RTS MODELLING REPORT

Strategic Option Development, Testing and Appraisal

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1. INTRODUCTION

Background

1.1 Nestrans, the North East of Scotland Transport Partnership, the successor to the original Nestrans voluntary partnership, is required by the Transport Act to draw up a statutory Regional Transport Strategy (RTS) for its region by 1st April 2007. The RTS provides the opportunity both to identify those strategic interventions that will best help to deliver the region's economic, social and environmental objectives; and to increase the pace of investment in the region's transport system.

1.2 Steer Davies Gleave were commissioned by the North East of Scotland Transport Partnership to assist in the development of the RTS. As well as strategy development, the work has involved extensive modelling using both the Aberdeen Sub-Area Model (ASAM) of the Transport Model for Scotland and an application of Steer Davies Gleave's Urban Dynamic Model developed specifically for the North East Scotland region. These models have been used together in order to assess the impacts of the proposed Regional Transport Strategy (RTS) on the region. These models each have their own strengths and have been used together to provide the outputs necessary to make an assessment of the RTS.

The Dynamic Model

1.3 As part of the strategy development stream of work, a model was developed - the Nestrans Dynamic Model.[1] The primary focus of the model was to assist in the identification and testing of ***strategic*** interventions that will best help to deliver the region's economic, social and environmental objectives as identified for the RTS. To this end the model was used to assess the strategic impacts of the RTS options against its objectives through the use of a number of measurable indicators. The model was used in a workshop and subsequently in order to develop a preferred strategy with the appropriate combinations of measures and activities.

ASAM

1.4 ASAM is a multi-modal model developed from the Transport Model for Scotland (TMfS) using the TRIPS network modelling application. It was intended to evaluate transport proposals in the Aberdeen City and Aberdeenshire area, particularly around the City and its immediate environs.

1.5 Since the initial objective of ASAM was to study the impact of the Aberdeen Western Peripheral Route (AWPR), the focus of data collection and model development is on those movements which are within the scope of this scheme. Accordingly ASAM is particularly useful for assessing the impacts of transport developments on those journeys that go into or pass through Aberdeen City. However, it is less well refined for other movements around Aberdeenshire that do not pass through Aberdeen.

[1] The NESTRANS dynamic model is based on an application of the Urban Dynamic Model, which tests strategic transport interventions, strongly linked to land use planning and to strategies for economic development

Structure of Report

1.6 This report provides a brief summary of the Nestrans Dynamic Model and the results from the various tests undertaken as part of the RTS development.

- Chapter 2 provides an overview of the ASAM model;
- Chapter 3 provides an overview of the Nestrans Dynamic Model;
- Chapter 4 provides the results of some strategic transport tests undertaken using the Nestrans Dynamic model. The results show at a high level the impact of changes in accessibility brought about by investment in transport at different levels, and how this could impact on the businesses, and social and environmental issues;
- Chapter 5 provides further detail on the way the transport schemes were modelled in the Nestrans Dynamic Model. This chapter also sets out the basis of what was assessed in ASAM
- Chapter 6 contains results of the assessment of the RTS.

2. ABERDEEN SUB-AREA MODEL (ASAM)

Introduction

2.1 The Aberdeen Sub Area Model (ASAM) is a multi-modal model developed to study options and carry out appraisal for transport proposals in the Aberdeen City and Aberdeenshire area, particularly the Aberdeen Western Peripheral Route (AWPR), which were developed as part of the "Modern Transport System (MTS)" developed by Nestrans and its constituent partners and endorsed by the Executive in 2001.

2.2 The model has been developed from the Scottish Executive/Transport Scotland's Transport Model for Scotland (TMfS) using the TRIPS network modelling application.

2.3 Since the initial objective of ASAM was to study the AWPR, the focus of data collection and model development is on those movements which are within the scope of this scheme. Therefore the model is particularly useful for assessing the impacts of transport developments on those journeys that go into or pass through Aberdeen City but is less strong for other movements around the region that do not pass through Aberdeen.

2.4 While the Dynamic Model describes the interaction of economic activity, travel and geography over time, it contains a strategic representation of the transport network. By contrast, ASAM includes a much more detailed description of the highway and public transport networks and can be used to calculate more precise estimates of the travel times (presented as generalised costs) between demand zones and the flows on particular links of the network. This allows more detailed estimates to be made of the travel benefits in terms of time savings that particular interventions may deliver.

2.5 There are though some types of intervention which are not suited to evaluation in network models such as ASAM. Also some of the proposed transport improvements included in the RTS are in parts of the area where ASAM is less well defined so would not be easy to represent and consequently not easy to derive good estimates of the effects of these schemes. It should therefore be noted that ASAM has not been used to model all of the interventions that make up the RTS package.

2.6 ASAM represents travel demand by dividing the area into demand zones. To allow data to be passed between the ASAM and the Dynamic Model (DM) the zone system for the Dynamic Model has been developed around the existing ASAM zone system. This has ensured that there is a well defined relationship between ASAM and DM.

How model outputs have been used

2.7 ASAM has been used to generate the highway and public transport travel cost matrices for the DM.

3. THE NESTRANS DYNAMIC MODEL

Introduction

3.1 Although the Nestrans Dynamic Model has much in common with land-use and transport interaction models, its scope and the technology underpinning it are quite different. Based on Steer Davies Gleave's Urban Dynamic Model, the model is a simulation of how North East Scotland might evolve over the next twenty years and how policy changes are likely to impact on the characteristics and dynamics of the region. A key feature of the model is that it allows rapid assessment of different scenarios relating to variations in the definition of the RTS options e.g. different transport measures.

3.2 This chapter provides a brief overview of the model, describing the main processes that it simulates. More detail on the mechanisms and mechanics of the Urban Dynamic Model can be found in a Technical Note contained on Steer Davies Gleave's website[2].

Scope of the Dynamic Model

3.3 The model combines conventional transport modelling techniques with models of business formation, population migration and land-use, to provide a view on how all of these factors work together and interact. Starting from a base year of 2001, it moves through simulated time in small steps, calculating at each stage how events are likely to change.

3.4 The Dynamic Model has been developed by Steer Davies Gleave using the System Dynamics modelling technology. This is a computer simulation technique concerned with replicating how complex systems evolve over time. It provides the means to model processes that are much harder to handle in traditional equilibrium models, particularly where feedback effects are concerned, such as the effect of congestion on travel conditions.

3.5 The model is built using a general simulation package called Vensim.[3] The model is "zonal", dividing the study area in to zones of varying size. In each zone the model keeps track of the population, businesses, infrastructure and the land which form the current conditions in the modelled region together with transport costs, which have been extracted from the Aberdeen Sub-Area Model (ASAM).

3.6 The model is a simulation of how the whole area is likely to evolve over the next 20 years, and shows both how transport is affected by changes and how transport interventions can influence the area.

[2] Available at http://www.steerdaviesgleave.com/pages/content/index.asp?PageID=149

[3] Developed by Ventana Systems in the US (see www.vensim.com)

Scope of the Nestrans Dynamic Model

3.7 The study area covers most of the North East of Scotland incorporating the districts of Aberdeen City and Aberdeenshire as internal model zones, and adjacent regions of Highland, Moray, Perth & Kinross and Angus as "buffer" zones.

3.8 In summary, there are:

- 111 zones covering the districts in Aberdeen City (43 zones) and Aberdeenshire (68 zones), consisting of individual Council wards used in the 2003 Council elections. This is the core area of interest.
- 4 buffer zones, designed to cover cross boundary trips to or from the area from the adjacent regions, including Highland, Moray, Perth & Kinross and Angus.

3.9 Transport provides the links between zones, and in particular is the means by which employers gain access to employees, customers and suppliers. The model covers the three key aspects of travel and explicitly models these:

- the decision about whether to travel or not;
- how far/where to travel to work, and
- the choice of mode.

3.10 The model can represent zone-to-zone travel using either a link-based network, or tables of generalised times or costs. This application of the model uses generalised times in minutes for all the modes represented – private transport (car/motorcycle), public transport (rail and bus) and active travel modes (walk/cycle).

3.11 Generalised times (gt's) contain all aspects of the journey expressed in minutes. For example, car gt's are typically a function of time in the vehicle, operating costs (i.e. fuel) and parking charges whereas a bus gt is a function of the fare paid, time on the bus, the time spent waiting for the bus to arrive, access and egress times and any interchange penalty.

3.12 The generalised times for car and public transport travel are derived from the ASAM model (combining journey times and costs of fares/travel costs), whilst the active travel mode times are inferred as a proportion of car times and actual propensity to use these modes derived from Travel to Work Census data.

3.13 Mode choice is controlled using logit models which compare the utilities of the competing modes in the dynamic model continuously through simulated time. It should be noted that small changes in generalised times can have significant impacts on mode choice. Therefore any transport interventions that are tested have been designed with the scale of the starting generalised cost in mind.

Model Dynamics

3.14 The main dynamics in the model are created via the idea of the attractiveness of each zone for different types of activity. The model monitors each zone through time, and considers how attractive it is from four points of view:

a) From the point of view of developers, who build offices and other business

premises;

b) From the point of view of house builders, who provide the housing;

c) From the point of view of businesses and employers, this includes;

- The availability of suitable premises, which are built by developers, and is a function of:
  - The availability of land;
  - The current balance of supply and demand;
  - Expectations of future growth[4].
- The ability to recruit staff - Each business needs to recruit staff, and if jobs cannot be filled this will limit the expansion of activity. The model simulates how people move in and out of employment over time, and knows the fraction of unfilled jobs at any time. High job vacancy rates will lower attractiveness, while low rates will raise it.
- Access to customers and suppliers.

d) From the point of view of households, this includes;

- The availability of suitable housing; (which depends on house builders, who will respond to:
  - The availability of land;
  - The current balance of supply and demand (i.e. vacancies); and
  - Expectations of growth.
- The availability of suitable employment - Locations with high levels of unemployment are deemed to be less attractive than those with low levels, so where jobs are easily found, net inward migration will tend to increase, and where they are not, net outward migration will tend to increase.

3.15 It is the detailed interaction between these 'actors' linked together through the accessibility provided by the transport system that produces the patterns of development and other impacts observed in the model.

Model Outputs

3.16 The Nestrans Dynamic Model provides a wealth of outputs for major "quantities" within the model. As noted elsewhere, the model is zonal with transport costs and therefore flows on an origin-destination zone basis and many of the outputs are produced by zone and can be reported at each time-step, for example a year, for which the model is run.

3.17 The role of the Nestrans Dynamic Model is to demonstrate how RTS options can contribute to the economic and social success of the region with the following forming the key indicators:

- Economic - How the labour market and business development in Aberdeen City and Aberdeenshire responds to changes in accessibility due to the development of

[4] These assumptions are, in turn, supported by recent research carried out by Steer Davies Gleave for the Department for Transport into how transport affects business location decisions. Interviews with property developers in the north east confirmed that their main priorities are the cost of land, the rents they can achieve and the prospects for growth in rents.

the transport system and land use strategies during the forecast period. Development of the transport system can help to unlock the potential of some sites in terms of providing better access to a workforce;

- Environmental - How the development of the transport system affects the travel to work patterns, mode shares and aggregate car miles; and
- Social Inclusion - It also looks at the social success of the region. This is set against a background where there are particular areas that currently have significant low accessibility to public facilities (e.g. university and hospital) so to improve the social inclusions of those areas over the future years.

3.18 The incremental change of these indicators as a result of implementation of the RTS options can be used to interpret how well the RTS can meet its objectives over the period to 2021.

3.19 The model results presented in the next chapter are ones that allow comparison of different RTS options in the context of how they affect the above factors. The model can also provide a range of other indicators including estimates of unemployment rates[5], job vacancy rates and the number of people who are employed in different industries. For transport, it can also provide the travel to work trip matrix, by mode and person type.

3.20 Please note that the Nestrans Dynamic Model is strategic in nature, thus very local or small transport interventions are represented in a simplistic manner, if at all. The results provided in the remainder of this report should be considered with this in mind. The model demonstrates the type of behaviour and the scale of change that may result from transport interventions. It should be considered alongside more detailed analysis using tools such as micro-simulation or network assignment models such as ASAM.

[5] The model's unemployment rates tend to be higher than those published by ONS, for two reasons. First, ONS figures are based on claimant counts, not all the unemployed; and second, they calculate the fraction of the population of working age that is out of work, whereas the model calculates the fraction of the workforce.

4. STRATEGIC TESTING WITH DYNAMIC MODEL AND ASAM

Introduction

4.1 This chapter sets out the basis and results from the modelling undertaken using the Dynamic Model and ASAM to support the development and assessment of the RTS.

RTS Objectives

4.2 The Nestrans Regional Transport Strategy 2006-2021 Option Generation Consultation proposed six different packages of complementary measures and activities. These packages aim to best meet the strategy's objectives as outlined below.

4.3 The RTS contains four strategic objectives and twelve objectives as indicated below:

Strategic Objective 1: Economy

To enhance and exploit the north east's competitive economic advantages, and reduce the impacts of peripherality.

i. To make the movement of goods and people within the north east and to/from the area more efficient and reliable,

ii. To improve the range and quality of transport to/from the north east to key business destinations,

iii. To improve connectivity within the north east, particularly between residential and employment areas,

Strategic Objective 2: Accessibility, Safety and Social Inclusion

To enhance choice, accessibility and safety of transport, particularly for disadvantaged and vulnerable members of society and those living in areas where transport options are limited.

iv. To enhance travel opportunities and achieve sustained cost and quality advantages for public transport relative to the car,

v. To reduce the number and severity of traffic related accidents and improve personal safety and security for all users of transport,

vi. To achieve increased use of active travel and improve air quality as part of wider strategies to improve the health of north east residents,

Strategic Objective 3: Environment

To conserve and enhance the north east's natural and built environment and heritage and reduce the effects of transport on climate and air quality.

vii. To reduce the proportion of journeys made by cars and especially by single occupant cars,

viii. To reduce the environmental impacts of transport, in line with national targets,

ix. To reduce growth in vehicle kilometres travelled,

Strategic Objective 4: Spatial Planning

To support transport integration and a strong, vibrant and dynamic city centre and town centres across the north east.

x. To improve connectivity to and within Aberdeen City and Aberdeenshire towns, especially by public transport, walking and cycling,

xi. To encourage integration of transport and spatial planning and improve connections between transport modes and services, and

xii. To enhance public transport opportunities and reduce barriers to use across the north east, especially rural areas.

Strategic Optioneering with the Dynamic Model

4.4 The six initial RTS option packages, as described in the RTS options paper, were:

- **Low Cost (Low)** – Measures and activities that require relatively low levels of revenue and capital funding. This would approximate to a continuing level of expenditure for transport broadly equivalent to present levels of funding.
- **Medium Cost Economy (MEc)** – This package would require an increased level of expenditure on transport over the life of the strategy, to relatively medium levels of revenue and capital funding. Options are included that would achieve objectives i to iii above, yielding benefits with an emphasis towards relieving congestion, boosting the north east's economy and infrastructure-based solutions.
- **Medium Cost Accessibility and Social Inclusion (MSoc)** - This package also requires relatively medium levels of revenue and capital funding of a scale broadly equivalent to the other Medium Cost packages. Schemes are included which would best achieve objectives iv to vi in the previous table, yielding benefits with an emphasis towards social inclusion such as public transport measures, making travel more affordable and favouring socially excluded sectors of population or areas.
- **Medium Cost Environmental (MEnv)** - A third package, also requiring relatively medium levels of revenue and capital funding similar to other Medium Cost packages. Focus is on schemes that would best achieve objectives vii to ix above, yielding benefits with an emphasis towards the environment, including measures to encourage modal shift and active travel.
- **Medium Cost Spatial Planning (MPlan)** – a further package requiring relatively medium levels of funding similar to other Medium Cost packages. Emphasis is on schemes which best achieve objectives x to xii above, yielding benefits for connectivity within and between settlements in the north east, and
- **High Cost (High)** – A package, which combines many of the schemes within the medium cost scenarios and contains some measures and activities requiring a relatively high level of revenue and capital funding. Many of the schemes within this category are highly expensive and could only be considered feasible if taking a very large proportion of all transport expenditure within the north east or in conjunction with new revenue streams, but have been included to ascertain their relative merits and acceptability.

4.5 All of these packages were assessed relative to a 'Reference Case'. The Reference Case comprised measures and activities which already have a relatively high degree of commitment and are expected be part of the North East's transport network early within the strategy's life. It was agreed that the Reference Case would include the Aberdeen Western Peripheral Route (AWPR), upgrades to the road network which are committed and public transport schemes anticipated to be implemented before 2011. It should be noted that elements contained in the Reference case are expected to be delivered in the early part of the life of the RTS.

4.6 In the different packages, specific measures and activities (or types of intervention) are combined and allocated. A comprehensive table was also provided in the RTS Options report which contains the interventions and their relevant packages.

4.7 It should be noted that the model developed here is a ***strategic*** model and so not all of the measures and interventions listed are represented within the modelled packages. The measures with a very local impact or with minimal direct spatial impact are recognised as contributing to the overall strategy, but are not possible to include within a strategic model.

Specified Runs

4.8 The six initial options were used as a basis for a workshop held on 18 September 2006 with members of the Nestrans board to assess the options against the RTS objectives and results presented demonstrating impact on a number of identified indicators. A process was then followed by which changes were made to those packages, the model re-run and the results inspected, with this process continuing as the group moved towards a preferred option.

4.9 In all, over 40 options and variants were tested subsequent to the workshop; not all were fully developed, however, as in some cases it was evident from initial results that the outcomes would be dominated (that is, bettered on all criteria) by one or more other options. A full list of those that were assessed are reported in Appendix C; details of the main six options together which what emerged as a preferred package are shown in table 4.1 overleaf.

4.10 It should be noted that all modelled options contain AWPR and use the same land use assumptions as ASAM.

TABLE 4.1 KEY SCENARIOS

ID	Run Name	Additional Transport Schemes
4	09 WPR Upgrade + ASAM Land (T00)	
5	Low Cost Package (T01)	- Bus priority/ bus lanes - On key radial approaches to city: A90 (northern approach), Anderson drive, A947, A96, A93, and A90 (southern approach) and in key locations within Aberdeenshire - Bus Partnerships - secure high quality bus services through the establishment of new partnership agreements with bus operators and Punctuality Improvement Partnerships
6	Medium Cost Economy Package (T02)	- Aberdeen Airport Surface Connections - Multimodal Interchange at airport terminal. Key components include new railway link and branded express bus service between Aberdeen Airport and city centre / other key locations - Inner city bus service – free low-emission city centre service - Mass transit (Micro Light Tram) - Promote and support introduction of system in Aberdeen's city centre - Pedestrian linkages between Guild Street and Union Street - Escalator - Strategic roads (capacity improvements) - A90 dualling (Ellon to Peterhead), A96 Complete Dualling (in partnership HITRANS), Haudigan Roundabout, Bridge of Dee, Anderson Drive (dualling on specific sections), Third Don Crossing, Stonehaven/Banchory/Inveruie - Travel plans - promote and support the development of travel plans for individuals, businesses, health care, and schools - Demand Management - consider the appropriateness of introducing measures that will control traffic demand (including urban parking surcharges, workplace parking controls, local congestion charging)
7	Medium Cost Accessibility and Social Inclusion Package (T03)	- Aberdeen Airport Surface Connections - Multimodal Interchange at airport terminal. Key components include new railway link and branded express bus service between Aberdeen Airport and city centre / other key locations - Inner city bus service – free low-emission city centre service - Mass transit (Guided Bus)- Promote and support introduction of system on appropriate radial routes to avoid congestion hotspots around Aberdeen - Bus priority/ bus lanes - On key radial approaches to city: A90 (northern approach), Anderson drive, A947, A96, A93, and A90 (southern approach) and in key locations within Aberdeenshire - Parking Strategy for north east - Develop and implement framework for managing supply / demand for parking, including pricing and enforcement - Travel plans - promote and support the development of travel plans for individuals, businesses, health care, and schools - Bus Quality Contracts - secure high quality bus services through the introduction of formal contracts with bus operators that will legally bind them into prescribed levels of bus service provision
8	Medium Cost Environmental Package (T04)	- Inner city bus service – free low-emission city centre service - Mass transit (Micro Light Tram) - Promote and support introduction of system in Aberdeen's city centre - Mass transit (Guided Bus) - Promote and support introduction of system on appropriate radial routes to avoid congestion hotspots around Aberdeen - Bus priority/ bus lanes - On key radial approaches to city: A90 (northern approach), Anderson drive, A947, A96, A93, and A90 (southern approach) and

		in key locations within Aberdeenshire - Parking Strategy for north east - Develop and implement framework for managing supply / demand for parking, including pricing and enforcement - Travel plans - promote and support the development of travel plans for individuals, businesses, health care, and schools - Bus Quality Contracts - secure high quality bus services through the introduction of formal contracts with bus operators that will legally bind them into prescribed levels of bus service provision - Demand Management - consider the appropriateness of introducing measures that will control traffic demand (including urban parking surcharges, workplace parking controls, local congestion charging)
9	Medium Cost Spatial Planning (T05)	- Aberdeen Airport Surface Connections - Multimodal Interchange at airport terminal. Key components include new railway link and branded express bus service between Aberdeen Airport and city centre / other key locations. - Inner city bus service – free low-emission city centre service - Mass transit (Micro Light Tram) - Promote and support introduction of system in Aberdeen's city centre - Mass transit (Guided Bus)- Promote and support introduction of system on appropriate radial routes to avoid congestion hotspots around Aberdeen - Pedestrian linkages between Guild Street and Union Street - Escalator - Bus priority/ bus lanes - On key radial approaches to city: A90 (northern approach), Anderson drive, A947, A96, A93, and A90 (southern approach) and in key locations within Aberdeenshire - Parking Strategy for north east - Develop and implement framework for managing supply / demand for parking, including pricing and enforcement - Travel plans - promote and support the development of travel plans for individuals, businesses, health care, and schools - Bus Partnerships - secure high quality bus services through the establishment of new partnership agreements with bus operators and Punctuality Improvement Partnerships - Demand Management - consider the appropriateness of introducing measures that will control traffic demand (including urban parking surcharges, workplace parking controls, local congestion charging)
10	High Cost Package (T06)	- Aberdeen Airport Surface Connections - Multimodal Interchange at airport terminal. Key components include new railway link and branded express bus service between Aberdeen Airport and city centre / other key locations. - Aberdeen Cross Rail - Inner city bus service – free low-emission city centre service - Mass transit (Micro Light Tram) - Promote and support introduction of system in Aberdeen's city centre - Mass transit (Guided Bus)- Promote and support introduction of system on appropriate radial routes to avoid congestion hotspots around Aberdeen - Pedestrian linkages between Guild Street and Union Street - Escalator - Rail extension Ellon - Introduce line and services - Rail extension Peterhead - Introduce line and services - Strategic roads (capacity improvements) - A90 dualling (Ellon to Peterhead), A96 Complete Dualling (in partnership HITRANS), Haudigan Roundabout, Bridge of Dee, Anderson Drive (dualling on specific sections), Third Don Crossing, Stonehaven/Banchory/Inveruie - Bus priority/ bus lanes - On key radial approaches to city: A90 (northern approach), Anderson drive, A947, A96, A93, and A90 (southern approach) and

		in key locations within Aberdeenshire - Parking Strategy for north east - Develop and implement framework for managing supply / demand for parking, including pricing and enforcement - Travel plans - promote and support the development of travel plans for individuals, businesses, health care, and schools - Bus Partnerships - secure high quality bus services through the establishment of new partnership agreements with bus operators and Punctuality Improvement Partnerships - Bus Quality Contracts - secure high quality bus services through the introduction of formal contracts with bus operators that will legally bind them into prescribed levels of bus service provision - Demand Management - consider the appropriateness of introducing measures that will control traffic demand (including urban parking surcharges, workplace parking controls, local congestion charging)
27	Run E00 T02 Econ Enhanced (New Park Charge 1 min)	- Aberdeen Airport Surface Connections - Multimodal Interchange at airport terminal. Key components include new railway link and branded express bus service between Aberdeen Airport and city centre / other key locations. - Aberdeen Cross Rail - Inner city bus service – free low-emission city centre service - Mass transit (Micro Light Tram) - Promote and support introduction of system in Aberdeen's city centre - Mass transit (Guided Bus)- Promote and support introduction of system on appropriate radial routes to avoid congestion hotspots around Aberdeen - Pedestrian linkages between Guild Street and Union Street - Escalator - Super Bus - Strategic roads (capacity improvements) - A90 dualling (Ellon to Peterhead), A96 Complete Dualling (in partnership HITRANS), Haudigan Roundabout, Bridge of Dee, Anderson Drive (dualling on specific sections), Third Don Crossing, Stonehaven/Banchory/Inveruie - Bus priority/ bus lanes - On key radial approaches to city: A90 (northern approach), Anderson drive, A947, A96, A93, and A90 (southern approach) and in key locations within Aberdeenshire - Parking Strategy for north east - Develop and implement framework for managing supply / demand for parking, including pricing and enforcement - Travel plans - promote and support the development of travel plans for individuals, businesses, health care, and schools - Bus Partnerships - secure high quality bus services through the establishment of new partnership agreements with bus operators and Punctuality Improvement Partnerships

Key Scenarios

4.11 In this section we provide results from two scenarios, these are:

- the Reference Case run referred to as T00 (Run 4), which includes the WPR transport investment and other committed highway and public transport schemes., and
- The preferred strategy which was developed from the Medium Cost Economy package and is referred to as Run 27.

4.12 The preferred strategy was found to perform best against the economic, environmental and social objectives that were developed interactively in the September 18 workshop. The economic and environmental objectives were SMART in that they specified quantitative targets for employment and car kilometres as a proxy for emissions.

4.13 The level of parking charge tested in run 27 was revised from that assumed in the previously modelled six initial options. The parking charge was modelled as a means of modelling constraints on car travel. However the original charge, which was set at either £0.60 or £1.20 depending on the destination of the car trip was found to be a far greater component of the generalised time than what was deemed to be realistic. Therefore the parking charge was reduced to £0.08 for all trips into Aberdeen, or 1 minute[6].

4.14 Results of these model runs now follow, a fuller set of results for the six initial options as well as run 27, the preferred option, can be found in Appendix D. The results focus on the sustainable future position and so correspond to the year 2021 at the end of the RTS period. The impacts of the options for the following indicators are reported in turn:

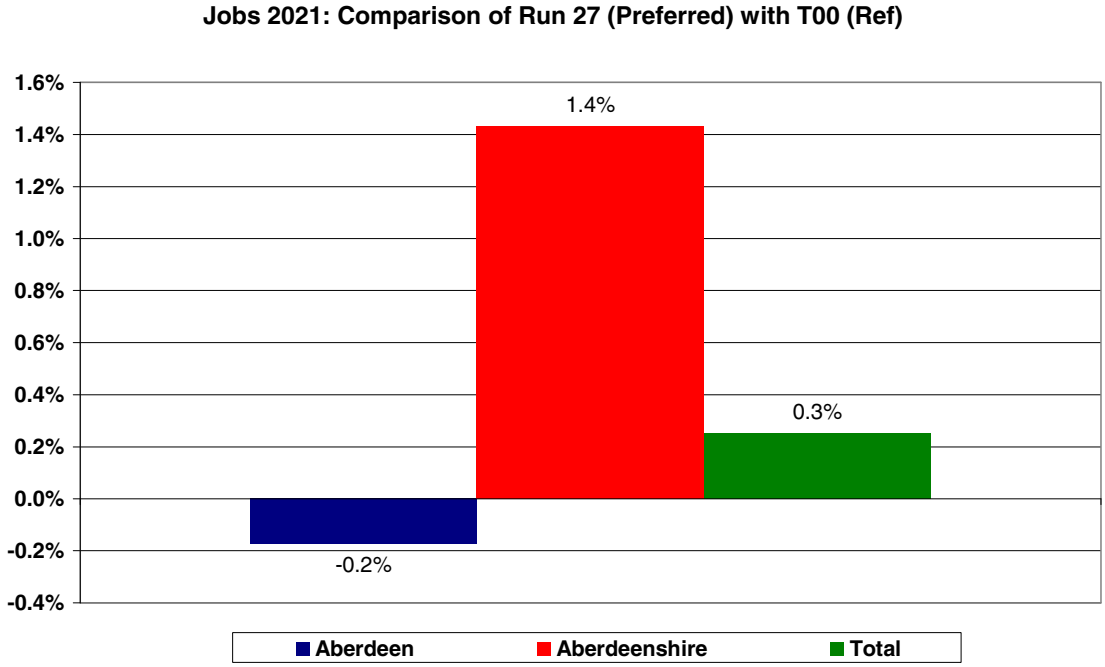
- Economic
  - Employment (jobs and jobs filled),
- Environmental
  - Mode shares,
  - Car miles,
  - Average distance travelled,
- Social Inclusion
  - Accessibility to public services, and
  - Accessible jobs.

[6] We have assumed a Value of Time (VoT) of £4.80 per hour which means that £0.08 charge is equivalent to 1 minute of generalised time.

Economic Indicators

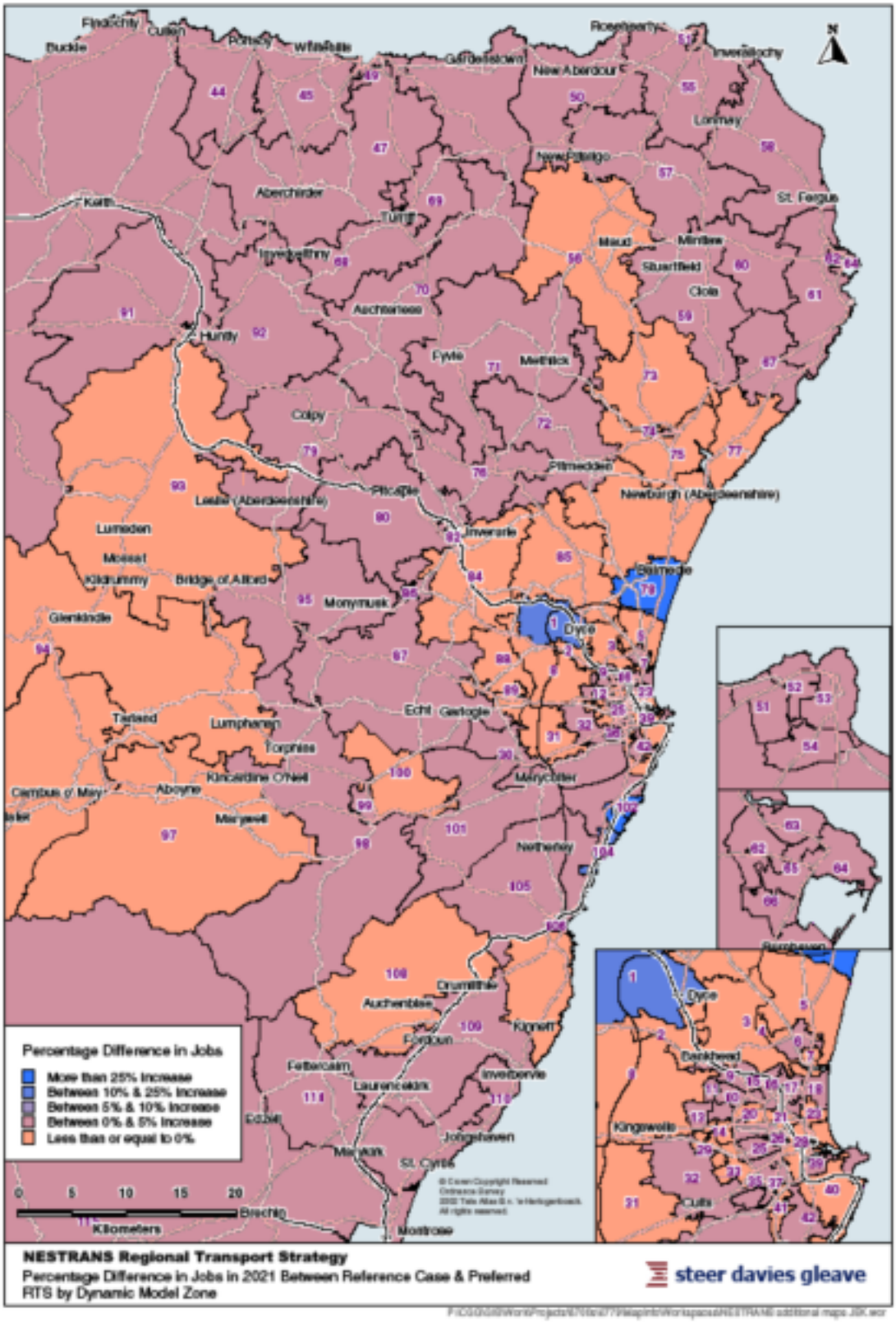
4.15 Figure 4.1 shows the job changes in the preferred option, run 27, as compared with the reference case, run 4. Run 27 shows insignificant changes in the city area, however, there is a growth of 1.4% of jobs in Aberdeenshire which is mainly in the zones adjacent to Aberdeen City and the AWPR.

FIGURE 4.1 TOTAL JOBS 2021 – COMPARISON WITH REFERENCE CASE



4.16 The thematic map overleaf shows these changes at a zonal level. There is strong growth in jobs in the periphery of Aberdeen city zones (esp. the Dyce Airport zones) and the Aberdeenshire zones.

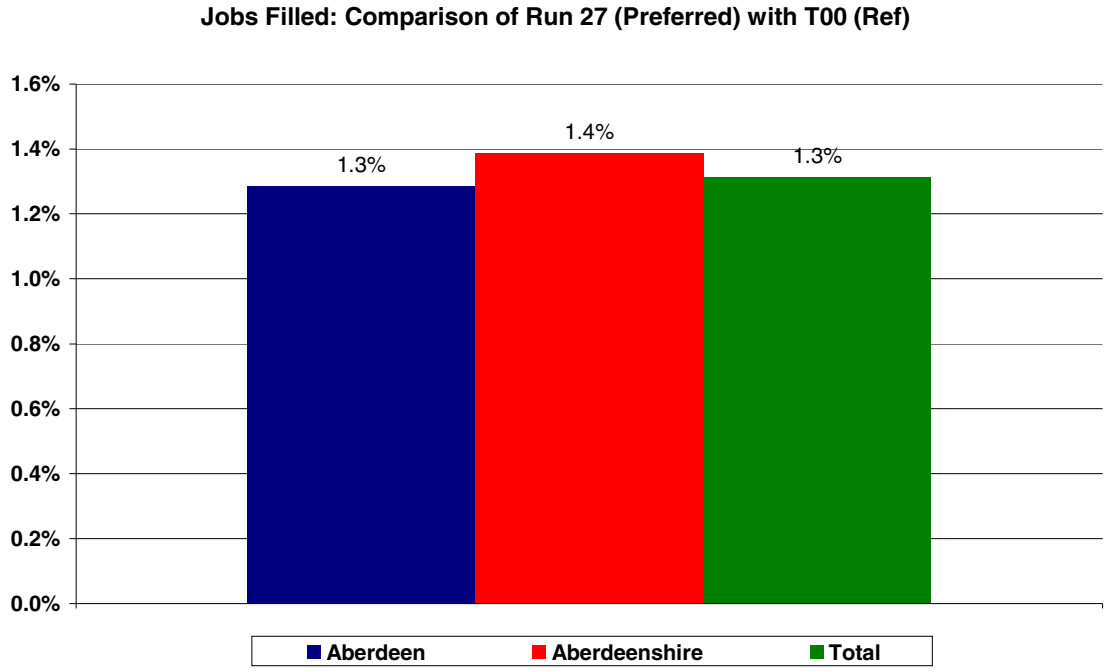
FIGURE 4.2 PERCENTAGE DIFFERENCE IN JOBS IN 2021 BETWEEN REFERENCE CASE & PREFERRED RTS BY DYNAMIC MODEL ZONE



4.17 Not all jobs are filled however; some remain vacant, which could be because people cannot access them or the region does not have the workforce with the skills to service those jobs. Improvements in the transport system can act to reduce vacancy rates as improved accessibility can bring jobs "closer" and also attract people to the region. Therefore vacancy rates can be reduced and this is a positive benefit to the region's competitive position.

4.18 Figure 4.3 shows the job filled changes compared to the Reference Case. Runs 27 and 4 both show an increase in jobs filled in the city, the county and the modelled area as a whole of approximately 1.3% showing that the RTS benefits the regional economy.

FIGURE 4.3 JOB FILLED 2021: COMPARISON WITH REFERENCE CASE



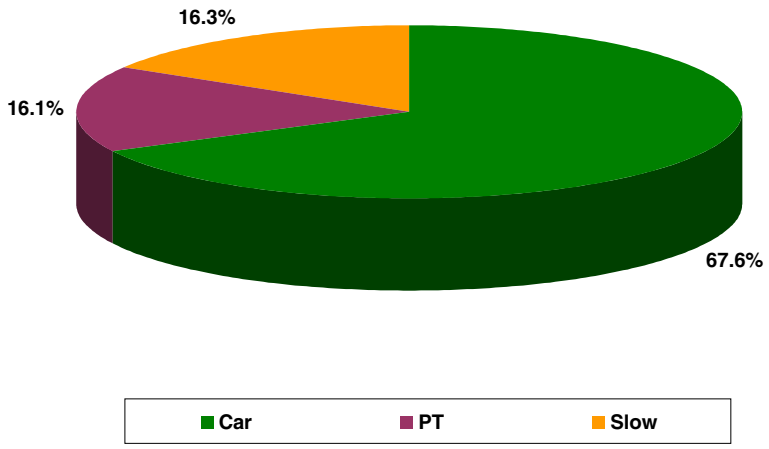
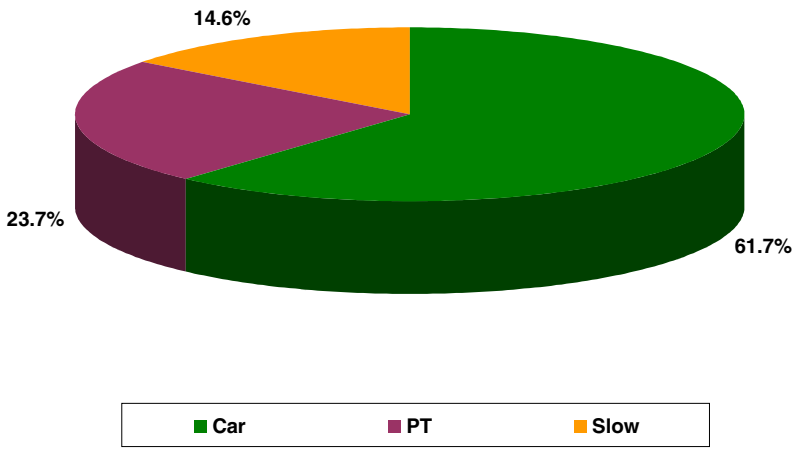
Environmental Indicators

4.19 In this analysis we used three indicators to assess the success of the RTS packages in meeting the environmental objectives of the RTS; mode shares, average distance travelled and car miles.

4.20 Table 4.2 shows mode shares for both the reference case and run 27 for the Aberdeen City area. The car share is reduced from 67.6% in the Reference Case (Run 4) to 62% by encouraging a shift to public transport (+7% in PT share). The non-mechanised mode share (walk and cycle) is also reduced by around 2%, which is largely due to the improvement in the public transport provision.

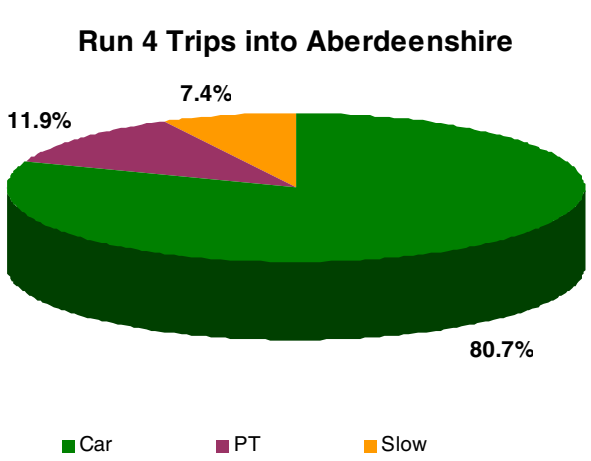
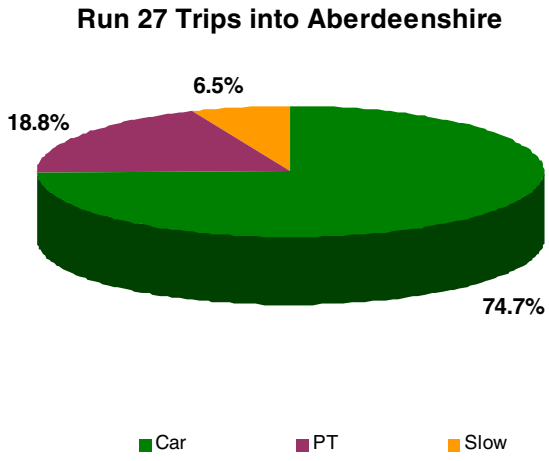
4.21 These results indicate that the RTS packages in run 27 are able to induce a transfer of journeys to Aberdeen city centre from car to public transport. This is due to a combination of an improvement in public transport provision and the parking charge operating in Aberdeen city centre which makes travel into the city centre more expensive.

TABLE 4.2 COMPARISON OF MODE SHARES FOR JOURNEYS INTO ABERDEEN CITY

Reference Case (Run 4): Trips into Aberdeen City	Preferred Option (Run 27): Trips into Aberdeen City
	

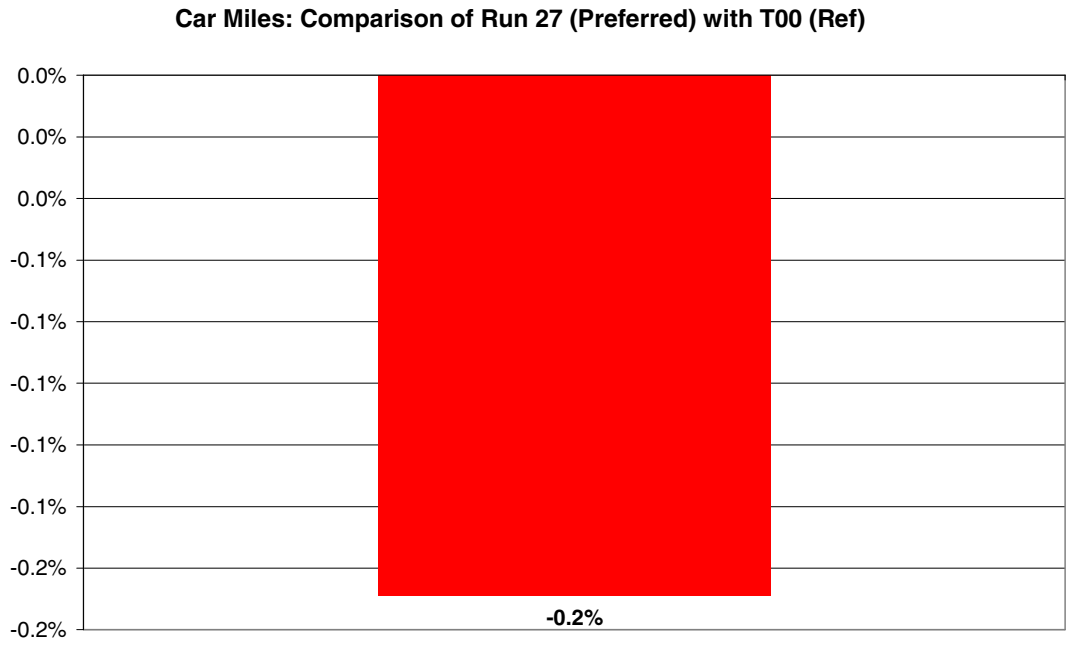
4.22 Looking outside the city centre and into the more rural areas of Aberdeenshire where car is more dominant as the favoured mode Table 4.3 overleaf shows that the preferred option induces a reduction in the car mode share by 6% (i.e. from 81% in Run 4 to 75%) with more people travelling by public transport (+7%). This will be partly down to the parking charges that have been introduced in some of the regional centres but also due to some public transport improvements on some corridors.

TABLE 4.3 COMPARISON OF MODE SHARES FOR JOURNEYS INTO ABERDEENSHIRE

Reference Case (Run 4): Trips into Aberdeenshire	Preferred Option (Run 27): Trips into Aberdeenshire
	

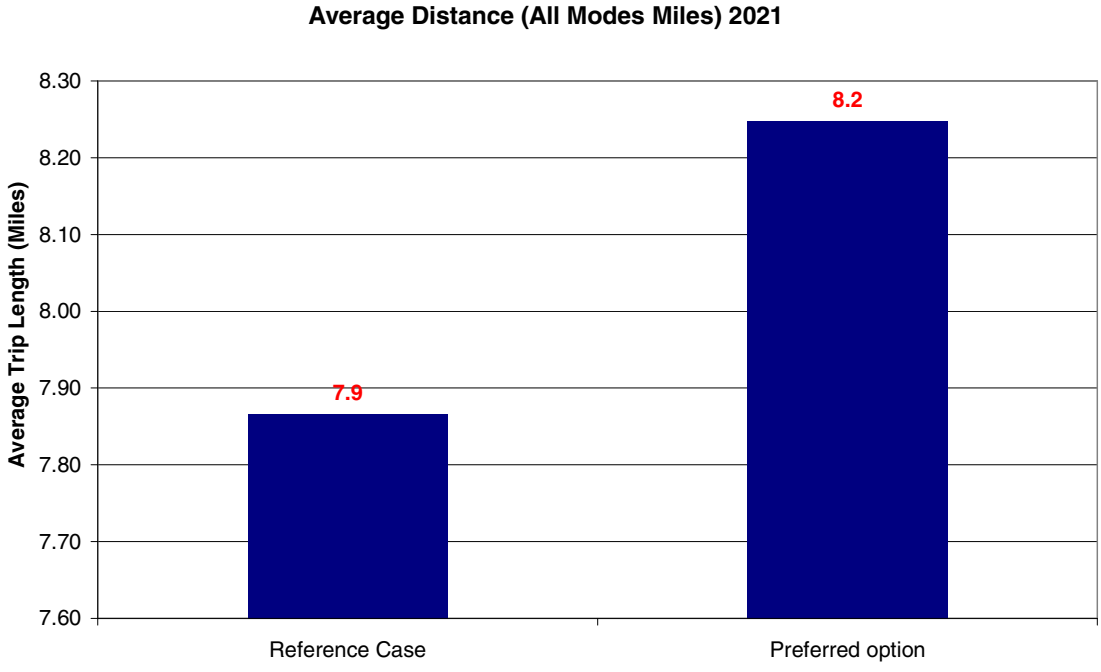
4.23 The total change in car miles as compared to the Reference Case is shown in Figure 4.4. The preferred RTS option (Run 27) reduces the car miles in the order of 0.2% (or a reduction of some 4,000 miles), which goes some way to meet environmental objectives.

FIGURE 4.4 CAR MILES COMPARISON WITH REFERENCE CASE IN 2021



4.24 Finally, Figure 4.5 shows the average travelling distances for all modes. This shows that Runs 27 predicts relatively longer travelling distances compared to the reference case. The results reflect the fact that Run 27 increases both the number of jobs and the opportunities for people to access jobs further away through improved accessibility.

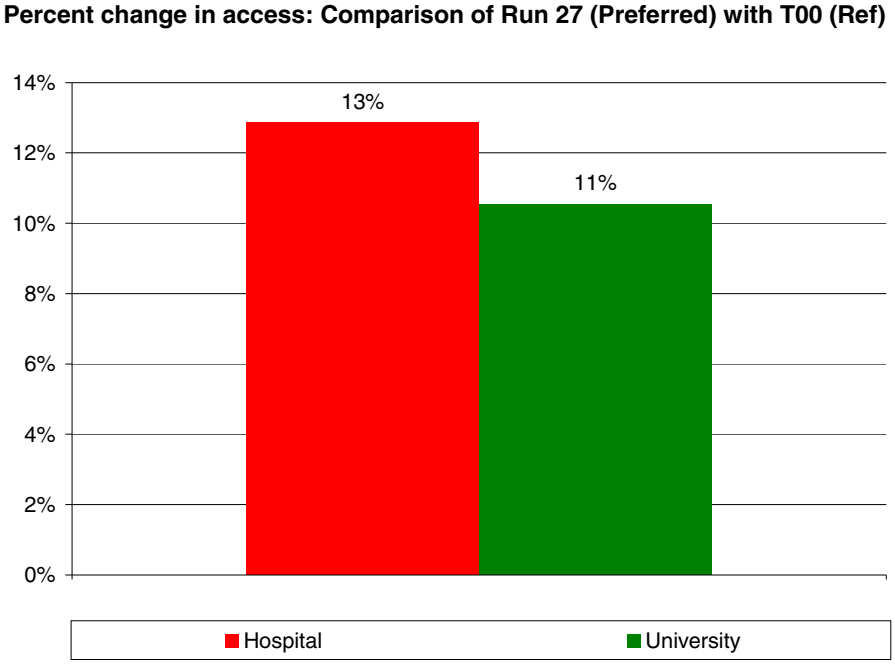
FIGURE 4.5 COMPARISON OF THE AVERAGE TRAVEL DISTANCES (MILES) FOR ALL MODES



Social Inclusion Indicators

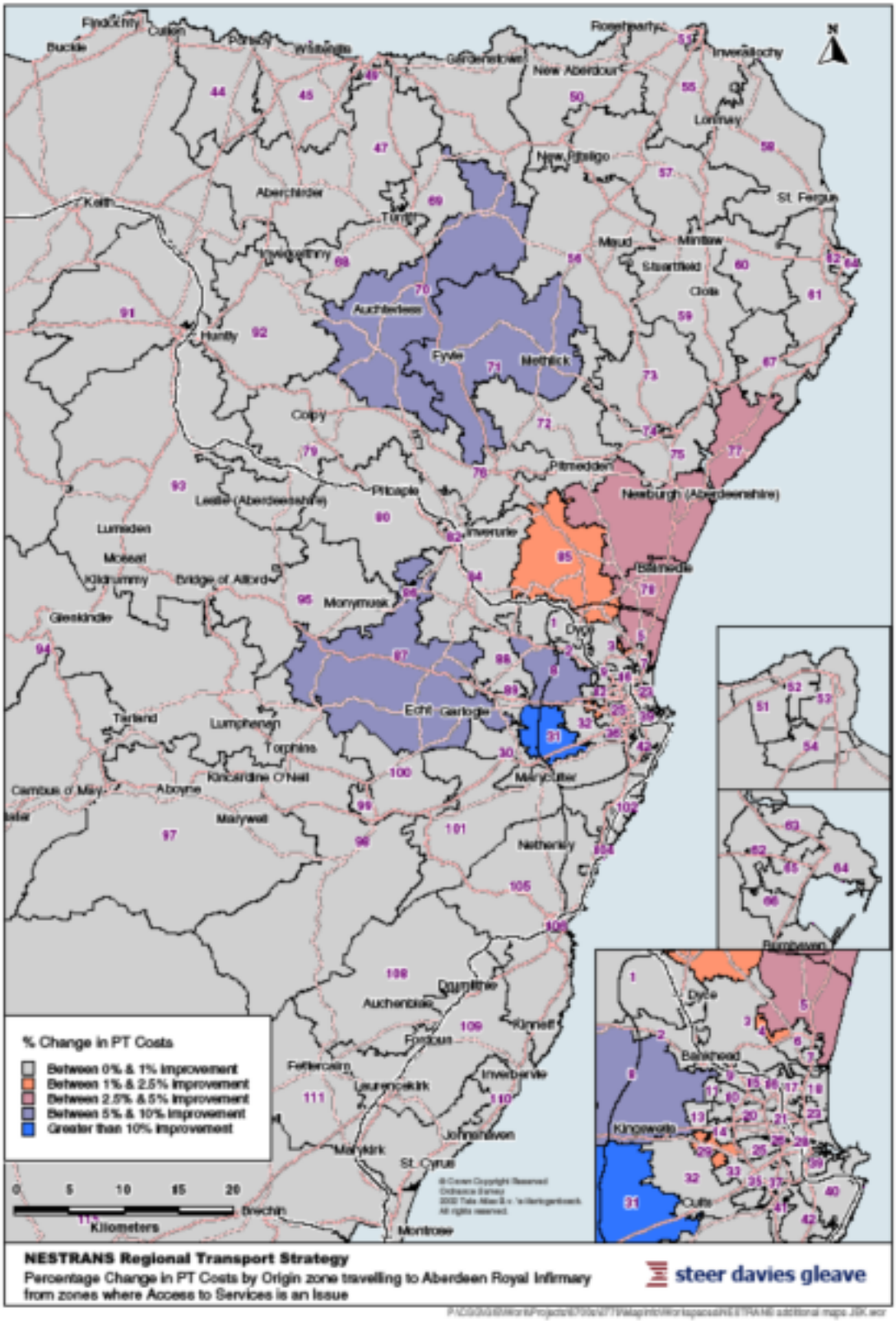
4.25 The changes in accessibility to the Aberdeen Royal Infirmary and University are shown in Figure 4.6. The preferred option (Run 27) shows an increase in the proportion of people who can access these sites due to improved accessibility provided through the transport strategy.

FIGURE 4.6 PERCENTAGE CHANGE IN ACCESSIBILITY.



4.26 To further examine the changes between the Reference Case and our preferred RTS (Run 27), a direct comparison between the public transport improvements to the hospital is provided at the zonal level overleaf. Figure 4.7 shows that small improvements in accessibility to the hospital apply to most areas although the greatest are for residents around the edge of the city.

FIGURE 4.7 ACCESSIBILITY TO HOSPITAL IN RTS PREFERRED OPTION COMPARED TO THE REFERENCE CASE



Model Conclusions

4.27 The main conclusion is that from the key runs tested in the Nestrans dynamic model, it was found that Run 27 offered the best results against the identified indicators and should therefore be developed as the Preferred Scenario for the Regional Transport Strategy. Compared to the Reference Case (Run 4), this model run provides positive returns against each of the key RTS objectives. The main indicators of the model results from Run 27, including:

- **Economy:** produce more jobs and jobs filled in the study area than the Reference Case by stimulating business activity, unlocking land for business, reducing vacancy rates and increasing the available workforce;
- **Environment:** reduce car use (reflected by car miles' reduction) through the improvement in public transport provision, selected highway improvements and car parking policy which encourages more travel by public transport; and
- **Social Inclusion:** improve the accessibility to Foresterhill hospital and Aberdeen University for residents of the region.

5. MODELLING OF THE PREFERRED STRATEGY IN THE DYNAMIC MODEL

5.1 The table below shows the list of schemes modelled using the Nestrans Dynamic Model as part of the preferred package, Run 27. Please note however that since the preferred strategy for the RTS was identified using the Dynamic Model in model in November 2006, the package of options has been further modified. Further there were other components of the strategy that were not modelled due to their scale, for example schemes with a small local impact. More details of the assumptions used in the Dynamic Model are included in Appendix B.

TABLE 5.1 SCHEMES MODELLED IN RUN 27

No.	Option	Mode	Timescale	Description
1	AWPR	Highway		AWPR
2	Opt21	PT	Long	Aberdeen Airport Surface Connections - Multimodal Interchange at airport terminal. Key components new railway link and branded express bus service between Aberdeen Airport and city centre / other key locations.
3	Opt23	PT	Medium	Aberdeen CrossRail
4	Opt29	PT	Short	Inner city bus service – free low-emission city centre service
5	Opt30	PT	Long	Mass transit (Micro Light Tram) - Promote and support introduction of system in Aberdeen's city centre
6	Opt32	PT	Medium	Mass transit (Guided Bus)- Promote and support introduction of system on appropriate radial routes to avoid congestion hotspots around Aberdeen
7	Opt34	Walk	Medium	Pedestrian linkages between Guild Street and Union Street – Escalator
8	Opt38	PT	Medium	Super Bus
9	Opt40	HW	Short	Strategic roads (capacity improvements on key approaches to the city).
10	Opt44	PT	Short	Bus priority/ bus lanes - On key radial approaches to city A90 (northern approach), Anderson drive, A947, A96, A93, and A90 (southern approach) and in key locations within Aberdeenshire
11	Opt47	HW	Short	Parking Strategy for north east - Develop and implement framework for managing supply / demand for parking, including pricing and enforcement
12	Opt59	PT	Medium	Travel plans - promote and support the development of travel plans for individuals, businesses, health care, and schools
13	Opt62	PT	Medium	Bus Partnerships - secure high quality bus services through the establishment of new partnership agreements with bus operators and Punctuality Improvement Partnerships

5.2 It was not possible to specify actual schemes such as a dual carriageway, in the modelling of Option 40. The dynamic model required inputs on expected changes in travel times between zones based on planned / proposed improvements to the infrastructure connecting these zones. The inputs to the model therefore represented improvements on the A90 north of Aberdeen into the city, on the A96 into the city and on the A90 south of the city. As in most cases junctions and other bottlenecks cause time delays, the journey time savings can be regarded as coming (principally) from enhancements at key junctions on these parts of the network.

Options included in draft RTS

5.3 Some additional road schemes were included in the Draft RTS published in December 2006. These were identified by Nestrans as important road safety schemes which would not add capacity and hence would not affect journey times. The impacts of these schemes were therefore not assessed using the Dynamic Model.

Options modelled in ASAM

5.4 Following the publishing of the Draft RTS, the package of options was finalised and subsequently modelled using ASAM. The schemes that have been represented in ASAM are shown in the table below. It should be noted that Schemes 1 and 2 in the following table were not included in the DUM modelling; however, it was taken to be reasonable that schemes intended to achieve safety improvements which did not increase road capacity would not increase car miles or affect employment, and that any social inclusion impacts would be positive. A description of the schemes modelled in ASAM can be found in Appendix A.

TABLE 5.2 SCHEMES MODELLED IN ASAM

ID	Description	Primary Mode	Timescale	Option No.
1	Haudagain Junction Improvements - Capacity Improvements	HW	Short	Opt 40[7]
2	Access to Aberdeen from the South - Capacity Improvements	HW	Short	Opt 40[8]
3	Rail * Increased Frequency of Aberdeen Crossrail	PT	Medium	Opt 23/35/36
4	Bus Improvements * Bus Priority	PT	Short	Opt 44
5	Bus Improvements - Mass Transit Options - Guided Bus	PT	Medium	Opt32
6	Bus Improvements - Banchory Park and Ride Site	PT	Short	Op 25
7	Bus Improvements * Super Bus	PT	Medium	Opt 38
8	Transport Interchange - City Centre Shuttle Bus	PT	Short	Opt 29
9	Airport Surface Connections * Express Bus Service	PT	Short	Opt 21
10	Airport Surface Connections * Dyce Shuttle	PT	Short	Opt 21
11	Changing Choices through Incentives and Partnerships * Bus Fares	PT	Medium	Opt 61
12	Parking Strategy	HW	Short	Opt 47

5.5 Because ASAM is a highway model, a number of public transport and slow mode schemes that were included in the last model run of the urban model have not been represented. These are as follows:

[7] This specific project can be regarded as an element in Option 40, but not the complete Option.

[8] This specific project can be regarded as an element in Option 40, but not the complete Option.

- Opt30: Mass transit (Micro Light Tram) - Promote and support introduction of system in Aberdeen's city centre
- Opt59: PT Travel plans - promote and support the development of travel plans for individuals, businesses, health care, and schools
- Opt34: Pedestrian linkages between Guild Street and Union Street – Escalator

5.6 All other schemes shown in table 5.1 have been represented in ASAM.

5.7 In addition it should be noted that the Banchory Park and Ride scheme (option 25) had not previously been modelled in the Dynamic Model.

5.8 The following chapter presents the results of the full assessment of the RTS incorporating the key outputs from the various models.

6. APPRAISAL OF REGIONAL TRANSPORT STRATEGY

Introduction

6.1 The Regional Transport Strategy is an integrated package of measures which support and complement each other. The degree of integration is such that good appraisal practice indicates that, as far as possible, the strategy should be appraised as a whole, as its total value will (or should) exceed the value of its individual components. This approach is in keeping with UK and European best practice guidance (see for example the Guide to Cost Benefit Analysis[9] produced by the Evaluation Unit of the DG Regional of the European Commission).

6.2 As far as possible the appraisal of the regional strategy follows the appraisal guidance in STAG, and therefore

- It is objective-led and based around the Scottish Executive's five appraisal objectives; and
- uses a multi-criteria framework approach.

6.3 However, as discussed below, it was not feasible to provide estimates of quantitative outcomes for the strategy as a whole due to limitations associated with the available modelling tools. The following uses the Scottish Executive's 5 appraisal objectives as the structure for reporting the appraisal outputs.

Environment

6.4 The UDM generated estimates of changes in car miles for the entire Nestrans area; from this estimates of CO2 can be made. Table 6.1 shows estimates of person miles made as car trips and total person miles made by all modes; this is taken from the UDM analysis. This shows that while the RTS generates more mobility (which is beneficial for the economy and for social inclusion), fewer person miles are undertaken by car due to the shift from car to public transport.

TABLE 6.1 CAR MILES WITHIN THE REFERENCE CASE AND RTS PACKAGE

	Year	Car miles (thousands)	All trip miles (thousands)
Reference case	2021	2,389	2,865
RTS package	2021	2,835	3,020

6.5 In addition, ASAM was used to make estimates of emissions for a range of pollutants. It should be noted that these estimates, while based on a more detailed transport model for the area around Aberdeen, are not estimates for the whole of the north east because of the geographic coverage of the ASAM model. Nonetheless, as most travel takes place in and around Aberdeen, the results can be regarded as reasonably representative of outcomes at the level of the region. It should be noted that this excludes aviation and shipping. Table 6.2 presents these estimates.

[9] http://ec.europa.eu/regional_policy/sources/docgener/guides/cost/guide02_en.pdf

6.6 These are modelled changes as a result of the interventions in the RTS and will be supplemented by improvements to engine technology, other measures by individuals, Governments etc to improve the efficiencies of vehicles and choice

TABLE 6.2 ASAM ESTIMATES OF ENVIRONMENTAL EMISSIONS (TONNES)

	Reference case		RTS Package	
	2012	**2027**	**2012**	**2027**
Carbon monoxide	2,310	2,325	2,289	2,306
Hydrocarbon THC	345	344	343	342
Nitrogen oxides NOX	2,355	1,650	2,344	1,643
Particulates PM10	68	49	68	49
Carbon dioxide CO_2	633,198	699,404	629,633	696,030

			Changes from the Reference Case	
	Tonnes		%	
	2012	**2027**	**2012**	**2027**
Carbon monoxide	-21	-19	-0.9%	-0.8%
Hydrocarbon THC	-3	-2	-0.7%	-0.7%
Nitrogen oxides NOX	-11	-7	-0.5%	-0.4%
Particulates PM10	-0.4	-0.3	-0.6%	-0.6%
Carbon dioxide CO_2	-3,565	-3,374	-0.6%	-0.5%

6.7 The changes in emissions reflect a shift towards use of public transport especially for city centre movements; park and rise usage is expected to increase in tandem with a slight reduction in car travel to central Aberdeen

Safety

6.8 The strategy will enhance the safety of travelling in the north east. This is because, compared with the Reference Case, overall car miles travelled is reduced, and accident rates involving cars are broadly proportional to car miles.

6.9 Associated with this, the strategy achieves mode shift from car to public transport, including a shift to rail. Bus travel generally achieves lower accident rates than car travel while rail travel has very low accident rates.

6.10 The strategy includes specific road improvements designed to increase safety, for example at particular junctions or on parts of routes where accident rates have been above average for that type of road in the north east.

6.11 Accordingly the strategy is expected to enhance safety levels across the region. In addition, measures to improve transport interchanges and to provide better information on public transport journeys are expected to increase the users' sense of personal security while using the transport system in the north east.

Economy

Transport economic efficiency (TEE)

6.12 While there had been an aspiration to undertake a TEE analysis for the whole of the strategy as an integrated package, this was not possible with the existing modelling tools. Specifically, the ASAM model was designed to examine transport measures within and close to Aberdeen and accordingly the demand side of the model is less detailed for the rest of the Nestrans area, and does not fully represent public transport demand. The UDM used cost data from ASAM but the UDM generates its own region wide demand outputs, which were used to generate the outputs on the environment and on EALI's. It was not however feasible to use the UDM demand outputs in ASAM.

6.13 Accordingly, it was judged that, in the absence of adequate region-wide modelling tools, it would not be sensible to undertake this element of the STAG appraisal for the strategy as a whole. This does not preclude undertaking TEE analysis for individual elements, although it is necessary to caveat any individual scheme appraisal with the warning that the appraisal might under or over estimate benefits and / or costs because of interactions with other elements within the strategy.

Economic Activity and Location Impacts (EALIs)

6.14 The UDM does make it possible to undertake the economic activity and location analysis (EALI) which is the other element of the economy objective in STAG. The UDM calculates two measures of economic activity, namely jobs and jobs filled. The former can be thought of as demand for labour, while jobs filled represents the situation where demand and supply have been matched by the model.

6.15 Jobs may be generated within the model in a range of locations as these become more attractive or competitive, but unless transport links are in place for travel to work and people within the working age population choose to use these links and take up jobs rather than to be economically inactive, jobs will remain unfilled. The indicator "filled jobs" therefore provides a good indication of how these processes are expected to work through within the regional economy. Economic analysis also indicates that in general positive EALI results correspond broadly to levels of time savings, which comprise the benefits side of the TEE analysis. It is reasonable therefore to infer that the conventional transport economic benefits (which it was not possible to quantify directly) will be positive at the level of the region.

6.16 The UDM analysis shows that the RTS package will increase the total level of jobs

filled by 1.3% over the Reference Case. In absolute numbers of jobs this amounts to 2,550 additional filled jobs and in total 196,890 filled jobs with the RTS package.

Accessibility

6.17 The UDM can be used to test and quantify accessibility changes between any zones in the model and between a group of zones and any specific zone. A limited series of accessibility tests was undertaken in order to examine access to centralised health care and to higher education sites. The results of the analysis were presented in Figure 4.8, which showed a 5% improvement in accessibility to health care (Aberdeen Royal Infirmary) and a 9% improvement in accessibility to Aberdeen University. These improvements are in addition to the accessibility gains shown for Reference Case compared with the do-minimum scenario.

Integration

6.18 Integration between transport modes is one of the integration tests. Integration is perhaps best seen as a means to an end, namely faster, more reliable, more "seamless" and hence more highly valued journeys, with an emphasis on public transport and achieving greater use of public transport compared with car, which already tends to be seen to offer a high degree of integration and flexibility.

6.19 The mode shift outcomes show that in the Aberdeen City area, the strategy is expected to reduce the car share from 67.6% in the Reference Case to 62% by encouraging a shift to public transport (+7% in PT share compared to the Reference Case). However, the slow mode share (walk and cycle) is also reduced by around 2%, which is largely due to the improvement in the public transport provision.

6.20 The strategy is therefore expected to induce a transfer of journeys to Aberdeen city centre from car to public transport. This is due to a combination of an improvement in public transport provision and the parking charge operating in Aberdeen city centre which makes travel into the city centre more expensive.

6.21 In the more rural areas of Aberdeenshire car is more dominant as the favoured mode; the strategy is expected to achieve a reduction in the car mode share by 6%, from 81% in the Reference Case to 75%, with more people travelling by public transport (+7%). This will be partly due to the parking charges that have been introduced in some of the regional centres but also due to some public transport improvements on some corridors.

6.22 Integration clearly contributes to the mode share changes, but at the level of the north east as a whole, integration appears to be less significant than other measures including parking measures and increased public transport provision. However, for specific journeys, elements of the RTS will generate worthwhile (largely local or journey specific) integration benefits. These include interchanges between public transport modes in the city centre, and bus – airport links which improve interchange between surface public transport and air services.

6.23 The other integration test is concerned with policy integration. The RTS has been developed within the framework of existing transport and other policies in the north

east and at national level and in particular the future transport policy context that will be delivered through implementation of projects within the Modern Transport System strategy. It should be noted, however, that the UDM analysis has included the use of a range of future land use planning scenarios; this was necessary because the new regional spatial strategy is being developed later than the RTS. With this proviso, the RTS can be regarded as fully "policy compliant" with other relevant policies within the north east.

Conclusions

6.24 The appraisal of a regional level transport strategy as a whole or in the round is highly desirable, because in an ideal world it would enable all the interactions between elements of the strategy to be captured. By appraising the strategy as a whole, it can in principle be fine tuned to achieve specific SMART objectives (as was the case in the development of the RTS), or it could be used to maximise the outcomes for any given level of investment.

6.25 In practice, what can be achieved at the strategic level is dependent on the modelling and analytical tools available. In the case of the RTS, two models were available, each with strengths and weaknesses, reflecting the fact that each had been developed for specific purposes, for specific areas and to look in detail at specific modes. Because of this not all the elements of a STAG appraisal could be undertaken. Nevertheless, it has been possible to report on the following in quantitative terms:

- **Environment**: analysis of CO2 and other emissions
- **Economy:** economic activity and location impacts (EALIs): jobs filled
- **Accessibility:** regional accessibility to key health and education locations
- **Integration:** by reference to public transport mode share.

6.26 All of these indicators show positive outcomes from the RTS compared with the Reference Case.

6.27 The overall conclusion is that the RTS performs well against the SMART objectives set by Nestrans and against four of the objectives used by the Scottish Executive / Transport Scotland in appraising projects. It is also reasonable to infer that the strategy would perform well against the transport economics (TEE) objective and against the safety objective.

6.28 There is scope to undertake further and more detailed work to improve upon this appraisal and in particular to produce a TEE / cost benefit analysis of the RTS package as a whole. However, this would depend upon the development of the existing transport, land use and economy modelling tools, which was not feasible within the timescales for production of the RTS.

APPENDIX A

ASAM MODELLING ASSUMPTIONS

A1. RTS SCHEMES MODELLED IN ASAM

APPENDIX: TABLE A1.1 ASAM MODELLING ASSUMPTIONS

ID	Description	Primary Mode	Timescale	Option No.	Details
1	Haudagain Junction Improvements - Capacity Improvements	Highway	Short	Opt40	These junction improvements follow the descriptions in the 'Haudagain STAG 1 Report' (SIAS, October 2006) and include a dual carriageway link road connecting North Anderson Drive with Auchmill Road. This includes two new signal controlled junctions with bus priority.
2	Access to Aberdeen from the South - Capacity Improvements	Highway	Medium	Opt40	The assessment of these potential capacity improvements assumes additional bus priority along the Wellington road corridor. This includes the capability of bus priority at and on the approach to five junctions.
3	Rail * Increased Frequency of Aberdeen Crossrail	PT	Medium	Opt23/35/36	These improvements build on the proposed introduction of Aberdeen Crossrail phase one, and create a 15 minute train service between Inverurie and Stonehaven. New rail stations at Newtonhill, Aberdeen North and South (ie Kittybrewster and Altens) are also included within the appraisal package (assuming some park and ride capability * ie a small 30 space car park). The new services are assumed to stop at all stations between Stonehaven and Inverurie.
4	Bus Improvements * Bus Priority	PT	Short	Opt44	A number of bus priority schemes are proposed at junctions along key radial approaches and city routes. These include the A947, A96, A93 and Anderson Drive. These modelled scheme tests assume that the junction improvement introduced will provide priority for all buses at and on the approach to a total of 13 intersections. It also assumes that this new bus priority is additional to the existing set up, with little detrimental effect to existing road and junction capacity.
5	Bus Improvements - Mass Transit Options - Guided Bus	PT	Medium	Opt32	A guided bus way is proposed along two corridors into Aberdeen * from the A944 Kingswells Park and Ride Site via the city centre to the A90 Bridge of Don Park and Ride site (including a relocated A90 Park and Ride Site to Blackdog with up to 1000 spaces). This modelled test assumes around 5 km of additional bus lane/ guideway capacity (in both directions) with bus priority at 15 junctions along the A90 and A944 corridors. The majority of buses operating along these routes are assumed to be able to use the new guide way.
6	Bus Improvements - Banchory Park and Ride Site	PT	Short	Op25	A new 250 space car park is included at Banchory. This improves the availability of direct access to bus and enhances existing service frequency to every 20 minutes in the morning and evening peaks.
7	Bus Improvements * Super Bus	PT	Medium	Opt38	Over the long term, improving the quality of bus services in and around will be explored, including the Super bus concept, and also developing integrated ticketing and real time information systems. These interventions have been represented in ASAM3B by improving

					the perception of urban and interurban bus services to that closer to rail (mode constant reduced from 1.2 to 1.1). This test assumes that the majority of bus service within Aberdeen and Aberdeenshire are improved to a 'super bus standard' with the substantial and widespread introduction of integrated ticketing and real time information.
8	Transport Interchange - City Centre Shuttle Bus	PT	Short	Opt29	A high frequency Aberdeen city centre shuttle bus has been included to improve access between the rail and bus stations and the main shopping area. This was incorporated into ASAM3B with a 10 minute (free) bus service loop around Guild Street and Schoolhill.
9	Airport Surface Connections * Express Bus Service	PT	Short	Opt20/21	To improve access to the airport a high quality branded express bus service between the city centre and the airport is proposed. This intervention was tested with the upgrading of the existing First 27 service to a 20 minute frequency (from the existing hourly service) with only one or two stops directly on route to the Airport (ie Union Street and ARI). The cost for a single journey will be £3 and the perception of quality will be regarded closer to rail (mode constant 1.2 reduced to 1.1 * similar to the super bus concept).
10	Airport Surface Connections * Dyce Shuttle	PT	Short	Opt20/21	To improve access to Aberdeen Airport, a free shuttle bus service is proposed to Dyce rail station. This service is assumed to be high frequency with services (where possible) integrated in line with arrival and departure times of trains at Dyce.
11	Changing Choices through Incentives and Partnerships * Bus Fares	PT	Medium	Opt62	Close cooperation with operators is envisaged to identify possible fare incentives to encourage bus use. This has been represented in ASAM3B by a 1.25% reduction in all bus fares (source: SDG Modelled Options Impact Note).
12	Parking Strategy	Highway	Short	Opt47	Developing a parking strategy to assist the control of traffic demand has been represented by increasing highway costs by 15 minutes for vehicles travelling to Aberdeen city centre (source: SDG Modelled Options Impact Note). This represents around double the current long stay parking charge within the city centre.

APPENDIX B

URBAN DYNAMIC MODEL MODELLING ASSUMPTIONS FOR PREFERRED PACKAGE

B1. SCHEMES MODELLED IN URBAN MODEL PREFERRED PACKAGE

APPENDIX: TABLE B1.1 URBAN MODEL PREFERRED OPTION MODELLING ASSUMPTIONS

No.	Option	Primary Mode	Timescale	Description	Impact Modelled as	Change in cost/time: Needs better explanation of model assumptions based on attractiveness	Movements Affected:
1	WPR	Highway	-	WPR	From ASAM	As ASAM	As ASAM
2	Opt21	PT	Long	Aberdeen Airport Surface Connections - Multimodal Interchange at airport terminal. Key components new railway link and branded express bus service between Aberdeen Airport and city centre / other key locations.	Reduction in in-vehicle-time to Aberdeen city centre from the Airport and change in mode from bus to LRT.	Reduce PT costs -13.7mins (From 27 mins by bus, mode weighting 1.2 to 17 mins by LRT, mode weighting 1.1)	Full benefit to movements from sectors South of City Centre, half benefit to urban model zones 15-20
3	Opt23	PT	Medium	Aberdeen CrossRail - Introduce 15 minute dedicated service and new railway stations	Reduction in total generalised time for PT	Percentage reduction in PT costs as in table below	See separate table
4	Opt29	PT	Short	Inner city bus service – free low-emission city centre service	Zero Fare (assume save £1) and higher freq (x3)	Reduce intra-zonal PT costs - 22.5min in Zone 28 (12.5 min (@ VoT £4.80/min) + 10min wait time reduction)	Within city centre zone only (Zone 28)
5	Opt30	PT	Long	Mass transit (Micro Light Tram) - Promote and support introduction of system in Aberdeen's city centre	Higher frequency (x3)	Reduce intra-zonal PT costs - 12.5min in Zone 28 (10min wait time reduction)	Within city centre zone only (Zone 28)
6	Opt32	PT	Medium	Mass transit (Guided Bus)- Promote and support introduction of system on appropriate radial routes to avoid congestion hotspots around Aberdeen	**Incremental benefit on option 44** PLUS A944 guided bus	Reduction in PT costs 7 min (both directions) [5 min JT reduction]	To/From zones 87-90,93-95 from/to City Centre zones (5 min reduction from zone 8 to City Centre)
7	Opt34	Walk	Medium	Pedestrian linkages between Guild Street and Union Street -	Reduction in 'slow modes' intra-zonal cost	5 min reduction in journey time	Within city centre zone only (Zone 28)

				Escalator			
8	Opt38	PT	Medium	Super Bus		Reduction of PT costs by 2-5 min for O-D pairs between City Centre zones and Airport, City Centre and Oldmachar, and City Centre to Shire zones.	Between city centre zones 21-28 and zones: 1, 2, 5, 30-32, 40, 42-43 51-84, 92, and 96-109
9	Opt40	Highway	Short	Strategic roads (capacity improvements): access to city from north, south and west	A range of reductions in highway costs of between 6 and 12 minutes (over the base times) on in-scope OD pairs based on the scope of each of the above schemes. The higher reductions are associated with the dualling schemes.	Reduction in highway costs of between 6 and 12 minutes on zone pairs affected by the capacity improvments	Trips originating zones 57-67, 74-78, 101-111 with destinations zones 1-43, and 100-111 and vice versa.
10	Opt44	PT	Short	Bus priority/ bus lanes - On key radial approaches to city A90 (northern approach), Anderson drive, A947, A96, A93, and A90 (southern approach) and in key locations within Aberdeenshire	Reduction in bus times to by 2-4 min from Airport, SW & SE city zones, and Shire to Aberdeen City Centre. No reduction in times for reverse trips i.e. going out of Aberdeen	See separate table	Selected origins to city centre zones 21-28
11	Opt47	Highway	Short	Parking Strategy for north east - Develop and implement framework for managing supply / demand for parking, including pricing and enforcement	Parking charges - as highway costs for trips terminating in each zone	Highway cost increased by 1 min for trips terminating in city and 1 min for trips terminating in other town centres	All origin trips to city and shire zones 9-28, 33-39, 46, 48, 51-54, 62-66, 81-83, 99, 106 and 107.
12	Opt59	PT	Medium	Travel plans - promote and support the development of travel plans for individuals, businesses, health care, and schools	Reduction of PT costs	Reduce the PT penalty in model by 80% for urban area and 2/3 for rural area	All zone pairs
13	Opt62	PT	Medium	Bus Partnerships - secure high quality bus services through the establishment of new partnership agreements with bus operators and Punctuality Improvement Partnerships	Reduction of PT costs	Reduction of PT costs by 0.5% across all movements (including intrazonal)	All zone pairs

APPENDIX: TABLE B1.2 OPT23 - CROSSRAIL MODEL ASSUMPTIONS

Station	Inverurie	Kintore	Dyce	Aberdeen North	Aberdeen	Aberdeen South	Cove Bay	Portlethen	Newtonhill	Stonehaven
Zone	**Z 80,81,82**	**Z 84**	**Z 1,2**	**Z 15,16,17**	**Z 27,28,38**	**Z 39,40**	**Z 42,43**	**Z 102,103**	**Z 104**	**Z 105-108**
Z 80,81,82	-	20%	20%	20%	20%	50%	50%	50%	50%	50%
Z 84	20%	-	20%	20%	20%	50%	50%	50%	50%	50%
Z 1,2	20%	20%	-	5%	5%	50%	50%	50%	50%	50%
Z 15,16,17	20%	20%	5%	-	5%	40%	40%	50%	50%	50%
Z 27,28,38	20%	20%	5%	5%	-	20%	20%	20%	20%	20%
Z 39,40	50%	50%	50%	40%	20%	-	20%	20%	20%	20%
Z 42,43	50%	50%	50%	40%	20%	20%	-	20%	20%	20%
Z 102,103	50%	50%	50%	50%	20%	20%	20%	-	20%	20%
Z 104	50%	50%	50%	50%	20%	20%	20%	20%	-	20%
Z 105-108	50%	50%	50%	50%	20%	20%	20%	20%	20%	-

B1.1 The table above shows the modelled percentage decreases in generalised times, assumed to apply to specific zone pairs. For example, it is assumed that public transport generalised times will be reduced by 50% between zone 104 (Newtonhill in the South East of Aberdeenshire) and Aberdeen North station which is located between zones 15, 16 and 17 which are Hilton, Woodside and St Machar respectively in the north of the city centre.

APPENDIX: TABLE B1.3 OPT44 - BUS PRIORITY ASSUMPTIONS

Zones	Zone Name	Time reduction to Zones 21-28 (
1,2	Dyce Airport	3.5
5	Oldmachar	2
31,31,32	Peterculter, Murtle, Cults	5
40.42.43	Tullos Hill, Nigg, Loriston	4
51-67	Fraserburgh, Buchan	2
68-72	Turriff	3.5
74-79	Ellon	2
80-84	Inverurie	3
92	Huntly	3
96-100	Deeside, Banchory	5
101-110	Portlethen, Newtonhill Stonehaven, Mearns	4

APPENDIX C

URBAN DYNAMIC MODEL - SCENARIOS TESTED

C1. FULL LIST OF OPTIONS TESTED

APPENDIX: TABLE C1.1 OPTION PACKAGES TESTED

Run ID	Run Name	Note
1	04 Ref Transport Cost	Reference Case
2	05 ASAM Land	Reference Case with ASAM land assumptions
3	**T00-1**	
4	**09 WPR Upgrade + ASAM Land (T00)**	**Reference Case with AWPR Upgrade**
5	Low Cost Package (T01)	Original RTS Option
6	Medium Cost Economy Package (T02)	Original RTS Option
7	Medium Cost Accessibility and Social Inclusion Package (T03)	Original RTS Option
8	Medium Cost Environmental Package (T04)	Original RTS Option
9	Medium Cost Spatial Planning (T05)	Original RTS Option
10	High Cost Package (T06)	Original RTS Option
11	E00 T02 No RUC	Medium Cost Economy Package without road user charging
12	E00 T04 No RUC	Medium Cost Environmental Package without road user charging
13	E00 T04 £1 RUC	Medium Cost Environmental Package with lower road user charging
14	E00 T04 ParkStrategy	
15	E00 T04 Park+5%Land	
16	E00 T02 Park, NoRUC,	
17	E00 T02 Park, NoRUC, +5%Land	
18	E00 T02 Park, Modified	
19	E00 T02 Econ Enhanced	
20	E00 T02 Econ Enhanced + 5% Land	
21	E00 T02 Econ Enhanced + 12% City Land	
22	E00 As R19 (No parking charge in Shire)	
23	E00 As R19 (Lower parking charge in City & Shire)	
24	E00 As R21 (5% housing land in City)	
25	E00 T02 Econ Enhanced (New Park Charge 3,5 min)	
26	E00 T02 Econ Enhanced (New Park Charge 2,4 min)	
27	**E00 T02 Econ Enhanced (New Park Charge 1 min)**	Enhanced Medium Cost Economy Package with parking charge
28	**E00 T02 Econ Enhanced (New Park Charge 1 min) + CC Land**	Enhanced Medium Cost Economy Package with parking charge and extra land in Aberdeen City.
29	E02 T02 Econ Enhanced As R27 with Cycle Benefits	

30	E02 T02 Econ Enhanced As R27 with 0.5 min Cycle Benefits
31	E02 T02 Econ Enhanced As R27 with 1.5/2 min Cycle Benefits
32	E02 T02 Econ Enhanced As R27 with High min Cycle Benefits

APPENDIX D

RESULTS FROM KEY MODEL RUNS

D1. ECONOMIC INDICATORS

D1.1 The tables below show results for the simulated year 2021 for each of the economic indicators from the reference case, the six initial model runs and the preferred option. Percentage changes as compared to the reference case are also shown. Note that the change in percentage points is shown in table D1.3, vacancy rates.

APPENDIX: TABLE D1.1 JOBS BY ZONE CATEGORY: 2021

	T00 Ref (Run 4)	T01 (Low)	T02 (Mec)	T03 (MSoc)	T04 (MEnv)	T05 (MPlan)	T06 (High)	Preferred RTS (Run 27)
Aberdeen City	169,430	169,562	153,940	151,979	144,988	145,761	143,164	169,135
Aberdeenshire	61,192	61,186	60,957	62,861	62,382	62,384	62,576	62,067
Total Modelled Area	**230,623**	**230,748**	**214,897**	**214,839**	**207,370**	**208,145**	**205,740**	**231,203**
Aberdeen City % Change	0.0%	0.1%	-9.1%	-10.3%	-14.4%	-14.0%	-15.5%	-0.2%
Aberdeenshire % Change	0.0%	0.0%	-0.4%	2.7%	1.9%	1.9%	2.3%	1.4%
Total Area % Change	**0.0%**	**0.1%**	**-6.8%**	**-6.8%**	**-10.1%**	**-9.7%**	**-10.8%**	**0.3%**

APPENDIX: TABLE D1.2 JOBS FILLED BY ZONE CATEGORY: 2021

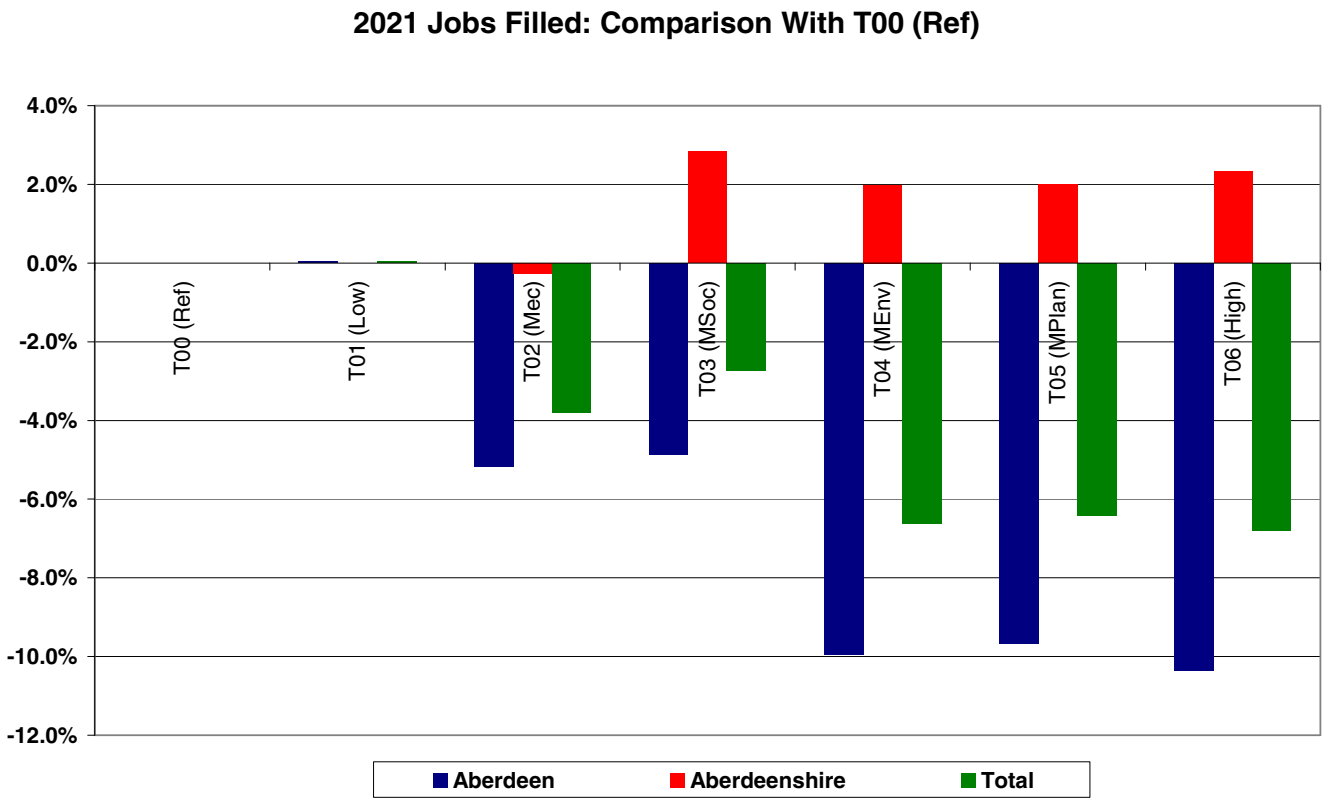
	T00 Ref (Run 4)	T01 (Low)	T02 (Mec)	T03 (MSoc)	T04 (MEnv)	T05 (MPlan)	T06 (High)	Preferred RTS (Run 27)
Aberdeen City	139,993	140,065	132,733	133,163	126,066	126,451	125,503	141,792
Aberdeenshire	54,340	54,340	54,197	55,878	55,418	55,427	55,604	55,093
Total Modelled Area	**194,333**	**194,405**	**186,931**	**189,041**	**181,484**	**181,878**	**181,107**	**196,886**
Aberdeen City % Change	0.0%	0.1%	-5.2%	-4.9%	-9.9%	-9.7%	-10.4%	1.3%
Aberdeenshire % Change	0.0%	0.0%	-0.3%	2.8%	2.0%	2.0%	2.3%	1.4%
Total Area % Change	**0.0%**	**0.0%**	**-3.8%**	**-2.7%**	**-6.6%**	**-6.4%**	**-6.8%**	**1.3%**

APPENDIX: TABLE D1.3 VACANCY RATE BY ZONE CATEGORY: 2021

	T00 Ref (Run 4)	T01 (Low)	T02 (Mec)	T03 (MSoc)	T04 (MEnv)	T05 (MPlan)	T06 (High)	Preferred RTS (Run 27)
Aberdeen City	17.4%	17.4%	13.8%	12.4%	13.1%	13.2%	12.3%	16.2%
Aberdeenshire	11.2%	11.2%	11.1%	11.1%	11.2%	11.2%	11.1%	11.2%
Total Modelled Area	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**
Aberdeen City % Diff	0.0%	0.0%	-3.6%	-5.0%	-4.3%	-4.1%	-5.0%	-1.2%
Aberdeenshire % Diff	0.0%	0.0%	-0.1%	-0.1%	0.0%	0.0%	-0.1%	0.0%
Total Area % Diff	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**	**0.0%**

D1.2 Overleaf are a number of key charts that were displayed at the workshop on the 18th September 2006.

APPENDIX: FIGURE D1.1 JOBS FILLED



D2. ENVIRONMENTAL INDICATORS

D2.1 The tables below show results for the simulated year 2021 for each of the environmental indicators from the reference case, the six initial model runs and the preferred option. Percentage changes as compared to the reference case are also shown. Note that the change in average distance travelled to work (TTW) is an absolute difference.

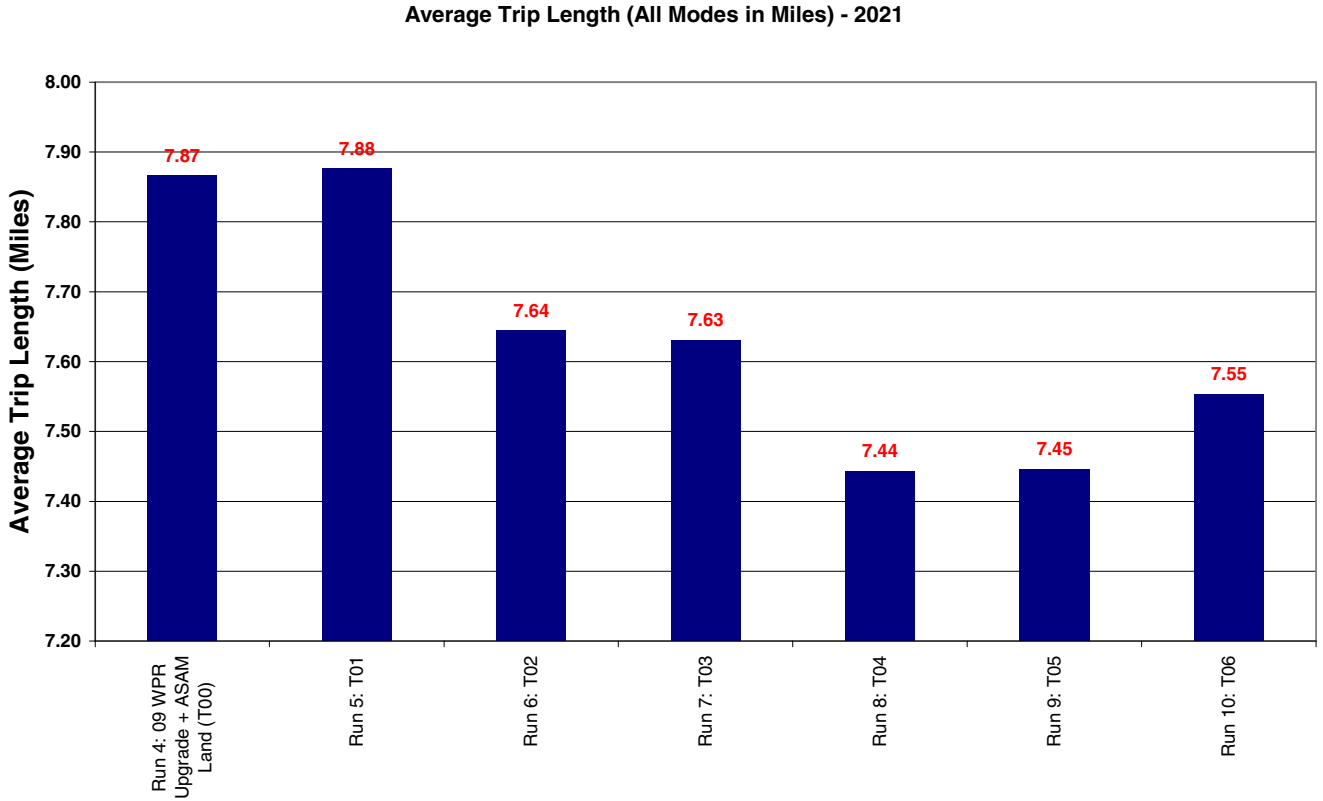
APPENDIX: TABLE D2.1 ENVIRONMENTAL INDICATORS: 2021

	T00 Ref (Run 4)	T01 (Low)	T02 (Mec)	T03 (MSoc)	T04 (MEnv)	T05 (MPlan)	T06 (High)	Preferred RTS (Run 27)
Total Car Miles	2,389,145	2,400,246	2,243,791	2,254,256	2,122,606	2,127,369	2,135,931	2,385,109
Total Travelled Miles	2,864,759	2,876,983	2,731,728	2,742,956	2,623,839	2,627,746	2,659,592	3,020,450
Average TTW Distance per trip	7.87 Miles	7.88 Miles	7.64 Miles	7.63 Miles	7.44 Miles	7.45 Miles	7.55 Miles	8.25 Miles
% Change in Car Miles	0.0%	0.5%	-6.1%	-5.6%	-11.2%	-11.0%	-10.6%	-0.2%
% Change in Total Miles	0.0%	0.4%	-4.6%	-4.3%	-8.4%	-8.3%	-7.2%	5.4%
Absolute change in average distance	0.00 Miles	0.01 Miles	-0.22 Miles	-0.24 Miles	-0.42 Miles	-0.42 Miles	-0.31 Miles	0.55 Miles

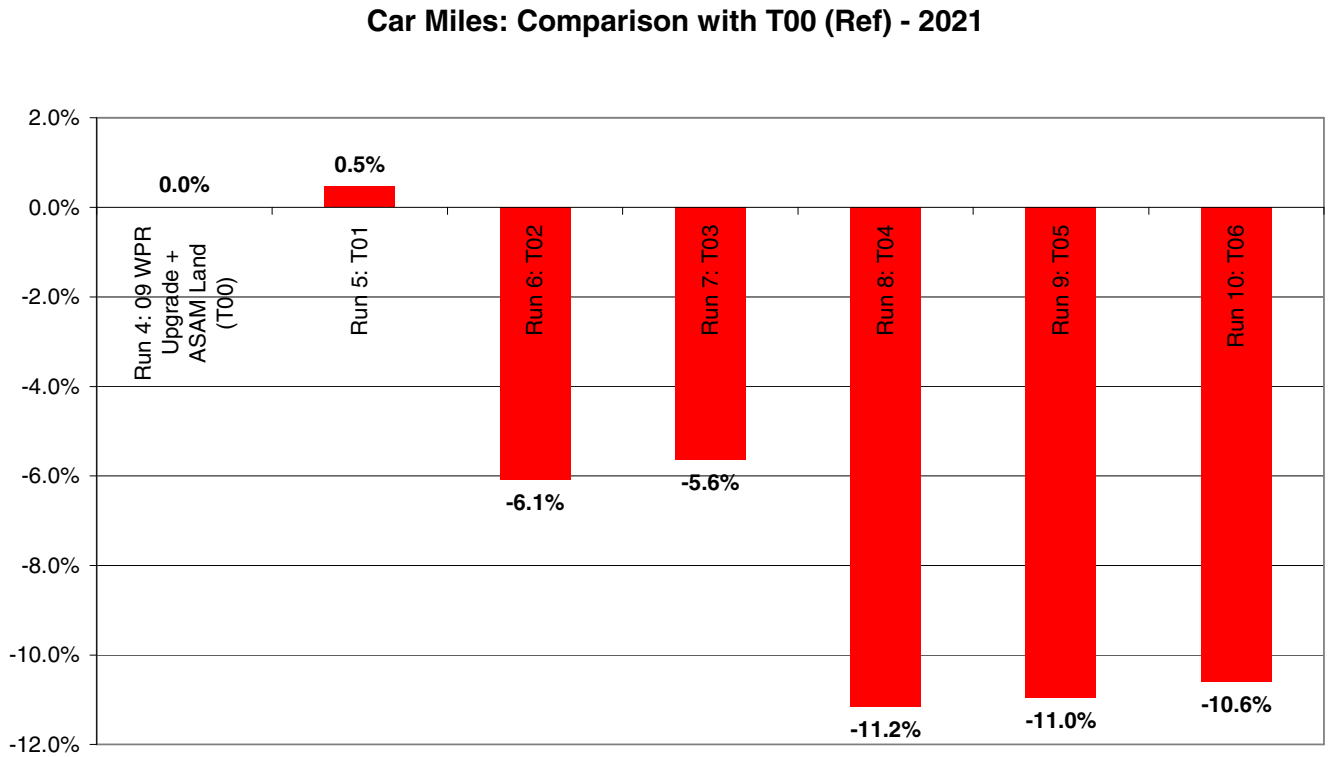
APPENDIX: TABLE D2.2 MODE SHARES BY DESTINATION: 2021

	T00 Ref (Run 4)	T01 (Low)	T02 (Mec)	T03 (MSoc)	T04 (MEnv)	T05 (MPlan)	T06 (High)	Preferred RTS (Run 27)
Car % Share: Aberdeen City	67.6%	70.6%	63.8%	65.6%	58.5%	58.6%	57.9%	61.7%
PT % Share: Aberdeen City	16.1%	14.8%	17.6%	16.9%	19.8%	19.7%	20.5%	23.7%
Slow % Share: Aberdeen City	16.3%	14.7%	18.7%	17.5%	21.7%	21.7%	21.5%	14.6%
Car Share: Aberdeenshire	80.7%	81.9%	80.4%	79.9%	78.2%	78.3%	77.4%	74.7%
PT Share: Aberdeenshire	11.9%	7.4%	8.1%	8.1%	9.0%	9.0%	10.2%	18.8%
Slow Share: Aberdeenshire	7.4%	10.8%	11.5%	12.0%	12.8%	12.8%	12.4%	6.5%

APPENDIX: FIGURE D2.1 AVERAGE TRIP LENGTH IN MILES FOR THE INITIAL SIX OPTIONS



APPENDIX: FIGURE D2.2 PERCENTAGE CHANGE IN CAR MILES FOR THE INITIAL SIX OPTIONS



APPENDIX E

DYNAMIC MODEL ZONE INDEX

E1. ZONING

APPENDIX: TABLE E1.1 ZONE CORESPONDANCE TABLE

Zone Number	Zone Name	Zone Category
1	Pitmedden	Rest of ABD City
2	Bankhead and Stoneywood	Rest of ABD City
3	Danestone	Rest of ABD City
4	Jesmond	Rest of ABD City
5	Oldmachar	Rest of ABD City
6	Bridge of Don	Rest of ABD City
7	Donmouth	Rest of ABD City
8	Newhills	Rest of ABD City
9	Auchmill	Rest of ABD City
10	Cummings Park	Rest of ABD City
11	Springhill	Rest of ABD City
12	Mastrick	Rest of ABD City
13	Sheddocksley	Rest of ABD City
14	Summerhill	Rest of ABD City
15	Hilton	North Central ABD City
16	Woodside	North Central ABD City
17	St Machar	North Central ABD City
18	Seaton	North Central ABD City
19	Kittybrewster	North Central ABD City
20	Stockethill	North Central ABD City
21	Berryden	North Central ABD City
22	Sunnybank	North Central ABD City
23	Pittodrie	North Central ABD City
24	Midstocket	North Central ABD City
25	Queens Cross	South Central ABD City
26	Gilcomston	South Central ABD City
27	Langstane	South Central ABD City
28	Castlehill	South Central ABD City
29	Hazlehead	Rest of ABD City
30	Peterculter	Rest of ABD City
31	Murtle	Rest of ABD City
32	Cults	Rest of ABD City
33	Seafield	Rest of ABD City
34	Ashley	South Central ABD City

35	Broomhill	South Central ABD City
36	Garthdee	South Central ABD City
37	Gairn	South Central ABD City
38	Duthie	South Central ABD City
39	Torry	South Central ABD City
40	Tullos Hill	Rest of ABD City
41	Kincorth West	South Central ABD City
42	Nigg	Rest of ABD City
43	Loirston	Rest of ABD City
44	Durn	NW of ABDshire
45	Banff West and Boyndie	NW of ABDshire
46	Banff	NW of ABDshire
47	Aberchirder	NW of ABDshire
48	Macduff	NW of ABDshire
49	Gamrie King Edward	NW of ABDshire
50	Buchan North	NW of ABDshire
51	Fraserburgh West	NW of ABDshire
52	Fraserburgh North	NW of ABDshire
53	Fraserburgh East	NE of ABDshire
54	Fraserburgh South	NE of ABDshire
55	Buchan North East	NE of ABDshire
56	South Buchan	NW of ABDshire
57	Central Buchan	NW of ABDshire
58	Lonmay and St Fergus	NE of ABDshire
59	Mintlaw Old Deer	NW of ABDshire
60	Mintlaw Longside	NE of ABDshire
61	Boddam Inverugie	NE of ABDshire
62	Blackhouse	NE of ABDshire
63	Buchanhaven	NE of ABDshire
64	Peterhead Central Roanheads	NE of ABDshire
65	Clerkhill	NE of ABDshire
66	Dales Towerhill	NE of ABDshire
67	Cruden	NE of ABDshire
68	Turriff West	NW of ABDshire
69	Turriff East	NW of ABDshire
70	Upper Ythan	NW of ABDshire
71	Fyvie Methlick	NW of ABDshire
72	Tarves	NW of ABDshire

73	Ythan	NW of ABDshire
74	Ellon Town	NW of ABDshire
75	Logie Buchan	NW of ABDshire
76	Meldrum	NW of ABDshire
77	Udny Slains	NE of ABDshire
78	Belhelvie	NE of ABDshire
79	Insch	Mid West of ABDshire
80	Chapel and Gadie	Mid West of ABDshire
81	Inverurie North	NW of ABDshire
82	Inverurie Central	NW of ABDshire
83	Inverurie South and Port Elphinstone	NW of ABDshire
84	Kintore and Keithhall	NW of ABDshire
85	Newmachar and Fintray	NW of ABDshire
86	Kemnay	Mid West of ABDshire
87	Echt	Mid West of ABDshire
88	Kinellar and Westhill North	Mid West of ABDshire
89	Westhill Central	Mid West of ABDshire
90	Elrick	Mid West of ABDshire
91	Huntly West	Mid West of ABDshire
92	Huntly East	NW of ABDshire
93	Strathbogie	Mid West of ABDshire
94	Donside and Cromar	Mid West of ABDshire
95	Alford	Mid West of ABDshire
96	Upper Deeside	SW of ABDshire
97	Aboyne	SW of ABDshire
98	Mid Deeside	SW of ABDshire
99	Banchory West	Mid West of ABDshire
100	Banchory East and Crathes	Mid West of ABDshire
101	Lower Deeside	SW of ABDshire
102	Portlethen North	SE of ABDshire
103	Portlethen South	SE of ABDshire
104	Newtonhill	SE of ABDshire
105	Stonehaven North and Fetteresso	SE of ABDshire
106	Stonehaven Central	SE of ABDshire
107	Stonehaven South	SE of ABDshire
108	Mearns North	SE of ABDshire
109	Mearns Central	SE of ABDshire
110	Inverbervie	SE of ABDshire

111	Mearns South	SE of ABDshire
112	Highland	Highland
113	Moray	Moray
114	Perth and Kinross	Perth and Kinross
115	Angus	Angus

CONTROL SHEET

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