 Time lost due to Congestion: 2007 to 2023 (Hours)

Scenario	Time Lost (Hours)	2007-2023	
		Change	% Change
2007 Base Year	5,799		
S1 Test 1	6,022	223	4%
S1 Test 2	5,984	185	3%
S2 Test 1	6,065	266	5%
S2 Test 2	6,044	245	4%
S3 Test 1	5,972	172	3%
S3 Test 2	5,929	129	2%
S4 Test 1	5,873	74	1%

5.19 The congestion analysis demonstrates that the time lost by all North East motorists due to the impact of congestion is around 5,800 hours during an average peak hour in 2007. This figure relates to around 40% additional time required to travel within the peak periods.

5.20 The time lost due to congestion is forecast to increase slightly over time, which suggests that the time-saving benefits associated with committed transport interventions may be off-set by the level of traffic growth. These impacts vary by scenario, which is illustrated by Figure 5.3.

5.21 The analysis indicates that the Stonehaven scenario (S4) is predicted to create the least detrimental impact to overall congestion levels. This trend is likely to reflect the location of these developments, which are situated in areas of the network which do not currently suffer from regular congestion. Furthermore, the AWPR Fastlink and A90 offer two major strategic routes to disperse development-related traffic widely across the network. Similar effects are associated the Elsick development, particular for Test 2 which would offer a new direct connection to the AWPR as an alternative to travelling via Charleston or the Bridge of Dee.

5.22 The traffic associated with Scenarios 1 and 2 is predicted to produce slightly higher levels of congestion than for other Scenarios. This trend is again likely to relate to the locations involved, where these developments are situated in relatively active areas of the road network. For example, Banchory Leggart is situated nearby the Bridge of Dee, where fewer dispersal options are available, which may result in a larger proportion of development-related traffic travelling via the Bridge of Dee or Charleston – potentially impacting on congestion levels.

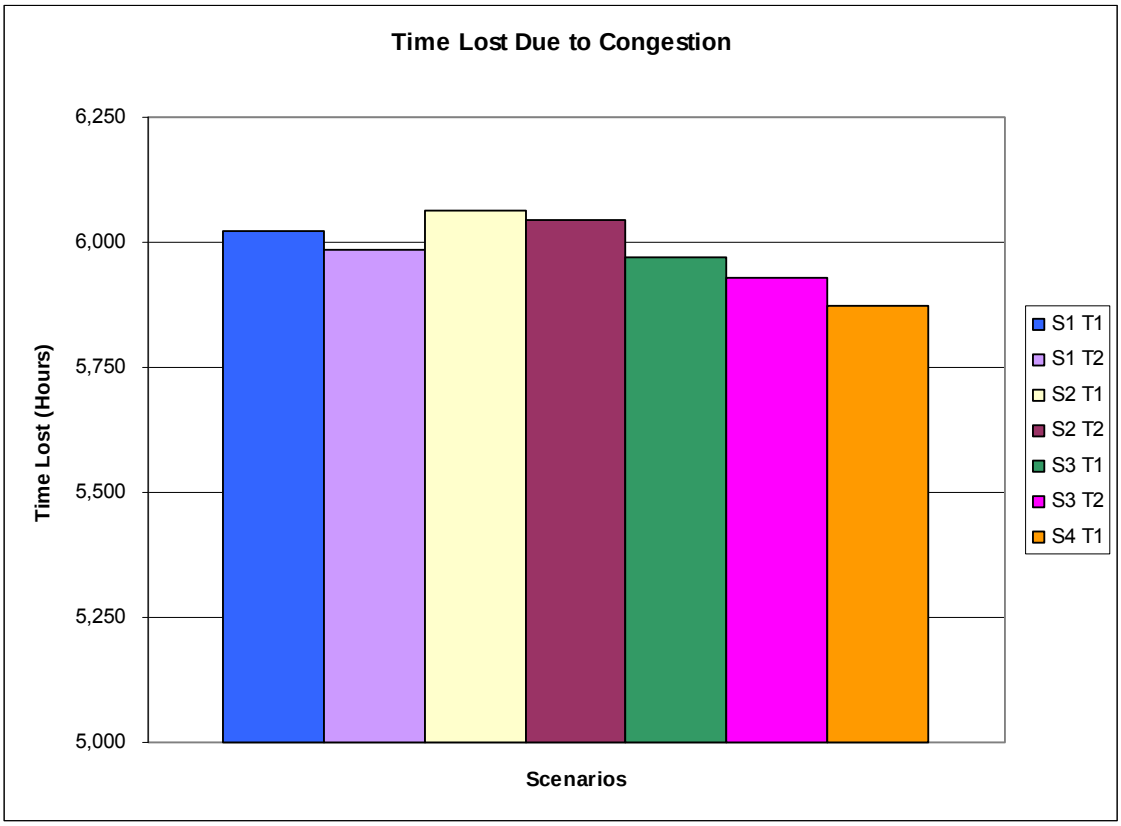


Figure 5.3 Time Lost due to Congestion in the Peak Periods (Hours)

6 Trip Generation & Mode Share of Development Scenarios

6.1 With developments located at different sites along the A90 South corridor, each Scenario may offer varying levels of accessibility and contribute towards various mixes of travel generation. Therefore, characteristics such as car and public transport trip making along with the proportion of trips that can be made within the actual development may alter between each scenario.

6.2 Table 6.1 below describes the predicted mode share and internal trip making for each development option. Note that only one access strategy is provided here for each development option, as the mode share forecasts for the alternative access strategies are broadly similar.

Table 6.1 Development Trips and PT Mode Share (Daily 2023 Person Trips)

Scenario	Development	Daily Trips	PT Mode Share
S1 T1	Banchory Leggart	11,991	13%
S1 T1	Schoolhill	7,340	11%
S2 T1	Banchory Leggart	11,939	13%
S2 T1	Portlethen West	7,395	11%
S3 T1	Elsick	19,541	11%
S4 T1	Mill of Forest	9,472	12%
S4 T1	Newtonleys	9,520	12%

6.3 The analysis indicates a broadly consistent level of mode share for each of the development options, with between 11% and 13% of trip generation related to PT trips. This outcome is perhaps not surprising as a similar level of public transport provision has been assumed for each Scenario.

6.4 Of the specific development sites, the modelling suggests that the Banchory Leggart development may produce a slightly higher proportion of PT mode share than other proposals. This outcome is likely to reflect the close proximity of this development to Aberdeen and the regular and relatively short bus journey assumed to be provided to access this site.

6.5 The analysis suggests that the Schoolhill and West Portlethen developments may have a slightly lower public transport mode share compared to the other development options. It is noted that these differences between Scenarios are relatively marginal, and that achieving higher PT mode share will be dependent on the final plans for public transport access to and from each site.

6.6 Existing settlements within the A90 South corridor (such as Stonehaven and Portlethen) have a recorded (or modelled) public transport mode share of around 10%-13% which is broadly inline with the PT forecasts associated with these new developments. Of course, the public transport forecasts provided here are dependent on the development actually delivering the (reasonably good) level of public transport accessibility assumed for this study.

6.7 For each development, the level of PT mode share is likely to be determined by a number of factors. Firstly, the ability of the development to provide PT services to access different parts of Aberdeen. At present each development scenario is assumed to provide similar levels of accessibility to central Aberdeen, but no PT options have been considered to directly link new developments to other areas out with central Aberdeen.

6.8 For a development to increase the likelihood for people to choose travel by public transport, new services are likely to be required to serve areas out with central Aberdeen - particularly as a considerable proportion of future development is planned for more peripheral locations. For example, providing direct or improved connections to serve key regional locations such as Aberdeen Royal Infirmary, industrial estates at Dyce, Kirkhill, Altens, Bridge of Don and Westhill would increase the choices available to travellers – particularly as car travel to these areas is likely to become more accessible with the arrival of the AWPR. Parking policy would of course be a further key issue here.

Internal Development Trip Making

6.9 The nature of the trip making associated with each scenario will be determined by the composition of each development, where an area that provides a variety of services located close to residential areas may increase the proportion of journeys made within the actual settlement – ie minimising the trips which appear on the strategic network. Furthermore, the design of the development may encourage residents to make journeys using more sustainable modes.

6.10 Within this study, levels of internal (motorised) trip making of around 7% have been applied to developments to account for trips that may remain within the actual developments. The availability of more detailed plans would be required to further consider and compare the level of internal trip making within a new development area.

6.11 There is some historical evidence to support the view that locating residential areas and local services within a mixed development may encourage journeys to be confined to the settlement. However, there is perhaps less evidence to support the concept that locating residential and major employment areas within a mixed site would reduce the requirement to travel out with the development. With the range of employment sites and opportunities available within a reasonable commuting distance of these new developments, it is perhaps unlikely that a substantial number of workers would choose to restrict their choices to just one settlement.

6.12 The size of development in supporting local services may have an impact on the ability to encourage internal trip making. For example, the towns of Stonehaven and Inverurie are at a sufficient scale to cater for a variety of local services. Whereas, smaller developments such as Kingswells or Newtonhill have fewer services available and are therefore likely to result in regular local journeys to neighbouring towns (such as Westhill or Portlethen) to access services.

6.13 Therefore, as the scale of development is significant in terms of settlements supporting a range of services, the Elsick development option, which is by far the largest single development proposal, may have potential to encourage a greater level of internal trip making than other Scenarios.

7 Strategic Operational Appraisal

7.1 The A90 South corridor is currently one of the most heavily used strategic arteries in the North East, with both the road and rail network regularly suffering from congestion or over-crowding at certain times during the day. This section discusses the impact that alternative development options may have on the operation of key sections of the A90 South corridor.

Road Network Traffic Flows

7.2 With locations at various sites along the A90, each new development option is likely to impact on the road network at different locations. Tables 7.1 to 7.5 describe how daily and peak period traffic flows are predicted to change between 2007 and 2023 with each development scenario. Table 7.1 overleaf describes the change in daily traffic flow (Average Annual Daily Traffic (AADT)) across three Screenline locations, as follows:

- River Dee Crossings: total traffic flow using the Bridge of Dee, King George VI Bridge, Queen Elizabeth Bridge, Victoria Bridge, Maryculter Bridge and Durris Bridge;
- A90 South of Charleston: total traffic flow using the A90 and various side roads to the East and West of the A90; and
- A90 North of Stonehaven: total traffic flow using the A90, B979 and the AWPR Fastlink.

Table 7.1 Daily Traffic Flow across Strategic Screenlines (AADT Vehicles)

Scenario	AADT / Change	River Dee Crossings	South of Charleston	North of Stonehaven
2007	**AADT**	**117,314**	**46,251**	**31,883**
S1 T1	Change	-10,825	11,658	12,206
	% Change	-9%	25%	38%
S1 T2	Change	-11,023	6,665	12,189
	% Change	-9%	14%	38%
S2 T1	Change	-10,580	6,040	12,230
	% Change	-9%	13%	38%
S2 T2	Change	-10,858	5,794	12,243
	% Change	-9%	13%	38%
S3 T1	Change	-10,064	11,422	13,104
	% Change	-9%	25%	41%
S3 T2	Change	-11,336	6,704	12,246
	% Change	-10%	14%	38%
S4 T1	Change	-11,925	5,360	20,270
	% Change	-10%	12%	64%

7.3 Table 7.1 indicates a consistent rise (+30%) in traffic levels to the North of Stonehaven for all development scenarios. This growth reflects the general rise in traffic associated with the Structure Plan but also the considerable level of development planned for the A90 South corridor. At this point, the modelling suggests the largest rise in traffic would be related to Scenario 4, where the Stonehaven developments are likely to contribute to higher levels of traffic using this part of the network to access Aberdeen and areas further north.

7.4 The growth in overall traffic levels using roads at the South of Charleston is reduced to some degree by the introduction of the AWPR, which offers some relief to existing routes. However, over the full day, traffic is still likely to be in excess of 2007 levels, and therefore this section of the A90 South corridor could well remain a strategic pressure point if the Structure Plan targets are achieved - particularly relating to development scenarios 1 and 3 (Test 1).

7.5 Identifying traffic using all bridges over the Dee (excluding the AWPR) provides a good illustration of the benefits of the AWPR, where motorists are expected to divert to use the new bypass thus reducing the total traffic flow using the existing crossings. Therefore this traffic diversion effect off-sets the growth in traffic forecast over time for these locations.

7.6 Table 7.2 describes more detailed changes in daily traffic flows at 5 key locations along the A90.

Table 7.2 Daily Traffic Flow along A90 (AADT Vehicles)

Scenario	AADT / Change	Bridge of Dee Approach	South of Charleston	North of Bruntland Rd	North of Stonehaven	West of Stonehaven
2007	**AADT**	**37,363**	**45,222**	**32,565**	**28,726**	**25,515**
S1 T1	Change	-8	2,983	-6,529	-6,374	9,114
	% Change	0%	6%	-20%	-20%	29%
S1 T2	Change	177	382	-6,550	-6,386	9,131
	% Change	0%	1%	-21%	-20%	29%
S2 T1	Change	423	2,973	-2,970	-6,434	9,129
	% Change	0%	6%	-9%	-20%	29%
S2 T2	Change	341	2,997	-2,999	-6,458	9,121
	% Change	0%	6%	-9%	-20%	29%
S3 T1	Change	-2,871	9,406	5,673	-5,471	9,489
	% Change	-2%	20%	18%	-17%	30%
S3 T2	Change	-3,684	4,806	874	-7,079	9,351
	% Change	-3%	10%	3%	-22%	29%
S4 T1	Change	-5,085	3,572	-1,490	-444	15,635
	% Change	-4%	8%	-5%	-1%	49%

7.7 The analysis illustrates a consistent growth in traffic over time to the West of Stonehaven, with the exception of Scenario 4, where a much larger increase in traffic is anticipated due to the close proximity of the Stonehaven related developments at these locations.

7.8 The benefits of the AWPR are again demonstrated just to the North of Stonehaven where a reduction in daily traffic flows of around 20% is predicted between 2007 and 2023. Again Scenario 4 is the exception where the Stonehaven related development traffic is forecast to mostly off-set this diversion effect related to the AWPR.

7.9 At the A90 just to the North of Bruntland Road a more mixed pattern of traffic changes is anticipated. Traffic levels associated with Scenarios 1 and 2 are anticipated to reduce traffic at this location (as the majority of these developments are located to the North of Portlethen). Furthermore, as traffic associated with the Stonehaven developments have the option of travelling Northbound via both the A90 and the AWPR Fastlink, this tends to lead to a small reduction in traffic from 2007 levels at this point.

7.10 For the Elsick Scenario, an increase in traffic using the A90 to the West of Portlethen is anticipated (Test 1 in particular), as the majority of traffic associated with this development would access the A90 just to the South of this point. With Elsick Access Test 2, which includes

an intersection connecting the development directly to the AWPR Fastlink, the traffic accessing the A90 reduces substantially and subsequently only leads to a small increase on the A90 North of Bruntland Road.

7.11 The introduction of the AWPR is generally expected to attract traffic away from using the A90 to the South of Charleston. However, the modelling suggests that these benefits would be largely off-set by the increase in traffic levels associated with all Scenarios - Particularly, the Elsick Scenario-Test 1, which is forecast to generate a 20% increase to daily traffic flows compared to 2007 levels.

7.12 On the A90 approaching the Bridge of Dee, the traffic patterns related to Scenarios 1 and 2 (which access the A90 close to this point) are anticipated to off-set the diversionary effects associated with the AWPR, resulting in similar traffic levels as observed in 2007. However, with Scenarios 3 and 4, traffic approaching the Bridge of Dee is expected to reduce slightly as much of the development related traffic would have the choice of diverting around this bottleneck by using the AWPR.

7.13 Tables 7.3 and 7.4 describe the predicted changes in hourly traffic flows between 2007 and 2023 for the AM Peak (Northbound flow) and PM Peak (Southbound flow) hours respectively (recorded in Passenger Car Units (PCUs)). The table also describes the capacity of the road utilised by the volume of traffic forecast to use these specific parts of the network (ie the Volume / Capacity ratio).

7.14 Firstly, the analysis demonstrates that in 2007, traffic travelling along the A90 South corridor gradually builds-up approaching Aberdeen. With around 50% of capacity utilised to the West of Stonehaven, around 55% to the North of Stonehaven, 60%-70% to the West of Portlethen, 80%-90% to the South of Charleston and over 100% on the Bridge of Dee.

7.15 The modelling suggests that for all 2023 forecast year Scenarios, the Bridge of Dee is anticipated to continue to act as a pinch-point for motorists approaching Aberdeen, with only marginal changes in traffic illustrated between scenarios.

Table 7.3 Peak Hour Traffic Flow using A90 (AM Northbound PCUs)

Scenario	AADT / Change	Bridge of Dee	South of Charleston	North of Bruntland Rd	North of Stonehaven	West of Stonehaven
2007	AM Peak	1,431	3,215	2,564	2,086	1,799
	Vol/Cap	119%	89%	71%	58%	50%
S1 T1	Change	-67	-175	-666	-493	262
	% Change	-5%	-5%	-26%	-24%	15%
	Vol/Cap	114%	84%	53%	44%	57%
S1 T2	Change	-66	-385	-675	-503	262
	% Change	-5%	-12%	-26%	-24%	15%
	Vol/Cap	114%	79%	52%	44%	57%
S2 T1	Change	-63	-146	-331	-508	256
	% Change	-4%	-5%	-13%	-24%	14%
	Vol/Cap	114%	85%	62%	44%	57%
S2 T2	Change	-67	-184	-337	-514	256
	% Change	-5%	-6%	-13%	-25%	14%
	Vol/Cap	114%	84%	62%	44%	57%
S3 T1	Change	-88	276	290	-416	275
	% Change	-6%	9%	11%	-20%	15%
	Vol/Cap	112%	97%	79%	46%	58%
S3 T2	Change	-88	2	-82	-470	287
	% Change	-6%	0%	-3%	-23%	16%
	Vol/Cap	112%	89%	69%	45%	58%
S4 T1	Change	-109	-34	-196	-24	790
	% Change	-8%	-1%	-8%	-1%	44%
	Vol/Cap	110%	88%	66%	57%	72%

Table 7.4 Peak Hour Traffic Flow using A90 (PM Southbound PCUs)

Scenario	AADT / Change	Bridge of Dee	South of Charleston	North of Bruntland Rd	North of Stonehaven	West of Stonehaven
2007	PM Peak	1,299	2,856	2,282	1,981	1,722
	Vol/Cap	108%	79%	63%	55%	48%
S1 T1	Change	-16	-148	-515	-469	478
	% Change	-1%	-5%	-23%	-24%	28%
	Vol/Cap	107%	75%	49%	42%	61%
S1 T2	Change	-14	-310	-514	-465	481
	% Change	-1%	-11%	-23%	-23%	28%
	Vol/Cap	107%	71%	49%	42%	61%
S2 T1	Change	-15	-125	-222	-478	477
	% Change	-1%	-4%	-10%	-24%	28%
	Vol/Cap	107%	76%	57%	42%	61%
S2 T2	Change	-18	-114	-212	-467	475
	% Change	-1%	-4%	-9%	-24%	28%
	Vol/Cap	107%	76%	57%	42%	61%
S3 T1	Change	-55	389	355	-424	503
	% Change	-4%	14%	16%	-21%	29%
	Vol/Cap	104%	90%	73%	43%	62%
S3 T2	Change	-49	144	102	-442	495
	% Change	-4%	5%	4%	-22%	29%
	Vol/Cap	104%	83%	66%	43%	62%
S4 T1	Change	-62	63	-31	22	970
	% Change	-5%	2%	-1%	1%	56%
	Vol/Cap	103%	81%	63%	56%	75%

7.16 The A90 South of Charleston is also anticipated to remain heavily trafficked for all Scenarios, with similar traffic flows forecast as observed in 2007 and around 75%-90% of capacity utilised. More significantly, the Elsick Scenario is anticipated to increase traffic levels and take up 90%-100% of capacity at this location. However, the introduction of an intersection with the AWPR is forecast to reduce traffic levels to less than 90% of capacity at this location – similar to the other alternative development Scenarios.

7.17 Again, with the exception of Scenario 3-Test 1, traffic levels are anticipated to reduce at the A90 North of Bruntland Road, with no more than 70% of capacity utilised for all other Scenarios. Even with around a 10% increase in traffic at this location with the Elsick development, no more than 80% of capacity is used.

7.18 Generally, a relatively consistent 20%-25% reduction in traffic and utilised capacity is predicted on the A90 to the North of Stonehaven. Scenario 4 is the exception to this trend, where a small change in flow is suggested, and this is not expected to have a significant effect on capacity.

7.19 To the West of Stonehaven, a 15% and 30% increase in traffic using the A90 is forecast for the AM and PM peak hours respectively. The Southbound flow is forecast to increase more substantially as the introduction of the AWPR allows motorists travelling Southbound on the B979 to directly access the A90, rather than travelling through Stonehaven.

7.20 For the Stonehaven Scenario this additional traffic may start affecting the performance of the network, as over 70% of capacity is utilised in 2023 compared to 50% in 2007 (similar to current levels at Portlethen). This extra traffic may present some access difficulties at junctions with shorter slip roads (eg Spurryhillock), or lower quality access points further south.

7.21 Table 7.5 describes the level of daily traffic predicted to use specific sections of the AWPR, comparing traffic related to these recent development related scenarios with traffic forecasts used previously in appraising the impacts of the AWPR.

7.22 The analysis indicates that the general level of AWPR-related traffic associated with these development scenario options are in excess of those predicted previously. For example, the traffic forecast to use the Fastlink section is anticipated to be around 50% greater than previous expectations, rising to over 80% for the Stonehaven Scenario.

7.23 Traffic predicted to use the AWPR between the A93 and the Kingswells North intersections is also expected to increase above that forecast previously by around 15%-20% (with the exception of the Elsick (Test 2) and Stonehaven Scenarios). Similarly, traffic forecasts are also anticipated to increase on the AWPR approaching the A96 by around 6%.

7.24 This increase in traffic forecast to use the AWPR is likely to reflect the additional development assumed within these Scenarios, which is in excess to that assumed during earlier studies. It may also reflect the location of these developments, where recent plans are focussed more on peripheral areas of Aberdeen and along specific Aberdeenshire corridors.

7.25 The reduction in traffic forecast to use the AWPR between the A947 and the A90 North is likely to reflect the assumed introduction of the 3rd Don Crossing and Haudagain junction improvements, which were not accounted for at the time of the previous AWPR study. These schemes are expected to provide some relieve to congestion in the North of the city which may attract traffic to travel via some of these more central orientated routes.

Table 7.5 Daily Traffic Flow using AWPR (AADT Vehicles)

Scenario	AADT / %Change	Stonehaven Fastlink	Charleston-Cleanhill	A93 - A944	Kingswells North- A96	A947 – A90 North
Previous Forecasts		13,500	17,400	40,100	52,800	22,000
S1 T1	AADT	21,390	20,420	46,550	55,840	19,460
	% Change	58%	17%	16%	6%	-12%
S1 T2	AADT	21,380	20,800	46,720	55,920	19,510
	% Change	58%	20%	17%	6%	-11%
S2 T1	AADT	21,470	20,510	46,650	55,870	19,480
	% Change	59%	18%	16%	6%	-11%
S2 T2	AADT	21,510	20,890	46,860	55,990	19,510
	% Change	59%	20%	17%	6%	-11%
S3 T1	AADT	21,380	20,740	46,720	56,020	19,620
	% Change	58%	19%	17%	6%	-11%
S3 T2	AADT	22,430	16,700	47,940	56,740	19,780
	% Change	66%	-4%	20%	7%	-10%
S4 T1	AADT	25,300	17,650	47,200	56,150	19,630
	% Change	87%	1%	18%	6%	-11%

7.26 The main conclusions that can be drawn from this traffic analysis include:

- The level of traffic using the A90 in 2023 is likely to be similar to that observed in 2007, therefore the diversionary benefits associated with the AWPR would be largely off-set by the increase in traffic brought about by general growth in the economy allied to the spatial configuration of the Structure Plan;
- Pressure on road capacity at the Bridge at Dee is expected to continue for all Scenarios, with perhaps pressure being slightly less severe for the Elsick and Stonehaven Scenarios;
- The Elsick scenario (Test 1) is forecast to increase traffic using the A90 directly South of Charleston in excess of 2007 levels, which may impact on the performance of this part of the network;
- Traffic using the A90 to the West of Stonehaven is anticipated to increase considerably if the Stonehaven developments were introduced. Although this additional traffic may not significantly impact on the performance of the A90, it may increase the difficulty for motorists accessing the A90 from the lower quality access points; and
- If the aspirations of the Structure and Development Plans are achieved, the daily level of traffic forecast to use the AWPR is expected to be in excess of that predicted to use the AWPR in previous studies.

Congestion Analysis

7.27 Road network and junction delays produced by ASAM4 can be used to plot congestion pinch-points to illustrate the impacts predicted for each of the development options.

7.28 This type of analysis is developed using a congestion mapping procedure, which separates the road network into a 250 metre grid system and calculates the difference in 'congested time' compared to 'free-flow' time for all vehicles within a grid square. Images that indicate the level of congestion in the A90 South corridor for each development Scenario are contained and discussed in Appendix A.

7.29 The main conclusions that can be drawn from this congestion analysis include:

- The Bridge of Dee area is likely to continue to remain a considerable bottleneck for traffic approaching Aberdeen from the South;
- Although the new A90 access points associated with the Banchory Leggart development are likely to provide some relief to the existing Bridge of Dee junction, the new roundabouts are also likely to become under pressure from development-related traffic. However, the provision of two junctions to access the A90 from Banchory Leggart eases delays approaching these junctions from the west;
- The Findon-Charleston section of the A90 is likely to remain under pressure in the AM Peak as the majority of diversionary benefits associated with the introduction of the AWPR are predicted to be off-set by the growth in traffic over time. Therefore, some delays are likely to the South of Charleston, particular for the Elsick Scenario (Test 1), where development related traffic is anticipated to increase the overall traffic flow at this location in excess of that currently observed;
- The relatively high traffic flows approaching Charleston interchange may have the potential to impact on the performance of this junction during the peak periods, particular for the Elsick Scenario (Test 1);
- No significant delays along the A90 between Findon Interchange and Bruntland Road are predicted as the AWPR diversionary benefits outweigh the growth in traffic over time - with the exception of the Elsick Scenario (Test 1), where an increase in traffic would be anticipated;
- No regular delays forecast between Stonehaven and Newtonhill or using the AWPR Fastlink for any of the development scenario options;
- Although traffic growth to the West of Stonehaven is anticipated to increase considerably, the capacity of this section of the A90 is expected to cope with this additional pressure, with only a slight reduction in free flow speed demonstrated. However, accessing the A90 via lower quality access junctions may prove more difficult with this increase in the mainline flow – particularly for the Stonehaven development Scenario; and
- The AWPR access interchange at Stonehaven may come under increasing pressure due to the level of traffic movements anticipated to increase to and from the South of Aberdeenshire (and beyond) and to areas to the periphery of Aberdeen and North and West Aberdeenshire. This potential impact is particularly relevant for the Stonehaven development Scenarios.

Road Journey times

7.30 The anticipated changes in traffic flows and level of congestion, may impact on the overall time required to travel from the South of Aberdeenshire to access key areas of Aberdeen and Aberdeenshire. Figures 7.1 to 7.5 describe the forecast change in relevant road journey times (northbound direction) for an average hour within the AM Peak period, including:

- Stonehaven to the Bridge of Dee;
- Stonehaven and Newtonhill to:
  - Aberdeen City Centre;
  - Aberdeen Royal Infirmary;
  - Aberdeen Airport; and
  - Altens industrial estate.

7.31 Note that 'modelled' journey times tend to be lower than those experienced at very congested peak times as they represent an 'average' journey time over a three hour morning period.

7.32 Figure 7.1 indicates that the introduction of all development scenarios would result in similar journey times along the A90 between Stonehaven and the Bridge of Dee to that experienced in 2007. This suggests that at the strategic level the beneficial diversionary effects provided by the AWPR would be largely off-set by the growth in traffic forecast over time for this corridor.

7.33 Figure 7.2 describes the wider impact of the development scenarios between Stonehaven / Newtonhill and Aberdeen City Centre. The analysis indicates a consistent rise in journey times to access central Aberdeen for all Scenarios. This is likely to reflect the increase in journey time along the A90, but also the general impact associated with the level of development targeted within the Structure Plan. Which would lead to considerable growth in traffic across the North East rather than be confined to the A90 South corridor.

7.34 As routes that are used to access the centre of Aberdeen are unlikely to experience such large diversionary benefits associated with the introduction the AWPR, the growth in traffic is predicted to generate additional congestion - therefore resulting in excess travel time to access these central areas from South Aberdeenshire.

7.35 Figure 7.3 describes the predicted change in travel time to the Aberdeen Royal Infirmary (ARI). Again the change in journey time is broadly similar for each Scenario, but varies between journey origins. Journeys from Stonehaven are likely to benefit as motorists would have the option of using the Fastlink and A944 to access the ARI. Whereas, journey times from Newtonhill would remain similar, as although the AWPR would provide an alternative to travelling via the Bridge of Dee, it would result in a much longer distance route, off-setting the time benefits for this particular movement.

7.36 Figure 7.4 describes the change in journey time between South Aberdeenshire and Aberdeen Airport and indicates a considerable time benefit for all Scenarios for this particular movement. This significant reduction in journey time is created by the AWPR, which would provide a high speed route for the majority of this travel movement. This benefit is also likely to reflect the benefits of the Haudagain improvement scheme, which is anticipated to reduce delays for motorists choosing to travel via this alternative route.

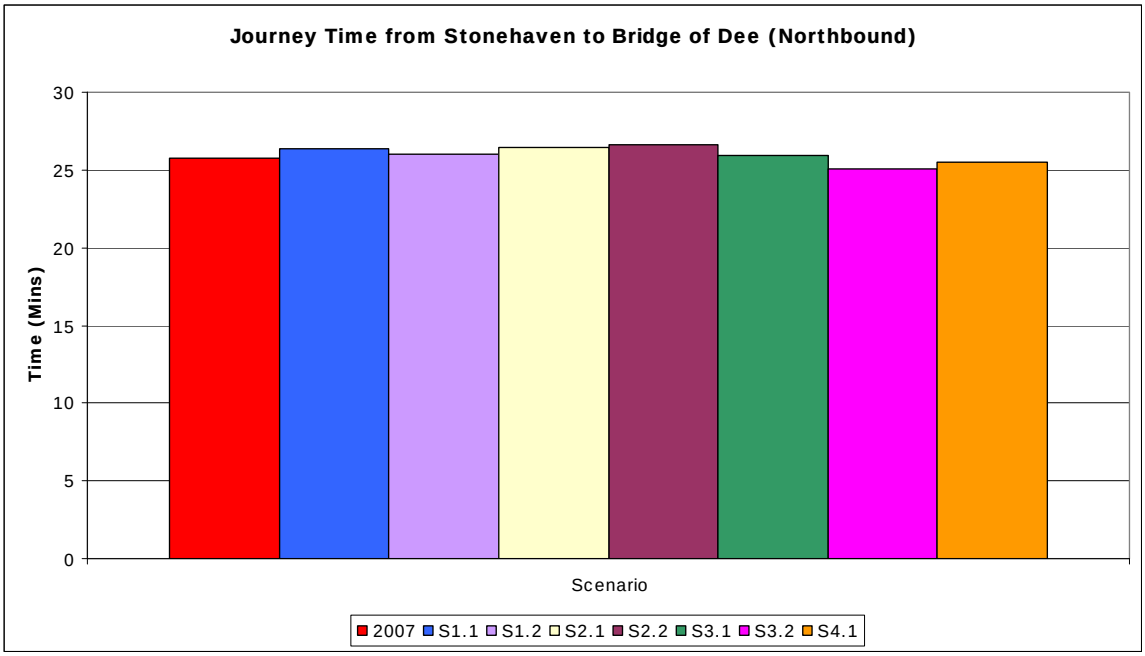


Figure 7.1 AM Peak Journey Time from Stonehaven to Bridge of Dee (2023)

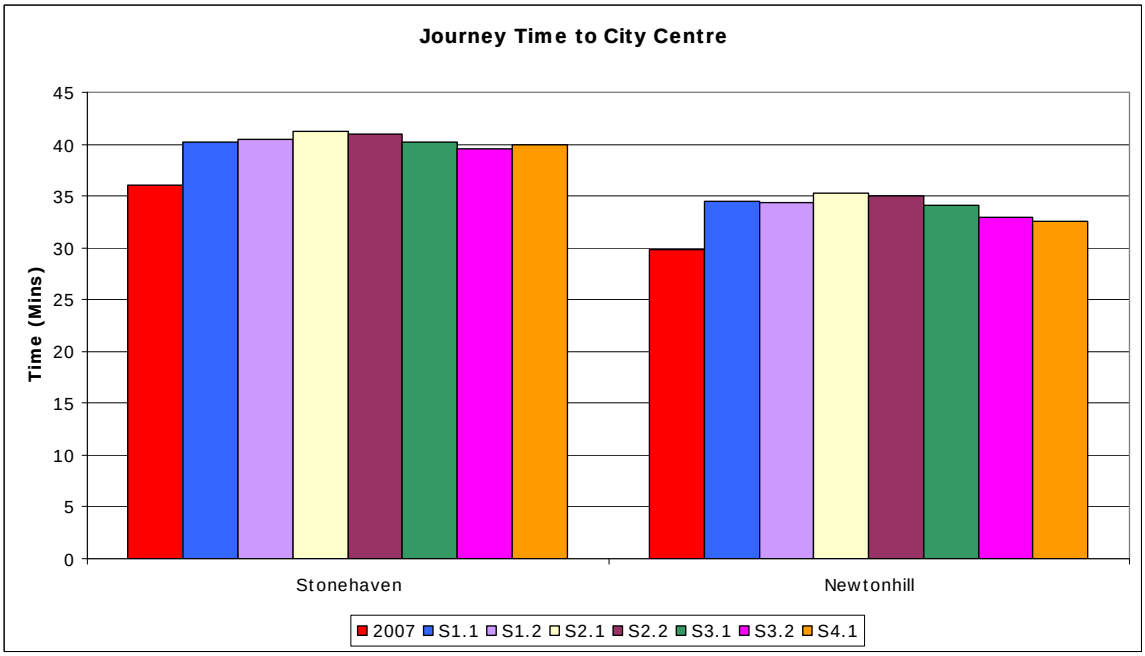


Figure 7.2 AM Peak Journey Time to Aberdeen City Centre (2023)

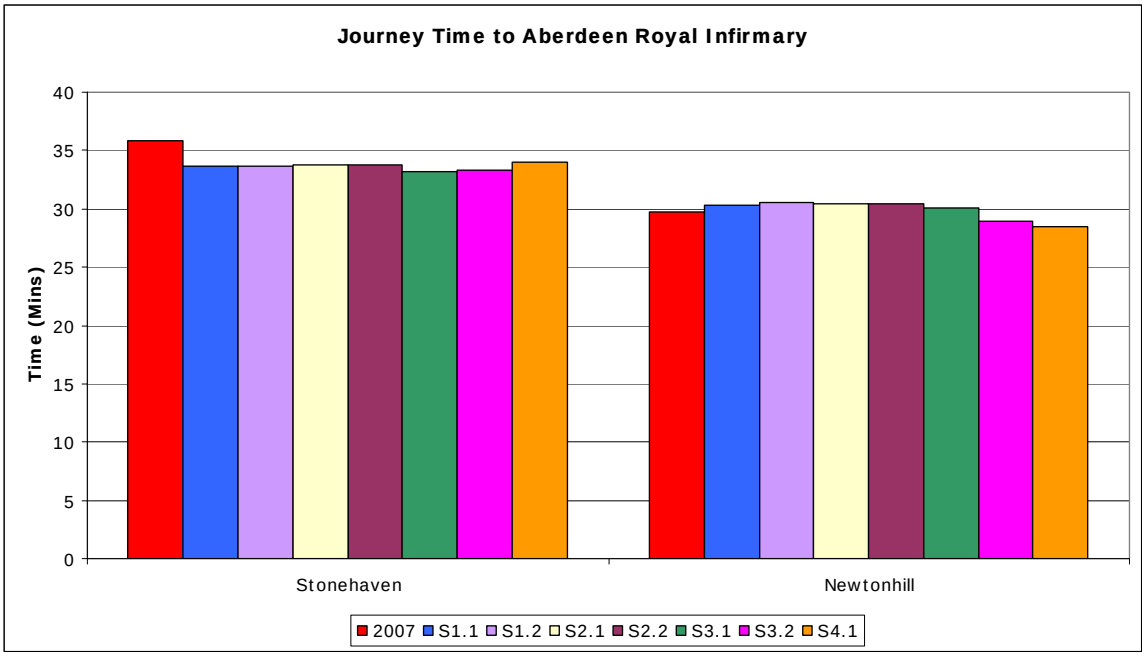


Figure 7.3 AM Peak Journey Time to Aberdeen Royal Infirmary (2023)

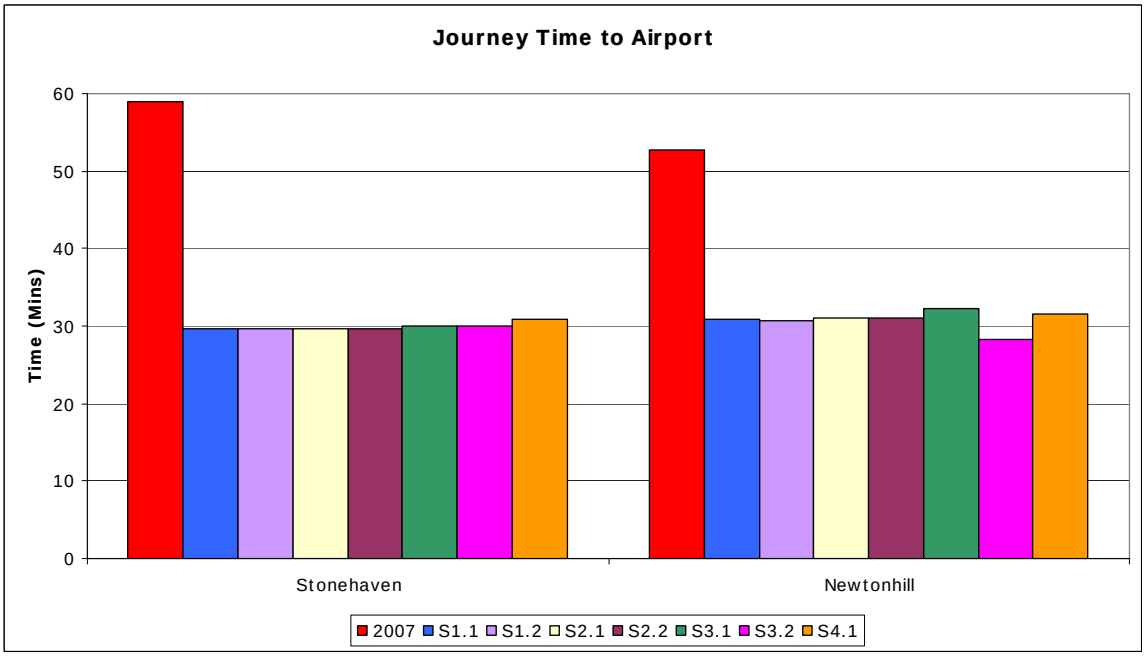
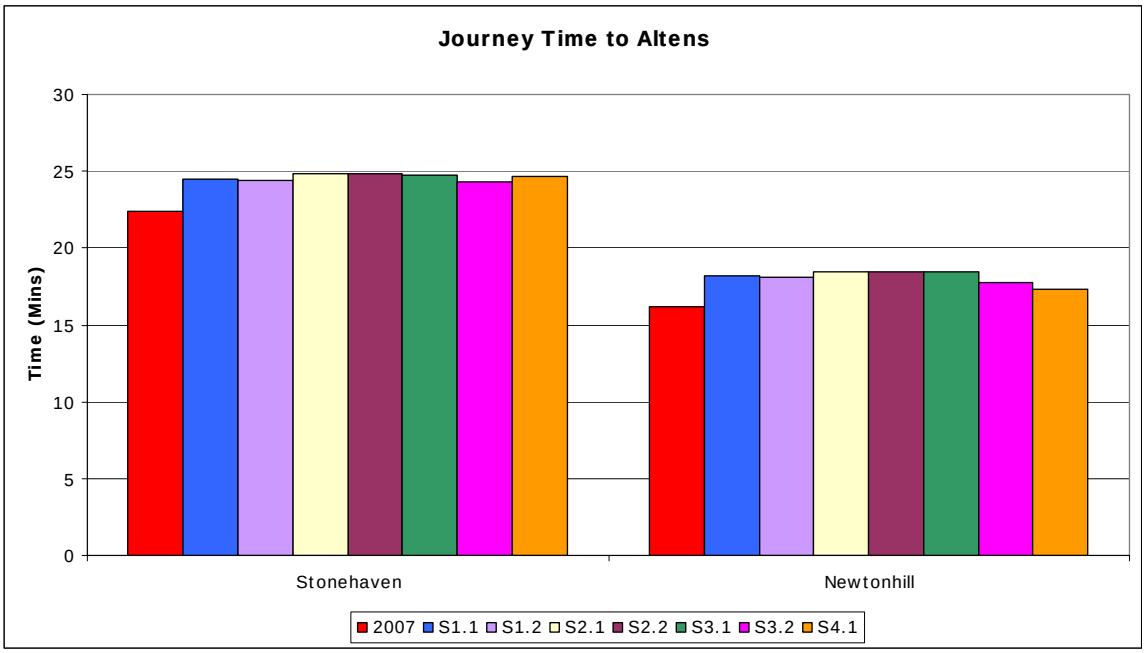


Figure 7.4 AM Peak Journey Time to Aberdeen Airport (2023)

7.37 The analysis described in Figure 7.5 indicates an increase in travel time between South Aberdeenshire and Altens. Although the AWPR is likely to provide an alternative route for some traffic currently travelling via the A956, it would also generate a change in travel movements for traffic accessing Altens. Therefore, some motorists that previously used Wellington Road and West Tullos Road would divert to access Altens using the AWPR, Charleston Interchange and the A956. This diversionary effect has the potential to increase the journey time for motorists travelling from the South via Charleston Interchange and the A956.

Figure 7.5 AM Peak Journey Time to Altens Industrial Estate (2023)



Public Transport Patronage

7.38 This section discusses the potential change to public transport patronage in the A90 South corridor. Table 7.6 describes the predicted change in daily public transport trips (bus and rail combined) for specific locations within the A90 South corridor (from a 2007 Base).

7.39 Note that forecasts are only provided for one Scenario access strategy, as the patronage results for alternative access strategies are broadly similar.

Table 7.6 Public Transport Patronage (Daily Passengers)

Scenario	Daily Passengers	North of Portlethen	North of Stonehaven	South of Stonehaven
2007 Base		**7,500**	**5,830**	**4,965**
S1 T1	Change	3,145	1,034	1,124
	% Change	42%	18%	23%
S2 T1	Change	3,177	1,059	1,137
	% Change	42%	18%	23%
S3 T1	Change	2,528	1,135	1,146
	% Change	34%	19%	23%
S4 T1	Change	2,234	1,839	1,194
	% Change	30%	32%	24%

7.40 This analysis indicates that public transport use is likely to increase in the A90 South corridor. This trend reflects the level of population growth anticipated for each development Scenario, where a proportion of inhabitants would choose to use public transport for their journey.

7.41 The increase in patronage is also likely to reflect the introduction of Laurencekirk rail station and associated services, which were not operational in 2007. Similarly, it would also reflect the introduction of a Park and Ride site and services operating at Schoolhill.

7.42 The modelling suggests a considerable growth in patronage to the North of Portlethen, particularly for Scenarios 1 and 2. This reflects the (assumed) operation of local bus services between the Banchory Leggart, Schoolhill / West Portlethen and Portlethen settlements.

7.43 Similarly, a considerable growth in patronage is demonstrated to the North of Stonehaven, and this trend is likely to reflect a proportion of the inhabitants of the Stonehaven-related developments choosing to use public transport to access Aberdeen.

7.44 Section 4 demonstrated the projected increase in Car Ownership across the North East over time. Although additional car use remains likely, these patronage trends suggest that, if successful, the level of development planned for the A90 South corridor and associated PT journeys would off-set the fall in PT journeys due to higher car availability.

7.45 Table 7.7 describes the predicted change in rail patronage on the East Coast mainline to the North of Portlethen between 2007 and 2023. It also indicates the average (seated) utilisation or occupancy of an average train service travelling in the AM and PM Peak hours.

7.46 Note that this analysis calculates an average seated occupancy for all services using this section of the East Coast Mainline. For the more popular services, the occupancy of these trains is expected to be in excess of the figures reported here.

Table 7.7 Rail Patronage & Utilisation North of Portlethen (Hourly Passengers)

Scenario	Passengers	AM Peak Northbound	PM Peak Southbound
2007	Passengers	298	284
	Utilisation	93%	71%
S1 T1	Change	51	43
	% Change	17%	15%
	Utilisation	91%	95%
S2 T1	Change	51	41
	% Change	17%	14%
	Utilisation	91%	95%
S3 T1	Change	44	41
	% Change	15%	14%
	Utilisation	89%	95%
S4 T1	Change	56	46
	% Change	19%	16%
	Utilisation	92%	95%

7.47 This rail analysis demonstrates that the occupancy of current day services is approaching seated capacity in the peak directions to the North of Portlethen - particularly for the AM Peak period.

7.48 The forecasts for each development scenario consistently suggest that the level of patronage at this point of the rail network would increase over time - which reflects the additional levels of population and employment in the A90 South corridor along with the (assumed) continued rise in longer distance rail journeys over time.

7.49 With the road network continuing to come under pressure when travelling to Aberdeen City centre (as indicated by Figure 7.3), the rail network allows a viable and un-congested alternative for these types of journeys. However, this analysis suggests a lack of seating capacity during peak travel times, which may discourage further travel by rail in the A90 South corridor.

8 Summary of Impacts & Benefits

8.1 Drawing on the comparative appraisal outlined in this report, the following section discusses the main impacts and benefits associated with each development Scenario. It also considers the potential for each development option to meet the transport objectives, and mitigate against any predicted detrimental effects.

Scenario 1: Banchory Leggart and Schoolhill

8.2 The major advantages associated with the Banchory Leggart and Schoolhill Scenario relates to the relative close proximity of these developments to Aberdeen, between which, most day-to-day journeys are anticipated to take place. Being situated closer to the periphery of Aberdeen would minimise the length of the average vehicle journey associated with newly generated trips and would produce the least Carbon emissions of the Scenario options.

8.3 However, in terms of traffic congestion, the close proximity of Banchory Leggart to the already congested Bridge of Dee also presents the highest risk for further delays to this part of the network. The concentration of development traffic in this already congested area means that a larger proportion of development-related traffic will travel via the Bridge of Dee or Charleston and potentially impact on congestion levels. Although the introduction of a roundabout for development-related (and re-routed South Deeside Road) traffic to access the A90 is anticipated to mitigate delays at the existing Bridge of Dee junction, in the wider context, this could move delays towards the new junction – particularly for Banchory Leggart traffic. A second access point to the A90 does help to alleviate these impacts, but congestion in this area remains likely.

8.4 The congestion impacts associated with Banchory Leggart would also depend on the level of local journeys which are contained within the new settlement. If Banchory Leggart is able to support local services (such as shops, GPs, supermarkets and schools) then some of these journeys would be made locally, thus reducing the need to travel on the strategic network. However, with the major retail choices available (just across the Dee) at Garthdee, it is likely that some residents would in fact regularly choose to travel to this nearby area. With these existing services perhaps just located outside walking distance and with limited public transport alternatives proposed, the choice for many is likely to be towards a short car trip. Overall, the close proximity of the Banchory Leggart development to the Bridge of Dee area should be seen as a risk and the development's local access strategy becomes the key issue.

8.5 The proposals for Banchory Leggart also include the development of a business park. It should be noted that the full scale proposal for this business park is much larger than the assumptions applied during this study, and if fully development (and occupied) it would generate more traffic than suggested here - therefore amplifying the impacts predicted.

8.6 The developers aim to produce a high quality business park in line with that situated to the west of Edinburgh (Edinburgh Park). Although the concept, design and the ability to attract businesses may be similar to Edinburgh Park, the options for serving the site by public transport seem much more limited. Edinburgh Park is currently served by several frequent bus services and is situated within walking distance of two railway stations. A new tram serving Edinburgh city centre and Edinburgh Airport is being built at present along with a third rail station, which (combined with existing stations) will provide business travellers with direct services to key areas of economic activity within Scotland. Current plans for Banchory Leggart include access to one regular bus route only and accessing the rail network will require a bus/train

interchange. This level of provision would be reflected in the out-turn public transport mode share.

8.7 Generally, the Schoolhill proposal does not appear to present the same challenges in terms of strategic traffic impact compared to other development options. A new grade separated interchange at Findon is now in operation and this would provide access to the A90. Depending on the detailed design and layout of the developments, the second Banchory Leggart roundabout could also provide an access option further north.

8.8 For Banchory Leggart, the feasibility for public transport services to provide access to the development appears reasonable, with potential for existing bus services to be extended. This level of accessibility is also anticipated to generate a slightly higher public transport mode share for Banchory Leggart when compared to other development proposals.

8.9 Although Banchory Leggart offers advantages in terms of bus travel, the site has the poorest access to the existing rail network of the options considered. It also provides little support to promoting the Regional Transport Strategy that aims to improve services and increase patronage along the East Coast mainline.

8.10 There are limited plans currently available that indicate potential public transport access options for Schoolhill. However, with the planned introduction of a new Park and Ride site at the Findon Interchange, the potential for access or alterations to services would be enhanced. The new Park and Ride site would be a short drive from Schoolhill, and depending on the design of the development, could be within walking distance. The range of bus services currently serving Portlethen also offers potential for access solutions, but any diversion may increase the travel time for existing passengers.

8.11 Although the number of trains serving Portlethen is currently quite limited, accommodating additional population relatively close to the rail station could support the desire for improved regional services.

Scenario 2: Banchory Leggart and West Portlethen

8.12 The specific impact of the Banchory Leggart development within this Scenario is generally similar to those discussed above for Scenario 1.

8.13 Due to the relatively close proximity to Aberdeen the overall combination of Banchory Leggart and West Portlethen developments also compares favourably in terms of vehicle distance travelled and potential Carbon emissions. Public transport mode share and levels of patronage are also anticipated to be similar to that forecast for Scenario 1.

8.14 Although the development of the West Portlethen site would see development-related traffic accessing the A90 to the West of Portlethen, the level of traffic there is predicted to be slightly less than current levels due to the AWPR / Fastlink.

8.15 A new grade-separated interchange at Bruntland Road would substantially improve access to the A90 for both existing and development-related traffic – reducing the delays in accessing this point of the network and mitigating the risk of further road traffic accidents at this location.

8.16 The potential for public transport services at West Portlethen appears broadly similar to that discussed for Schoolhill. Travellers associated with both developments could potentially use and support new park and ride services at Findon and rail services to and from Portlethen.

Scenario 3: Elsick

8.17 With a site located further away from Aberdeen, the Elsick development is forecast to generate slightly longer journeys than that forecast for Scenarios 1 and 2. Due to the development's more rural location, it also generates slightly less public transport mode share than for Scenarios 1 and 2. However, due to the scale of development, Elsick perhaps presents a better opportunity to encourage a higher level of self containment than the other development options – which if realised could potentially reduce the development-related impacts described here.

8.18 As the majority of Elsick related traffic would access the A90 to the South of Charleston Interchange, the level of traffic travelling along this section of the A90 is forecast to be in excess of that currently experienced. Therefore, there is a risk of this development impacting on the operation of the new AWPR Charleston Interchange. The inclusion of a direct access point on the AWPR Fastlink reduces this risk though. However, the section of the A90 between Findon Junction and Charleston would remain heavily trafficked.

8.19 The Elsick Scenario would also provide a new grade-separated interchange at Bruntland Road, therefore reducing delays and mitigating the risk of further road traffic accidents at this location. Similarly, upgrading the lower standard access points at Newtonhill would also reduce the difficulty in accessing the A90 further south.

8.20 The potential for public transport services to Elsick reflects the opportunities discussed for both Schoolhill and West Portlethen. As Elsick is located further from the planned Park and Ride site at Findon and Portlethen train station, it would require a slightly longer distance car journey to access these services. However, due to the scale of development, Elsick may present better potential to support alterations to existing bus services and/or the development of new routes and priority measures.

Scenario 4: Mill of Forest and Newtonleys

8.21 With locations further south, it is perhaps unsurprising that the Stonehaven-related developments are forecast to generate the longest vehicle journeys and the highest Carbon emissions of the options considered. However, despite the relatively rural location, the public transport mode share and increase in patronage levels associated with the Mill of Forest and Newtonleys developments are similar to that forecast for the other proposals.

8.22 These developments, particularly Mill of Forest could be situated within walking distance of Stonehaven train station, encouraging use of existing services and potentially supporting the introduction of improved service patterns. However, with seated capacity on some peak period train services already limited, a substantial increase in regional rail patronage could become constrained. It is assumed that the operator would respond to pressures of this nature in the medium term.

8.23 The introduction of these developments is anticipated to considerably increase traffic levels using the A90 to the West of Stonehaven. However, as this section of the A90 is relatively uncongested at present, the network is anticipated to cope with this additional pressure without

significantly affecting strategic journeys times – a point illustrated by the Stonehaven Scenario producing the least time lost due to congestion of all development options. However, at peak times, accessing the A90 from lower quality access points may become more difficult with the introduction of this scenario.

8.24 The introduction of the AWPR Fastlink would provide a high quality route for Stonehaven residents to travel to the North and West of Aberdeen, whereas a higher proportion of traffic associated with alternative development Scenarios are likely to travel via the potentially pressurised junctions at Charleston and/or the Bridge of Dee.

8.25 However, the significant increase in traffic anticipated to travel via the Fastlink interchange at Stonehaven is in excess of that predicted in previous studies, and this could therefore potentially impact on the operation of this strategic location.

Common Themes

8.26 As all development proposals are generally located within the same strategic corridor and are of a similar scale, there are a number of common themes associated with each Scenario, these include:

- congestion in the Bridge of Dee area is likely to continue, and the highest risk of increased delays is likely to be associated with Scenarios that include the Banchory Leggart development, where development traffic is concentrated in this area;
- the level of traffic forecast between the Findon and Charleston interchanges is similar to that currently experienced. Therefore, journey times through this area of the network may continue to come under pressure and there may be potential for impacting on the performance of the Charleston Interchange. This risk is highest in relation to the Elsick development;
- there is also some risk to the operation of the Fastlink interchange at Stonehaven, particularly relating to the Mill of Forest and Newtonleys development proposals;
- the occupancy of rail services between Stonehaven and Aberdeen is forecast to remain close to or above seated capacity, potentially constraining the desire to further increase patronage along this route; and
- although new developments may provide a sufficient level of public transport accessibility to central Aberdeen, it is unclear how areas in more peripheral locations (where significant amounts of development are also anticipated) could be reasonably accessed without access to a car. Therefore, the ability for these proposals to work towards the vision of the RTS in the promotion of more sustainable modes may be limited, if further interventions or access options are not considered. This risk could become particularly relevant, as with the introduction of the AWPR, areas around the periphery of Aberdeen would become quicker to access than parts of central Aberdeen.

B APPENDIX B – S-PARAMICS LOCAL TRANSPORT MODELLING

Aberdeenshire Council
A90 Southern Approach – Comparative Appraisal
S-Paramics Traffic Modelling Report

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1 INTRODUCTION

1.1 Introduction

1.1.1 Under the North East Term Commission SIAS Limited (SIAS) has been commissioned to undertake a study assessing, at a high level, the road traffic implications of various development scenarios on the A90, south of Aberdeen.

1.1.2 Following on from initial findings using the strategic Aberdeen Sub Area Model (ASAM), SIAS was asked by the client Steering Group to undertake more detailed analysis using S-Paramics microsimulation. The focus of the additional analysis being the A90 between Charleston Interchange and Bridge of Dee northbound during the AM peak period.

1.1.3 The timescale for this detailed work was limited by the Local Development Plan Schedule and best use of available data has been made.

1.1.4 The S-Paramics study area is illustrated in Figure 1.1. The key focus is the impact on Bridge of Dee southern roundabout and the operation of the Charleston Interchange with the Aberdeen Western Peripheral Route and agreed structure plan assumptions in place.

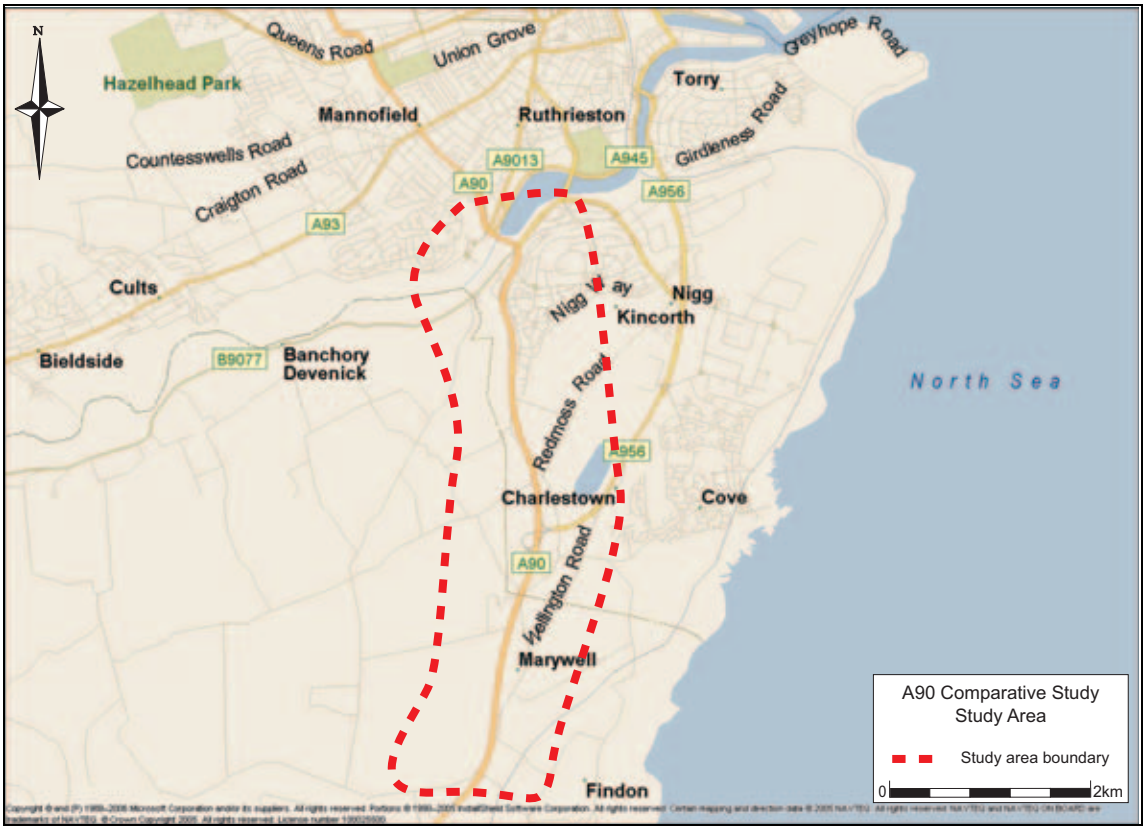

Figure 1.1 : Study Area

1.1.5 The S-Paramics modelling used travel demand changes derived from the strategic ASAM4 model to inform matrix changes to be applied in the local network.

1.1.6 This short Briefing Note summarises the base model development, the test scenarios considered, the future year matrix growth assumptions and, finally, the model findings.

1.2 Aim

1.2.1 The main aim of this piece of work is to assess, making best use of the available data, the impact of the proposed development scenarios on the A90 between Charleston and Bridge of Dee and identify whether the traffic modelling shows this impact to affect the operation of the future Aberdeen Western Peripheral Route at Charleston.

1.2.2 Key junctions at Bridge of Dee and at Cairngorm Drive will remain as per the base scenario with no assumptions regarding improvements or increased capacity.

1.2.3 The potential impact on the operation of an HOV lane that Aberdeen City Council has been considering has not been taken into account in this piece of work due to time constraints, it may be necessary to revisit this at a future date.

1.3 Addendum

1.3.1 This Briefing Note is an update to the original testing Briefing Note *(SIAS Ref. TPATCDPM/72353, 26 January 2010)* and includes additional sensitivity testing which is reported in Section 6.

2 BASE MODEL DEVELOPMENT

2.1 Introduction

2.1.1 SIAS undertook a programme of surveys on 30 September and 1 October 2009 for a separate study on behalf of Aberdeen City Council. Aberdeen City Council has permitted the use of this data to inform the base model development for this A90 southern approach modelling.

2.1.2 The 2009 surveys considered the turning movements for Bridge of Dee, Cairngorm Drive, Nigg Way and Charleston Interchange which form the basis of the corridor model. Key queue lengths were also surveyed and both turning movements and queue length surveys are available for the AM peak period between 06:30 – 09:30.

2.2 Network Development

2.2.1 The local area network was developed to represent the network conditions through the corridor illustrated in Figure 2.1. The model has been developed, calibrated and validated in version 2008.1 of S-Paramics microsimulation.

2.2.2 The model was developed from Ordinance Survey data with aerial photographs and video data used to determine the network configuration in terms of lane numbers and junction turning lane allocations.

2.2.3 In line with the requirements of the study, the model was developed for the AM peak period only:

- AM peak period: 06:30 – 09:30

2.2.4 The peak hour was calculated from the survey data and was determined to be 07:30 – 08:30.

2.2.5 As it is a corridor model, there is no route choice in the base model. Public transport information was collated by SIAS from a number of on-line data sources to provide some representation of public transport routes.

2.3 Matrix and Profile Development

2.3.1 The model zone system is illustrated in Figure 2.1 and highlights the location of each zone and the network description. Some zones have been coded into the model to allow future year testing and matrix development to be undertaken efficiently.

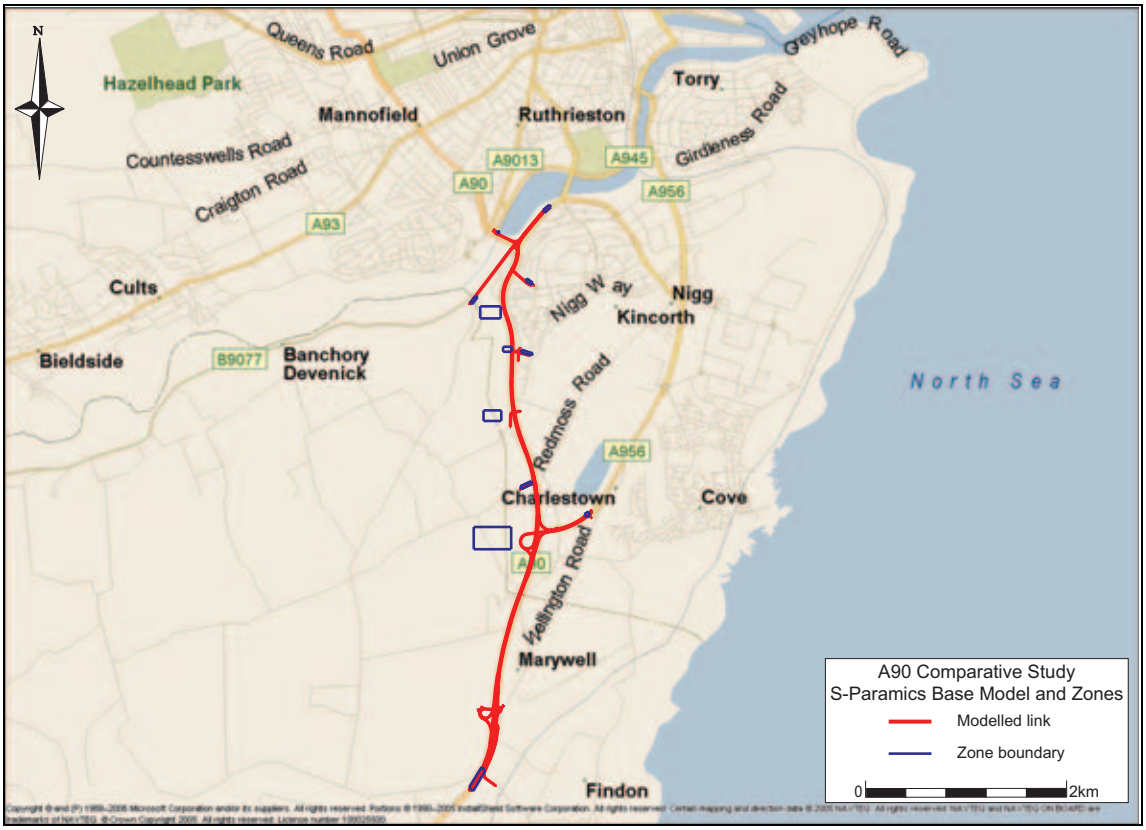

Figure 2.1 : Local Model Study Area

2.3.2 The model matrices were developed using the 2009 survey count data with Light vehicle and Heavy vehicle matrices resulting. Table 2.1 details the matrix split and the vehicle types modelled.

Table 2.1 : Vehicle Type Model Details

Matrix	S-Paramics Vehicle Type No'	Description	Proportion (%)
1	1	Cars	87
1	12	LGV	13
2	13	OGV1	47
2	14	OGV2	52
2	15	Private Coach	1

2.4 Calibration Notes

2.4.1 Calibrating the junction of the Southern Roundabout of Bridge of Dee has proven to be challenging. In calibrating the model SIAS noted that a number of 'non-compliant' manoeuvres had to be incorporated into the model to enable the close correlation of counts and queues between observed and modelled data.

2.4.2 Non-compliant manoeuvres are defined, in this case, as manoeuvres which are contrary to either road markings, signing or indeed accepted junction behavior according to the Highway Code.

2.4.3 SIAS conducted a number of site visits and a review of video data to observe the behaviour and verify the initial findings from the traffic model.

The following existing behaviour was noted at the southern junction during the AM peak:

- From A90 two-lane approach:
  - Both lanes ahead to single lane Bridge of Dee, some 'merge' on entry to Bridge of Dee, some travel all the way around roundabout (450°)
- From Leggart Terrace two-lane approach:
  - Both lanes ahead to single lane Great Southern Road, mainly 'merge' on roundabout circulating carriageway

2.4.4 These non-compliant movements have been represented to the best of the currently available data for the purpose of this modelling exercise.

2.5 2009 Base Model Validation

2.5.1 The main consideration of this study is the A90 approach to Bridge of Dee. Information will be provided for other locations, but the main focus of the base model development was to accurately model the A90 approach to Bridge of Dee from the south.

2.5.2 Traffic Flow Comparison

2.5.3 The requirements for validation as defined in *Design Manual for Roads and Bridges* (*DMRB*) Vol 12. suggests individual link flows should have a GEH less than or equal to 5 in 85% of cases over a 1hr interval. In a local model, such as this, the model calibration can be undertaken on individual turning movements.

2.5.4 The modelled traffic turning counts were compared against the 2009 observed turn count data at key locations. Table 2.2 presents the summary calibration traffic flow comparisons for the AM peak hour and AM peak period respectively (07:30 – 08:30 and 06:30 – 09:30).

Table 2.2 : AM 2009 Base Model and Observed Traffic Flow Comparisons

TURNCOUNT VALIDATION			Observed Flow 07:30 - 08:30	Observed Flow 06:30 - 09:30	Model Peak Hour 07:30 - 08:30			Model Peak Period 06:30 - 09:30		
					Count	Diff (mod - obs)	GEH	Count	Diff (mod - obs)	GEH
Junction Description	From	To								
Bridge of Dee Roundabout										
	GSR	BoDee	354	992	357	3	0.2	993	1	0.0
		Leggart Terrace	114	255	92	-22	2.2	256	1	0.1
		A90	402	1,005	364	-38	1.9	1,015	10	0.3
	A90	GSR	354	1,233	391	37	1.9	1,243	10	0.3
		BoDee	888	2,649	857	-31	1.0	2,653	4	0.1
		Leggart Terrace	9	36	12	3	0.9	37	1	0.2
	Leggart Terrace	A90	62	155	59	-3	0.4	159	4	0.3
		GSR	148	463	172	24	1.9	467	4	0.2
		BoDee	311	674	247	-64	3.8	676	2	0.1
	BoDee	Leggart Terrace	63	142	53	-10	1.3	143	1	0.1
		A90	663	1,715	629	-34	1.3	1,723	8	0.2
		GSR	615	1,692	622	7	0.3	1,692	0	0.0
Cairngorm Drive										
	A90 South	A90 North	1,200	3,779	1,222	22	0.6	3,820	41	0.7
		Cairngorm Drive	125	210	72	-53	5.3	225	15	1.0
	Cairngorm Drive	A90 South	35	111	39	4	0.7	110	-1	0.1
		A90 North	16	38	15	-1	0.3	40	2	0.3
	A90 North	Cairngorm Drive	203	333	117	-86	6.8	321	-12	0.7
		A90 South	1,002	2,719	938	-64	2.1	2,576	-143	2.8
Nigg Way	A90 South	Nigg Way	13	37	14	1	0.3	37	0	0.0
	Nigg Way	A90 North	39	113	38	-1	0.2	115	2	0.2
Charleston	A90 North	A956	347	823	297	-50	2.8	824	1	0.0
	A90 South	A956	1,490	3,274	1,515	25	0.6	3,281	7	0.1
	A956	A90 South	246	715	242	-4	0.3	718	3	0.1
	A956	A90 North	35	124	42	7	1.1	122	-2	0.2

2.5.5 Table 2.2 shows that a good level of correlation between surveyed and modelled turning movements has been achieved. Differences can be attributed to different survey days between junctions and also the variances in traffic profiles over the period. All turning movements over the AM period have a GEH less than 4.

2.6 Queue Length Validation

2.6.1 A further validation of the model has been carried out through comparisons between observed and modelled queue lengths. Queue lengths can vary from day to day with flows of a similar nature and it can be difficult to quantify precise queueing statistics.

2.6.2 Queue length surveys were undertaken in 2009 at Bridge of Dee Southern Roundabout, the key junction in the local S-Paramics model network. The queue length surveys showed that, in the AM peak, the most notable queues formed on the A90 approach to Bridge of Dee with queues extending over 1km.

2.6.3 The following graphs have been extracted from the S-Paramics model via the Data Analysis Tool (DAT) and shows comparisons between modelled and observed queues. Also plotted on the A90 approach arm are the findings from a previous 2008 study undertaken by SIAS to evaluate the A90 queue on approach to Bridge of Dee.

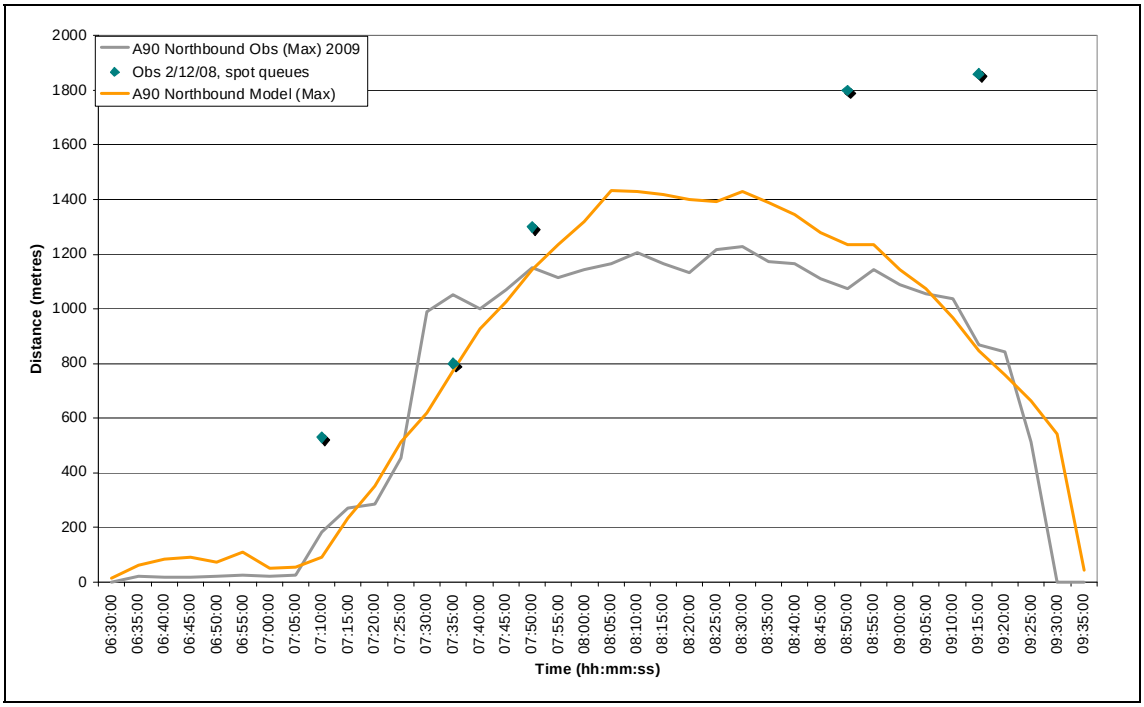

Figure 2.2 : A90 Approach to Bridge of Dee Southern Roundabout

2.6.4 Figure 2.2 shows that the modelled queues compare favorably with the 2009 observations with the model reaching a maximum of around 1.5km compared with the observed 1.2km. The 2009 observations and the 2009 model do not reach the level of queue on the A90 observed in 2008 which were recorded as extending beyond 1.8km. It should be noted that observed queues of this length are, by their nature, difficult to monitor on street due to the shockwave effect and platoons of traffic moving at different speeds.

2.6.5 Figure 2.3 shows the queue comparisons at Leggart Terrace.

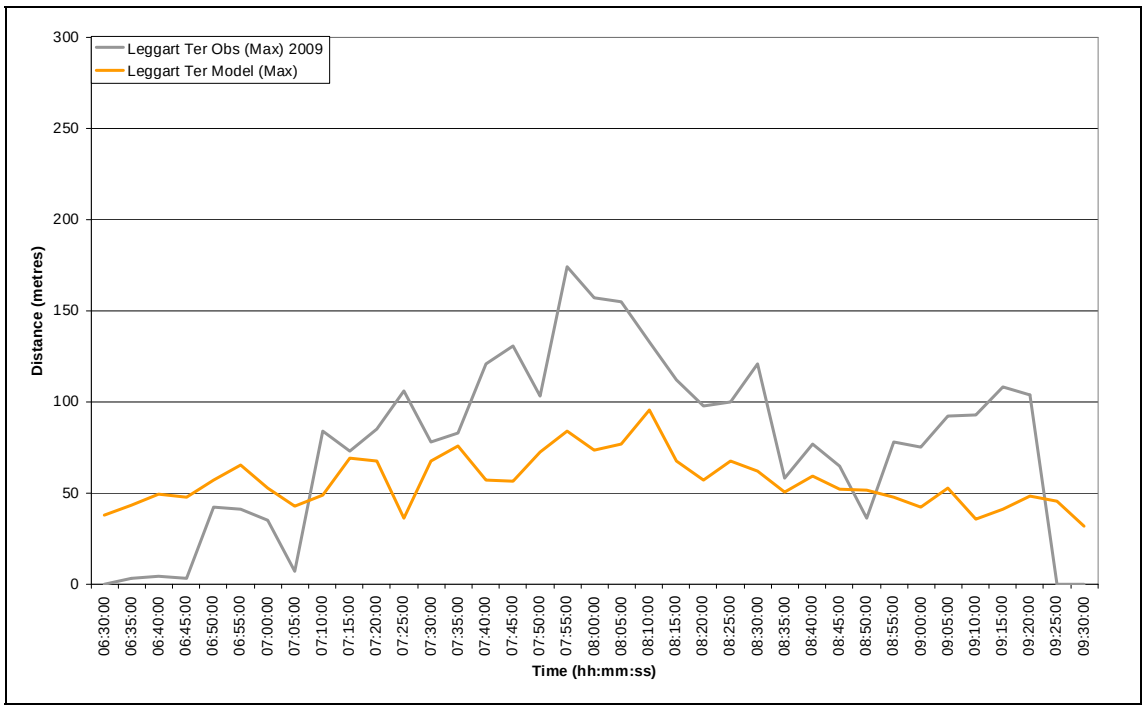

Figure 2.3 : Leggart Terrace Approach to Bridge of Dee Southern Roundabout

2.6.6 Figure 2.3 shows that the S-Paramics model compares well to observations on Leggart Terrace though it does not quite achieve the same peak around 08:00.

2.6.7 Figure 2.4 shows the queue comparisons at Bridge of Dee.

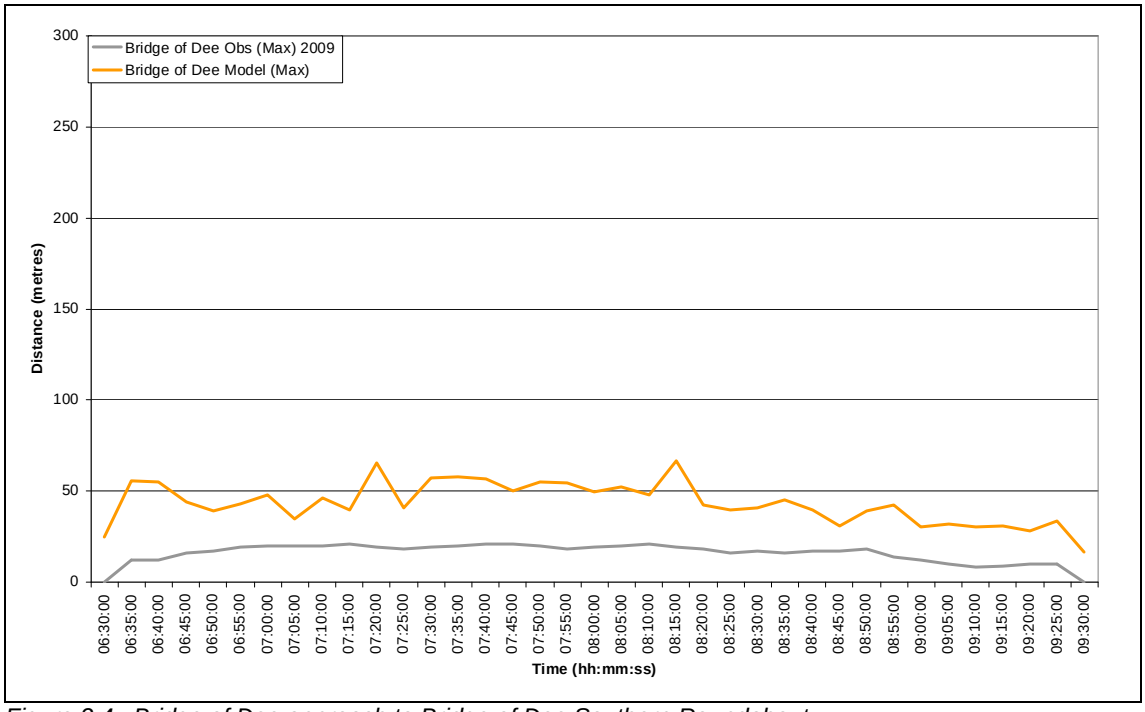

Figure 2.4 : Bridge of Dee approach to Bridge of Dee Southern Roundabout

2.6.8 Figure 2.4 shows that the S-Paramics model compares well to observations on Bridge of Dee.

2.6.9 Figure 2.5 shows the queue comparisons at Great Southern Road.

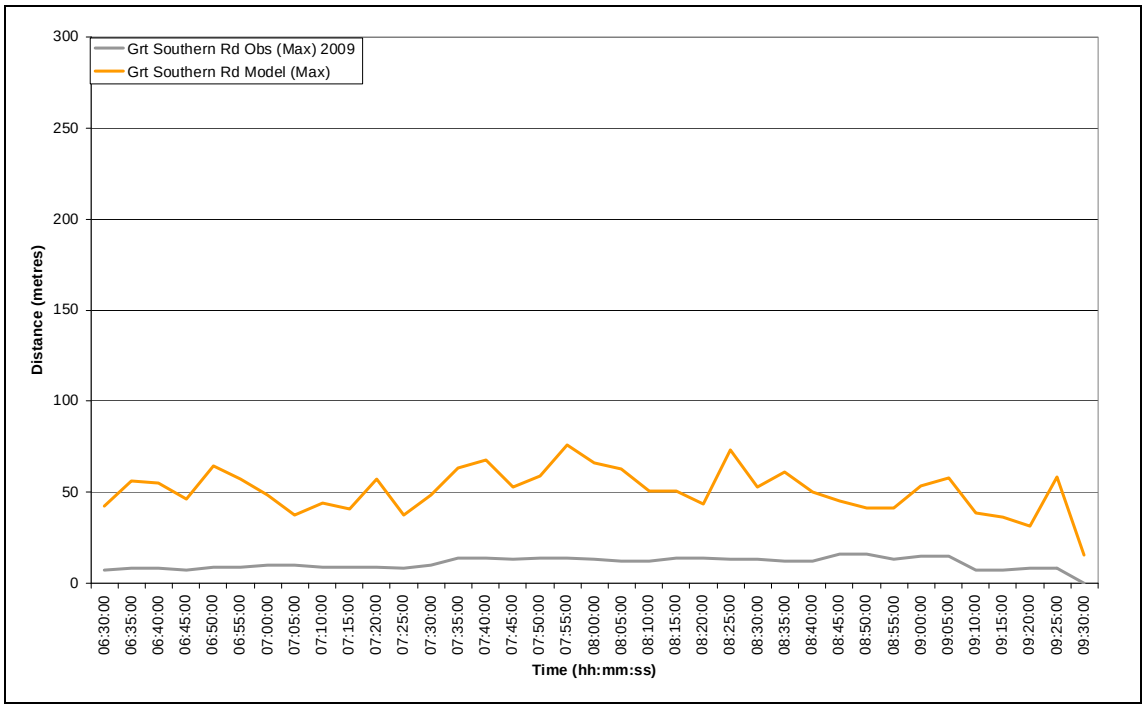

Figure 2.5 : Great Southern Road approach to Bridge of Dee Southern Roundabout

2.6.10 Figure 2.5 shows that the S-Paramics model compares well to observations on Great Southern Road.

2.7 Base Model Development Summary

2.7.1 The 2009 base model has been calibrated in detail to on-site observations and operational behaviour using traffic survey data from 2009.

2.7.2 The validity of the model has been demonstrated through comparisons of traffic flows over turning movements for both the peak hour and peak period. Queue length comparisons have also been demonstrated throughout the model period for each approach to the Bridge of Dee southern roundabout.

2.7.3 The model to observed comparisons provides evidence that the model is suitable for the assessment of the A90 southern approach to Aberdeen and has been accepted by the Client Team as fit for purpose.

3 MODEL TESTING

3.1 Scenarios

3.1.1 A number of development scenarios have been considered within the A90 comparative appraisal. Table 3.1 sets out the scope of consideration for the local S-Paramics modelling.

Table 3.1 : Model Scenarios

Scenario	Test	Development 1	Development 2	Infrastructure 1	Plus Infrastructure 2
1	1	Banchory/Leggart	Schoolhill	Rndbt at Nigg Way	
1	2	Banchory/Leggart	Schoolhill	Rndbt at Nigg Way	Rndbt Between Charleston and Nigg Way
2	1	Banchory/Leggart	Portlethen	Rndbt at Nigg Way	
2	2	Banchory/Leggart	Portlethen	Rndbt at Nigg Way	Rndbt Between Charleston and Nigg Way
3	1	Elsick			
3	2	Elsick		AWPR Fastlink Connection	
4	1	Mill of Forest and Newtonleys			

3.1.2 Table 3.1 demonstrates that there were four land use scenarios in consideration and these are detailed in the main report. Scenarios one, two and three all had two different infrastructure considerations.

3.1.3 The ASAM4 model has been used for forecasting future year demand changes and the ASAM4 model forecast year used is 2023 including Aberdeen Western Peripheral Route.

3.1.4 The Aberdeen Western Peripheral Route junction at Charleston has been modelled in all scenarios using available information. Detailed Ordinance Survey designs were not available to code the AWPR junction. The models used here are accurate in terms of lane lengths and approximate location, compared to existing AWPR models and are suitable for this testing.

3.2 Aberdeen Sub Area Model (ASAM)

3.2.1 Traffic demand was supplied for forecast scenarios using a defined cordon from a full ASAM4 demand model run. The base cordon and the first forecast scenario (S1T1) are illustrated in Figure 3.1. Traffic data was provided for the 2023 forecast year for Cars and Lights (combined) and Heavy Goods Vehicles for peak hours.

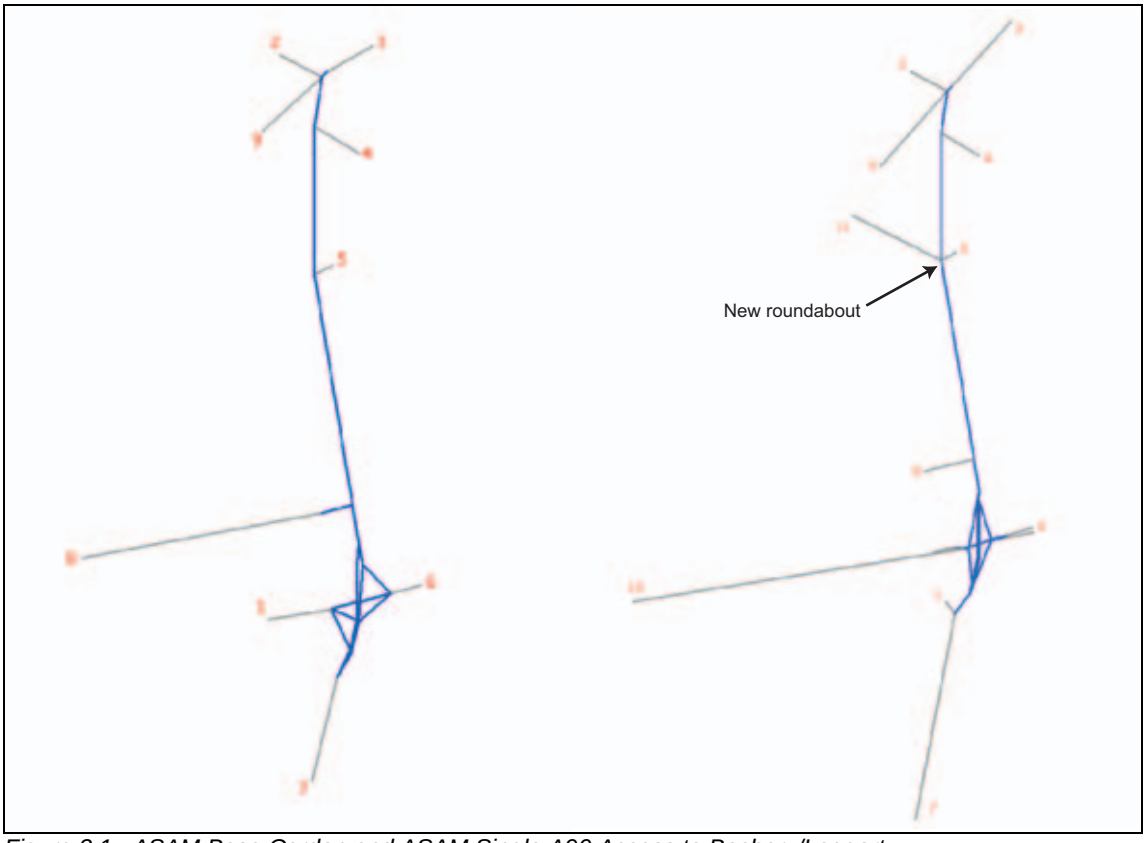

Figure 3.1 : ASAM Base Cordon and ASAM Single A90 Access to Bachory/Leggart
Images supplied by MVA

3.2.2 Figure 3.1 illustrates that S1T1 has an extra zone loading point to the A90 west of Nigg Way and the AWPR is now also included.

3.2.3 The ASAM4 cordon for scenarios with two access points on the west of the A90 between Charleston and Bridge of Dee and the scenarios which only have the AWPR access within the cordon are illustrated in Figure 3.2.

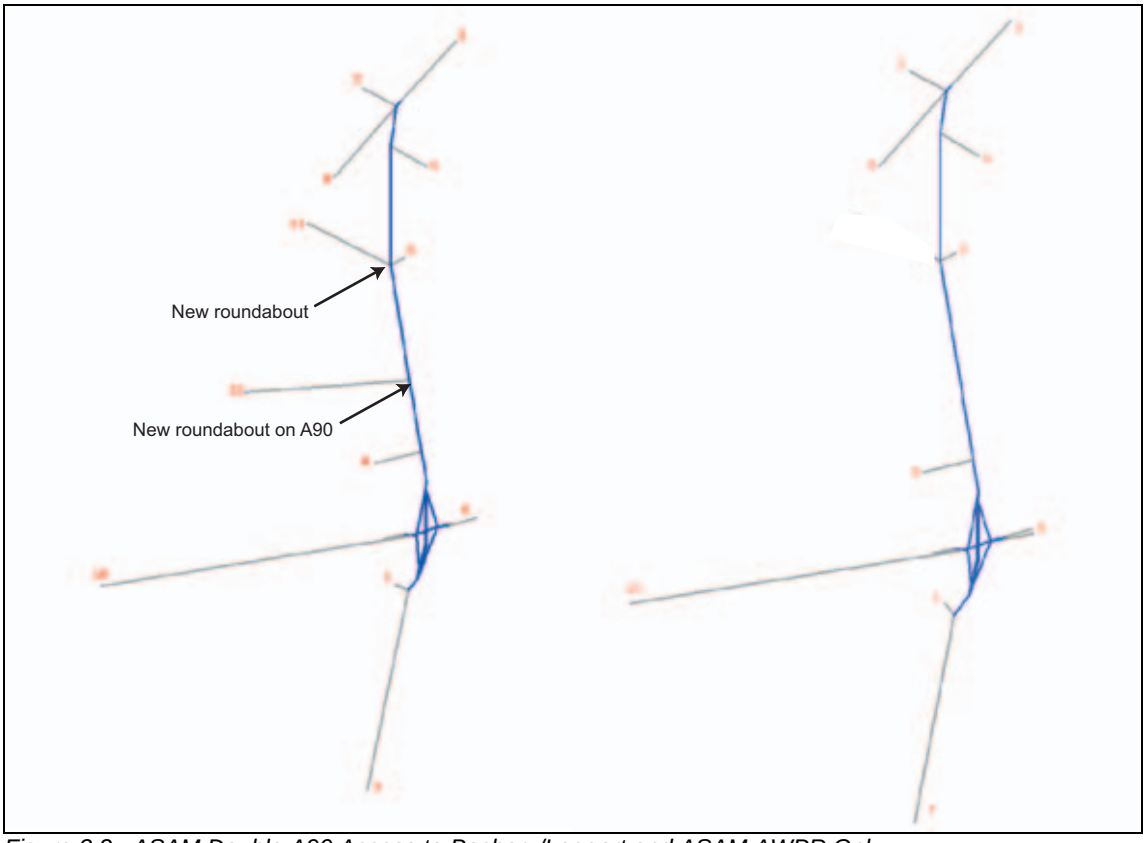

Figure 3.2 : ASAM Double A90 Access to Bachory/Leggart and ASAM AWPR Only
Images supplied by MVA

3.2.4 The cordon matrices supplied from ASAM4 were factored by SIAS to peak period values using a factor calculated from observed data. The AM peak hour to peak period factor used in this instance was **2.67**.

3.2.5 Due to the close correlation between the ASAM4 cordon zones and the S-Paramics zones SIAS derived the travel demand changes in absolute vehicles at O/D cell level.

3.2.6 Traffic demand was supplied for forecast scenarios using a defined cordon from a full ASAM4 demand model run (ASAM4 includes assumptions for modal share for each individual land use scenario). The relevant scenario infrastructure was included in ASAM. It should be noted that where the Banchory/Leggart development takes access west of Nigg Way, Nigg Way will included a bus gate, allowing **no** access for traffic to and from the A90.

3.2.7 Table 3.2 demonstrates how the S-Paramics matrix totals change as a result of the growth changes determined via ASAM4.

Table 3.2 : ASAM4 Growth to S-Paramics Model

Scenario	Test	ASAM Peak Hr Vehs	Peak Hr Diff Vehs	Peak Period Diff Vehs	S-Paramics Pk Period Vehs	Diff Vehs
Base		6,293	-	-	15,505	
1	1	8,295	2,003	5,068	20,621	5,116
1	2	8,440	2,148	5,431	20,986	5,481
2	1	8,339	2,046	5,149	20,703	5,198
2	2	8,434	2,141	5,377	20,934	5,429
3	1	8,294	2,001	4,998	20,505	5,000
3	2	7,852	1,560	3,906	19,414	3,909
4	1	7,857	1,565	3,955	19,463	3,958

3.2.8 Table 3.2 demonstrates that the absolute growth determined in ASAM4 between each scenario is reflected well in the S-Paramics demands and provides a general check that the process has been robust.

3.2.9 MVA note that in ASAM the overall level of traffic entering/exiting the sub area in S1, Test 2 is slightly higher than that for S1, Test 1. MVA's interpretation from ASAM4 is that this is mostly associated with the traffic using the second new access road from Banchory/Leggart. MVA has also advised that the level of traffic travelling along the A90 South of Charleston changes as some traffic opts to access the A90 at the new Roundabout, rather than the interchange at Findon.

3.3 2023 S-Paramics Models

3.3.1 There are effectively three 2023 S-Paramics networks. The following core networks were prepared ready for the various demand scenarios:

A. Base + AWPR Charleston Interchange

B. Base + AWPR Charleston Interchange + Nigg Way Roundabout

C. Base + AWPR Charleston Interchange + Nigg Way Roundabout + 2nd Roundabout Access West of A90

3.3.2 For the roundabout options providing access to the west of the A90 for the Banchory/Leggart development, a 40m ICD roundabout has been assumed with two lane entries on all arms and two circulating lanes. This would be a similar configuration to existing dual carriageway roundabouts in Aberdeenshire on the A96 at Inverurie.

3.3.3 The assumption of roundabouts for this testing is simply to enable the networks to perform and undertake the initial assessment required for this study, a more detailed assessment will be required to confirm the optimum junction type and arrangement.

3.3.4 Table 3.3 demonstrates where each network description has been used in each of the seven forecast demand scenarios.

Table 3.3 : S-Paramics Networks and Demand Scenarios

Ref	Scenario	Test	S-Paramics Network	Label
1	Observed Data	n/a	n/a	
2	Base		Base	Base
3	1	1	B	3_S1T1
4	1	2	C	4_S1T2
5	2	1	B	5_S2T1
6	2	2	C	6_S2T2
7	3	1	A	7_S3T1
8	3	2	A	8_S3T2
9	4	1	A	9_S4T1

3.4 S-Paramics Sensitivity on Test S2T2

3.4.1 During initial testing, it was clear that scenarios with Banchory/Leggart, while showing traffic operating on the A90, had significant volumes of traffic unreleased in the S-Paramics zones to the west of the A90 exiting from the Banchory/Leggart site. A sensitivity test was undertaken to identify the potential impact of re-routeing between the access junctions and also Findon Interchange.

3.4.2 The sensitivity test was conducted on the highest demand test, Test 6_S2T2. The model was coded to permit movements via Findon to and from the Banchory/Leggart site. In S-Paramics, in order to introduce route choice, the 'Feedback' routeing algorithm was permitted at 2min intervals, a feedback co-efficient of 0.8 was used with a generalised cost based only on time.

3.4.3 The network code for the original Test 6_S2T2 is illustrated in Figure 3.3.

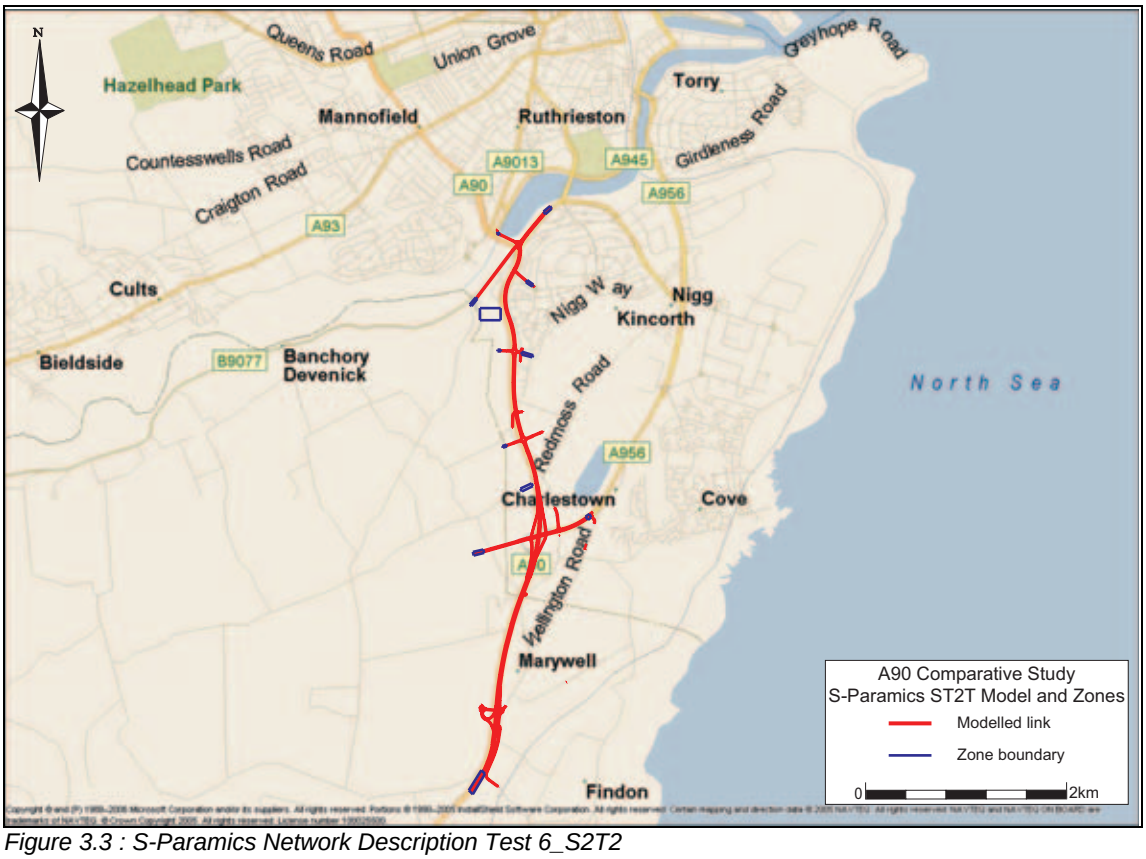

Figure 3.3 : S-Paramics Network Description Test 6_S2T2

3.4.4 Figure 3.3 illustrates that there is no route choice to the west of the A90 between either access junctions or indeed the Findon Interchange.

3.4.5 This sensitivity test is labeled as Test 6c_S2T2 and the modelled network is illustrated in Figure 3.4.

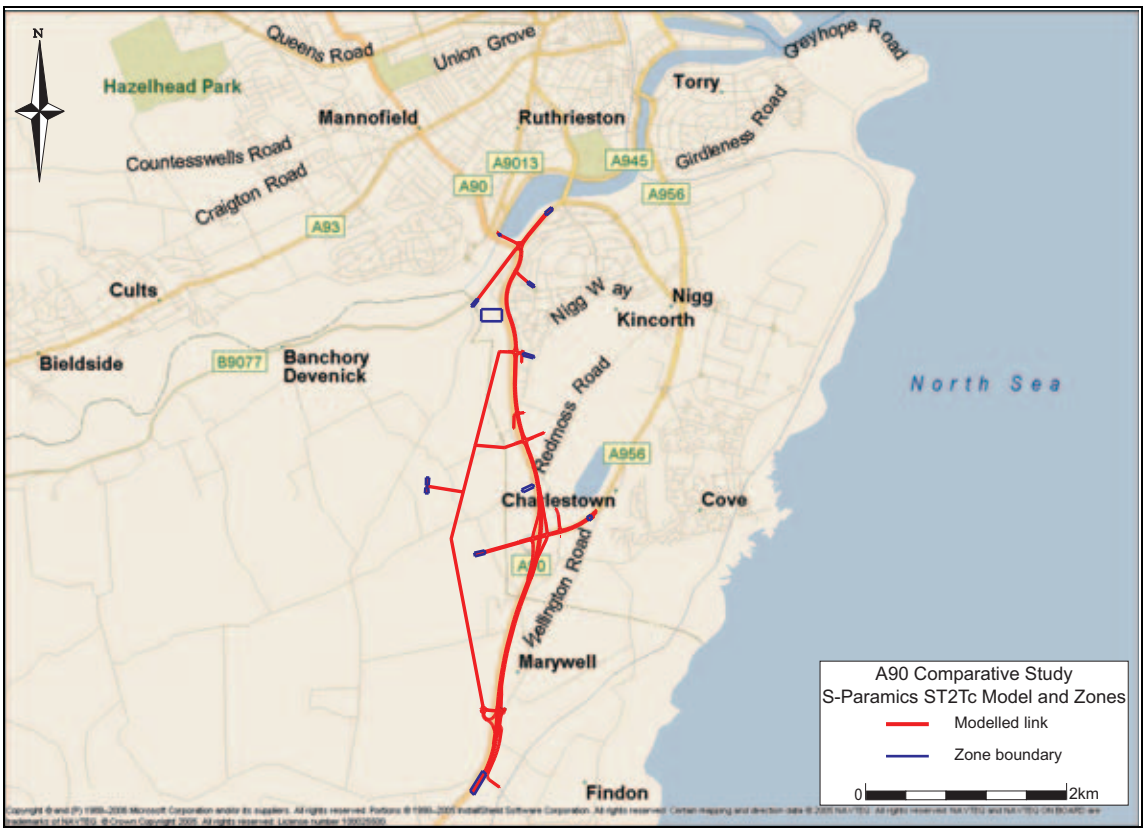

Figure 3.4 : S-Paramics Network Description Test 6c_S2T2

3.4.6 Figure 3.4 illustrates that route choice has been coded coarsely to permit vehicles seeking access and egress at the Banchory/Leggart site via either of the two roundabout junctions or indeed the Findon Interchange.

3.4.7 No detailed plan for the Banchory/Leggart site was made available for this testing and, as such, it is difficult to determine the central loading points for the main trip generators/attractors within the site. For the purpose of undertaking the sensitivity test, a point approximately mid-way between Bridge of Dee and Findon Interchange has been assumed. Once specific loading points are identified, this will alter the relative attractiveness of the final access arrangements.

3.4.8 The connections have been coded as a theoretical exercise to permit the Banchory/Leggart zones to load with the route choice algorithms informing the junction choice at which vehicles will join the A90. Figure 3.4 illustrates these connections and demonstrate that they have not been subject to any detailed design.

3.4.9 No assessment of the capacity of the Findon Interchange has been made during this series of tests.

4 S-PARAMICS MODEL RESULTS

4.1 Introduction

4.1.1 Each scenario was run 6 times in S-Paramics with average statistics compiled for the A90 northbound queue length, the A90 northbound journey time, key traffic flows and total queueing in the study area.

4.2 A90 Northbound Queue Length Comparisons between Charleston and Bridge of Dee

4.2.1 Figure 4.1 shows average queue length results which have been extracted from the models via the Data Analysis Tool (DAT).

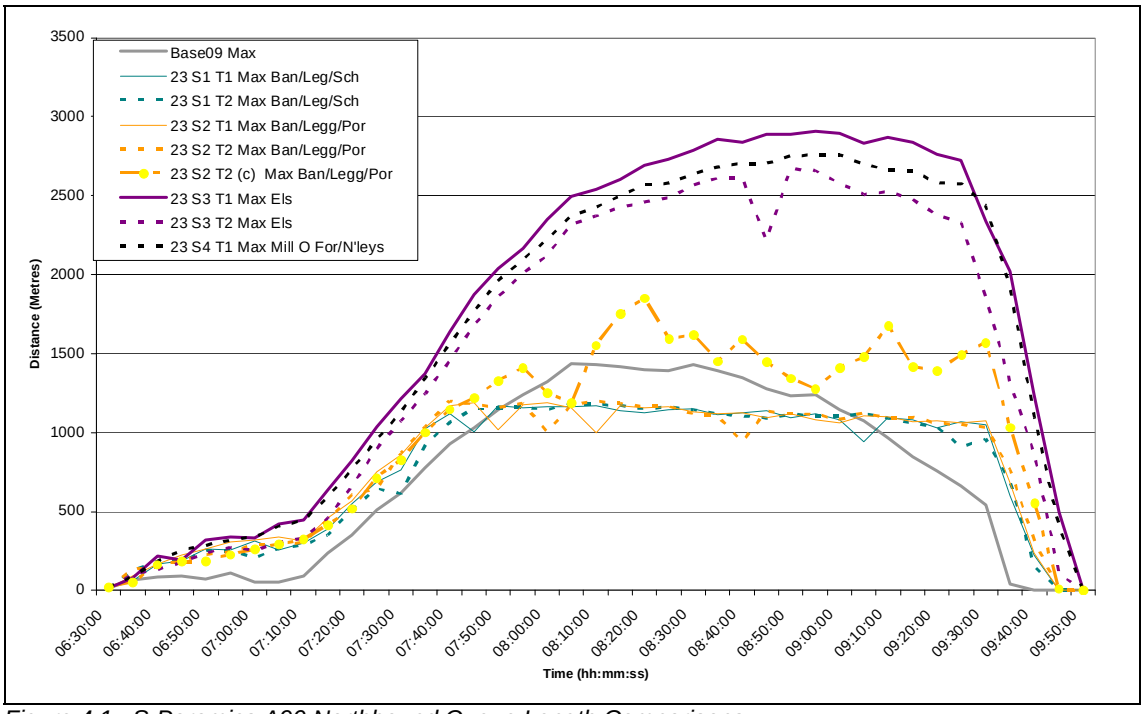

Figure 4.1 : S-Paramics A90 Northbound Queue Length Comparisons

4.2.2 Figure 4.1 shows that the Scenario 3 and Scenario 4 queues are considerably longer than the other Scenarios and considerably longer than existing observed conditions. Charleston interchange is around 2.5 to 3.0km from Bridge of Dee and the results indicate that the queues could impact on the operation of the future AWPR junction.

4.2.3 Scenarios 1 and 2 show similar maximum levels of queue to the base scenario but that the queue occurs earlier and dissipates later. The flattening of the graphs demonstrates where the queue from Bridge of Dee gets back to the Nigg Way junction and vehicles begin to queue back into the Banchory/Leggart site due to the main A90 northbound being the priority movement.

4.2.4 Observations of the models for Scenario 1 and Scenario 2 shows between 500 – 600 unreleased vehicles in the development site (west of A90 between Charleston and Bridge of Dee) in scenario S2T1 with a single access point and between 300 – 400 unreleased vehicles in scenario S2T2 with two access points. There is no evidence of unreleased vehicles in any other scenario considered. The scale of the queues back into the Banchory/Leggart site are significant.

4.2.5 Scenario S2_T2c, the routeing sensitivity test, shows a slight increase in the queue on the A90 but suggests that this queueing would remain similar to the existing base conditions. It should

be noted that there are still queues developing into the Banchory/Leggart site and the A90 queue again occurs earlier and dissipates much later than the base.

4.2.6 While the queue on the A90 in some scenarios extended as far as Charleston, no scenario modelled showed this queue to impact upon the performance of the future AWPR Charleston Interchange.

4.3 Journey Time Comparisons

4.3.1 Figure 4.2 shows average journey time results which have been extracted from the models via the Data Analysis Tool (DAT).

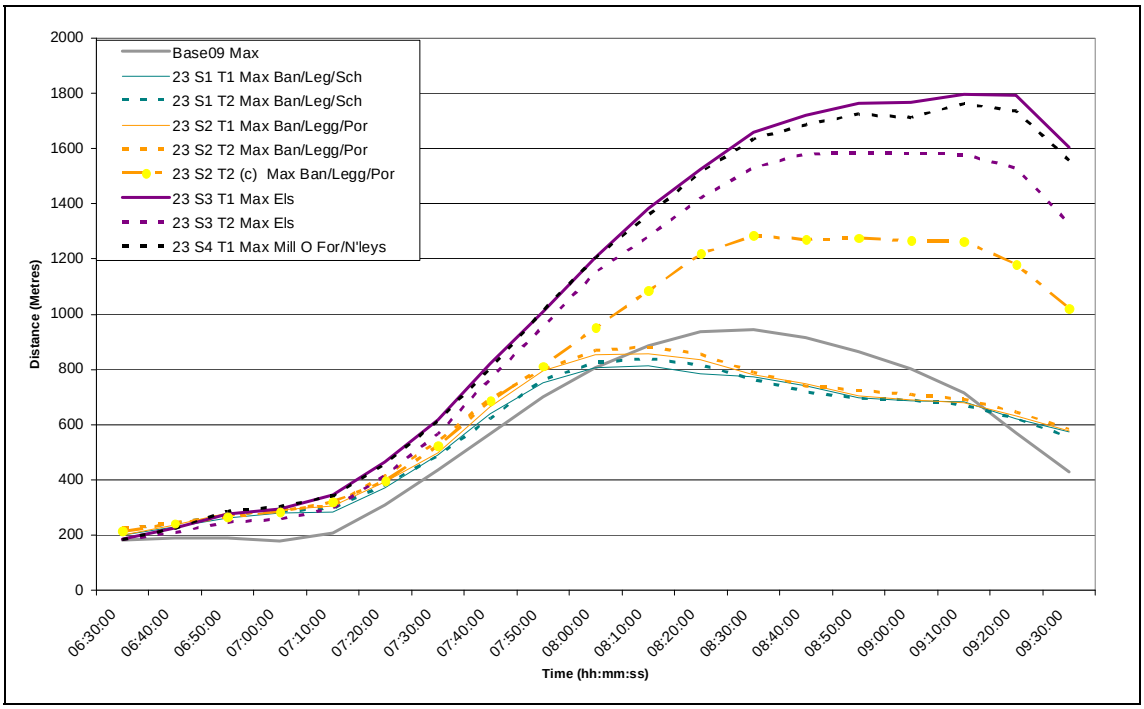

Figure 4.2 : S-Paramics Journey Time Comparisons

4.3.2 Figure 4.2 illustrates a similar pattern to the queue length results in that journey times are much longer for Scenario 3 and 4 tests, peaking at around 30min.

4.3.3 Figure 4.2 demonstrates via the sensitivity test that, if routeing occurs from Banchory/Leggart to Findon due to delays on the new access roundabouts, the A90 journey times will increase above the base conditions, to a peak of 20min, though they are not at the same level as the Scenario 3 and 4 results.

4.4 Queue Cordon Comparisons

4.4.1 Figure 4.3 shows average maximum in metres of vehicles queued within the whole modelled study area. Results have been extracted from the models via the Data Analysis Tool (DAT) and do not take account for unreleased vehicles.

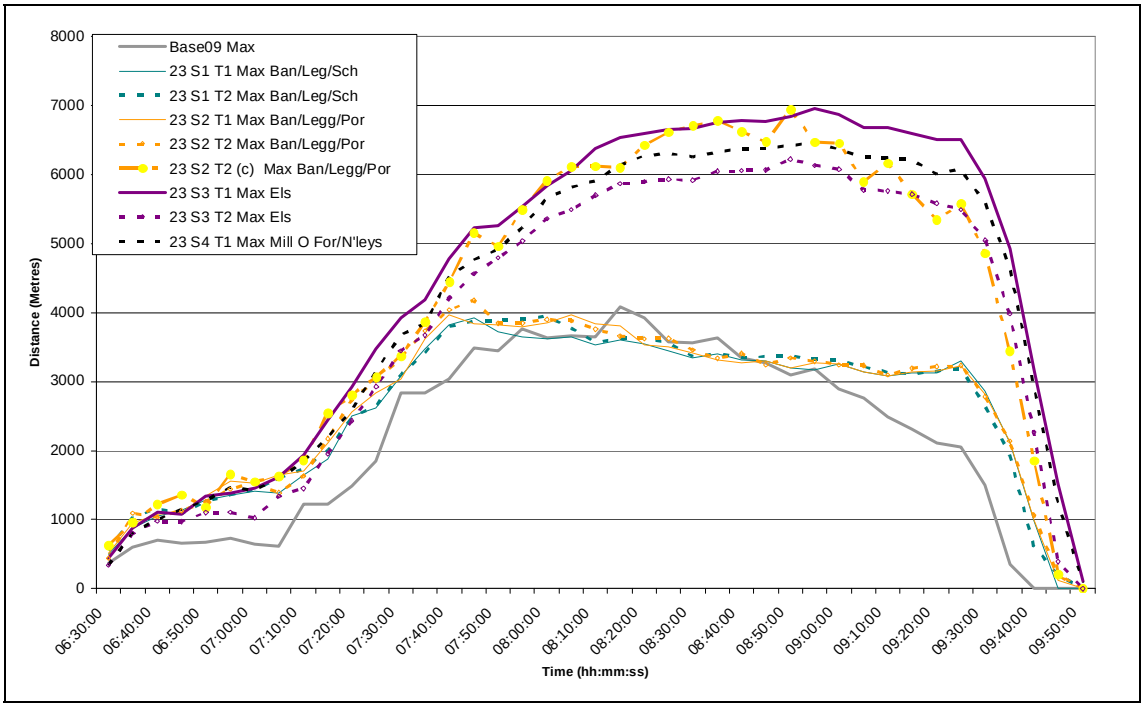

Figure 4.3 : S-Paramics Total Study Area Queued Metres

4.4.2 Figure 4.3 illustrates that, while Figure 4.1 shows less queueing for Scenarios 1 and 2 on the A90, the total queueing occurring within the study area within the Scenario 2 sensitivity test is similar to Scenarios 3 and 4. This indicates that the cumulative distance of queue in the full study area is likely to remain similar between Scenarios 1, 2, 3 and 4 with Scenario's 1 and 2 affording additional stacking capacity into the site accesses.

4.4.3 It should again be noted that the models for the Banchory/Leggart site in Scenarios 1 and 2, where re-routeing was not permitted, show around 500 – 600 unreleased vehicles in scenario S2T1 with a single access point and around 300 – 400 unreleased vehicles in scenario S2T2 with two access points.

4.5 Traffic Flow Comparisons

4.5.1 Key traffic flows have been extracted from the models and compared in Table 4.1 for the peak hour and Table 4.2 for the peak period.

Table 4.1 : Peak Hour Traffic Flow Comparisons

		Model Peak Hour 07:30 - 08:30 Count (vehs)								
Location	**Direction**	**Base 09**	**S1 T1**	**S1 T2**	**S2 T1**	**S2 T2**	**S2 T2 (c)**	**S3 T1**	**S3 T2**	**S4 T1**
A90 South of Bridge of Dee	Northbound	1,261	1,235	1,254	1,216	1,228	1,248	1,136	1,128	1,107
A90 North of Nigg Way	Northbound	1,386	1,373	1,409	1,332	1,327	1,414	1,215	1,244	1,199
A90 South of Nigg Way	Northbound	1,473	1,195	1,198	1,187	1,157	1,271	1,293	1,345	1,289
A90 North of Charleston	Northbound	1,472	1,193	1,124	1,183	1,215	1,205	1,512	1,544	1,498
A90 South of Bridge of Dee	Southbound	1,052	1,002	984	995	1,005	1,001	980	919	926
A90 North of Nigg Way	Southbound	949	926	932	920	919	921	860	814	798
A90 South of Nigg Way	Southbound	972	794	773	773	765	702	959	912	886
A90 North of Charleston	Southbound	970	790	878	771	946	816	955	911	883
A90 cutting movement at Bridge of Dee	Westbound	502	435	424	442	433	431	534	542	544

4.5.2 Table 4.1 shows that while the flows on the A90 northbound are generally higher in the Scenario 1 and Scenario 2 tests than in the Scenario 3 and 4 tests, the cutting movement across the A90 northbound at Bridge of Dee is much less because Leggart Terrace has limited access. This allows for more capacity on entry to the southern Bridge of Dee roundabout from the A90.

4.5.3 It should also be noted that the values within Tables 4.1 to 4.4 provide stop line flows from the model. The peak hour difference between Charleston and Nigg Way in the northbound direction for Scenarios 3 and 4 are down to the number of vehicles queued on the A90 between the two points.

Table 4.2 : Peak Period Traffic Flow Comparisons

		Model Peak Period 06:30 - 09:30 Count (vehs)								
Location	**Direction**	**Base 09**	**S1 T1**	**S1 T2**	**S2 T1**	**S2 T2**	**S2 T2 (c)**	**S3 T1**	**S3 T2**	**S4 T1**
A90 South of Bridge of Dee	Northbound	3,932	4,203	4,247	4,198	4,221	4,220	3,995	3,947	3,885
A90 North of Nigg Way	Northbound	4,044	4,590	4,692	4,565	4,592	4,592	4,289	4,283	4,195
A90 South of Nigg Way	Northbound	4,045	3,304	3,298	3,269	3,190	3,745	4,289	4,283	4,194
A90 North of Charleston	Northbound	4,044	3,303	3,113	3,270	3,372	3,420	4,289	4,284	4,193
A90 South of Bridge of Dee	Southbound	2,893	2,763	2,708	2,741	2,765	2,765	2,694	2,528	2,550
A90 North of Nigg Way	Southbound	2,615	2,572	2,586	2,554	2,564	2,563	2,375	2,257	2,205
A90 South of Nigg Way	Southbound	2,693	2,503	2,161	2,485	2,167	1,930	2,664	2,543	2,464
A90 North of Charleston	Southbound	2,692	2,504	2,455	2,487	2,660	2,302	2,664	2,543	2,465
A90 cutting movement at Bridge of Dee	Westbound	1,392	1,209	1,179	1,236	1,204	1,202	1,487	1,506	1,512

4.5.4 Table 4.2 also shows that while the flows on the A90 northbound are generally higher in the Scenario 1 and Scenario 2 tests than in the Scenario 3 and 4 tests, the cutting movement across the A90 northbound at Bridge of Dee is much less because Leggart Terrace has limited access.

4.5.5 Turning movements at the Southern Bridge of Dee roundabout have been extracted from the models and compared in Table 4.3 for the peak hour and Table 4.4 for the peak period.

Table 4.3 : Peak Hour Key Turning Movement Summary

		Model Peak Hour 07:30 - 08:30 Count (vehs)								
		Base 09	**S1 T1**	**S1 T2**	**S2 T1**	**S2 T2**	**S2 T2 (c)**	**S3 T1**	**S3 T2**	**S4 T1**
GSR	BoDee	357	392	382	399	390	388	370	371	375
	Leggart Terrace	92	7	7	6	7	7	92	94	93
	A90	364	412	428	415	415	413	384	373	353
A90	GSR	391	549	559	546	551	547	471	466	475
	BoDee	857	676	681	661	669	693	654	651	620
	Leggart Terrace	12	13	13	13	14	12	13	12	11
Leggart Terrace	A90	59	15	15	15	16	16	43	39	42
	GSR	172	2	2	2	2	2	146	146	152
	BoDee	247	61	62	61	62	61	230	229	231
BoDee	Leggart Terrace	53	39	38	37	39	38	73	77	78
	A90	629	577	541	568	576	577	553	508	534
	GSR	622	712	750	730	716	714	634	681	645
Leggart	In	157	59	58	56	60	57	178	183	182
	Out	478	78	79	78	80	79	419	414	425

Table 4.4 : Peak Period Key Turning Movement Summary

		Model Peak Period 06:30 - 09:30 Count (vehs)								
		Base 09	**S1 T1**	**S1 T2**	**S2 T1**	**S2 T2**	**S2 T2 (c)**	**S3 T1**	**S3 T2**	**S4 T1**
GSR	BoDee	993	1,093	1,062	1,116	1,085	1,082	1,034	1,035	1,047
	Leggart Terrace	256	18	18	17	18	18	254	266	260
	A90	1,015	1,156	1,192	1,155	1,155	1,155	1,071	1,040	981
A90	GSR	1,243	1,827	1,831	1,835	1,845	1,844	1,674	1,648	1,691
	BoDee	2,653	2,337	2,376	2,326	2,340	2,338	2,286	2,259	2,157
	Leggart Terrace	37	41	39	41	42	39	40	39	36
Leggart Terrace	A90	159	42	41	40	41	42	117	107	114
	GSR	467	2	2	2	2	2	399	392	411
	BoDee	676	167	169	169	168	166	626	632	635
BoDee	Leggart Terrace	143	105	104	104	105	102	200	212	211
	A90	1,723	1,568	1,478	1,545	1,572	1,571	1,507	1,382	1,458
	GSR	1,692	1,942	2,038	1,986	1,951	1,948	1,728	1,858	1,758
Leggart	In	436	164	161	162	165	159	494	517	507
	Out	1,302	211	212	211	211	210	1,142	1,131	1,160

4.5.6 Table 4.3 and 4.4 provide further information on the changes in individual turning movements forecast for the Bridge of Dee southern roundabout.

4.5.7 These figures demonstrate the change due to the limited access of Leggart Terrace in Scenarios 1 and 2 compared to Scenarios 3 and 4 where full access is retained.

5 SUMMARY OF RESULTS

5.1.1 The S-Paramics tests demonstrate the sensitivity of the capacity of the Bridge of Dee southern roundabout to the capacity of the A90 approach from the south.

5.1.2 All scenarios show queues occurring earlier and dissipating later than the base scenario. In Scenarios 1 and 2, where the A90 has the priority movement past the development access junctions between Charleston and Bridge of Dee, the development accesses share the queue rather than it being concentrated solely on the A90. The queue from the Bridge of Dee effectively goes back through the access junction and compromises the ability of traffic to exit the site.

5.1.3 The traffic flows indicate that the cutting movement across the A90 approach to Bridge of Dee has an influence on the queue length on the A90. Some of the scenarios tested show increases in this movement compared to the base scenario which influence the queue and journey time results. Further investigation of these issues may be required through ASAM4 to assess how reliable these forecast fluctuations are with and without the limited access to Leggart Terrace.

5.1.4 The comparison of the total distance of queued traffic occurring in the study area has demonstrated that there is potentially little difference in total queue between Scenarios and that Scenarios 1 and 2 provide additional stacking capacity between Charleston and Bridge of Dee by way of the site access points.

5.1.5 While the queue on the A90 in some scenarios extended as far as Charleston, the model indicated that none impacted on the performance of the future AWPR Charleston Interchange. While this may provide some comfort it should be noted that Scenarios 3 and 4 were queued to the northbound slips. Bearing in mind the sensitivity of this location both in current observations and in the options tested, it is possible that queueing could interrupt the performance of the AWPR Charleston junction in the future.

5.1.6 Best use of available data has been made in undertaking this limited local assessment. The known sensitivities of the existing junction performance at the Bridge of Dee and the potential to provide additional stacking capacity between Charleston and Bridge of Dee are the over riding factors in the A90 queue fluctuations between Scenario tests.

5.1.7 It would be difficult to justify the prioritisation of any scenario on the basis of the analysis of the impact on the A90 between Charleston and Bridge of Dee undertake in this study. Further work would be required to assess the detailed site trip generation/distributions, site access plans and specific junction configurations and design. The success of Scenarios 1 and 2 could be compromised if significant queueing occurred into the site. Were junctions to be designed to reduce queueing into the site it would have a resultant impact on queues and delays on the A90.

5.1.8 No account has been taken for future junction enhancements at the Bridge of Dee southern roundabout or indeed to parallel alternative routes such as Wellington Road or West Tullos Road. Any such changes, which could change the travel pattern and performance of the southern Bridge of Dee roundabout, are likely to impact on resulting queues of traffic between Charleston and Bridge of Dee.

6 ADDITIONAL SENSITIVITY TESTING

6.1 Introduction

6.1.1 Following initial reporting of results to the study working group, further sensitivity testing was required for Scenarios 1 and 2 to evaluate the potential impact on the A90 were the route from Banchory/Leggart to Findon available. This sensitivity scenarios undertaken here for Scenarios 1 and 2 are of a similar assumed infrastructure arrangement to that undertaken for S2T2c with the only variable being the junction access to the A90.

6.1.2 Consistent with the initial assessment already reported, the additional sensitivity testing will be reported using the A90 queue length, the A90 journey time and finally an indication of total vehicles queued in the study area.

6.1.3 It has not been possible within the study timescale to undertake sensitivity tests in the S-Paramics model for tests S3T1, S3T2 and S4T1 replicating transport interventions in the S-Paramics model from Land Use Scenario 1 and 2 on a like-for like basis.

6.1.4 Land Use Scenario 3 (Elsick) and 4 (Stonehaven Sites) would have required to incorporate a realignment of B9077 near Leggart Terrace, a bus gate on Leggart Terrace, a new at-grade junction on the A90 and the strategic model re-run to achieve consistent inputs for the S-Paramics model.

6.1.5 The B9077 realignment and associated works was an integral part of the S1 and S2 proposals in tests 1 and 2. It is however remote from Land Use Scenarios 3 and 4 and the ability for delivery of such infrastructure with these sites would be subject to further investigation.

6.1.6 While the B9077 realignment and associated works may have some potential to provide capacity enhancement at the Bridge of Dee roundabout, it has not been quantified here for the Elsick and Stonehaven scenarios. It would be a major additional intervention to consider for Scenarios 3 and 4.

6.2 A90 Northbound Queue Length Comparisons between Charleston and Bridge of Dee

6.2.1 Figure 6.1 shows average queue length results which have been extracted from the models via the Data Analysis Tool (DAT).

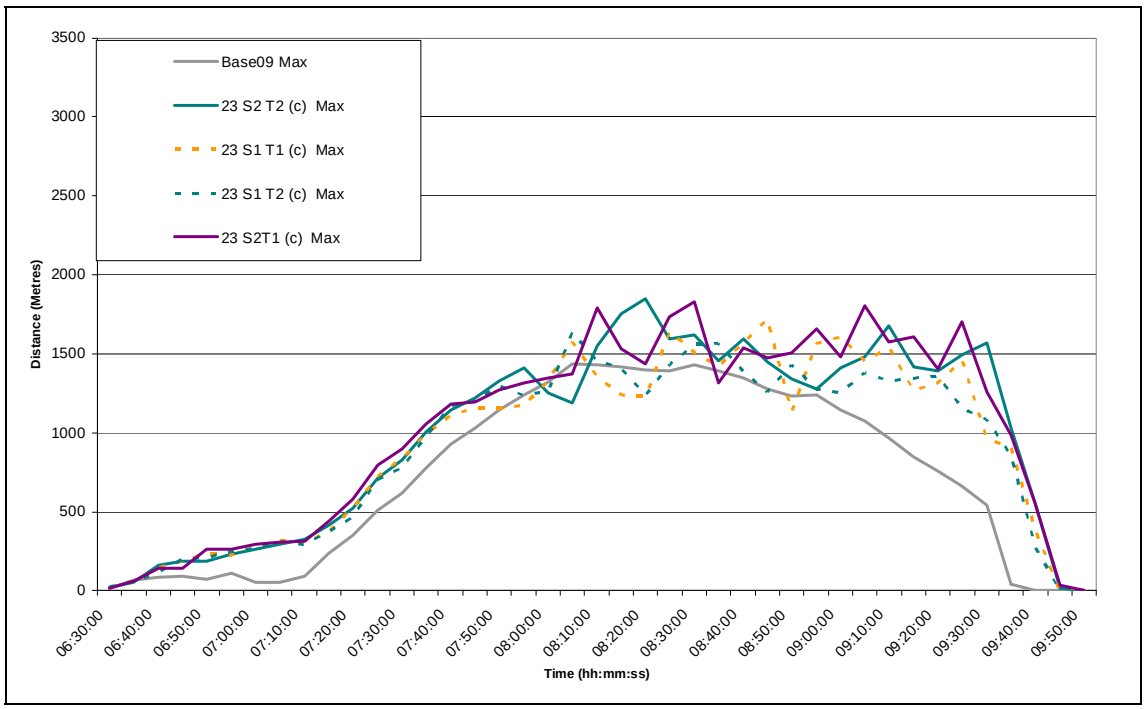

Figure 6.1 : S-Paramics A90 Northbound Queue Length Comparisons

6.2.2 Figure 6.1 shows that in all scenarios, the queue on the A90 remains over a longer duration than the base model with all scenarios generally longer than the base, extending to between 1.5 and 2.0km. This is back through the junctions on the A90 causing queueing into the Banchory/Leggart site in all scenarios.

6.3 Journey Time Comparisons

6.3.1 Figure 6.2 shows average journey time results which have been extracted from the models via the Data Analysis Tool (DAT).

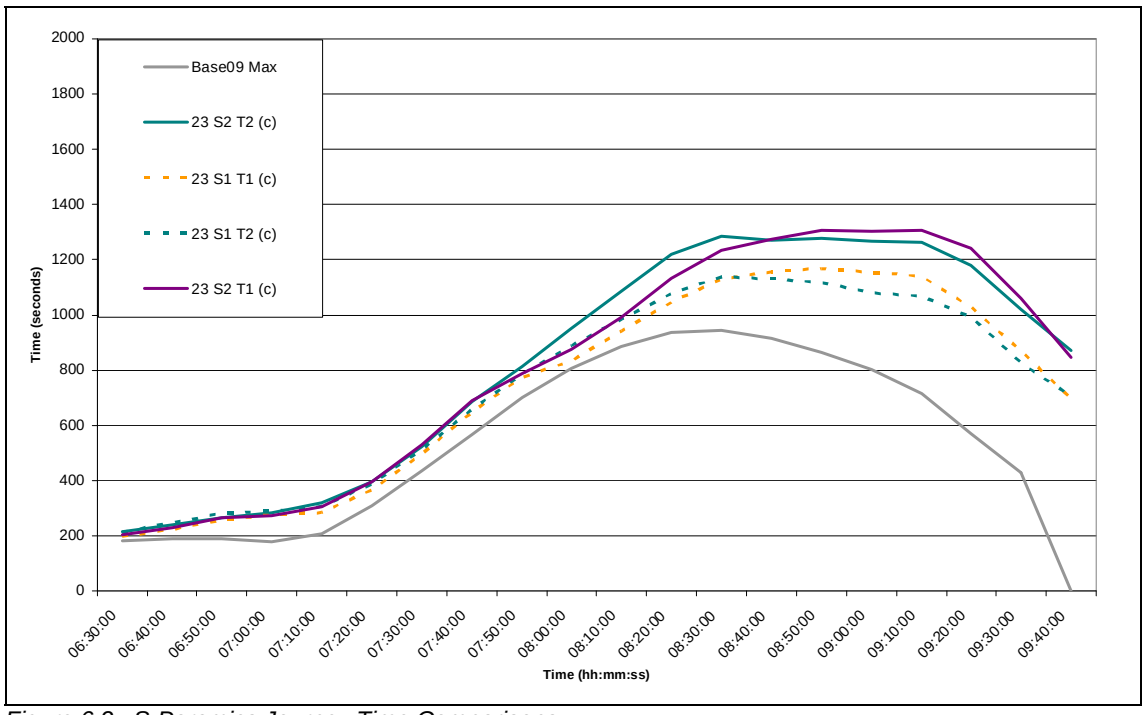

Figure 6.2 : S-Paramics Journey Time Comparisons

6.3.2 Figure 6.2 illustrates that journey times are longer than the base for all scenarios. It also appears that journey times for Scenario 1, be it with a two or single junction strategy for Banchory/Leggart, are consistently better than Scenario 2.

6.4 Queue Cordon Comparisons

6.4.1 Figure 6.3 shows average maximum in metres of vehicles queued within the whole modelled study area. Results have been extracted from the models via the Data Analysis Tool (DAT) and do not account for unreleased vehicles.

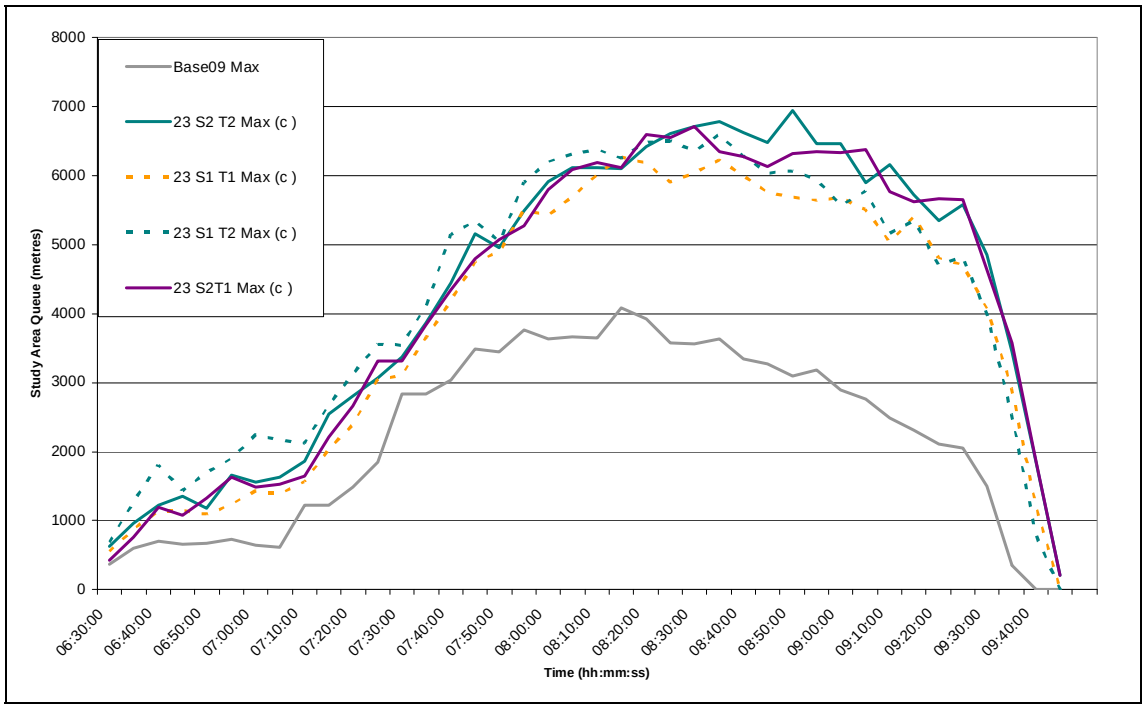

Figure 6.3 : S-Paramics Total Study Area Queued Metres

6.4.2 Figure 6.3 illustrates that the total queueing occurring within the study area in the sensitivity tests is similar to Scenarios 3 and 4 illustrated previously in Figure 4.3. This indicates that the cumulative distance of queue in the full study area is likely to remain similar between Scenarios 1, 2, 3 and 4, with Scenario's 1 and 2 affording additional stacking capacity into the site accesses. The scale of the queueing back into the Banchory/Leggart site is still notable in Scenarios 1 and 2.

6.5 Additional Testing Findings

6.5.1 The additional sensitivity testing has shown that, were route choice to be available between the Banchory/Leggart A90 access junctions and Findon Interchange, there could be a balancing of delay between the A90 and the site access roads.

6.5.2 The queue lengths on the A90 remain reasonably consistent between the Scenario 1 and 2 sensitivity tests, but journey times are longer than those of the base model and Scenario 1 appears to fair slightly better than Scenario 2.

6.5.3 With regards to total queued distance occurring within the model study area, the sensitivity scenarios are consistent with one another and there is no discernable difference between Scenarios 1, 2, 3 and 4.

C APPENDIX C – ACCESSIBILITY ASSESSMENT – ACTIVE TRAVEL

C.1 Introduction

The employment population located within 1.6km and 5km of the site has been identified to provide an indication of the accessibility of sites contained within the four land use scenarios. The existing employment population has been identified using 2001 Census data, with the size and location of potential employment sites supplied by Aberdeenshire Council.

Accession and Mapinfo GIS software has been used to plot walking and cycling isochrones and identify the employment population located within active travel distance of the sites.

Accession is a software package 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 24 August 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. Each land use scenario has been appraised separately in terms of access by walk and cycle with travel times calculated from the centre of the sites.

C.2 Land Use Scenario 1

An appraisal of the accessibility of the sites by active travel modes (walking and cycling) has been undertaken based on their proximity to existing and potential future employment and education opportunities. Figures C1 and C2 confirm the accessibility of Land Use Scenario 1 sites on foot and by cycle.

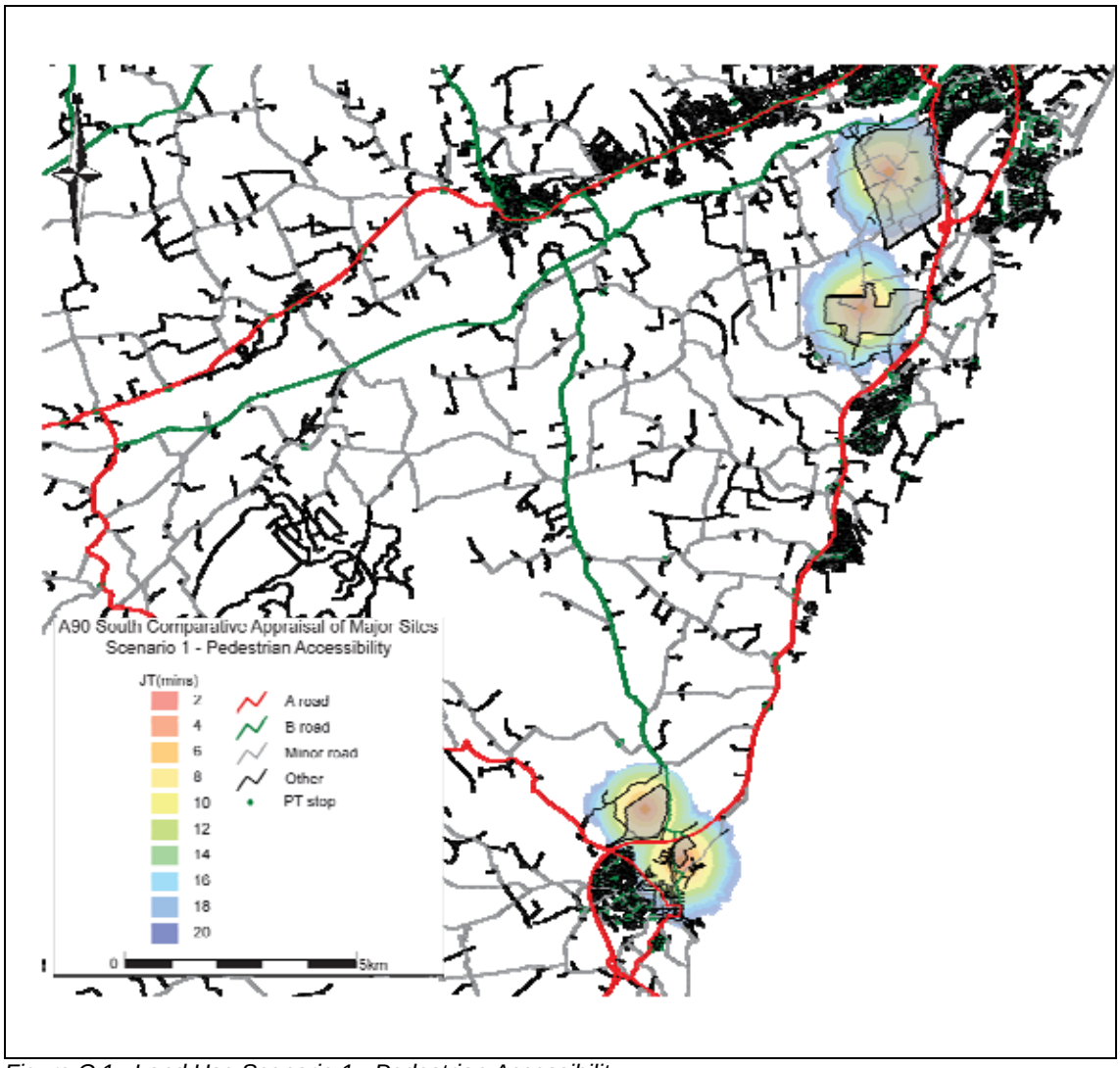

Figure C.1 : Land Use Scenario 1 - Pedestrian Accessibility

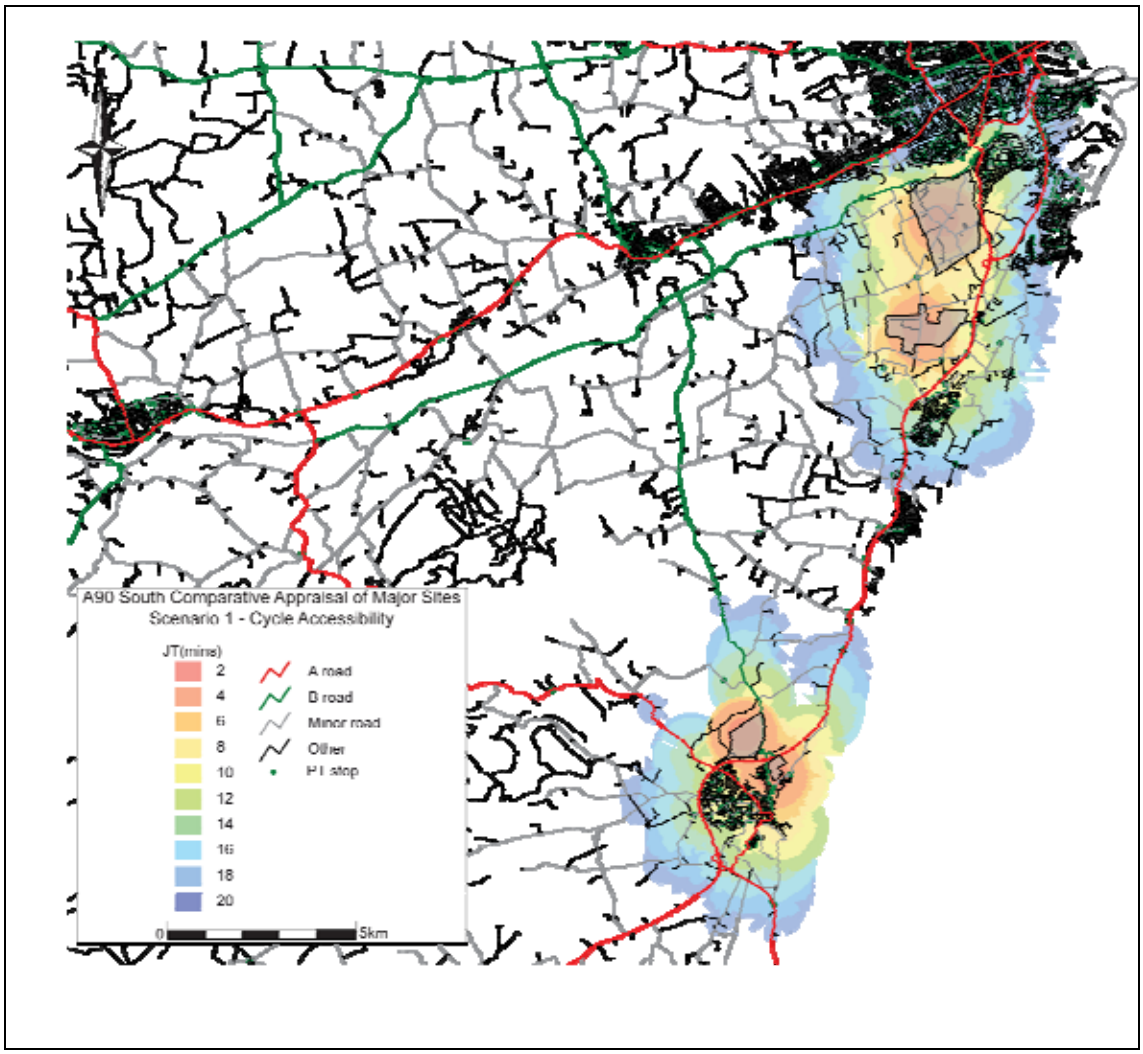

Figure C.2 : Land Use Scenario 1 - Cycle Accessibility

It is anticipated that there will be future employment provided in the Banchory Leggart and Schoolhill sites, with residents of the sites expected to be able to access these opportunities on foot or by cycle. The Schoolhill site is predicted to be the most accessible in terms of active travel modes as it is located within 5km of the North Portlethen and Marywell employment areas and within 1.6km of the North Portlethen site.

Both the Banchory Leggart of Schoolhill sites are to be developed to include a primary school, which will be accessible on foot and by cycle. The location of the nearest existing secondary schools in Kincorth and Portlethen are considered to be outwith convenient walking distance of both sites although they are considered to be accessible by cycle. For the purpose of this study it has been assumed that there is to be a secondary school provided at Loirston Loch, which would be located within a convenient cycle distance of the Banchory Leggart site.

C.3 Land Use Scenario 2

An appraisal of the accessibility of the sites by active travel modes (walking and cycling) has been undertaken based on their proximity to existing and potential future employment and education opportunities. Figures C3 and C4 confirm the accessibility of Land Use Scenario 2 sites on foot and by cycle.

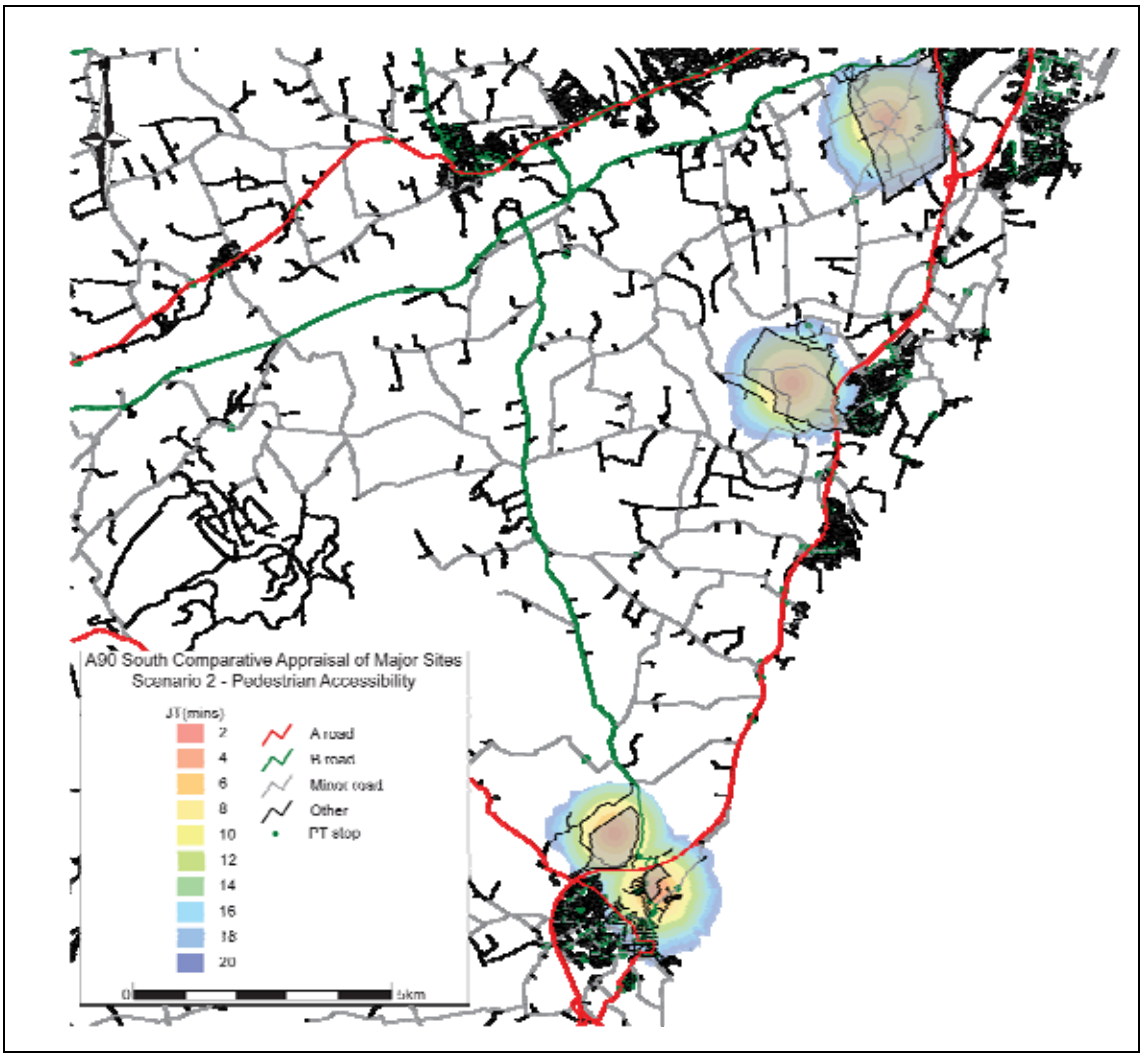

Figure C.3 : Land Use Scenario 2 - Pedestrian Accessibility

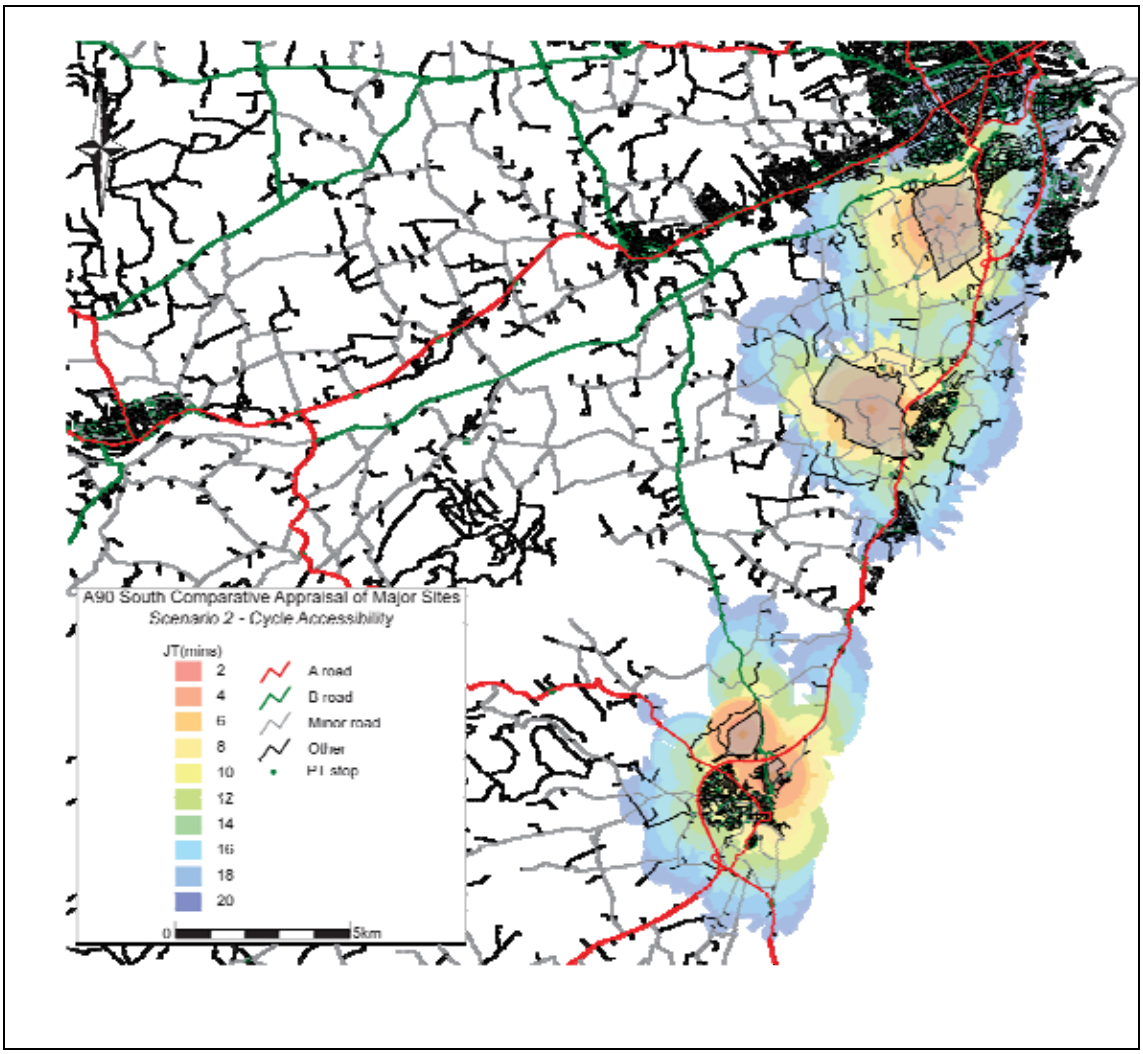

Figure C.4 : Land Use Scenario 2 - Cycle Accessibility

It is anticipated that there will be future employment provided in the Banchory Leggart and West Portlethen sites, with residents of the sites expected to be able to access these opportunities on foot or by cycle.

Both the Banchory Leggart of West Portlethen sites are to be developed to include a primary school which will be accessible on foot and by cycle. The location of the nearest existing secondary schools in Kincorth and Portlethen are considered to be outwith convenient walking distance of both sites, although they are considered to be accessible by cycle. For the purpose of this study it has been assumed that there is to be a secondary school provided at Loirston Loch, which would be located within a convenient cycle distance of the Banchory Leggart site.

C.4 Land Use Scenario 3

An appraisal of the accessibility of the sites by active travel modes (walking and cycling) has been undertaken based on their proximity to existing and potential future employment and education opportunities. Figures C5 and C6 confirm the accessibility of Land Use Scenario 3 sites on foot and by cycle.

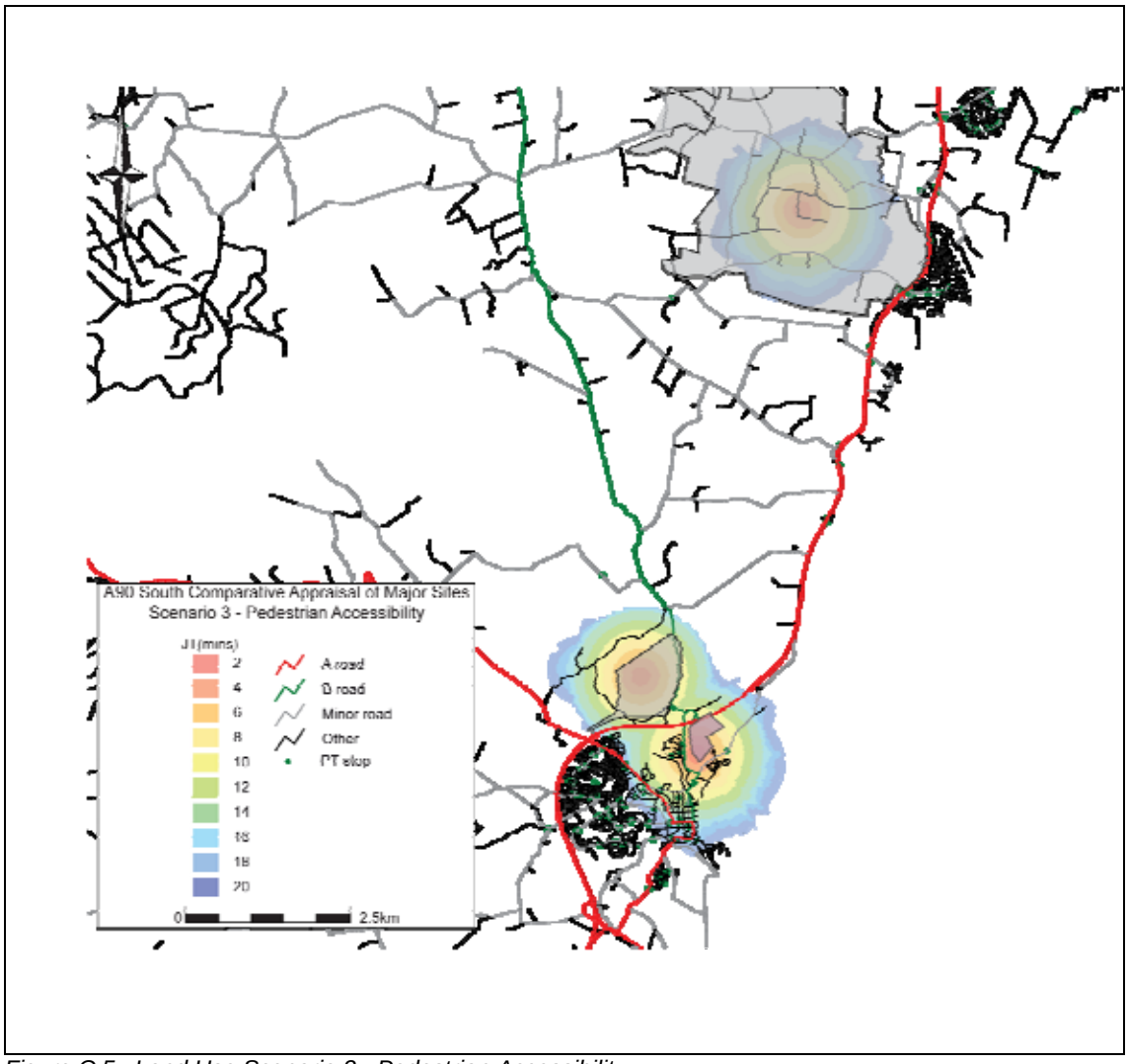

Figure C.5 : Land Use Scenario 3 - Pedestrian Accessibility

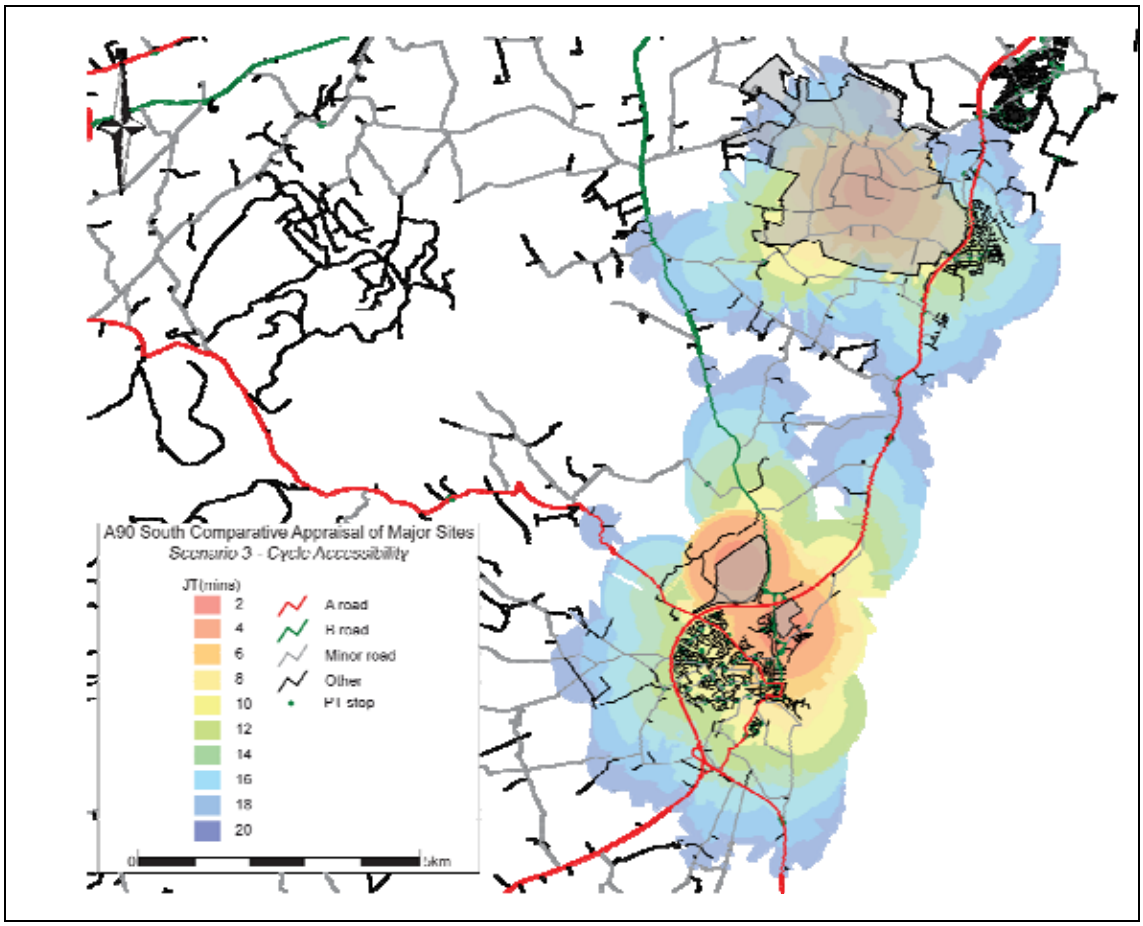

Figure C.6 : Land Use Scenario 3 - Cycle Accessibility

It is anticipated that there will be future employment provided in the Elsick site, with residents expected to be able to access these opportunities on foot or by cycle.

The Elsick site is to be developed to include a primary school which will be accessible on foot and by cycle. The location of the nearest existing primary school in Newtonhill is considered to be accessible by cycle from the site. The nearest existing secondary school is located in Portlethen which is outwith convenient cycling distance of the site. It is expected that local bus services will offer the most realistic alterative to the private car when accessing Portlethen Academy.

C.5 Land Use Scenario 4

An appraisal of the accessibility of the sites by active travel modes (walking and cycling) has been undertaken based on their proximity to existing and potential future employment and education opportunities. Figures C7 and C8 confirm the accessibility of Land Use Scenario 4 sites on foot and by cycle.

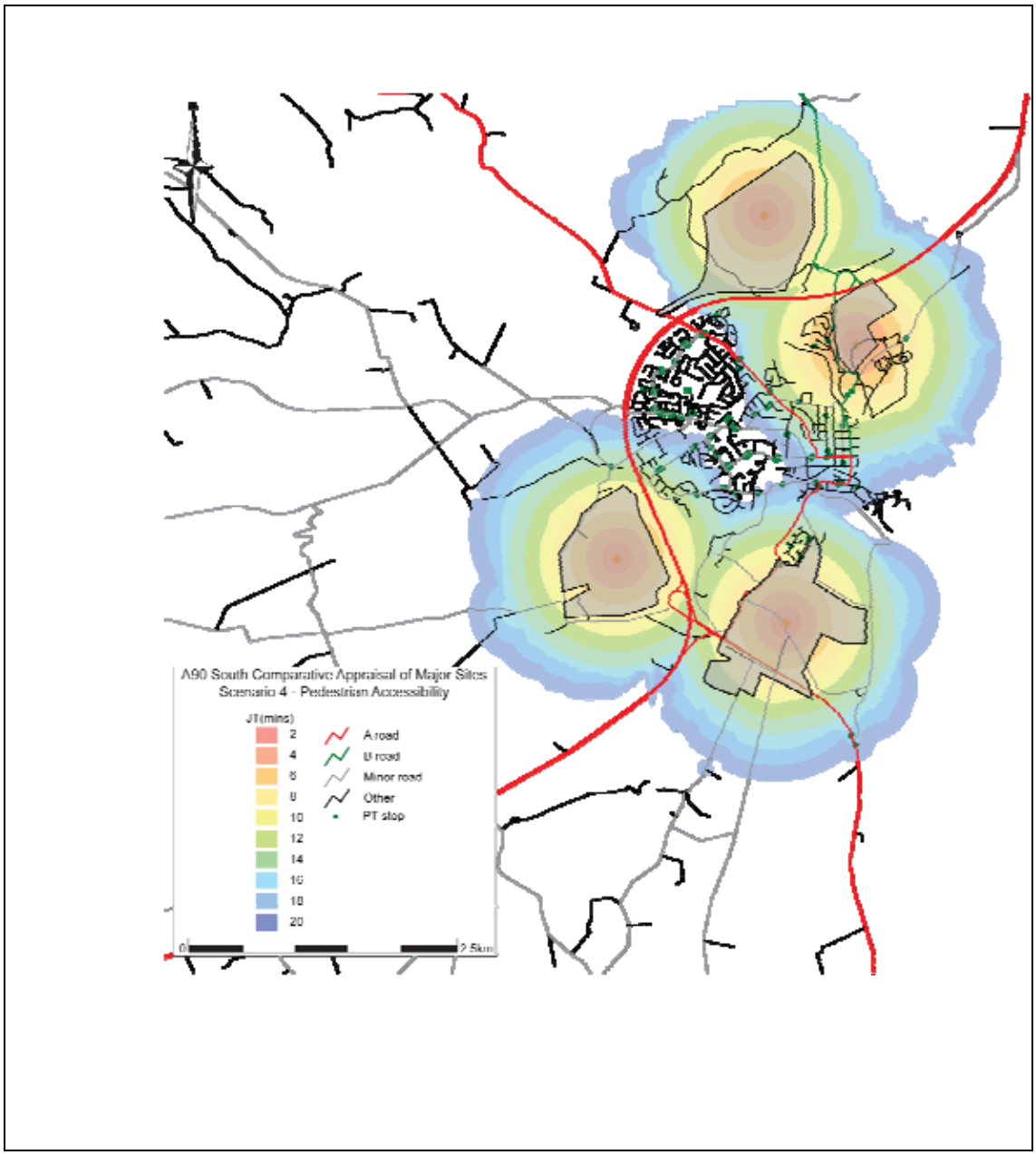

Figure C.7 : Land Use Scenario 4 - Pedestrian Accessibility

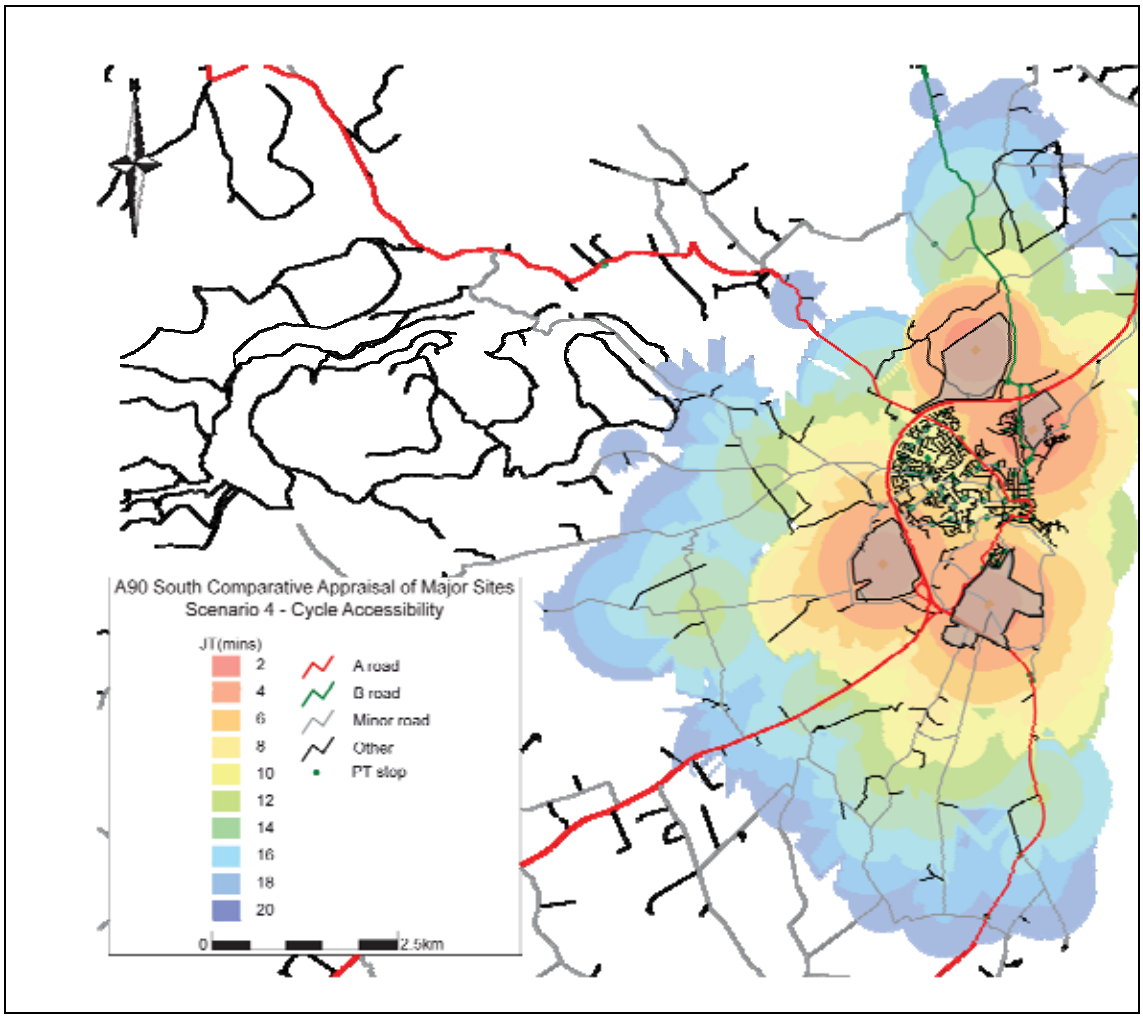

Figure C.8 : Land Use Scenario 4 - Cycle Accessibility

It is anticipated that there will be future employment provided in the Mill of Forest and East Newtonleys site, with residents expected to be able to access these opportunities on foot or by cycle.

The Mill of Forest and East Newtonleys sites are to be developed to include a primary school, which will be accessible on foot and by cycle. A primary school is also planned to be introduced in the vicinity of the Mains of Cowie site. With this provision, all four sites will be located within convenient walking distance of a primary school.

It is considered that Mackie Academy is located within convenient cycling distance of all four sites.

D APPENDIX D – ACCESSIBILITY ASSESSMENT - PUBLIC TRANSPORT

D.1 Introduction

Accession GIS software has been used to appraise the existing level of service provision in the vicinity of the sites in addition to assessing the impact of the potential bus service improvements.

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.

Both local and network accessibility appraisals have been undertaken to inform this study.

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 two buses per hour in the weekday peak. A 30min service frequency is considered to represent the minimum level of service provision which can support the development of the sites.

D.2 Land Use Scenario 1

It is expected that it will be relatively straightforward to extend Service No. 17 which currently terminates in Kincorth, into the Banchory Leggart site in association with the necessary road improvements including formation of a development access junction. The service could utilise the proposed development access with a bus gate introduced on Nigg Way to prevent its use by general vehicular traffic. It is expected that the existing service frequency could be reduced from its current four buses per hour to a 20min frequency without the need for additional buses to operate on the route. Journey times would be unaffected for existing residents.

It is proposed to introduce a new Portlethen town circular service to link Portlethen with the land use scenario sites and the Schoolhill Park & Ride. This service could enable the route of existing Coastrider services to be rationalised through Portlethen. The service is likely to be self-financing given the number of residents which are planned to live within the development sites. Introduction of the service will enhance the service provision for existing Portlethen residents and provide access to the Schoolhill Park & Ride.

Figures D1 and D2 show the accessibility of the land use scenario sites in terms existing and proposed bus service provision.

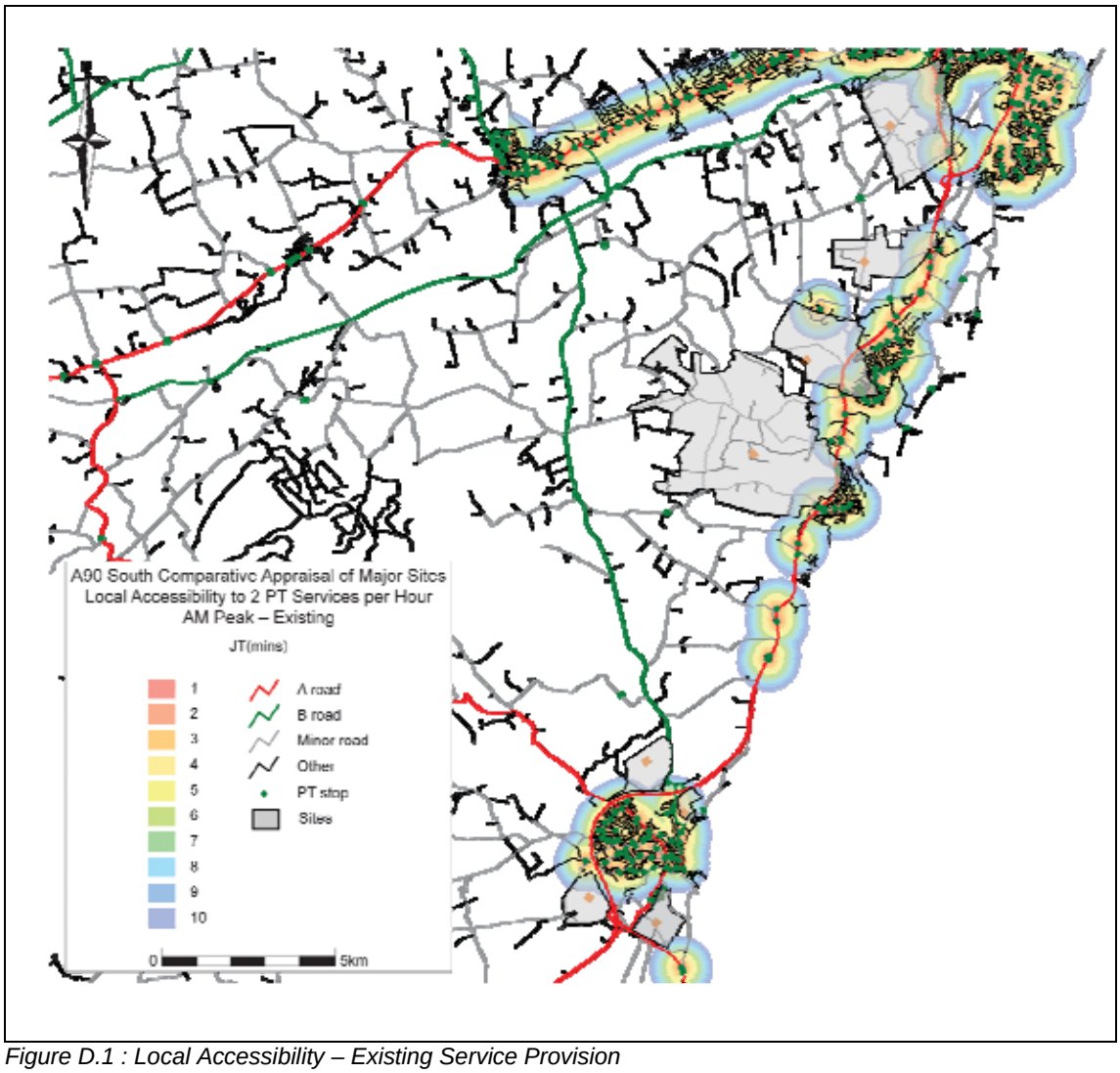

Figure D.1 : Local Accessibility – Existing Service Provision

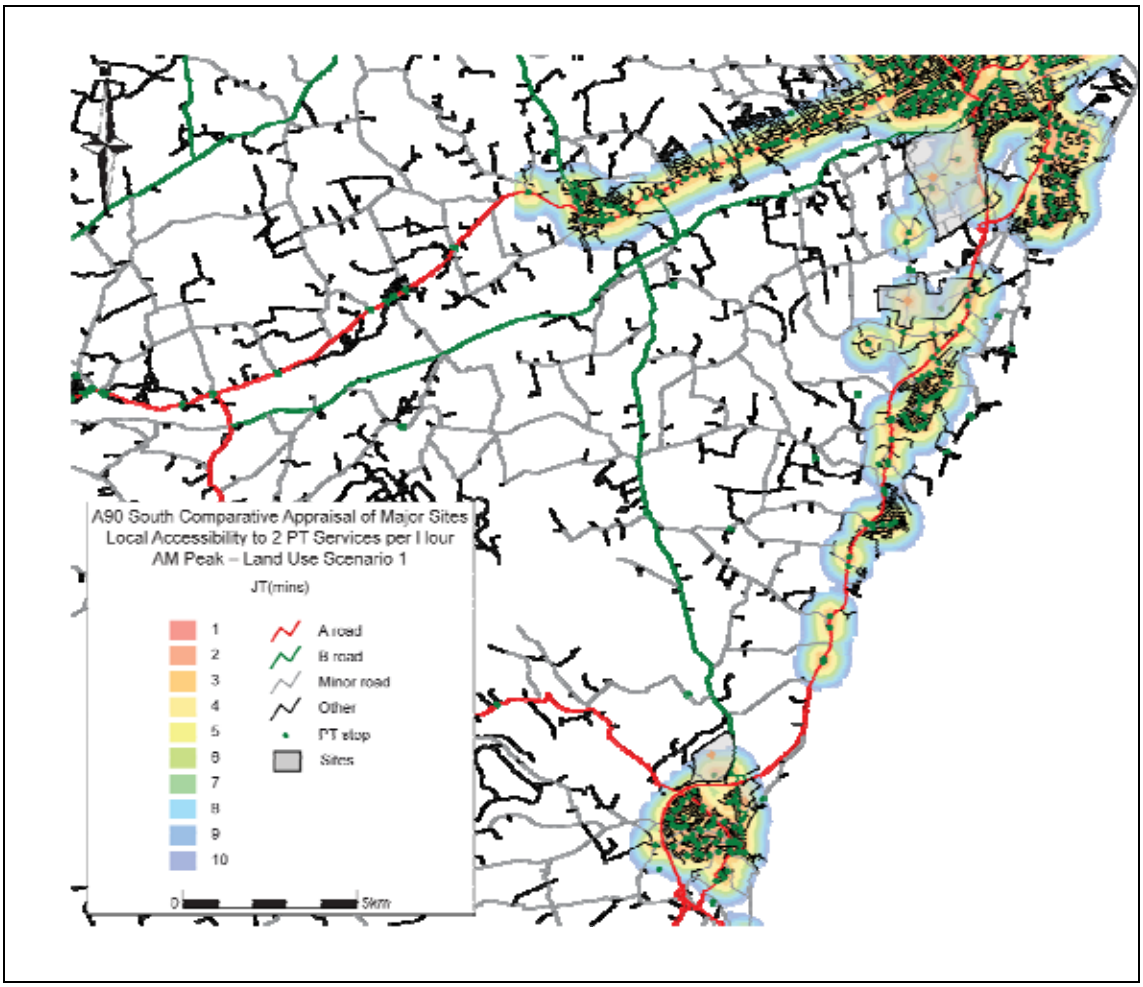

Figure D.2 : Local Accessibility – Proposed Service Provision

As can be seen from the presented accessibility analysis, the introduction of new and extended bus services is shown to ensure that a proportion of the sites will be located within a 10min walk of a 30min bus service.

Network accessibility calculations have been undertaken to determine the accessibility of the potential development sites 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

The accessibility of the sites to the centre of Aberdeen has been appraised in the peak period. Figures and D4 confirm the accessibility of the centre of Aberdeen from the sites in terms of existing and proposed bus service provision.

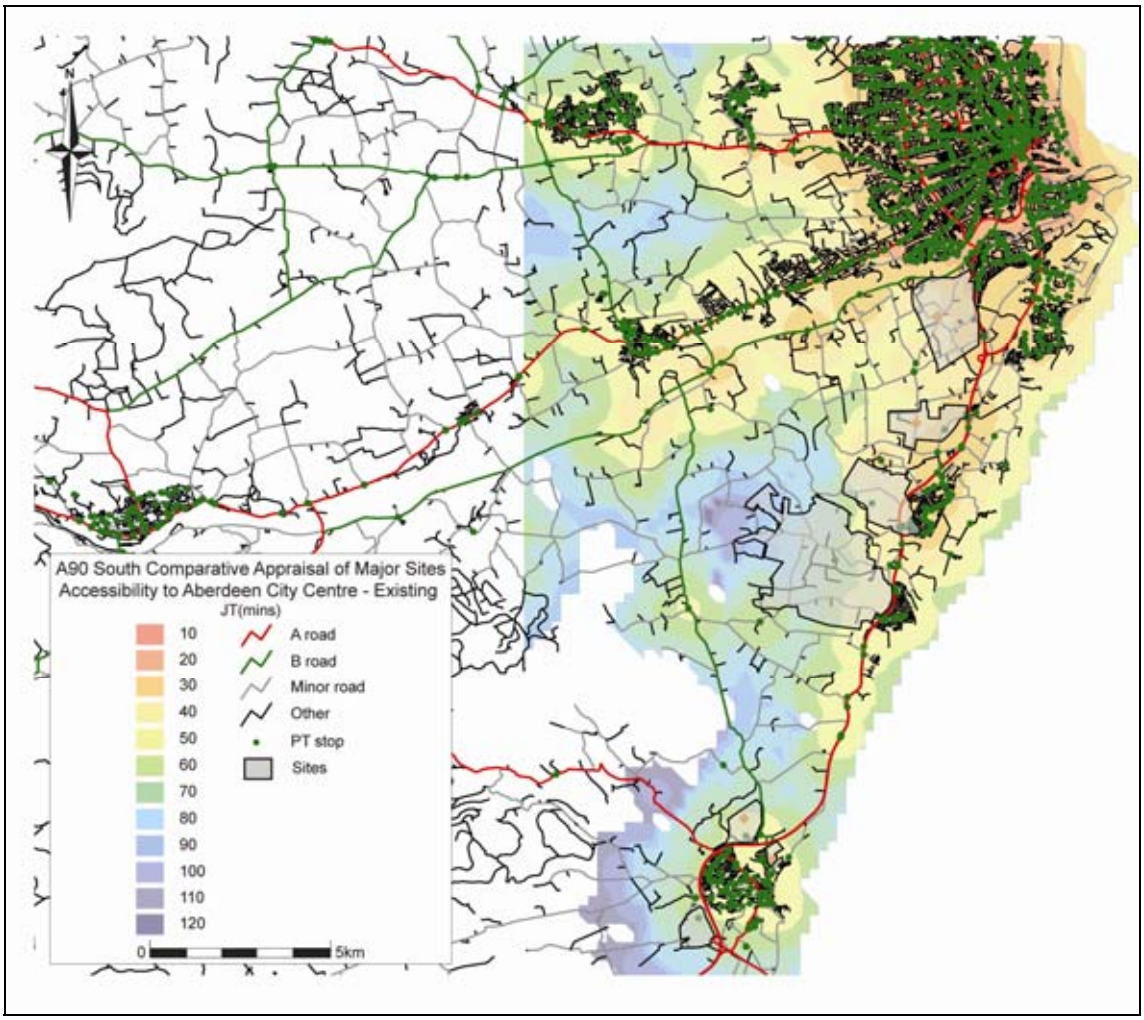

Figure D.3 : Accessibility to Aberdeen – Existing Service Provision

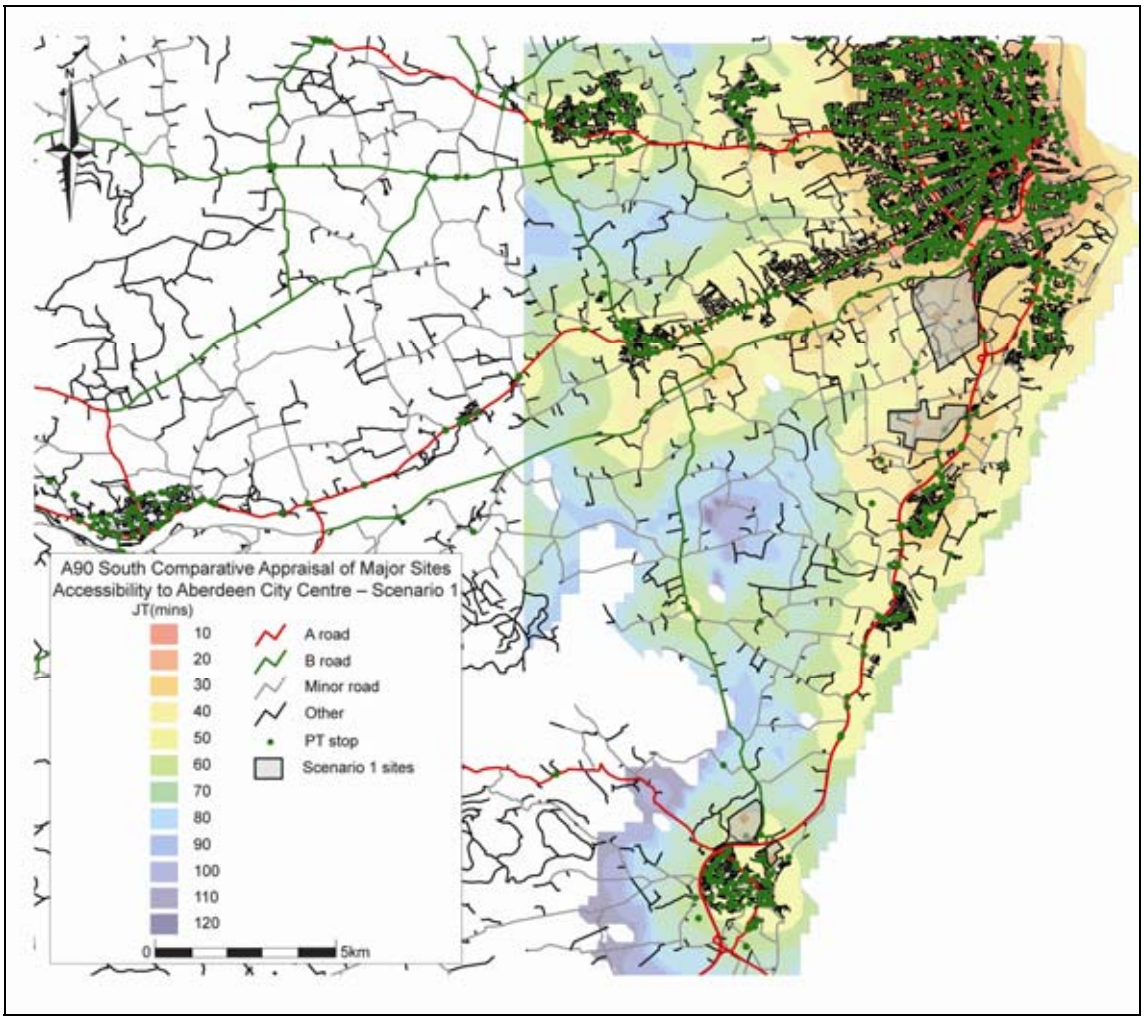

Figure D.4 : Accessibility to Aberdeen – Proposed Service Provision

As can be seen from the accessibility analysis, the bus service improvements are predicted to have a minor impact on journey times although the frequency of service provision has been improved to the Banchory Leggart and Schoolhill sites.

D.3 Land Use Scenario 2

It is expected that it will be relatively straightforward to extend Service No. 17 which currently terminates in Kincorth, into the Banchory Leggart site in association with the necessary road improvements including formation of a development access junction. The service could utilise the proposed development access with a bus gate introduced on Nigg Way to prevent its use by general vehicular traffic. It is expected that the existing service frequency could be reduced from its current four buses per hour to a 20min frequency without the need for additional buses to operate on the route. Journey times would be unaffected for existing residents.

It is proposed to introduce a new Portlethen town circular service to link Portlethen with the land use scenario sites and the Schoolhill Park & Ride. This service could enable the route of existing Coastrider services to be rationalised through Portlethen. The service is likely to be self-financing given the number of residents planned to live in the development sites. Introduction of the service will enhance the service provision for existing Portlethen residents and provide access to the Schoolhill Park & Ride.

Figures D5 and D6 show the accessibility of the land use scenario sites in terms existing and proposed bus service provision.

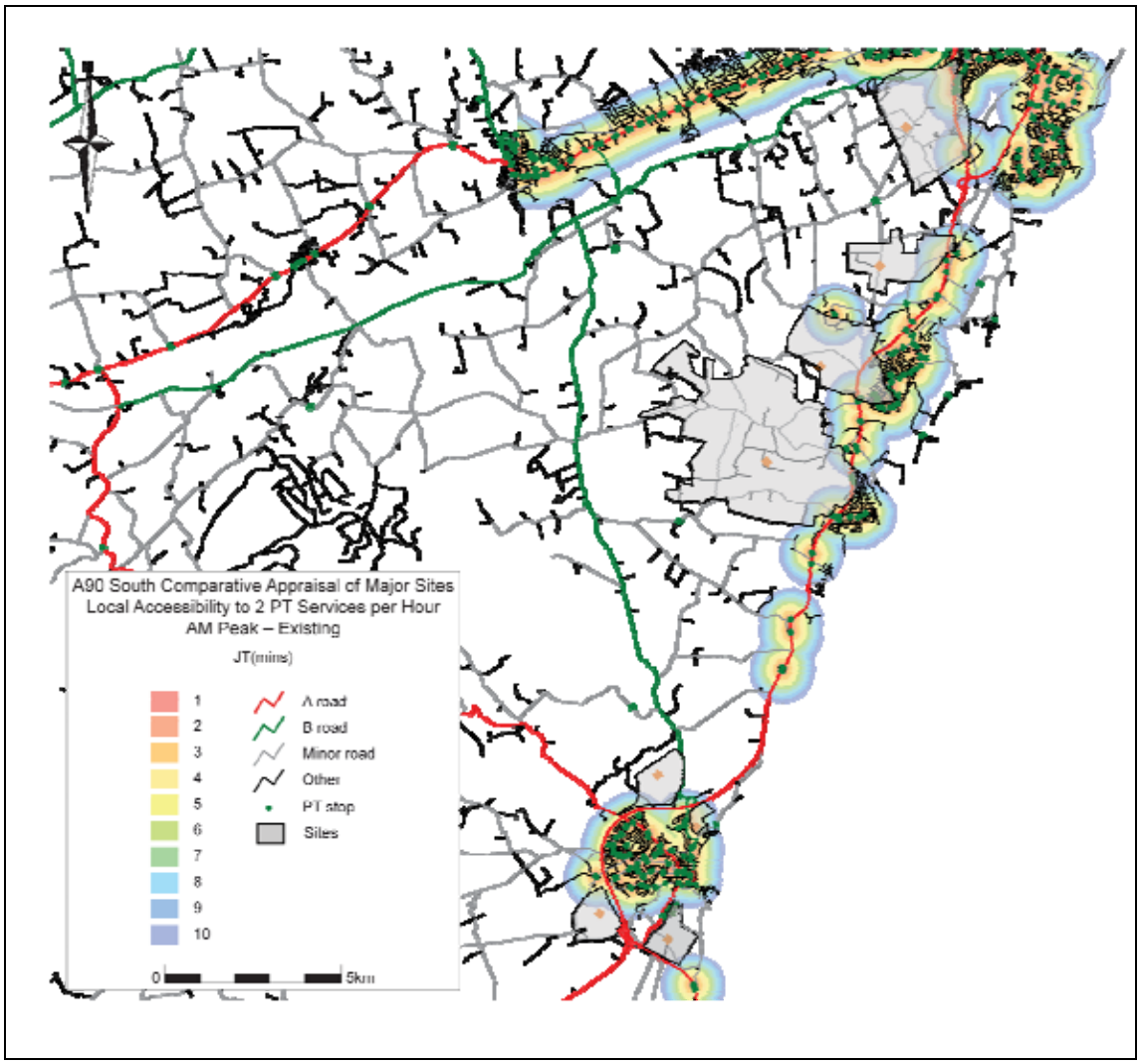

Figure D.5 : Local Accessibility – Existing Service Provision

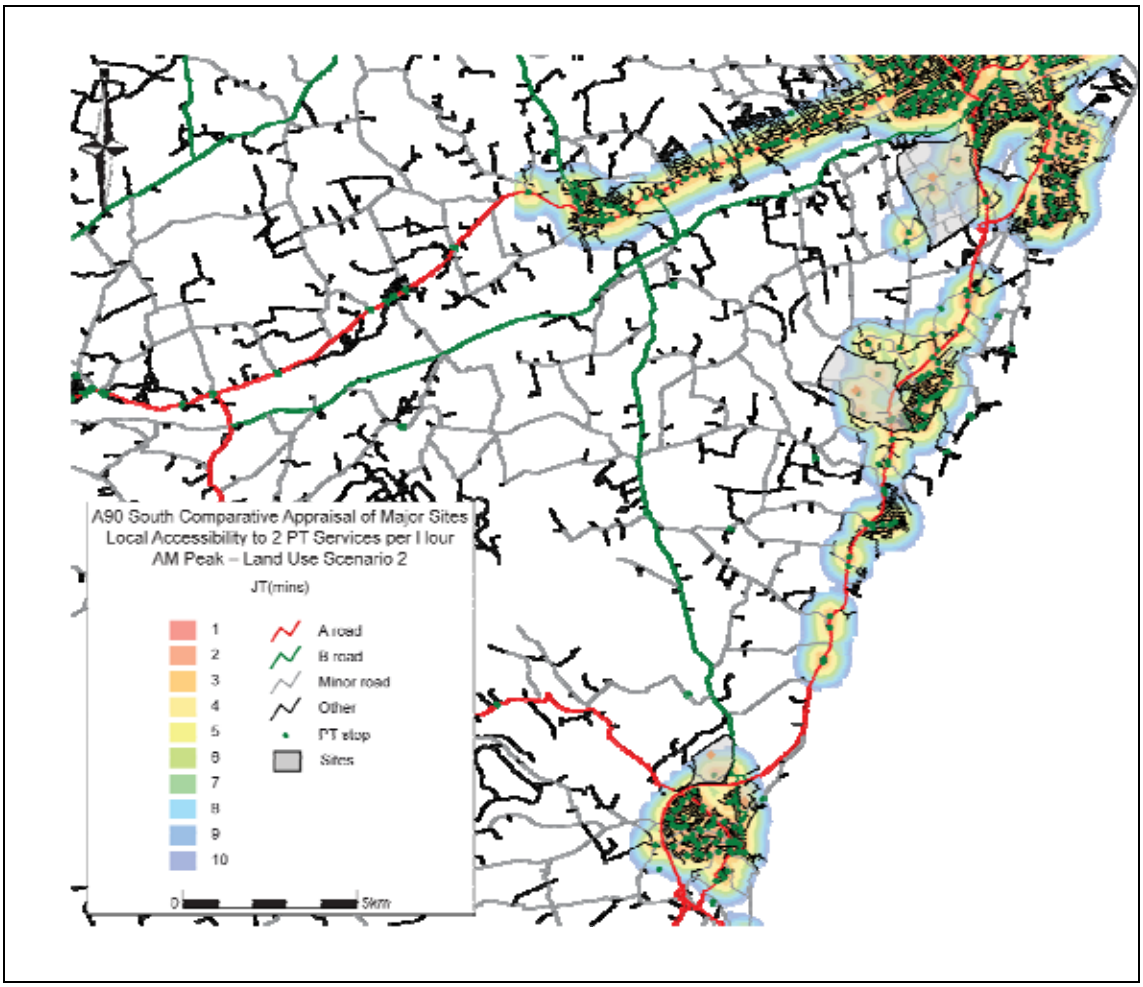

Figure D.6 : Local Accessibility – Proposed Service Provision

As can be seen from the presented accessibility analysis, the introduction of new and extended bus services is shown to ensure that a proportion of the sites will be located within a 10min walk of a 30min bus service.

Network accessibility calculations have been undertaken to determine the accessibility of the potential development sites by bus.

The accessibility of the sites to the centre of Aberdeen has been appraised in the peak period. Figures D7 and D8 confirm the accessibility of the centre of Aberdeen from the sites in terms of existing and proposed bus service provision.

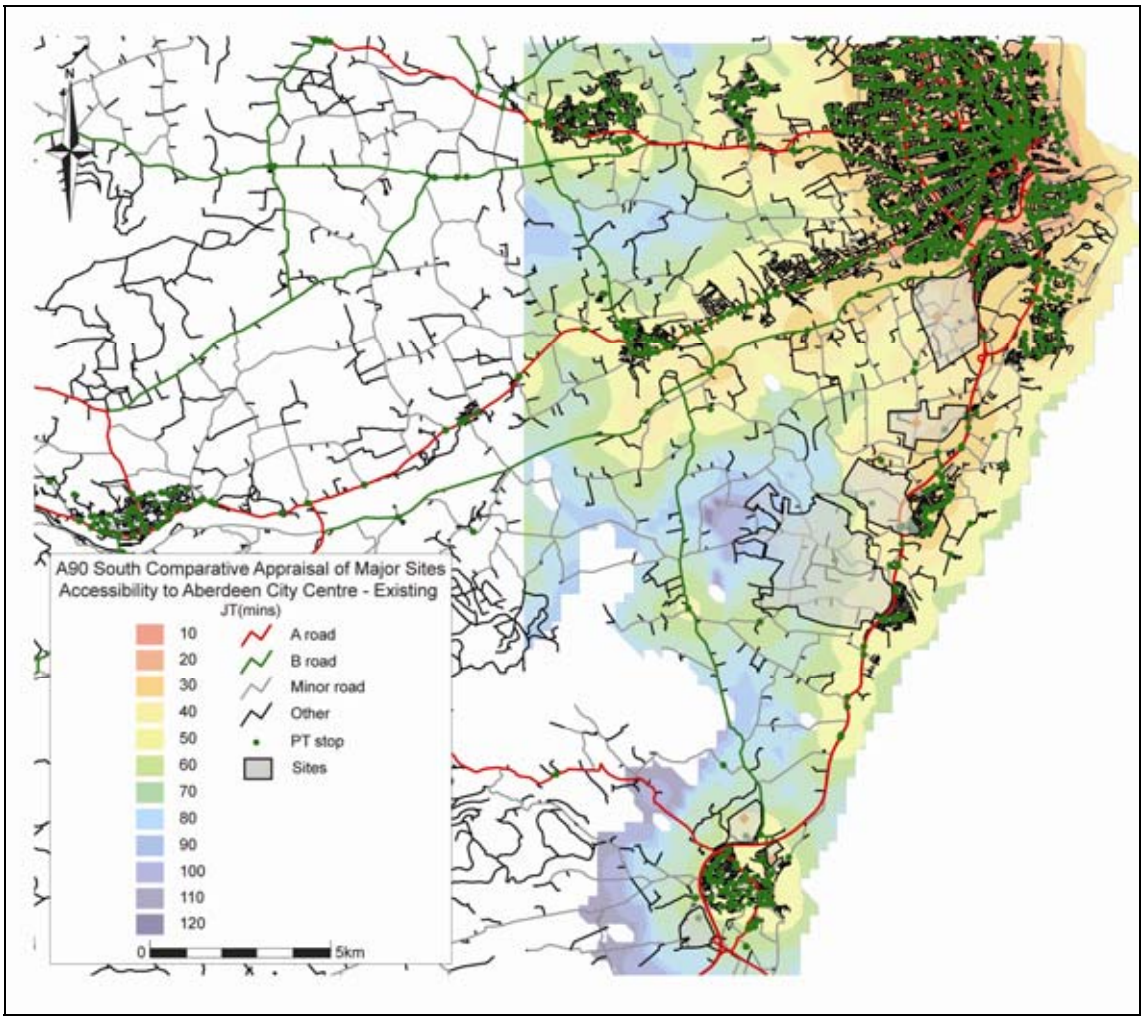

Figure D.7 : Accessibility to Aberdeen – Existing Service Provision

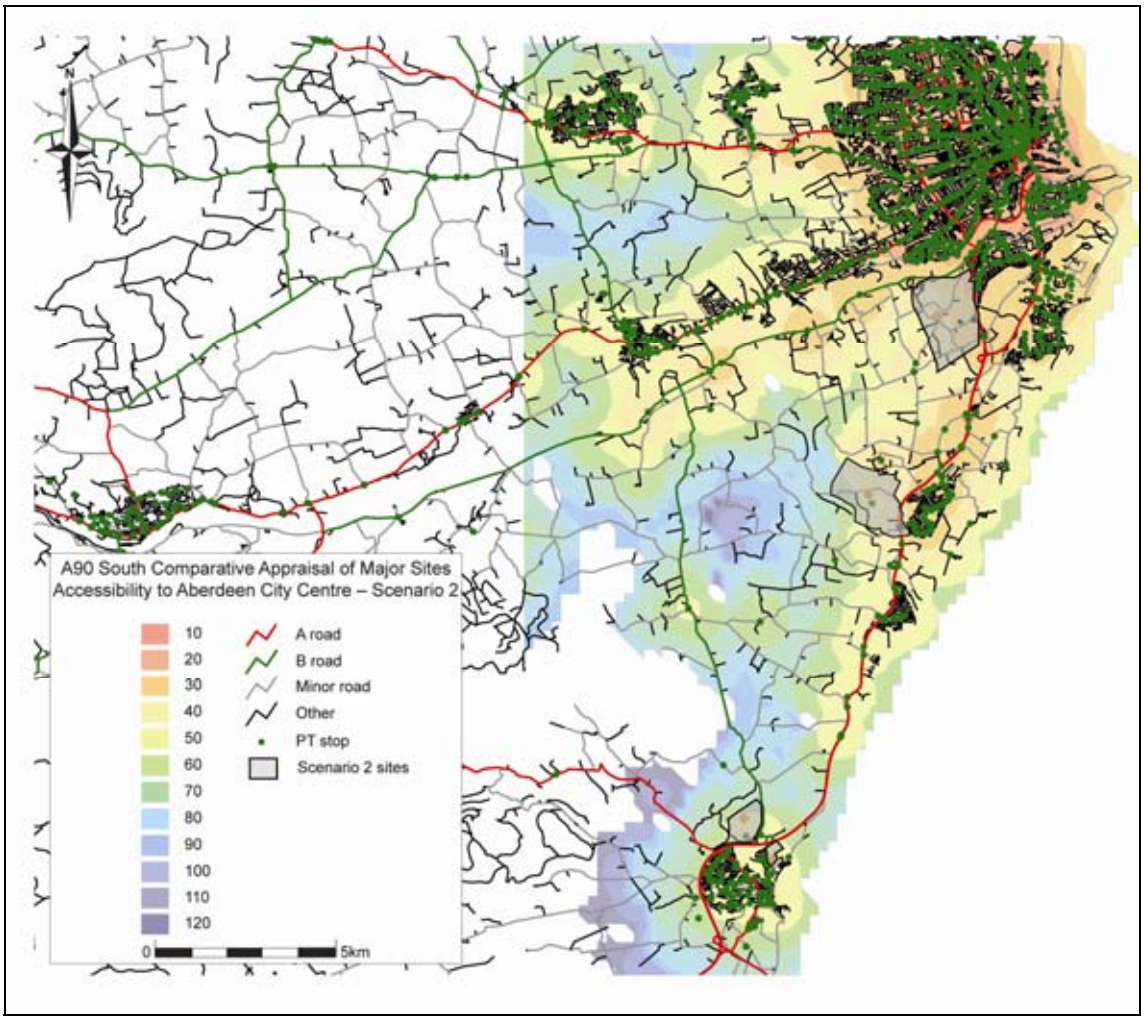

Figure D.8 : Accessibility to Aberdeen – Proposed Service Provision

As can be seen from the accessibility analysis, the bus service improvements are predicted to have a minor impact on journey times although the frequency of service provision has been improved to the Banchory Leggart site. The proposed bus service improvements are predicted to reduce the journey time from the centre of the West Portlethen site from approximately 50 to 40min.

D.4 Land Use Scenario 3

The scale of the Elsick site is anticipated to result in existing Coastrider services being required to undertake a significant detour from the existing route to serve the site. It is considered unlikely that the service diversion can be achieved without a significant impact on existing journey times and potentially the service frequency. Additional buses will be required to serve the route with a potentially large financial commitment associated with the operation of the additional buses.

The diverted bus services are unlikely to travel through Portlethen when connecting the Elsick site with Aberdeen given the impact which this will have on journey times. Existing Newtonhill and Portlethen residents are unlikely to benefit existing residents or bus service users.

Figures D9 and D10 show the accessibility of the land use scenario site in terms existing and proposed bus service provision.

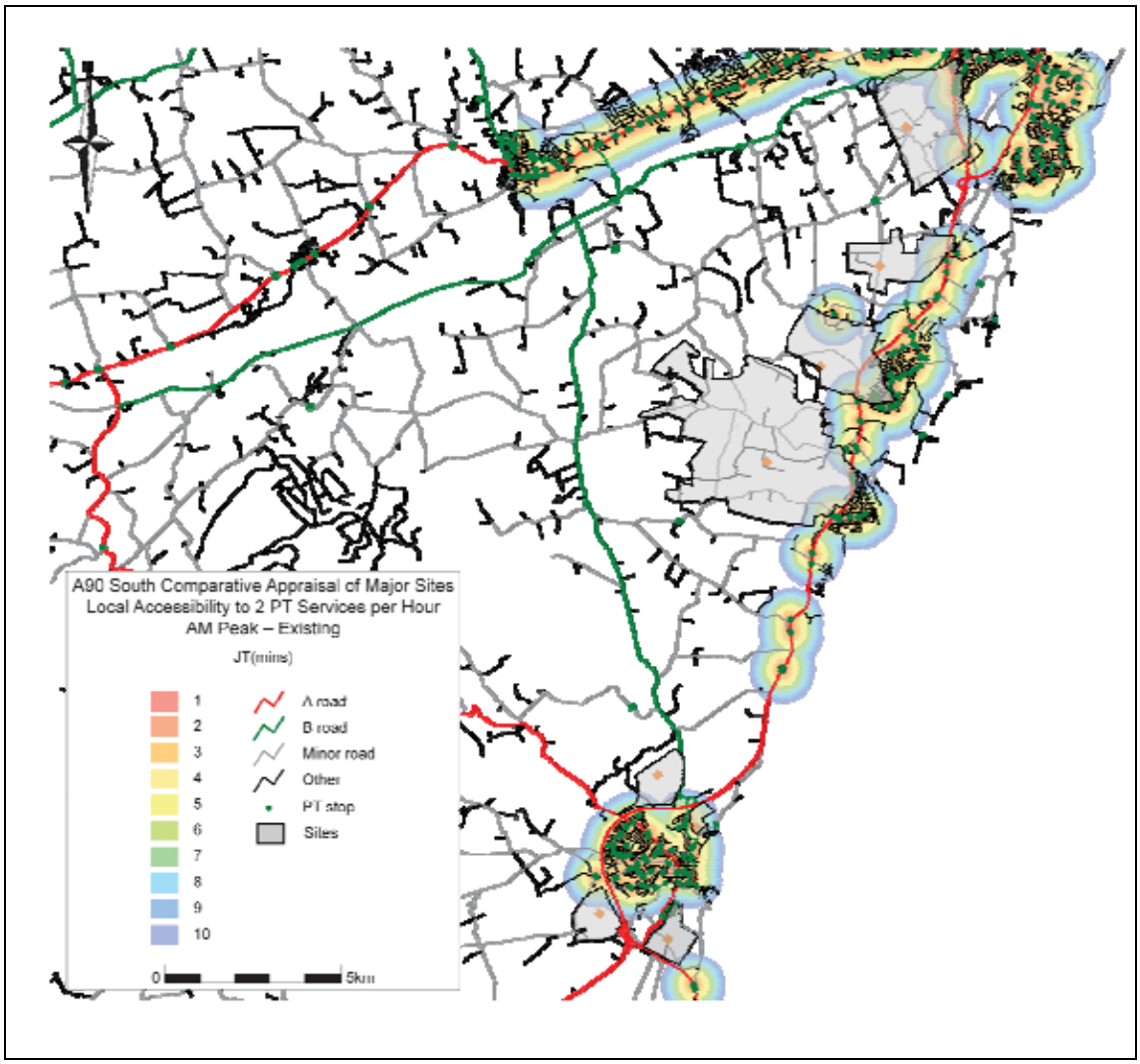

Figure D.9 : Local Accessibility – Existing Service Provision

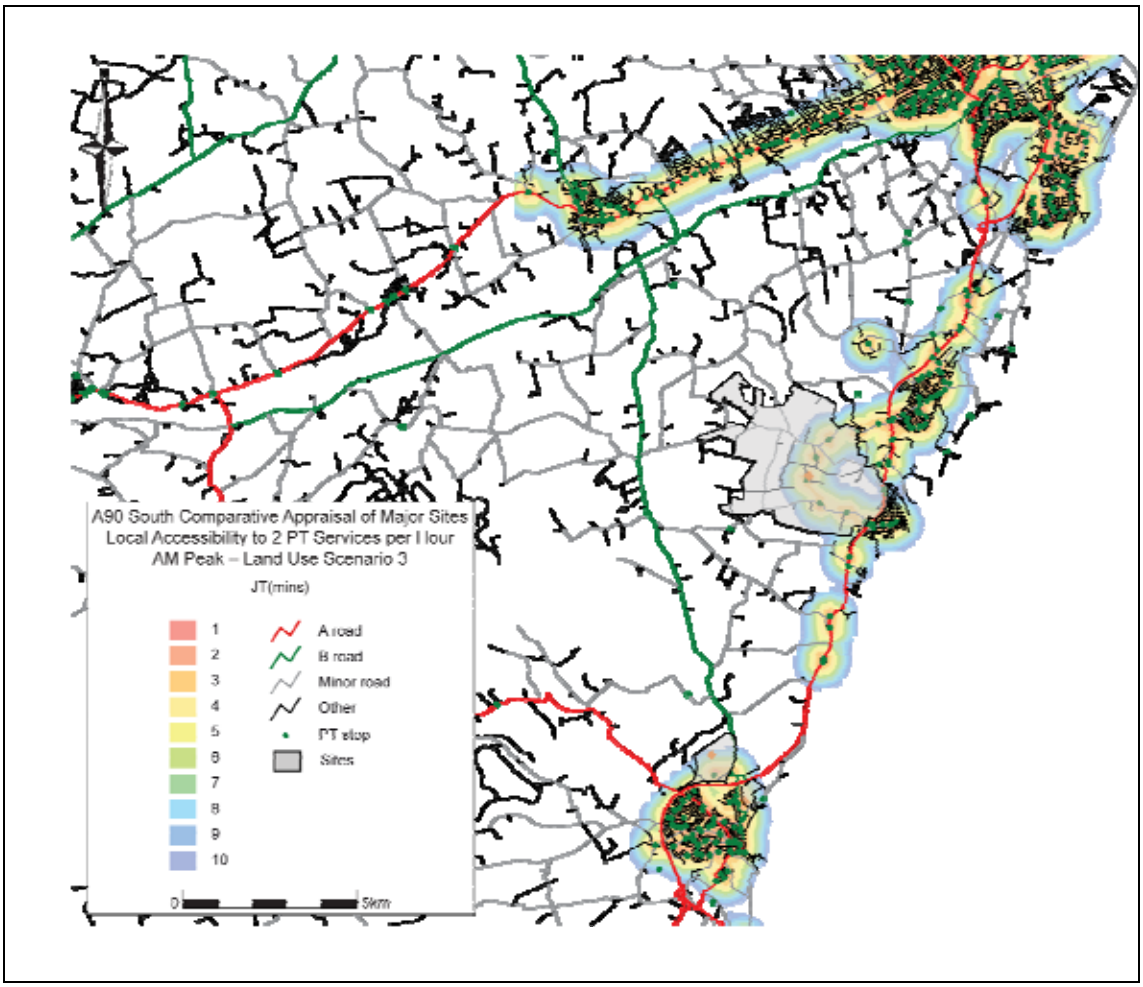

Figure D.10 : Local Accessibility – Proposed Service Provision

As can be seen from the presented accessibility analysis, the introduction of new and extended bus services is shown to ensure that a proportion of the Elsick site will be located within a 10min walk of a 30min bus service.

Network accessibility calculations have been undertaken to determine the accessibility of the potential development site by bus.

The accessibility of the Elsick site to the centre of Aberdeen has been appraised in the peak period. Figures D11 and D12 confirm the accessibility of the centre of Aberdeen from the site in terms of existing and proposed bus service provision.

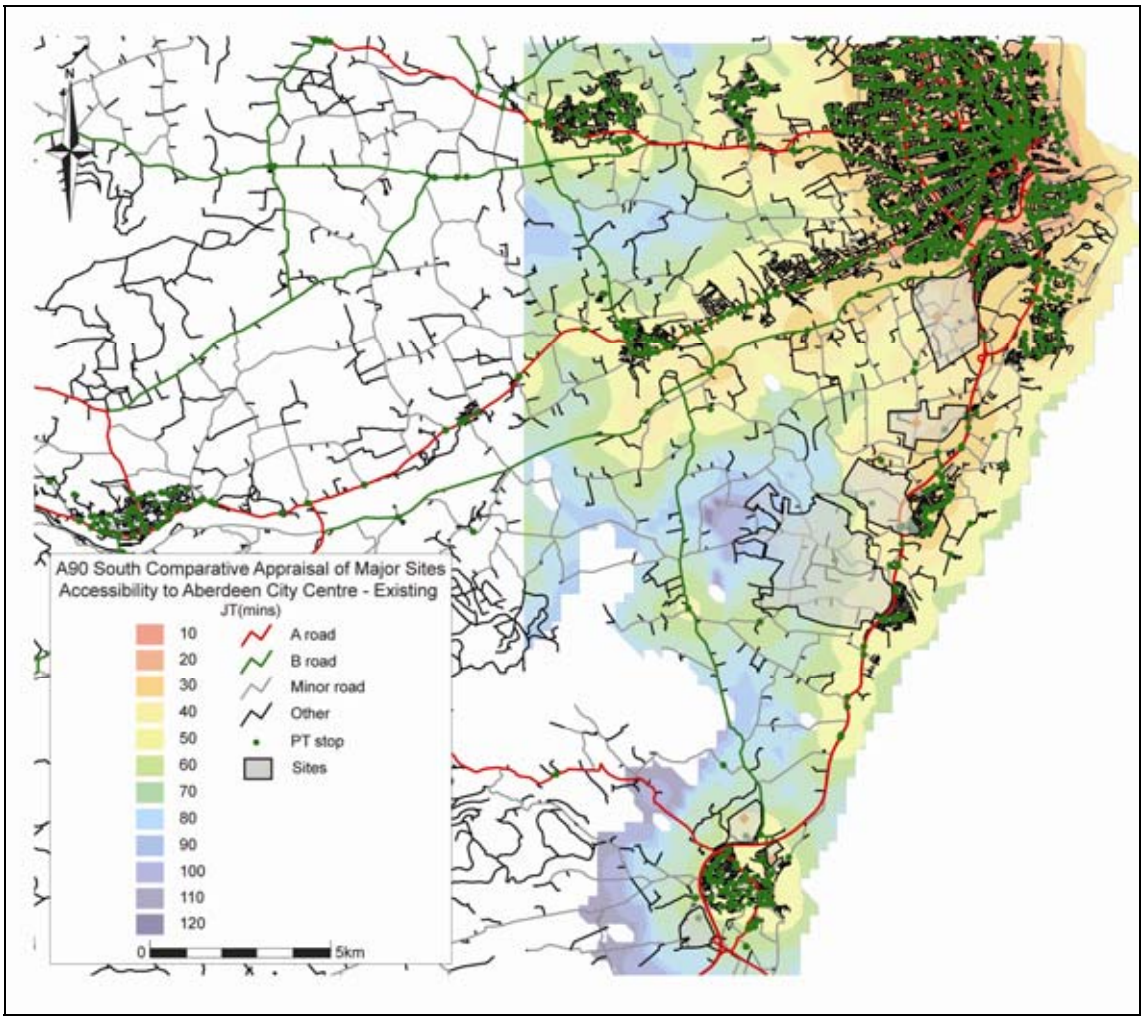

Figure D.11 : Accessibility to Aberdeen – Existing Service Provision

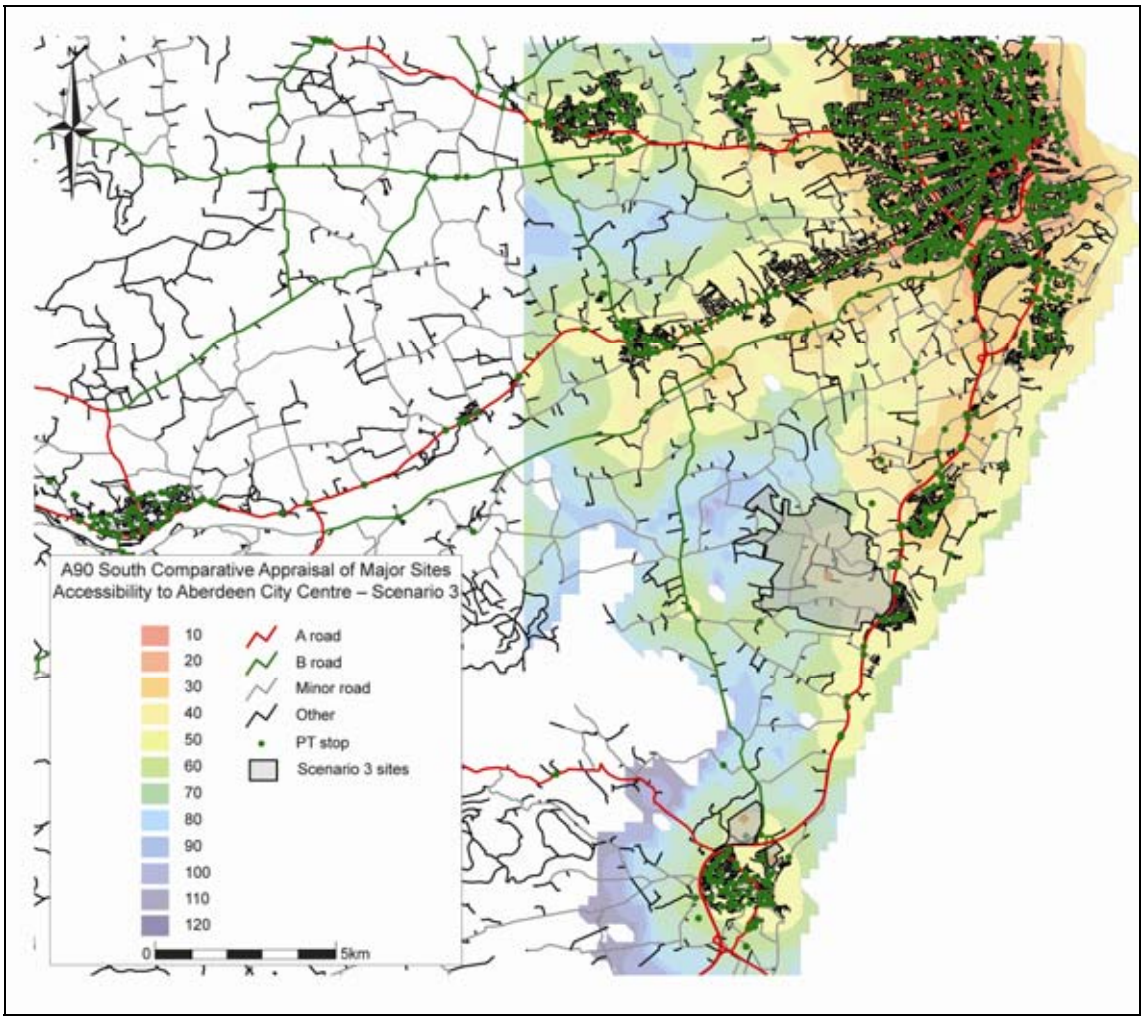

Figure D.12 : Accessibility to Aberdeen – Proposed Service Provision

As can be seen from the accessibility analysis, the bus service improvements are predicted to reduce the journey time from the centre of the Elsick site from approximately 60 to 50min.

D.5 Land Use Scenario 4

It is understood that the existing Stonehaven town bus service is currently under threat and the extension of the service to serve all four sites will assist in supporting the service. The introduction of infrastructure improvements in association with development of the sites, including provision of a road crossing of Glen Ury and the A90(T) will provide potential for the route of the existing bus service to be made more efficient.

The circular bus service will provide connection between the sites and existing Stonehaven amenities including the town centre and rail station providing opportunity for onward journey to Aberdeen by rail.

ACPTU has suggested that a 30min service should be introduced which is an improvement over the current service provision. This will benefit existing residents, but require initial financial commitment from developers to fund the improvements.

Figures D13 and D14 show the accessibility of the land use scenario sites in terms existing and proposed bus service provision.

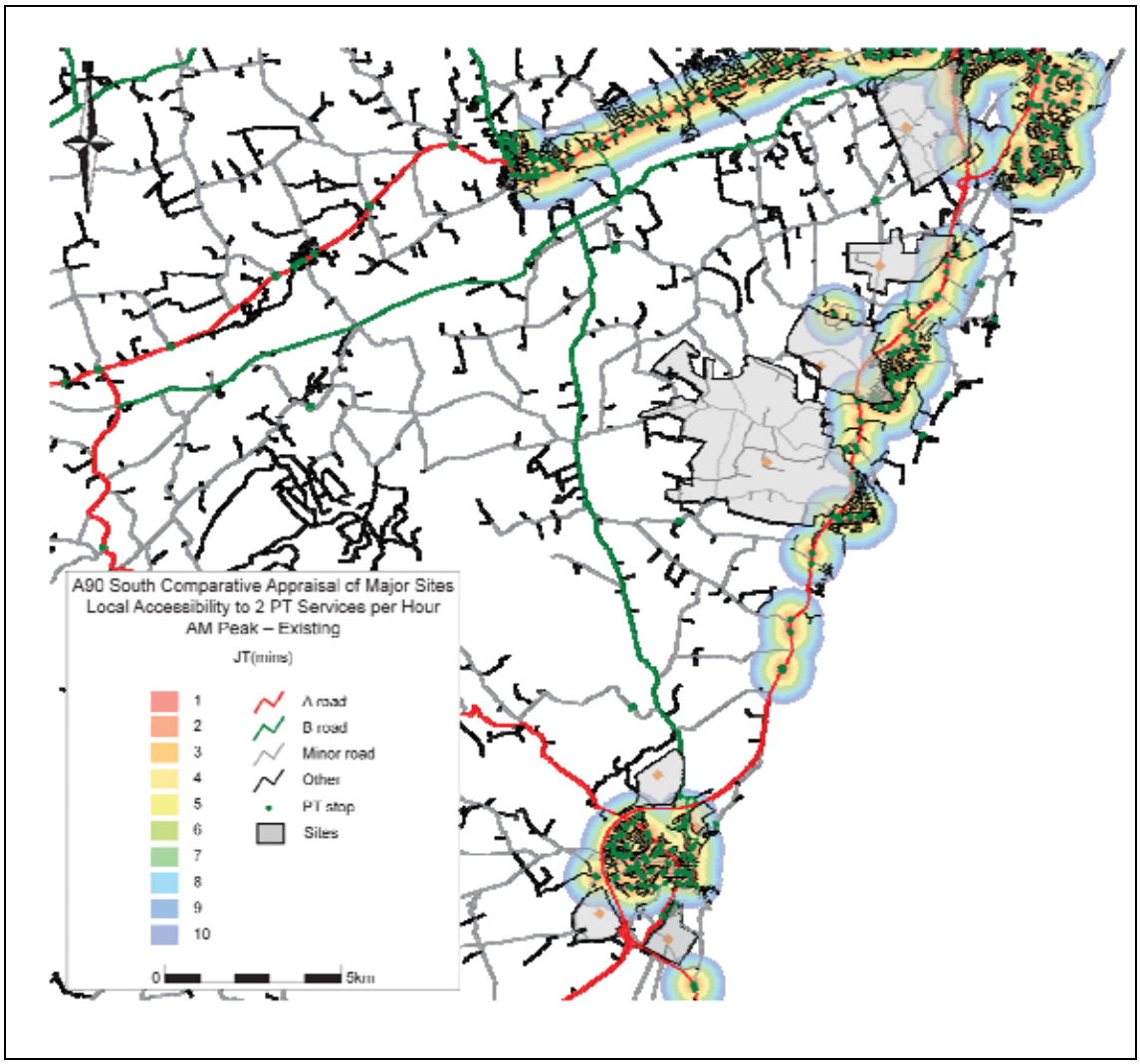

Figure D.13 : Local Accessibility – Existing Service Provision

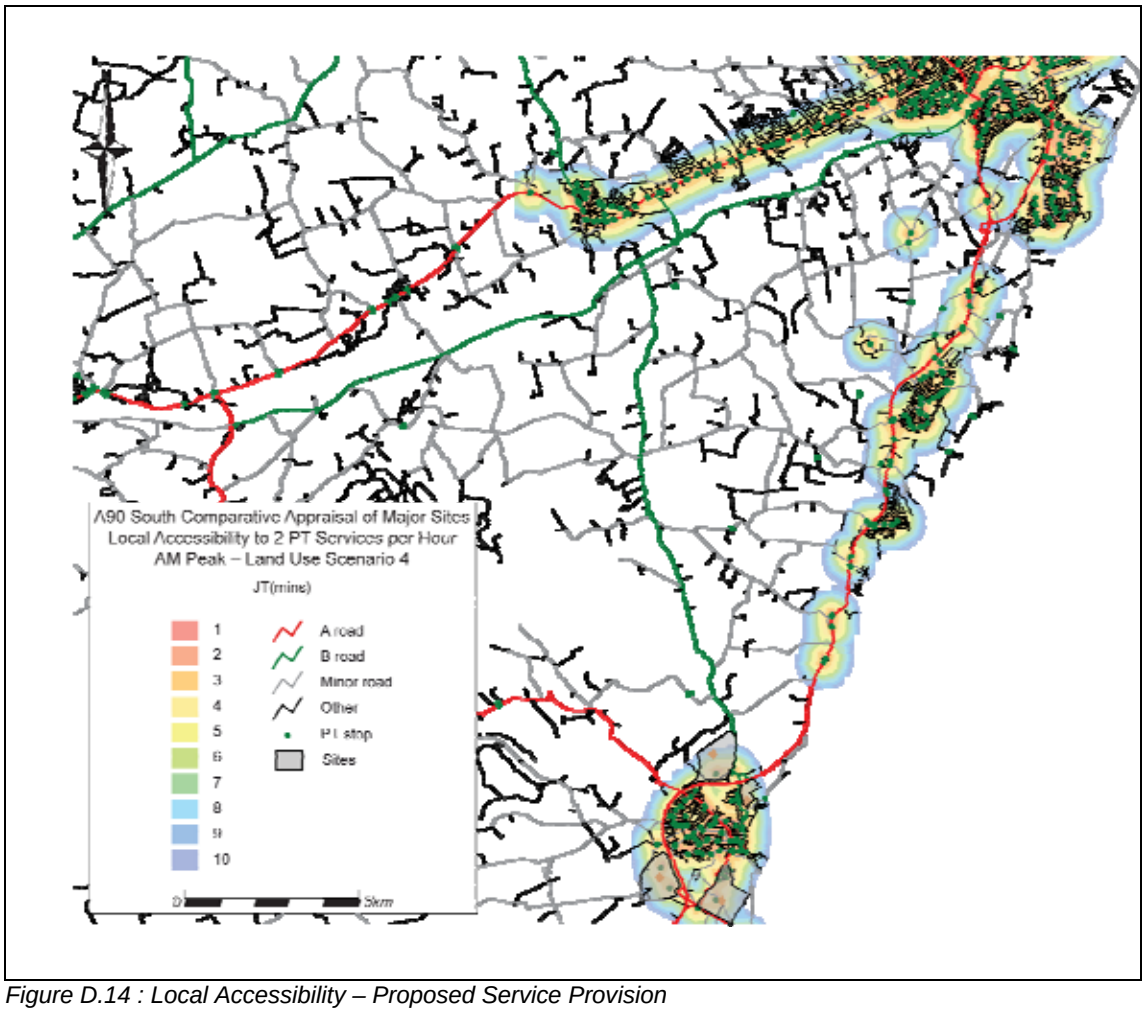

Figure D.14 : Local Accessibility – Proposed Service Provision

As can be seen from the presented accessibility analysis, the introduction of new and extended bus services is shown to ensure that a proportion of the sites will be located within a 10min walk of a 30min bus service.

Network accessibility calculations have been undertaken to determine the accessibility of the potential development sites by bus.

The accessibility of the sites to the centre of Aberdeen has been appraised in the peak period. Figures D15 and D16 confirm the accessibility of the centre of Aberdeen from the sites in terms of existing and proposed bus service provision.

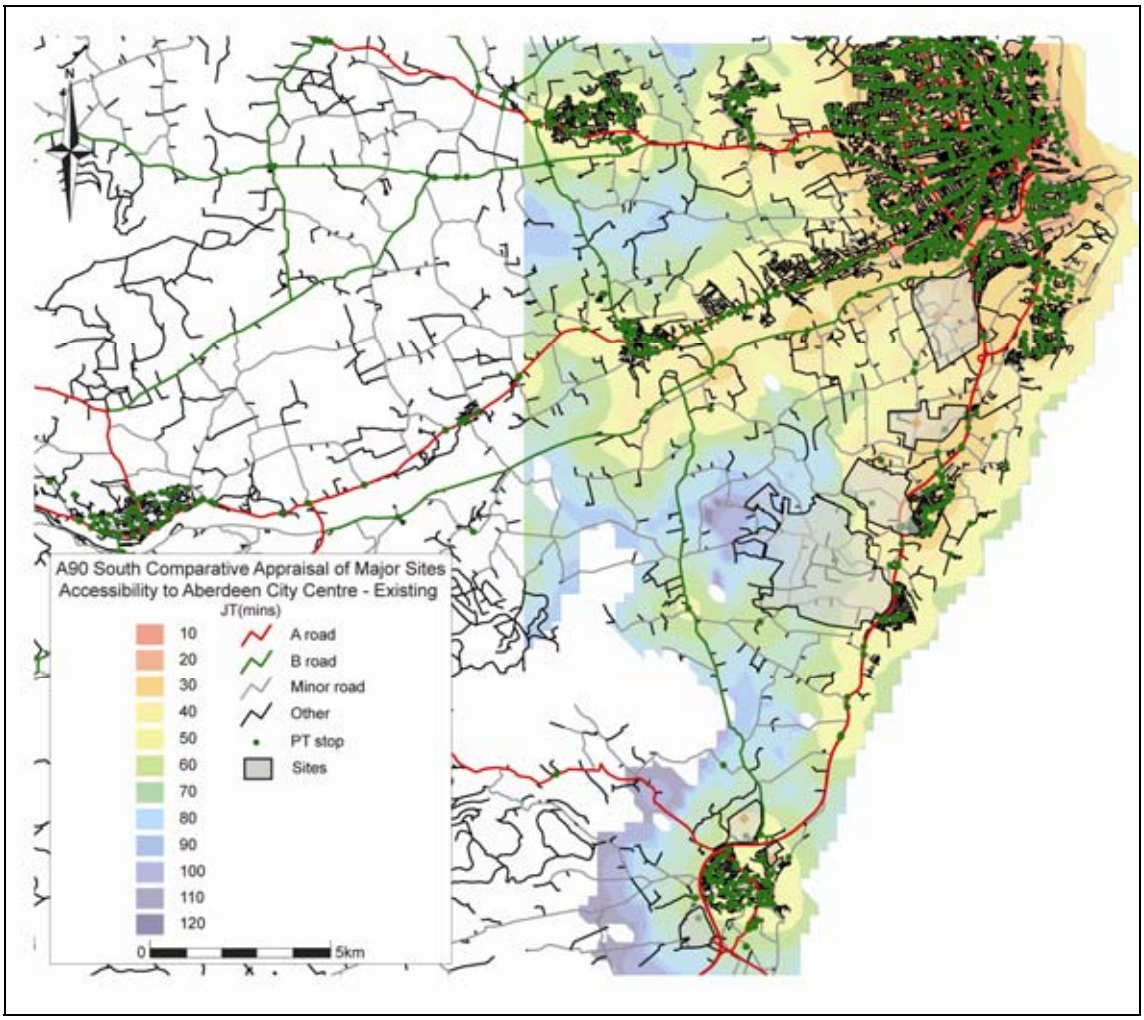

Figure D.15 : Accessibility to Aberdeen – Existing Service Provision

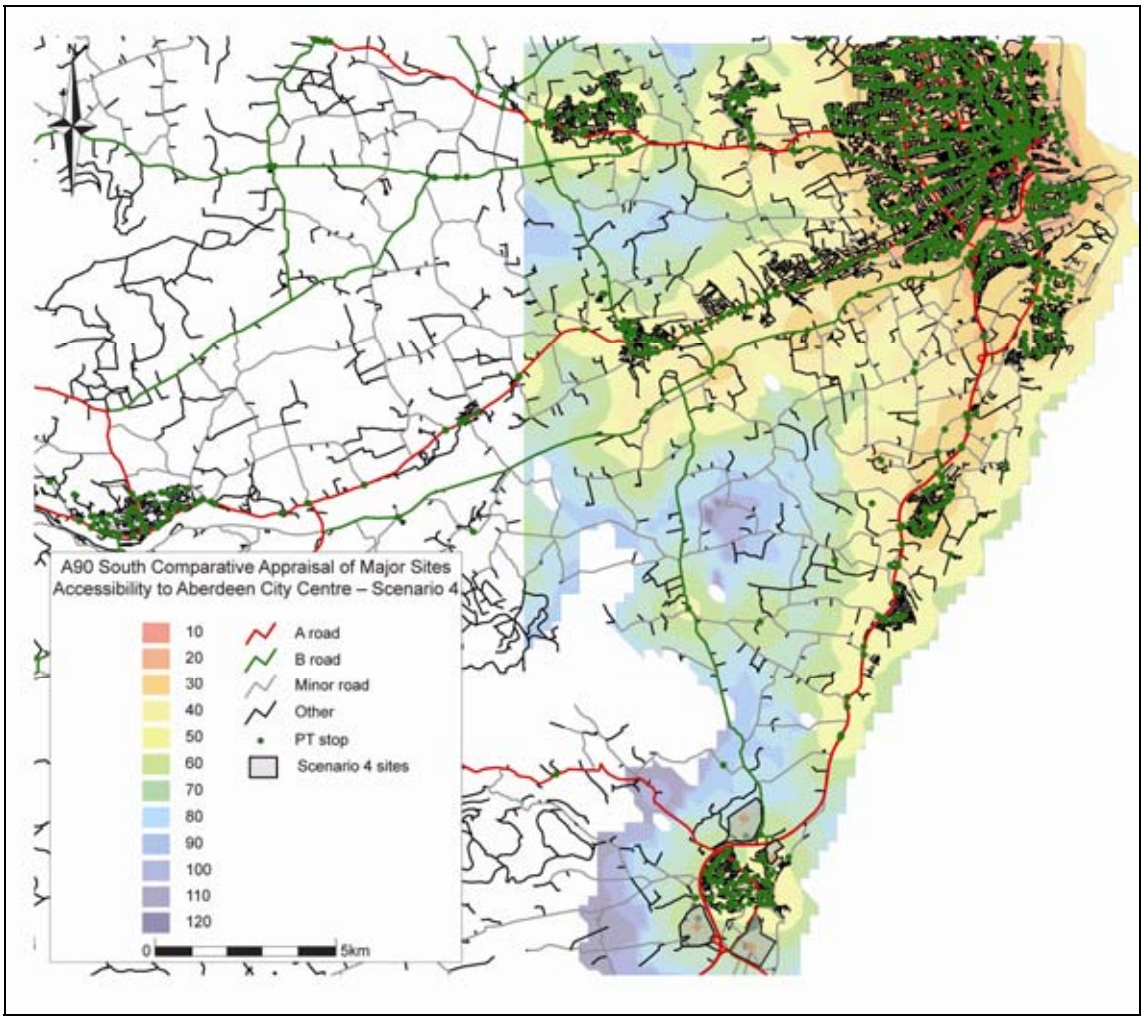

Figure D.16 : Accessibility to Aberdeen – Proposed Service Provision

As can be seen from the accessibility analysis, the bus service improvements are predicted to improve the journey times from the Mill of Forest and East Newtonleys sites by approximately 5min.

The presented accessibility analysis has excluded the influence of rail services to enable the impact of bus service improvements to be identified. It is, however, expected that rail services are likely to provide the most attractive alternative to the car for journeys to Aberdeen.

E APPENDIX E – AST TABLES

F APPENDIX F – OVERALL SUMMARY TABLE

A90 South Comparative Appraisal of Major Sites - A DPMTAG Based Study
Aberdeenshire Council
Overall Summary Table

Study Objectives

Objective 1 **Make the most efficient use of the transport network** – by movement of people and goods using existing and committed networks; locally, across boundaries, and strategically
Objective 2 **Reducing the need for people to travel** – in terms of communities to operate locally for some journeys; by reducing distance to other facilities
Objective 3 **Making sure that walking and cycling are attractive choices** – by taking cognisance where sites are accessible to facilities within an active travel range and that any natural or manmade barriers to walking or cycling movement are considered
Objective 4 **Making sure that public transport is an attractive choice** – by making best locational use of existing public transport networks and identifying where additional measures can be effectively provided

			Scenario 1 Transport Test 1	Scenario 1 Transport Test 2	Scenario 2 Transport Test 1	Scenario 2 Transport Test 2	Scenario 3 Transport Test 1	Scenario 3 Transport Test 2	Scenario 4 Transport Test 1
Descriptions	Land Use Scenario		K121 Banchory Leggart - 2544 households 840 jobs K125 Schoolhill - 1626 households 537 jobs K73 Ury - 230 households K122 Mains of Cowie - 200 households		K121 Banchory Leggart - 2544 households 840 jobs K90 West Portlethen - 1626 households 537 jobs K73 Ury - 230 households K122 Mains of Cowie - 200 households		K142 Elsick - 4170 households 1376 jobs K73 Ury - 230 households K122 Mains of Cowie - 200 households		K73 Mill of Forest - 2085 households 688 jobs K101 East Newtonleys - 2085 households 688 jobs K73 Ury - 230 households K122 Mains of Cowie - 200 households
	Transport Test		K121- 1 x access from A90 at Nigg Way, 2x local accesses from south. Bus gates at Leggart Terrace and Nigg Way K125- 2x local accesses from north, 1 from east and 1 from south	K121- 2 x access from A90 at Nigg Way and Redcraigs, 2x local accesses from south. Bus gates at Leggart Terrace and Nigg Way K125- 2x local accesses from north, 1 from east and 1 from south	K121- 1 x access from A90 at Nigg Way, 2x local accesses from south. Bus gates at Leggart Terrace and Nigg Way K90- access from A90 via Bourtreebush junction and 1 from north	K121- 2 x access from A90 at Nigg Way and Redcraigs, 2x local accesses from south. Bus gates at Leggart Terrace and Nigg Way K90- access from A90 via Bourtreebush junction and 1 from north	K142- 2 accesses from A90 via Bourtreebush junction and Newtonhill Interchange	K142- 2 accesses from A90 via Bourtreebush junction and Newtonhill Interchange with an access provided from AWPR Fastlink	K73 - 1 x access from A90 via altered A90/A92 interchange and 1 x access from Mill of Forest Road K101- 1 x access from the A92 and A957
Cumulative Impact	Daily Traffic Flow A90(T) % Change 2007 - 2023 [1]	Bridge of Dee Approach South of Charleston	0% 6%	0% 1%	0% 6%	0% 6%	-2% 20%	-3% 10%	-4% 8%
	Time Lost Due to Congestion % Change 2007 - 2023 [2]	Comparison with average hour in AM and PM peaks	4%	3%	5%	4%	3%	2%	1%
	Change in Rail Patronage & Utilisation North of Portlethen (Hourly [3]	AM Peak Northbound	17%	17%	17%	17%	15%	15%	19%
Objective 1	Making Efficient Use of the Transport Network [4 & 5]	Journey Time (mins) Cumulative Queue (metres)	19.5 6300	19.0 6600	21.8 6700	21.4 6900	29.9 7000	26.4 6200	29.4 6500
Objective 2	Reducing the Need for People to Travel - Change in Annual Vehicle Kilometres (2007 - 2023) [6]	Annual Vehicle km (Millions)	960	958	999	1,000	1,012	1,009	1,052
Objective 3	Existing Site Accessibility to Employment (No. of employment opportunities)	On Foot By Cycle	4,039 51,028	4,039 51,028	1,993 51,237	1,993 51,237	1,924 13,260	1,924 13,260	2,155 15,749
	Potential Future Site Accessibility to Employment	On Foot By Cycle	5,415 52,404	5,415 52,404	3,369 52,613	3,369 52,613	3,300 14,636	3,300 14,636	3,531 17,125
	Barriers to Active Travel Movement		River Dee A90(T) to east of Banchory Leggart Limited pedestrian / cycle network	River Dee A90(T) to east of Banchory Leggart Limited pedestrian / cycle network	River Dee A90(T) to east of Banchory Leggart Limited pedestrian / cycle network A90(T) to east of West Portlethen	River Dee A90(T) to east of Banchory Leggart Limited pedestrian / cycle network A90(T) to east of West Portlethen	A90(T) AWPR Fastlink Limited pedestrian / cycle network	A90(T) AWPR Fastlink Limited pedestrian / cycle network	A90(T) Limited pedestrian / cycle network East Newtonleys site located over 70m higher than Stonehaven town centre
	Potential Active Travel Measures		Provision of a foot / cycle bridge over the River Dee Introduction of pedestrian crossing facilities on the A90(T) Provision of connection to existing transport networks	Provision of a foot / cycle bridge over the River Dee Introduction of pedestrian crossing facilities on the A90(T) Provision of connection to existing transport networks	Provision of a foot / cycle bridge over the River Dee Introduction of pedestrian crossing facilities on the A90(T) Provision of connection to existing transport networks Provision of ped / cycle facilities as part of the grade separation of A90(T) Bourtreebush Interchange	Provision of a foot / cycle bridge over the River Dee Introduction of pedestrian crossing facilities on the A90(T) Provision of connection to existing transport networks Provision of ped / cycle facilities as part of the grade separation of A90(T) Bourtreebush Interchange	Provision of ped / cycle facilities as part of the grade separation of A90(T) Bourtreebush Interchange Introduction of underpasses in association with construction of AWPR Fastlink Provision of connection to existing transport networks	Provision of ped / cycle facilities as part of the grade separation of A90(T) Bourtreebush Interchange Introduction of underpasses in association with construction of AWPR Fastlink Provision of connection to existing transport networks	Introduction of ped crossing facilities in association with new link to Mill of Forest Road Provision of connection between site and existing transport networks via link to Mill of Forest Road Provision of connection to existing transport networks Provision of adequate PT linkage between the town centre and the site
Objective 4	Ensuring Public Transport is an Attractive Choice (Weighted Journey Time to Aberdeen City Centre) [7]	Bus Rail (Service frequency: 7am - 9am) Car	42mins 31mins (2 services) 21mins	42mins 31mins (2 services) 21mins	46mins 31mins (2 services) 22mins	46mins 31mins (2 services) 22mins	60mins 33mins (2 services) 32mins	60mins 33mins (2 services) 32mins	65mins 36mins (4 services) 40mins
	Ensuring Public Transport is an Attractive Choice (Weighted Journey Time to Westhill Employment [8]	Public Transport Car	59mins 38mins	59mins 38mins	63mins 39mins	63mins 39mins	70mins 42mins	70mins 42mins	69mins 57mins
	Ensuring Public Transport is an Attractive Choice (Average weighted distance to nearest in metres) [9]	Bus stop Rail station	65 4,830	65 4,830	65 5,220	65 5,220	100 5,000	100 5,000	350 2,500
	Potential Bus Measures [10]		Extension of Service No. 17 into Banchory Leggart site Introduction of new Portlethen town bus service to connect town with Banchory Leggart and Schoolhill sites	Extension of Service No. 17 into Banchory Leggart site Introduction of new Portlethen town bus service to connect town with Banchory Leggart and Schoolhill sites	Extension of Service No. 17 into Banchory Leggart site Introduction of new Portlethen town bus service to connect town with Banchory Leggart and West Portlethen sites	Extension of Service No. 17 into Banchory Leggart site Introduction of new Portlethen town bus service to connect town with Banchory Leggart and West Portlethen sites	Divert a proportion of Coastrider services (No.'s 107, 117 and X7) into the site. Additional buses required to reduce impact on existing services	Divert a proportion of Coastrider services (No.'s 107, 117 and X7) into the site. Additional buses required to reduce impact on existing services	Extend existing Stonehaven town bus service (Service No. 108) into Mill of Forest and East Newtonleys sites
Implementability Appraisal	Overall Feasibility of Transport Interventions		-1	-2	-1	-2	-1	-2	-1
STAG Criteria	Environment (based on physical constraints)		-2	-2	-2	-2	-1	-1	-2
	Change in Greenhouse Gas Emissions [11]	(Tonnes CO_2e)	90,668	90,040	99,547	99,668	99,473	98,650	109,611
	Safety		-1	-2	-1	-2	+2	+2	0
	Economy		-1	-1	-1	-1	-1	0	0
	Integration		+1	+1	+1	+1	0	0	+1
	Accessibility & Social inclusion		+2	+2	+2	+2	+1	+1	+2
Potential Timeframe of Implementability of Infrastructure	Phase 1 [12] Phase 2 Phase 3		Schoolhill Full Banchory Leggart Part Banchory Leggart Full	Schoolhill Full Banchory Leggart Part Banchory Leggart Full	West Portlethen Full Banchory Leggart Part Banchory Leggart Full	West Portlethen Full Banchory Leggart Part Banchory Leggart Full	Elsick Part Elsick Full	Elsick Part Elsick Full	East Newtonleys Full Mill of Forest Full

Notes:

The Appraisal has been undertaken in part using the following seven point scale of assessment which is set out in STAG:
+3 – Major benefit
+2 – Moderate benefit
+1 – Minor benefit
0 – No benefit or impact
-1 - Small negative impact
-2 - Moderate negative impact
-3 - Major negative impact

[1] - % Change in Daily Traffic Flow on A90(T) (Table 7.2 of the report titled Forecasting Transport Impacts in the A90 South Corridor, MVA, 19/02/10)
[2] - Time lost due to congestion (% change 2007 - 2023) comparison with road network operation during an average hour in the AM and PM Peak periods (Table 5.5 of the report titled Forecasting Transport Impacts in the A90 South Corridor, MVA, 19/02/10)
[3] - Change in Rail Patronage & Utilisation North of Portlethen (Hourly Passengers) (Table 7.7 of the report titled Forecasting Transport Impacts in the A90 South Corridor, MVA, 19/02/10)
[4] - Corridor S-Paramics assessment, A90 northbound AM peak period (06:30 - 09:30) between Charleston and Bridge of Dee with allowance for re-routing via Findon (see SIAS Report Ref 72376) - Maximum Journey Time shown
[5] - Maximum cordoned queue in the AM peak period (06:30 - 09:30) predicted by the S-Paramics corridor assessment with allowance for re-routing via Findon (see SIAS Report Ref TPATCDPM/72492)
[6] - Change in Annual Vehicle Kilometres: 2007 - 2023 (Millions) (Table 5.3 of the report titled Forecasting Transport Impacts in the A90 South Corridor, MVA, 19/02/10)
[7] - Journey time calculations based on total travel from centre of sites to Aberdeen City Centre (including car access to nearest rail station). Bus travel time data obtained from Accession, rail timetable information obtained (30/10/09) from http://www.nationalrail.co.uk/ and car travel time estimated using http://www.transportdirect.info/
[8] - Journey time calculations based on total travel from centre of sites to Westhill. Quickest journey time by car and public transport has been estimated using http://www.transportdirect.info/
[9] - Distance to nearest bus stop and rail station is measured from the site boundary. Only bus stops which are serviced by a minimum service frequency of 60mins have been included.
[10] - Potential Bus Measures developed based on information included in developers TA's and following initial discussions with Aberdeenshire Council PTU
[11] - Change in Annual Greenhouse Gas Emissions (Tonnes CO_2e) (Table 5.4 of the report titled Forecasting Transport Impacts in the A90 South Corridor, MVA, 19/02/10)
[12] - Ury and Mains of Cowie sites included within Phase 1 of all land use scenarios