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CUMULATIVE TRANSPORT APPRAISAL

Option Testing – Final Report

SYSTRA

ABERDEEN CITY & ABERDEENSHIRE SDP

CUMULATIVE TRANSPORT APPRAISAL

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TABLE OF CONTENTS

EXECUTIVE SUMMARY		**7**
1.	**INTRODUCTION**	**11**
1.1	BACKGROUND	11
1.2	STUDY PURPOSE	11
1.3	TRANSPORT MODELLING TOOLS	11
1.4	REPORT STRUCTURE	12
2.	**METHODOLOGY**	**13**
2.1	TRANSPORT & DEVELOPMENT SCENARIOS	13
2.2	UPDATED SDP DEVELOPMENT TEST CASE SCENARIO	13
2.3	APPRAISAL APPROACH	16
2.4	STUDY CORRIDOR ANALYSIS	16
3.	**UPDATED SDP DEVELOPMENT TEST CASE**	**19**
3.1	INTRODUCTION	19
3.2	ROAD NETWORK OPERATING CONDITIONS: REGIONAL OVERVIEW	19
3.3	PUBLIC TRANSPORT OPERATING CONDITIONS	23
3.4	UPDATED SDP TEST CASE IMPACTS SUMMARY	26
4.	**OPTION PACKAGES**	**27**
4.1	INTRODUCTION	27
4.2	APPRAISAL APPROACH – INTERVENTION OPTION PACKAGES	27
4.3	TRANSPORT OPTION UPDATES	28
4.4	INTERVENTION OPTION SCHEMES	28
5.	**TRANSPORT PLANNING OBJECTIVES**	**32**
5.1	REGIONAL & LOCAL TPO'S	32
6.	**IMPACT OF TEST PACKAGES: TPO APPRAISAL**	**37**
6.1	INTRODUCTION	37
6.2	TPO 1: EFFICIENCY AND RELIABILITY	37
6.3	TPO 2: REDUCE JOURNEY TIMES TO KEY DESTINATIONS	59
6.4	TPO 3: INCREASING TRAVEL BY SUSTAINABLE MODES	66
6.5	TPO 4: REDUCE ENVIRONMENTAL IMPACT	73
6.6	TPO 5: REDUCE THE RATES AND SEVERITY OF TRAFFIC ACCIDENTS	77
6.7	OBJECTIVES APPRAISAL SCORING	78

7.	**IMPACT OF TEST PACKAGES: STAG CRITERIA APPRAISAL**	**79**
7.1	**INTRODUCTION**	**79**
7.2	**STAG CRITERIA – ECONOMY**	**79**
7.3	**STAG CRITERIA – ENVIRONMENT**	**80**
7.4	**STAG CRITERIA – SAFETY**	**81**
7.5	**STAG CRITERIA – INTEGRATION**	**81**
7.6	**STAG CRITERIA – ACCESSIBILITY AND SOCIAL INCLUSION**	**84**
7.7	**DELIVERABILITY**	**85**
7.8	**COST TO GOVERNMENT**	**86**
7.9	**SUMMARY OF STAG CRITERIA ASSESSMENT SCORING**	**86**
8.	**SUMMARY AND CONCLUSIONS**	**87**

LIST OF FIGURES

Figure 1.	Map of Aberdeen Corridors	18
Figure 2.	Map of Aberdeenshire Corridors	18
Figure 3.	Local Transport Planning Objectives and KPIs for Regional Objective 1	33
Figure 4.	Local Transport Planning Objectives and KPIs for Regional Objective 2	34
Figure 5.	Local Transport Planning Objectives and KPIs for Regional Objective 3	35
Figure 6.	Local Transport Planning Objectives and KPIs for Regional Objective 4	36
Figure 7.	AM Peak Total Vehicle km for 'Central' Corridors	39
Figure 8.	PM Peak Total Vehicle km for 'Central' Corridors	39
Figure 9.	AM Peak Total Vehicle km for 'AWPR and Outer City' Corridors	40
Figure 10.	PM Peak Total Vehicle km for 'AWPR and Outer City' Corridors	41
Figure 11.	AM Peak Total Vehicle kms for 'Aberdeenshire' Corridors	42
Figure 12.	PM Peak Total Vehicle kms for 'Aberdeenshire' Corridors	42
Figure 13.	AM Peak Time Lost Due to Congestion (Hours) for 'Central' Corridors	44
Figure 14.	PM Peak Time Lost Due to Congestion (Hours) for 'Central' Corridors	44
Figure 15.	AM Time Lost Due to Congestion (Hours) for 'AWPR and Outer City' Corridors	46
Figure 16.	PM Time Lost Due to Congestion (Hours) for 'AWPR and Outer City' Corridors	46
Figure 17.	AM Time Lost Due to Congestion (Hours) for 'Aberdeenshire' Corridors	47
Figure 18.	PM Time Lost Due to Congestion (Hours) for 'Aberdeenshire' Corridors	47
Figure 19.	AM Peak Vehicle Speed (kph) for 'Central' Corridors	49
Figure 20.	PM Peak Vehicle Speed (kph) for 'Central' Corridors	49
Figure 21.	AM Peak Vehicle Speed (kph) for 'AWPR and Outer City' Corridors	50
Figure 22.	PM Peak Vehicle Speed (kph) for 'AWPR and Outer City' Corridors	50
Figure 23.	AM Peak Vehicle Speed (kph) for 'Aberdeenshire' Corridors	52
Figure 24.	PM Peak Vehicle Speed (kph) for 'Aberdeenshire' Corridors	52
Figure 25.	Change in Traffic Delays: Package 1 vrs SDP Test Case, PM Peak Aberdeen	54
Figure 26.	Change in Traffic Delays: Package 1 vrs SDP Test Case, PM Peak Aberdeenshire	54
Figure 27.	12-hour Total Vehicular Mode Split (ASAM14 Modelled Area)	67
Figure 28.	AM Peak Vehicle km in Corridors Representing Aberdeen AQMAs	74
Figure 29.	PM Peak Vehicle km in Corridors Representing Aberdeen AQMAs	74
Figure 30.	AM Peak Vehicle Speeds in Corridors Representing Aberdeen AQMAs	75
Figure 31.	PM Peak Vehicle Speeds in Corridors Representing Aberdeen AQMAs	75
Figure 32.	AM Time Lost Due to Congestion in Corridors Representing Aberdeen AQMAs	76
Figure 33.	PM Time Lost Due to Congestion in Corridors Representing Aberdeen AQMAs	76
Figure 34.	High Level NTS Objectives Alignment – PAF	83
Figure 35.	Second-tier Objectives Alignment - PAF	83

LIST OF TABLES

Table 1.	ASAM14 Planning Data Inputs: 2017-2032	15
Table 2.	ASAM14 Planning Data Inputs: 2032-2037	15
Table 3.	List of Study Corridors	17
Table 4.	Traffic Volumes in Aberdeen City – Total Vehicle km per hour	20
Table 5.	Traffic Volumes in Aberdeenshire – Total Vehicle km per Hour	20
Table 6.	Total Time Lost Due to Congestion in Aberdeen City	21
Table 7.	Total Time Lost Due to Congestion in Aberdeenshire	21
Table 8.	Average Traffic Speed in Aberdeen City	22
Table 9.	Average Traffic Speed in Aberdeenshire	22

Table 10.	Public Transport Passenger Boardings	23
Table 11.	Public Transport Passenger Boardings – Change from Previous Scenario (Actual & %)	23
Table 12.	AM & PM Rail Seating Capacity Loading (East Coast Mainline, Portlethen-Aberdeen)	24
Table 13.	AM & PM Rail Seating Capacity Loading (Inverness Line, Aberdeen-Dyce)	24
Table 14.	Rail Station Car Park Occupancy	25
Table 15.	Bus Park and Ride Car Park Occupancy	26
Table 16.	Transport Intervention Options	29
Table 17.	Traffic Volumes in Aberdeen City – Total Vehicle km per Hour	38
Table 18.	Traffic Volumes in Aberdeenshire – Total Vehicle km per Hour	38
Table 19.	Total Time Lost Due to Congestion in Aberdeen City	43
Table 20.	Total Time Lost Due to Congestion in Aberdeenshire	43
Table 21.	Average Traffic Speed in Aberdeen City	48
Table 22.	Average Traffic Speed in Aberdeenshire	48
Table 23.	Journey Times to/from Key Destinations by Car (minutes)	60
Table 24.	Journey Times to/from Key Destinations by Public Transport (minutes)	60
Table 25.	% of Population with Access to Key Destinations within the AM Peak	63
Table 26.	Summary of Changes to Accessibility to Key Destinations in the AM Peak	64
Table 27.	Volume of Trips by Mode (ASAM14 Modelled Area)	66
Table 28.	Public Transport Passenger Boardings	68
Table 29.	Public Transport Passenger Boardings – Change from Test Case (Actual & %)	68
Table 30.	AM & PM Rail Seating Capacity Loading (East Coast Mainline, Portlethen-Aberdeen)	69
Table 31.	AM & PM Rail Seating Capacity Loading (Inverness Line, Aberdeen-Dyce)	69
Table 32.	Rail Station Car Park Occupancy	70
Table 33.	Bus Park and Ride Car Park Occupancy	71
Table 34.	Transport Planning Objective Scoring Table	78
Table 35.	Total Road Network Travel Time in Aberdeen City & Aberdeenshire	79
Table 36.	Total Road Congested Travel Time in Aberdeen City & Aberdeenshire	79
Table 37.	% of Population in SIMD Zones with Access to Key Destinations in the AM Peak	84
Table 38.	STAG Assessment Scoring	86

Appendix A: Traffic Congestion Hotspot Mapping

EXECUTIVE SUMMARY

Strategic Development Plan Appraisal

In August 2018, the Strategic Development Planning Authority (SDPA) agreed that the Proposed Aberdeen City & Shire Strategic Development Plan (SDP) represented the final settled view of recommended development content for the City Region.

As part of the Plan process SYSTRA was commissioned to identify the cumulative transport impacts resulting from the delivery of the SDP, and reported the outcomes through a 'Cumulative Transport Appraisal' (CTA) in August 2018, prior to the publication of the Proposed SDP. Following this study, supplementary appraisal was undertaken to consider amendments to the level of development content contained in the final Proposed SDP, and critically, to understand how a range of transport intervention proposals would mitigate predicted impacts to facilitate the delivery of the Proposed Plan. This supplementary appraisal is the focus of this report.

Study Approach

Guidance and Transport Modelling

The study was undertaken in line with DPMTAG and STAG guidance, which provide an objective-led approach to ensure transport objectives and intervention options are considered that address the specific problems, opportunities, issues and constraints (POIC) identified within the study area.

The study considered relevant POICs relating to the Proposed SDP transport impacts through appraising transport and land use modelling scenarios and reviewing policy documents. This evidence-base established a number of Transport Planning Objectives, and subsequently three Packages of transport intervention options were produced, with the aim of meeting these objectives and addressing the problems faced. The Packages were appraised using a number of modelled scenarios.

Transport and Land Use Modelling Scenarios

The Aberdeen Sub Area Model 2014 (ASAM14) was utilised to prepare scenarios to represent committed transport infrastructure and services (such as the AWPR and Kintore rail station), and the scale and distribution of development allocations across Aberdeen City and Aberdeenshire.

The key scenarios developed to demonstrate and compare both transport and development orientated impacts included:

- **'Do Minimum':** SDP Effective Land Supply and Demand to 2030/32 with 'Do Minimum' Schemes – demonstrating the impact of planned development build out and population and employment growth, set against the benefits of committed transport investments, such as the AWPR, A90 Balmedie to Tipperty, Haudagain Link Road, Kintore station and new rail revolution services;
- **'Reference Case':** based on the Do Minimum and with 2010 CTA Schemes – demonstrating the benefits of additional transport interventions proposed as part of the earlier 2010 CTA study (such as a new river crossing at the Bridge of Don and cross city bus services);
- **'Test Case' Proposed SDP Development:** based on the Reference Case with additional SDP development proposals to 2035/37 (updated to reflect final development allocations); and
- **'Package Tests':** Packages of transport investment options aimed at mitigating impacts.

Development Allocations

Regional development, population and employment forecasts were provided by the Transport, Economic Land Use Model of Scotland (TELMoS14), with local site details provided by the SDPA.

The SDPA provided new and more detailed information based on the emerging preferred options within the Local Development Plan Main Issues Reports of Aberdeen City and Aberdeenshire Councils to represent the amendments associated with the final Proposed Plan, which were not represented in the 2018 CTA. These were used to create and appraise an updated 'SDP Development Test Case' scenario to confirm the cumulative impacts of the Proposed SDP published in August 2018. The SDP updates amounted to an additional 2,800 housing units within the 'Test Case' scenario (5,500 increased to 8,300 units), in addition to the effective housing land supply of 37,000 units (represented in the Do Minimum and Reference Case scenarios).

Updated SDP Impacts

The updated assessment of the latest development allocations proposed for Aberdeen City and Aberdeenshire demonstrated a slightly greater impact across the region when compared with the earlier appraisal reported in the 2018 CTA. The traffic analysis demonstrated that the more significant housing allocations contained within the final Proposed Plan would generate higher traffic flows and generally amplify congestion impacts across the region. The distribution of impacts was shown to be generally similar to those reported earlier through the 2018 CTA.

Therefore, the predicted impacts and general conclusions associated with the delivery of the SDP remain consistent in terms of the identified problems, opportunities, issues and constraints, and subsequent objective setting and transport option generation as reported in August 2018.

Objectives

The 2018 CTA study undertook a significant exercise in understanding the problems, opportunities, issues and constraints associated with the future transport network. From this exercise, a set of both regional and local level Transport Planning Objectives (TPOs) were established, including:

1. Improve the efficiency and reliability of the transport network in the study area.
   - Local objective: improve the efficiency and reliability of the identified problem corridors.
2. Achieve a reduction in journey times for all modes, to key destinations within the study area.
   - Local objective: to achieve a reduction in journey times to key destinations within the study area that have access problems, in particular for sustainable modes.
3. Increase the proportion of travel undertaken by sustainable transport modes.
   - Local objective: to improve the competitiveness of public transport relative to car, for each of the key destinations within the study area,
   - Local objective: to reduce overcrowding at problem rail station car parks and capitalise on rail service on-board capacity.
4. Reduce the negative environmental impact of transport within the study area.
   - Local objective: to reduce emissions and negative environmental impacts on noise and air quality in problem areas, in particular AQMAs.

A Local Objective was not specified for the fifth Regional Objective '*Reduce the rates and severity of traffic accidents within the study area*', as it was considered that a regional level appraisal would be sufficient when combined with the 'Safety' criteria undertaken as part of the STAG assessment.

Transport Option Packages

The following three transport option Packages were generated in response to these objectives, with each containing various infrastructure schemes and policy proposals to mitigate predicted impacts.

- **Package 1:** Road junction improvements, traffic signals, bus priority measures, active travel initiatives and the A96 Dualling East of Huntly to Aberdeen scheme;
- **Package 2:** As Package 1, and also including new rail stations and rail service connections at Bucksburn, Cove and Newtonhill; and
- **Package 3:** As Package 2, and also including additional junction upgrades, traffic signals, carriageway improvements and new link roads.

The impact of these Packages were assessed against the SDP 'Test Case' scenario (which represents the impact of the build out of additional development proposals), and the 'Reference Case' scenario, which reflects the delivery of the effective land supply only. The overall aim of the Packages was to improve network performance and reduce impacts down to, or below levels seen in the Reference Case - therefore fully mitigating the impact of development proposals (nil detriment).

Appraisal Outcomes

Package 1

Package 1 demonstrates strong benefits for areas within Aberdeenshire, with the A96 corridor in particular seeing substantial congestion relief and travel time savings. Congestion benefits are also predicted along the A90 North and A90 South corridors, with the majority of Aberdeenshire problem areas being mitigated down to nil-detriment impact.

Congestion relief is also generated in many peripheral areas of the city, particularly at the AWPR Cleanhill and A944 interchanges. However, several pinch-point locations are shown to remain under pressure at peak times, including the A96 / Airport, and A947 Parkhill areas.

Within central areas of Aberdeen, Package 1 is less effective, with no significant reduction in traffic delays, and many areas remaining congested (for example residual impacts continue at intersections along the Anderson Drive corridor, such as at the A93 Great Western Road and around the Bridge of Dee). Some relief is though provided along the Wellington Road corridor.

Public transport time savings are brought about through bus priority measures, and some minor mode shift impacts towards higher public transport use are seen. Relevant policy measures are also considered to facilitate more short distance trips to be made by active modes.

In relation to the TPOs, Package 1 provides moderate positive impact to the efficiency and reliability objective, both regionally and locally. A minor positive impact is seen for the reduction in journey times to key destinations objective, again both regionally and locally. For the increase in proportion of sustainable modes, Package 1 shows a minor positive impact at a regional level, and for the local objective related to reducing overcrowding at rail station car parks, but a neutral impact on the local objective for improving the competitiveness of public transport to car. A minor positive impact is also achieved for reducing the rates and severity of traffic accidents overall.

Package 1 was also considered against STAG criteria. It scored a moderate positive benefit for economy, through achieving travel time user benefits for both road and public transport overall, and in particular by facilitating access to key SDP development growth and investment areas.

Environmental impacts were considered as a minor negative overall, as although there are benefits in some areas through more efficient flow of traffic (reducing emissions and improving local air quality),

the modelling indicates higher traffic volumes overall, likely increasing global emissions. There would also likely be impacts associated with construction and land environment from major infrastructure projects such as the A96 Dualling.

A minor positive impact is likely to be seen for safety, integration, and accessibility and social inclusion criteria, due to improved infrastructure provision, enhanced modal connectivity, and enhanced local accessibility for areas of deprivation. A high-level assessment of deliverability in terms of feasibility and affordability found Package 1 to be moderately positive - reflecting the level of benefits achieved, relatively small-scale nature of proposals and the Government commitment for the A96 scheme.

Package 2

Although Package 2 does not demonstrate region-wide or significant traffic-congestion benefits (over and above those shown for Package 1), the new rail stations do produce some significant time savings and accessibility benefits for the new local rail catchment areas.

As such, in relation to the TPOs the appraisal scoring is largely in line with Package 1, but with the local objective for journey times moved from a minor positive to a moderate positive impact due to localised public transport journey time improvements at the new rail stations.

For the STAG criteria, Integration, Accessibility and Social Inclusion receive a moderate positive impact (compared to minor in Package 1). This reflects the enhancements to park and ride and localised rail accessibility improvements. Deliverability, however, is reduced to a minor positive scoring due to the increased cost and more challenging feasibility of rail station options, and combining new stops into the existing timetable without significant disruption.

Package 3

Package 3 provides further benefits for the Ellon area, and for the periphery of Aberdeen at the A96 and A947 AWPR intersections. However, these local benefits are generally masked when considered at the regional level due to some impedance of high traffic volume routes (caused by the aim to reduce delays and improve access from connecting roads through signal control). Subsequently, local disbenefits increase at some problem areas, such as the Bridge of Dee. The benefits that are observed appear greater within the evening peak, with less relief identified during the morning peak period.

In relation to the TPOs, the scoring of this package is generally in line with Package 2. Although there are greater benefits seen in some areas, the limited scale of these and disbenefits forecast for other corridors mean that benefits are not sufficient to affect the overall scoring of the Package. This is also true of the STAG criteria assessment and deliverability scoring. As a result, Package 3 tends to demonstrate less value overall, compared to the earlier Packages.

Conclusions

Overall, all Packages generate benefits compared to the Test Case scenario, with many areas seeing congestion reduce down to Reference Case levels and therefore achieving no net detriment to the road network. Several congestion pinch points do though remain, particularly within central Aberdeen, with further mitigation required to mitigate all predicted development impacts. There is also some evidence of secondary impacts being generated, as proposals improve local traffic operation, increasing the throughput of vehicles and knock-on impacts further downstream.

Although there are some benefits identified for public transport use, further intervention would be required to increase public transport competitiveness, particularly for movements where rail services do not provide a viable option.

These appraisal findings can be used to determine the transport impacts associated with the Proposed Plan, understand the value of potential mitigation options, and ultimately support the delivery of the Aberdeen City and Shire SDP.

1. INTRODUCTION

1.1 Background

1.1.1 In August 2018, the Strategic Development Planning Authority (SDPA) agreed the Proposed Aberdeen City & Shire Strategic Development Plan (SDP) as the settled view of the recommended final content of the next SDP for the City Region. The Proposed SDP covers a number of key issues which will help shape the City Region over the coming years.

1.1.2 To inform the Plan process, evidence was required to understand the potential impact development may generate across the transport network. SYSTRA Ltd was commissioned by Nestrans to identify the cumulative transport impacts resulting from the delivery of the proposed SDP for Aberdeen City and Aberdeenshire, and report the outcomes through the completion of a 'Cumulative Transport Appraisal' (CTA).

1.1.3 The CTA study considered the scale and location of new development, planned transport infrastructure, future network impacts on the main transport modes, and identified a list of interventions with the potential to mitigate predicted impacts. The study outcomes are described in the 'Cumulative Transport Appraisal Final Report', August 2018.

1.1.4 The residential and employment development allocations applied and reported within the August 2018 CTA reporting were based on development information received during early 2018. These development inputs were subsequently updated, and are discussed further within this report.

1.2 Study Purpose

1.2.1 During late 2018 to Spring 2019, SYSTRA undertook supplementary appraisal to support the Proposed SDP and accompanying Cumulative Transport Appraisal. This study aimed to appraise the transport intervention options identified by the CTA to understand the potential for options to mitigate the predicted impacts from the delivery of the SDP. Transport interventions are formed into three Test Packages for appraisal.

1.2.2 This subsequent study also looked to reflect the final level of development allocations as published within the Proposed SDP. These allocations provide new development and population growth assumptions and are used to form an updated SDP scenario to compare and appraise intervention options against.

1.2.3 These development allocation scenario updates and subsequent transport intervention appraisal are described within the remainder of this report.

1.3 Transport Modelling Tools

1.3.1 This study utilises the Aberdeen Sub Area Model 2014 (ASAM14), which is a multi-modal strategic transport model covering the North East of Scotland. ASAM14 is capable of forecasting changes in travel demand and travel patterns over time, identifying potential impacts from new developments, and assessing the benefits associated with proposed transport investment and policies.

1.3.2 The study also uses the Transport, Economic Land use Model of Scotland (TELMoS14) to provide land use planning and goods vehicle forecasts into ASAM14.

1.3.3 The Transport Model for Scotland (TMfS14) is used to provide 'external' travel forecasts to/from the ASAM14 North East of Scotland coverage area. (i.e. providing forecasts along the A90 and A96 corridors and associated East Coast Mainline and Inverness rail line).

1.4 Report Structure

1.4.1 Following this introduction, the remainder of the report is structured as follows:

- Section 2 describes the methodology employed, including a description of the updated SDP development scenario allocations and basis of appraisal;
- Section 3 discusses the predicted impacts of the updated SDP Development Test Case scenario;
- Section 4 outlines the transport interventions, describing each of the three Test Packages appraised;
- Section 5 describes the Transport Planning Objectives;
- Section 6 appraises each of the Test Packages using a number of key performance indicators to understand the level of mitigation provided and potential secondary impacts. This section compares the impacts compared to the Transport Planning Objectives;
- Section 7 presents the assessment of Test Packages against STAG criteria; and
- Section 8 provides a summary and conclusions.

2. METHODOLOGY

2.1 Transport & Development Scenarios

2.1.1 The prediction of SDP impacts and appraisal of proposed transport mitigation options is based on comparing a number of scenarios using the ASAM14 transport model. These scenarios represent combinations of future transport interventions and development proposals. The scenarios include:

A. **2017 'Baseline'** – present day network conditions, **pre AWPR**, with 2017-level of development build-out - illustrating a baseline to compare future year scenarios;

B. **2017 'Do Minimum'** – 2017 baseline demand with future 'Do Minimum' Schemes – demonstrating the benefits of committed transport investments, such as the AWPR, A90 Balmedie to Tipperty, Haudagain Link Road, Kintore station and rail service improvements;

C. **2030/32 'Do Minimum'** - 2030/32 Existing SDP Demand with 'Do Minimum' Schemes – demonstrating the impact of planned development build out and population and employment growth;

D. **2030/32 'Reference Case'** - 2030/32 existing SDP demand with 'Do Minimum' and 2010 CTA Schemes – demonstrating the benefits of additional transport proposals (such as a new river crossing at the Bridge of Dee and orbital bus services); and

E. **2035/37 Proposed SDP Development 'Test Case'** – based on Reference Case with additional SDP development proposals to 2035/37;

2.1.2 The full range of scenarios and underlying methodology are described within the 'Cumulative Transport Appraisal Final Report', August 2018.

2.1.3 Note that as the main source of planning forecasts (TELMoS) produces outputs in five-yearly increments, the TELMoS 2032 outputs were used as the closest year available to build and represent the SDP 2030 scenario. Similarly, 2037 TELMoS outputs were used to reflect the longer term 2035 SDP growth. This report uses the terms 2032 and 2037 to describe the relevant 2030 and 2035 SDP scenarios.

2.1.4 Note the different terminology / forecast years contained within the Proposed Plan for the requirements of Scottish Planning Policy.

2.2 Updated SDP Development Test Case Scenario

2.2.1 Planning and development data and associated predicted changes in population and employment are input to ASAM14 to forecast changes in levels of road and public transport demand over time. The following section describes the forecast year housing, population and employment inputs used to generate the scenarios described above, including the updated SDP Development Test Case Scenario.

2.2.2 During 2018, an initial 'SDP Development Test Case' scenario was created to understand the cumulative impacts of the emerging SDP. The development inputs and assumptions

applied were developed using the most current information available at the time to inform the transport modelling. This amounted to an additional 5,500 housing units, 11,400 population and 6,100 jobs within the Test Case scenario (compared to the Reference Case scenario).

2.2.3 The Proposed Aberdeen City & Shire SDP now includes a housing allowance of 8,335 units, in addition to the effective housing land supply of 37,000 units (represented within the Reference Case scenario). The Proposed SDP figures therefore represent an additional 2,800 housing units to the initial allowances appraised and reported in August 2018.

2.2.4 The level of Proposed SDP housing allocations by geographical area was provided by the SDPA informed by the shapefiles of the preferred bid sites within the emerging Aberdeen City and Aberdeenshire Local Development Plan Main Issues Reports and equating to the total now allocated in the Proposed SDP. Each housing allocation was then input to the nearest ASAM14 zonal geography. This approach provided a more detailed set of development inputs within the transport modelling where sites were represented in the approximate location where specific development is planned, rather than distributed (on average) across wider areas.

2.2.5 The population assumptions for the updated SDP scenario assumed an average level of population based on the underlying model zone/area. This approach is consistent with the earlier modelling, but with a larger population growth now input to reflect the additional housing allowances, and the more detailed geographical site representation.

2.2.6 The overall employment assumption for the updated Test Case scenario was calculated based on the additional forecast level/proportion of working population. These additional jobs were then dispersed across similar housing market zones, based on the underlying level of employment/jobs within the relevant model zones/areas. This approach is consistent with the earlier modelling, but with an increase in the total level of jobs to reflect the higher level of population/ working population.

2.2.7 The updated development Test Case scenario therefore represents the delivery of the Proposed SDP housing allowances, and associated population and economic/ employment growth. The transport network remains consistent with the previous Reference Case scenario, and therefore when the two scenarios are compared, this will again specifically isolate the predicted impacts of development.

Households, Population & Employment Inputs: 2017-2032-2037

2.2.8 Table 1 describes the planning inputs applied to generate the development scenarios through to 2032. These highlight a considerable growth in households, population and employment (jobs) over this longer-term timeframe, particularly within Aberdeen City.

2.2.9 Overall, a total additional population of around 38,000 households, 55,000 population and 34,000 jobs are contained and appraised within the 2032 forecast year scenario.

2.2.10 These figures form the basis of the Do Minimum and Reference Case transport demand forecasts, with new trips generated for new development sites, and associated population and employment activity.

Table 1. ASAM14 Planning Data Inputs: 2017-2032

DATA SET	LA	2017	CHANGE 2017-2032	% CHANGE 2017-2032
Households	City	110,811	21,188	19%
	Shire	113,429	16,580	15%
	Total	**224,240**	**37,768**	**17%**
Population	City	235,064	36,316	15%
	Shire	262,574	18,470	7%
	Total	**497,637**	**54,786**	**11%**
Employment (Jobs)	City	178,047	29,925	17%
	Shire	102,592	3,824	4%
	Total	**280,639**	**33,749**	**12%**

2.2.11 Table 2 describes the updated Development Test Case planning inputs, indicating an overall change in households, population and employment of around 3% from 2032, with the majority of growth associated with Aberdeen City. These reflect the overall level of additional growth associated with the Proposed SDP, with an additional 8,130 households, 17,100 population and 9,400 jobs assumed to be delivered.

Table 2. ASAM14 Planning Data Inputs: 2032-2037

DATA SET	LA	2032	CHANGE 2032-2037	% CHANGE 2032-2037
Households	City	132,000	4,170	3.2%
	Shire	130,009	3,960	3.0%
	Total	**262,008**	**8,130**	**3.1%**
Population	City	271,380	8,720	3.2%
	Shire	281,044	8,340	3.0%
	Total	**552,424**	**17,060**	**3.1%**
Employment (Jobs)	City	207,972	6,250	3.0%
	Shire	106,416	3,200	3.0%
	Total	**314,388**	**9,450**	**3.0%**

2.2.12 Overall, the planning data inputs represent a relatively high level of growth assumed within the modelling scenarios – providing scenarios where the relevant components of the Development Plan are assumed to be delivered.

2.2.13 The forecast changes in transport impacts when the Proposed Plan housing Allocations are applied are discussed within Chapter 3.

2.3 Appraisal Approach

2.3.1 The CTA study is based on the principles of DPMTAG, which sets out an objective-led approach to appraisal, proportionate to the scale of land use and intervention considered.

2.3.2 The earlier stages of the CTA considered the ability of the future transport network to accommodate the SDP, and reported the predicted transport impacts and problem areas. A range of transport solutions were identified that have potential to mitigate predicted impacts as defined by a number of transport objectives and indicators.

2.3.3 STAG represents best practice appraisal in Scotland, and DPMTAG references STAG in relation to the appraisal of transport options. STAG was applied in a proportionate manner to demonstrate the operational, economic, environmental and safety issues of the proposed solutions.

2.3.4 This report documents the appraisal of the identified transport options, comparing scheme impacts against the updated SDP Development Test Case scenario and the transport planning objectives. ASAM14 was used to provide a quantitative appraisal of transport options, comparing with objectives using a number of performance indicators.

2.3.5 Chapter 4 describes these transport options, and the three 'Test Package' Scenarios formed to appraise the various transport options.

2.4 Study Corridor Analysis

2.4.1 For the purpose of the appraisal, the study area was divided into 21 corridors. This provided a manageable and accessible means of assessing the large volume of information that was generated during the study, while being able to identify impacts on areas of particular importance.

2.4.2 Corridor design took account of the strategic transport corridors in and around the study area, while capturing predicted 'hotspots' of impact on the transport network.

2.4.3 The corridor based analysis approach also provided a geographic reference for identifying potential transport interventions. These study corridors are set out in Table 3, with corridors grouped based on whether they are 'Central' Aberdeen, 'AWPR and Outer City', or 'Aberdeenshire'.

Table 3. List of Study Corridors

NO.	CORRIDOR	GROUPING
1	Aberdeen City Centre	Central
2	Bridge of Dee	Central
3	Wellington Road	Central
4	South Anderson Drive	Central
5	A944 Lang Stracht & Westburn Road	Central
6	North Central: St Machar Drive, King Street	Central
7	Persley Bridge, Haudagain, North Anderson Drive	Central
8	Parkway	Central
9	A947 Parkhill-Bridge of Don	AWPR and Outer City
10	Stoneywood Road	AWPR and Outer City
11	A96, Kirkhill, Airport	AWPR and Outer City
12	A944 Kingswells-Westhill	AWPR and Outer City
13	AWPR: Charleston and A90 South	AWPR and Outer City
14	AWPR: Cleanhill	AWPR and Outer City
15	AWPR: Deeside A93	AWPR and Outer City
16	AWPR: Kingswells North	AWPR and Outer City
17	AWPR: Stonehaven	AWPR and Outer City
18	A90 South Approaches	Aberdeenshire
19	A96 Inverurie	Aberdeenshire
20	A90 North: Ellon	Aberdeenshire
21	A947 Rural	Aberdeenshire

2.4.4 The corridor locations within the study area are shown in Figure 1 and Figure 2.

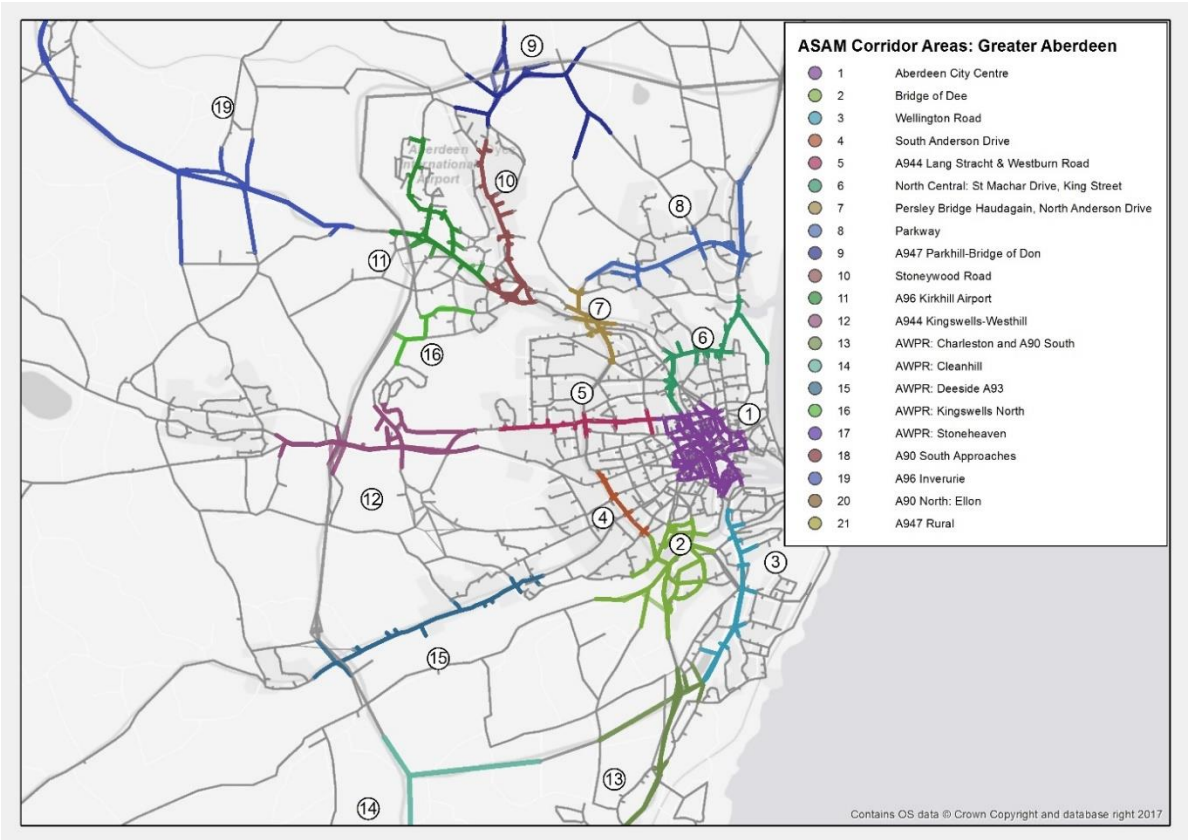

Figure 1. Map of Aberdeen Corridors

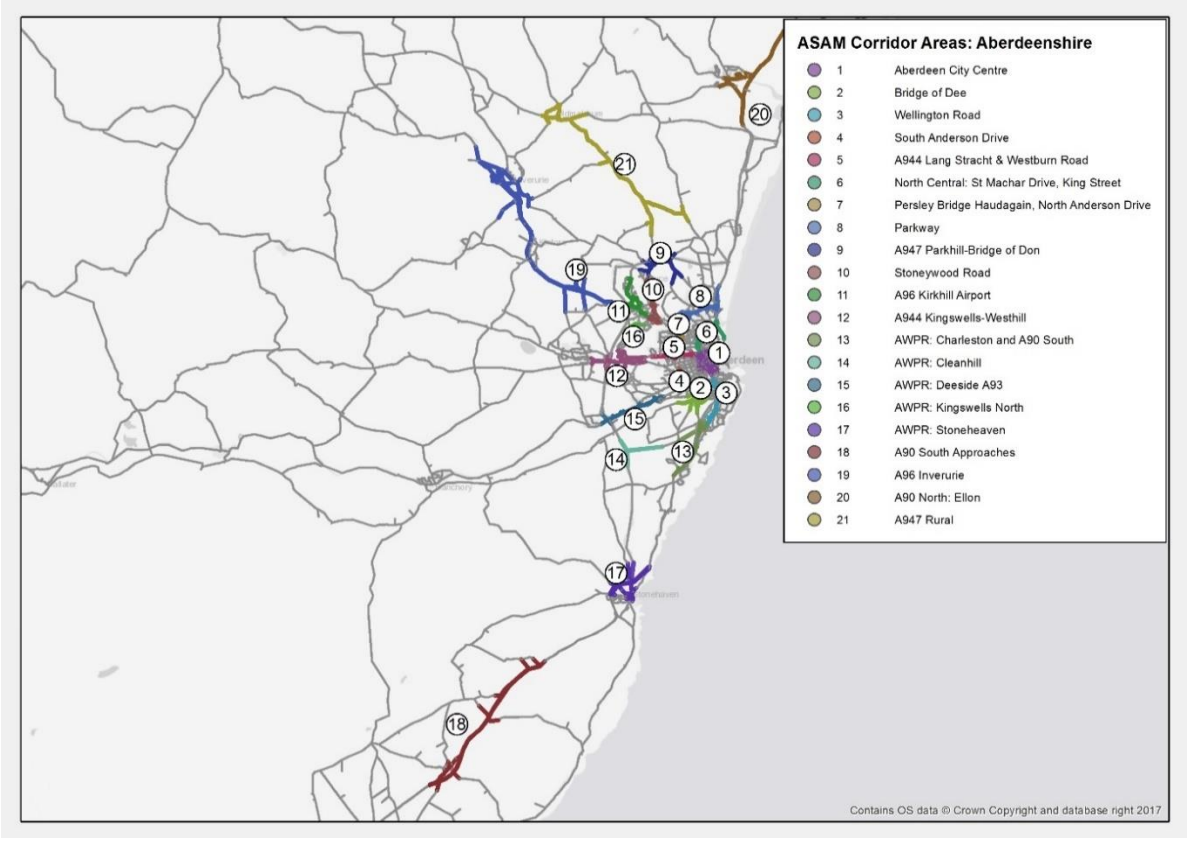

Figure 2. Map of Aberdeenshire Corridors

3. UPDATED SDP DEVELOPMENT TEST CASE

3.1 Introduction

3.1.1 This section summarises the predicted transport impacts associated with the updated SDP Test Case scenario, which reflects the July 2018 Proposed Plan allocations. The summary uses the transport operating conditions at the regional level to describe impacts and compare with the earlier SDP scenario, and other comparison scenarios.

3.2 Road Network Operating Conditions: Regional Overview

3.2.1 This section describes road network statistics for each scenario, highlighting the potential impact to operating conditions across the Aberdeen City and Aberdeenshire Local Authority areas as the level of travel movements change over time.

Traffic Volumes: Total Vehicle kilometres

3.2.2 The forecast level of road traffic travelling across the Aberdeen and Aberdeenshire road network is shown in Table 4 and Table 5 respectively (measured in vehicle kilometres (vkms) – Saturn Traffic Model 'Actual Flows').

3.2.3 The analysis indicates a substantial increase in vehicle kilometres by 2032 as development is delivered and associated trip movements use the network. The Do Minimum and Reference Case schemes are also shown to increase the level of vehicle kilometres. This trend is mainly associated with the AWPR, where many motorists are likely to choose to travel via this faster, but often longer distance alternative.

3.2.4 Further growth in vehicle kilometres is shown between 2032 and 2037 as new development associated with the Proposed SDP is built out. The updated SDP scenario increase vkms by around 3-4% within Aberdeen and 4-5% within Aberdeenshire (compared to the Reference Case scenario).

3.2.5 Previously, under the emerging SDP scenario, the Test Case increased vkms at a lower level, by 2-3% in the City and 3-5% within the Shire. This more considerable rise in vehicle kms under the latest scenario indicates that the road network would need to accommodate additional traffic levels, with the potential for subsequent impacts to network operation.

Table 4. Traffic Volumes in Aberdeen City – Total Vehicle km per hour

	VEHICLE KILOMETRES PER HOUR			% CHANGE FROM PREVIOUS SCENARIO		
Scenario	**AM Peak**	**Inter Peak**	**PM Peak**	**AM**	**IP**	**PM**
2017 Baseline	305,055	222,515	328,084	-	-	-
2017 Do Minimum	336,121	238,332	370,202	10.2%	7.1%	12.8%
2032 Do Minimum	419,951	316,055	448,851	24.9%	32.6%	21.2%
2032 Reference Case	427,254	321,463	455,002	1.7%	1.7%	1.4%
2037 Test Case	438,721	335,821	467,336	2.7%	4.5%	2.7%

Table 5. Traffic Volumes in Aberdeenshire – Total Vehicle km per Hour

	VEHICLE KILOMETRES PER HOUR			% CHANGE FROM PREVIOUS SCENARIO		
Scenario	**AM Peak**	**Inter Peak**	**PM Peak**	**AM**	**IP**	**PM**
2017 Baseline	842,668	563,008	942,182	-	-	-
2017 Do Minimum	860,795	572,035	979,193	2.2%	1.6%	3.9%
2032 Do Minimum	1,063,168	735,660	1,183,695	23.5%	28.6%	20.9%
2032 Reference Case	1,065,146	737,147	1,182,338	0.2%	0.2%	-0.1%
2037 Test Case	1,109,850	773,076	1,232,778	4.2%	4.9%	4.3%

Time Lost Due to Congestion

3.2.6 The subsequent impact to network operation from additional traffic levels is considered by calculating the total vehicle time lost due to congestion (hours) for Aberdeen City and Aberdeenshire (described in Table 6 and Table 7 respectively).

3.2.7 The modelling shows that with the delivery of the Do Minimum schemes, time lost due to congestion drops notably in Aberdeen City, showing the positive impact of these committed schemes on congestion. More considerable percentage changes are seen for Aberdeenshire, albeit from a lower base point.

3.2.8 As 2032 development is built out across the Do Minimum transport network, the impacts of traffic growth can be seen to raise congestion levels. For Aberdeen City, time lost to congestion rises by around 60-70%, compared to the 2017 Do Minimum. These values generate around a 40% increase, when compared to the 2017 Baseline.

3.2.9 For Aberdeenshire, time lost to congestion rises by 115% in the AM peak and 72% in the PM Peak, compared to the 2017 Do Minimum. These values produce around a 40-50% increase, when compared to the 2017 Baseline.

3.2.10 The 2032 Reference Case scheme proposals are shown to have a relatively modest impact in terms of total time lost due to congestion for Aberdeen City, with some improvements highlighted within the morning and evening peak hours. There are some minor changes in congestion highlighted for Aberdeenshire, mainly as the Reference Case interventions are associated with Aberdeen City, and are only likely to influence routing within Aberdeenshire, rather than congestion. These Reference Case comparisons demonstrate that, at a regional level, the earlier 2010 CTA scheme proposals are not sufficient to mitigate the predicted congestion generated within the 2032 scenario.

3.2.11 The updated 2037 Test Case scenario further increases congestion impacts in both Aberdeen (by +7% to +10%) and Aberdeenshire (by +8% to +16%). These congestion impacts are greater than those forecast from the earlier, emerging SDP scenario.

Table 6. Total Time Lost Due to Congestion in Aberdeen City

	TOTAL TIME LOST DUE TO CONGESTION (HOURS)			% CHANGE FROM PREVIOUS SCENARIO		
Scenario	**AM Peak**	**Inter Peak**	**PM Peak**	**AM**	**IP**	**PM**
2017 Baseline	4,471	2,160	5,770	-	-	-
2017 Do Minimum	3,844	1,999	4,630	-14.0%	-7.5%	-19.7%
2032 Do Minimum	6,219	3,076	8,045	61.8%	53.9%	73.8%
2032 Reference Case	6,050	3,071	7,951	-2.7%	-0.2%	-1.2%
2037 Test Case	6,498	3,284	8,753	7.4%	6.9%	10.1%

Table 7. Total Time Lost Due to Congestion in Aberdeenshire

	TOTAL TIME LOST DUE TO CONGESTION (HOURS)			% CHANGE FROM PREVIOUS SCENARIO		
Scenario	**AM Peak**	**Inter Peak**	**PM Peak**	**AM**	**IP**	**PM**
2017 Baseline	1,280	250	1,662	-	-	-
2017 Do Minimum	914	231	1,353	-28.6%	-7.5%	-18.6%
2032 Do Minimum	1,968	432	2,323	115.4%	87.2%	71.7%
2032 Reference Case	1,957	440	2,342	-0.6%	1.8%	0.8%
2037 Test Case	2,266	498	2,527	15.8%	13.3%	7.9%

Average Traffic Speed per Hour

3.2.12 The impacts to regional network operation are also seen in relation to the average traffic speed forecast across the road network (shown in Table 8 and Table 9).

3.2.13 The speed data shows that as Do Minimum schemes become operational, average speeds increase in Aberdeen and Aberdeenshire, showing the positive impact of investment on network efficiency. As 2032 development is built-out, traffic impacts can be seen to cause a deterioration in network efficiency and lower traffic speeds:

3.2.14 The Reference Case schemes have a relatively modest impact in terms of improving average speeds in Aberdeen, and only produce marginal changes in Aberdeenshire - again highlighting that the schemes are not sufficient to mitigate the overall level of congestion generated.

3.2.15 The updated 2037 Test Case is shown to decrease average speeds in both Aberdeen and Aberdeenshire, demonstrating a more considerable impact than the earlier SDP scenario.

Table 8. Average Traffic Speed in Aberdeen City

	AVERAGE SPEED (KPH)			% CHANGE FROM PREVIOUS SCENARIO		
Scenario	**AM Peak**	**Inter Peak**	**PM Peak**	**AM**	**IP**	**PM**
2017 Baseline	29	33	26	-	-	-
2017 Do Minimum	33	36	32	16.5%	9.9%	22.8%
2032 Do Minimum	30	35	27	-9.8%	-3.6%	-15.0%
2032 Reference Case	31	35	28	2.3%	1.0%	1.7%
2037 Test Case	30	35	26	-1.9%	-0.5%	-3.3%

Table 9. Average Traffic Speed in Aberdeenshire

	AVERAGE SPEED (KPH)			% CHANGE FROM PREVIOUS SCENARIO		
Scenario	**AM Peak**	**Inter Peak**	**PM Peak**	**AM**	**IP**	**PM**
2017 Baseline	74.4	81.5	72.9	-	-	-
2017 Do Minimum	78.7	83.1	76.6	5.8%	2.0%	5.2%
2032 Do Minimum	74.2	82.3	73.3	-5.7%	-0.9%	-4.4%
2032 Reference Case	74.3	82.3	73.2	0.1%	-0.1%	-0.1%
2037 Test Case	73.2	82.0	72.8	-1.6%	-0.3%	-0.5%

3.3 Public Transport Operating Conditions

3.3.1 Future changes in public transport operating conditions were considered through analysing PT statistics for each scenario, including the updated development Test Case:

- **Public transport demand** - passenger boardings for both rail and bus services;
- **Rail service loading** – comparing seated capacity with forecast passenger volumes;
- **Rail station Park & Ride occupancy** figures, considering parking demand in relation to car park capacity; and
- **Bus Park & Ride occupancy**, considering parking demand in relation to capacity.

Public Transport Demand

3.3.2 Table 10 and Table 11 show public transport boardings for each scenario over a 12 hour period - as absolute values and the change from the previous scenario respectively.

Table 10. Public Transport Passenger Boardings

MODE	2017 BASELINE	2017 DO MINIMUM	2032 DO MINIMUM	2032 REF. CASE	2037 TEST CASE
Rail	16,055	17,969	20,671	20,334	21,366
Bus (non-Orbital)	108,148	106,101	103,353	95,866	98,699
Bus - Orbital	0	0	0	10,049	10,315
Bus Total	**108,148**	**106,101**	**103,353**	**105,915**	**109,013**
Total	**124,202**	**124,069**	**124,025**	**126,249**	**130,380**

Table 11. Public Transport Passenger Boardings – Change from Previous Scenario (Actual & %)

MODE	2017 DO MINIMUM		2032 DO MINIMUM		2032 REF. CASE		2037 TEST CASE	
Rail	1,914	12%	2,703	15%	-337	-2%	1,032	5%
Bus (non-Orbital)	-2,047	-2%	-2,747	-3%	-7,488	-7%	2,832	3%
Bus - Orbital					10,049		267	3%
Bus Total	**-2,047**	**-2%**	**-2,747**	**-3%**	**2,561**	**2%**	3,099	3%
Total	**-133**	**0%**	**-44**	**0%**	**2,224**	**2%**	4,131	3%

3.3.3 The analysis indicates that rail passenger boardings increase as the 'Rail Revolution' schemes and the opening of Kintore Rail Station attracts additional rail passengers. The committed (2032) development also produces further rail boardings. An equivalent reduction is seen in bus service boardings, resulting in little change to public transport boardings overall (2017/2032 Do Minimum scenarios). However, the potential (and

currently theoretical) introduction of orbital bus services proposed as part of the 2010 CTA interventions, sees an increase in overall bus use.

3.3.4 The updated SDP development Test Case creates a further rise in all public transport boardings, with the rise in bus trips (3% compared to the earlier 2%), bringing total bus trips slightly above 2017 baseline levels. Rail service use also increases (at 5% compared to the previously reported 4% for the initial (August 2018) Test Case Scenario).

Rail Service Passenger Loading

3.3.5 Rail service loadings have been considered to highlight potential issues with overcrowding on the rail network. Table 12 shows the rail seating capacity and forecast passenger numbers on the East Coast Mainline (ECML) between Portlethen and Aberdeen.

3.3.6 This demonstrates a relatively high utilisation of seated capacity in the Baseline scenario, with passenger crowding shown to reduce as rail revolution capacity enhancements are delivered. This capacity allows for additional demand to be accommodated, including the level of passengers forecast within the updated 2037 Test Case scenario.

Table 12. AM & PM Rail Seating Capacity Loading (East Coast Mainline, Portlethen-Aberdeen)

	AM PEAK- INBOUND			PM PEAK - OUTBOUND		
Scenario	**Seating Capacity**	**Passengers**	**% Seated Capacity**	**Seating Capacity**	**Passengers**	**% Seated Capacity**
2017 Baseline	619	494	80%	693	621	90%
2017 Do Minimum	875	529	60%	961	643	67%
2032 Do Minimum	875	629	72%	961	720	75%
2032 Reference Case	875	612	70%	961	682	71%
2037 Test Case	875	647	74%	961	721	75%

3.3.7 The equivalent data for the Inverness Line between Aberdeen and Dyce, (Table 13), also shows that the introduction of extra capacity would accommodate the increase in rail demand predicted over time, with sufficient capacity within the updated 2037 Test Case.

Table 13. AM & PM Rail Seating Capacity Loading (Inverness Line, Aberdeen-Dyce)

	AM PEAK- INBOUND			PM PEAK - OUTBOUND		
Scenario	**Seating Capacity**	**Passengers**	**% Seated Capacity**	**Seating Capacity**	**Passengers**	**% Seated Capacity**
2017 Baseline	557	385	69%	595	370	62%
2017 Do Minimum	1000	505	51%	1104	471	43%
2032 Do Minimum	1000	634	63%	1104	584	53%
2032 Reference Case	1000	620	62%	1104	557	50%
2037 Test Case	1000	653	65%	1104	591	54%

Rail Station Park and Ride

3.3.8 Rail station parking was analysed to consider if forecast occupancy levels at stations may impact access to rail services. Table 14 shows the peak car park occupancy (at 10:00am) at each station, in terms of the number of vehicles parked and the percentage of capacity occupied (≥80% are highlighted in orange, and ≥100% in red). It can be seen that:

- A number of station car parks are either at capacity or are expected to be at or over capacity by the 2017 and 2032 Do Minimum scenarios, namely Aberdeen, Dyce, Huntly, Portlethen, Stonehaven and potentially Laurencekirk[1];
- While most occupancy figures increase slightly or remain relatively static, a reduction can be seen at Inverurie in the 2017 Do Minimum as some passengers switch to access services at the new Kintore station; and
- Additional parking spaces at Inverurie provided as part of the Do Minimum schemes offer further capacity to accommodate increased demand in future year scenarios.

Table 14. Rail Station Car Park Occupancy

STATION	2017 BASELINE		2017 DO MINIMUM		2032 DO MINIMUM		2032 REFERENCE CASE		2037 TEST CASE	
	Occupancy/	%	Occupancy/	%	Occupancy/	%	Occupancy/	%	Occupancy/	%
Aberdeen	189	100%	193	102%	202	107%	202	107%	207	110%
Dyce	90	90%	102	102%	120	120%	120	120%	126	126%
Huntly	28	105%	29	106%	36	134%	36	132%	38	142%
Insch	32	73%	30	69%	36	81%	35	80%	37	84%
Inverurie	107	76%	93	54%	110	64%	108	63%	114	67%
Portlethen	31	112%	38	137%	36	130%	36	127%	39	139%
Stonehaven	63	135%	64	136%	69	146%	67	143%	71	150%
Keith	55	62%	56	64%	60	69%	60	68%	61	69%
Laurencekirk	34	49%	36	52%	41	59%	40	58%	42	60%
Kintore	0	-	110	67%	122	73%	120	72%	124	74%
Total	**630**	**86%**	**752**	**81%**	**832**	**90%**	**824**	**89%**	**858**	**92%**

[1] Note that while Laurencekirk station is not highlighted as over-capacity here, the current level of parking utilisation at Laurencekirk is less certain and may require re-basing within the modelling. A separate study is investigating Aberdeenshire rail car parking requirements and this may aid understanding of capacity issues.

3.3.9 Equivalent parking occupancy figures were also considered at bus-based Park and Ride sites, with the following key points highlighted when comparing scenarios described within Table 15:

- A small decrease in Park and Ride use is observed between the Baseline and the 2017 Do Minimum, brought about by the overall reduction in bus use;
- Between the 2017 Do Minimum and the 2032 Do Minimum there is a small increase in park and ride usage due to development growth;
- A small overall increase in parking is seen between the 2032 Do Minimum and 2032 Reference Case, and also to the updated 2037 Test Case; and
- The updated Test Case scenario displays similar trends to those forecast for the earlier scenario.

Table 15. Bus Park and Ride Car Park Occupancy

BUS P&R SITE	2017 BASELINE		2017 DO MINIMUM		2032 DO MINIMUM		2032 REF. CASE		2037 TEST CASE	
	Occupancy/	%	Occupancy/	%	Occupancy/	%	Occupancy/	%	Occupancy/	%
Bridge of Don	150	23%	151	23%	167	26%	167	26%	167	26%
Ellon	106	30%	105	30%	111	32%	111	32%	113	32%
Kingswells	113	13%	106	12%	138	15%	146	16%	150	17%
A96	91	9%	81	8%	92	9%	92	9%	96	10%
Oldmeldrum	8	21%	8	19%	8	20%	8	19%	8	20%
Total	**469**	**16%**	**451**	**15%**	**516**	**18%**	**524**	**18%**	**533**	**18%**

3.4 Updated SDP Test Case Impacts Summary

3.4.1 The more extensive development allocations and subsequent population growth included within the updated Test Case scenario is shown to generate additional traffic volumes and subsequently reduce average traffic speeds across the network. These outcomes tend to suggest a slightly higher road network impact than that generated under the earlier development scenario.

3.4.2 The new scenario is also shown to produce slightly higher bus and rail passenger volumes, with the modelling demonstrating that the capacity provided by future rail services would be sufficient to accommodate the forecast rise in passenger volumes.

4. OPTION PACKAGES

4.1 Introduction

4.1.1 As part of the CTA reported during August 2018, a set of transport options were identified that had the potential to alleviate the predicted impacts of the SDP. These options were then tested to understand the potential benefits associated with scheme proposals. This Chapter describes the approach for testing transport options, and the specification of each of the transport interventions appraised using the Aberdeen Sub Area Model.

4.2 Appraisal Approach – Intervention Option Packages

4.2.1 Following the August Progress meeting, the client group agreed that given the range and scale of mitigation options put forward, three underlying packages of options would be prepared to understand potential mitigation benefits. These packages include.

Transport Option Packages

5. **Package 1:** Road, public transport and active travel schemes – ie optimising the network and implementing minor scheme proposals and/or policy aims (inclusive of the A96 Dualling Scheme to represent this Government commitment);

6. **Package 2:** Significant public transport infrastructure, such as new rail stations; and

7. **Package 3:** More significant road infrastructure, such as major junction upgrades and/or new links.

4.2.2 The first package was compiled to firstly identify a minimum level of mitigation for each relevant area impacted by the SDP. This would look to achieve a no net detriment level of mitigation (i.e with transport conditions no worse than the Reference Case scenario) and also providing an acceptable level of service at key network points.

4.2.3 Packages 2 and 3 contain more significant interventions, which are likely to be considered necessary to achieve the desired level of mitigation associated with certain impacts. These options would also aim to achieve an appropriate level of service, and may also generate further benefits to produce an overall 'betterment' to the transport system.

4.2.4 Note that schemes included within package 1 may alleviate some of the most significant impacts, and result in less requirement for further intervention. Alternatively, providing mitigation, and the potential 'release' of traffic in one area may cause subsequent issues for areas of the network downstream – potentially requiring further intervention.

4.2.5 Intervention proposals associated with impacts located within Aberdeen City Centre are not included here. A separate exercise is being undertaken to identify benefits and impacts associated with Aberdeen City Centre Masterplan proposals (ie Bus and taxi only routes and associated traffic management).

4.3 Transport Option Updates

4.3.1 A number of updates were applied to some of the options included within the packages following the initial stages of the appraisal modelling. These included:

Package, 1, 2 & 3: Signal Optimisation

4.3.2 The transport investments recently delivered and planned for the North East are likely to significantly alter the level and movement of vehicles across the network. There is therefore potential to monitor and optimise the network to more efficiently accommodate the pattern of future travel movements. This may require changes to junction layouts, traffic signal settings, or more significantly, introduction of new traffic signals to manage travel patterns.

4.3.3 To understand the level of benefits this may produce a separate sensitivity test was undertaken by optimising traffic signals within the traffic modelling undertaken for Package 3.

Package 3: Grade Separated Flyover at A96

4.3.4 The Package 1 modelling highlighted benefits at the A96 / Dyce Drive junction following the introduction of at-grade capacity improvements. The modelling also highlighted that a key future pinch-point appeared to be focussed at the AWPR / Dyce Drive link road intersection further West. As a grade separated solution would likely release further vehicles into the at-grade AWPR junction, it was deemed that an alternative, more proportionate measure should be appraised. This was agreed as an additional approach lane accessing the AWPR interchange from the Dyce Drive link road, included within Package 3.

Package 3: Anderson Drive Corridor Traffic Signals

4.3.5 Initial testing indicated that implementing traffic signals along the Anderson Drive corridor tended to increase congestion impacts and push traffic onto other routes, and did not show an overall reduction to help mitigate development impacts. Therefore, it was agreed to remove this set of traffic signalisation schemes from the finalised Package 3 specification.

4.4 Intervention Option Schemes

4.4.1 Table 16 describes the road, public transport and policy related transport intervention options proposed for each of the three test packages.

Table 16. Transport Intervention Options

PACKAGE & OPTION	DESCRIPTION
1: Cross City Connections: Refinement of (Reference Case) orbital bus routes to reflect improved bus access to development areas	Serving Countesswells Development to Anderson Drive to Loirston to Chapelton corridor by extending First Service 15 to Countesswells. Passengers can then interchange with (new Reference Case) Anderson Drive services.
1: Bus Priority Bus priority measures are proposed in several corridors, including: -Wellington Road -A90 Charleston to Bridge of Dee -Anderson Drive -B977 Scotstown Rd Extension -Ellon Road to King St. -Parkway corridor -A96 extension towards Airport -A944 Lang Stracht to Anderson Drive (Eastbound) -A93 Peterculter to Anderson Dr	Limited information is available to understand the exact nature and location where these measures may be introduced. Therefore, bus priority is represented more generally with one-two priority measures introduced within a corridor to generate a bus journey time saving and encourage mode shift. There is some uncertainty if improvements would provide overall 'additional' capacity or create bus priority by prioritising existing road space (reducing capacity for motorists. City Centre Masterplan proposal associated with Union Street bus priority is not included here.
1: Rail Station Car Parking	Additional spaces at Dyce (208 spaces in total). 50 extra spaces assumed at Portlethen, Stonehaven and Huntly.
1: Behavioural Initiative / Smarter Travel: Increase, encouragement / marketing of Grasshopper Ticket	Behavioural change represented by a 10% reduction in modelled PT boarding and transfer penalties - to reflect ease of ticketing & improved perception of interchange.
1: Behavioural Initiative – active travel areas & improvements: -City Centre Masterplan area -Bridge of Dee – Stonehaven Road -Wellington Road Corridor -Anderson Drive -Lang Stracht-Westburn-Berryden -Bucksburn & Dyce, Cove & Altens -Parkway, linking to Ellon Rd -A944 Westhill cycle route and A93 -Access between Blackdog, Murcar, Grandhome, Stoneywood and Dyce -Portlethen & Ellon areas -Inverurie & Inverurie to Aberdeen -accessing new development areas	Active travel improvements are proposed for several areas, which may encourage new cyclists and reduce car use. Many active travel proposals are not specific, but delivery could generally promote further cycling/ walking uptake and reduce short-distance car use. To reflect this, a 5% reduction to road vehicles is implemented for short-distance car trips travelling within a 5km radius of the centre of a corridor where improvements are proposed (commuter and other travel purposes only).
1: Monitor/ Optimise traffic signals To improve traffic operations following delivery of investments	Apply road model signal optimisation mechanism to reflect improvement to traffic signal operation to cater for changes to future turning movements.

PACKAGE & OPTION	DESCRIPTION
1: AWPR: Cleanhill Intersection Traffic Signals	Introduce traffic signals at intersection approaches to provide balanced capacity for all turning movements
1: AWPR: A944 Intersection Traffic Signals	Introduce traffic signals to manage capacity and improve operation of traffic turning movements
1: A90 South: Connecting road access	Upgrade priority junctions to northbound slip roads at Fordoun and Drumlithie to improve access to A90
1: Toll of Birness Junction Upgrade	Upgrade toll of Birness priority junction at the A90 North / A952 to a roundabout
1: Upgrade roundabout at A90 / A948 with additional capacity	Roundabout specification from Fraserburgh/Peterhead to Aberdeen-study - Increased diameter with additional entry and exit lanes for the A90(T) approaches
1: Upgrade roundabout at A90 / B9005 with additional capacity	Specification from Fraserburgh/Peterhead to Aberdeen-study - Increased diameter with an increase to two lanes on the northbound exit to the A90(T) Ellon Bypass
1: Wellington Road: Hareness Roundabout Traffic Signals	Implement traffic signal control - provision of additional lanes and traffic signal control for crossroads
1: Wellington Road: Souterhead Roundabout Traffic Signals	Incorporate further signals at approaches to Souterhead and provision of additional approach lanes
1: A96/ Dyce Drive Traffic signals – additional lanes	Widen Western approach to four lanes and additional right turn lane from Dyce Drive north to A96 West
1: A947 Route Strategy: Minor capacity improvements	Representing further accesses at Newmachar to fully represent local network (representing model update of local accesses, rather than all route strategy options)
1: Parkway Capacity and Access	Additional capacity at Balgownie Road junction and additional turning lanes to access Grandhome
1: A96 Dualling: East of Huntly to Aberdeen New route corridor to East of Inverurie with Northern connection with existing A96 to the north of Colpy and Southern A96 connection just North of Kintore	A96 proposals represented from Transport Scotland website – indicative corridor reflects 'blue' route option, with 'violet' route option to Kintore. Grade separation assumed at north and south connections, and intermediate intersection towards Oldmeldrum. Assumed closure of junction at the summit of Kirkton of Skene, with a single grade separated intersection providing access to Blackburn and a grade separated junction at the south end of Kintore

PACKAGE & OPTION	DESCRIPTION
2: Rail station at Bucksburn / Stoneywood	New station served by Inverness-to-Aberdeen line services (+1 minute running time for current services)
2: Rail station at Newtonhill	New station served by East Coast Mainline services (+1 minute running time for current services)
2: Rail station at Cove (near Stationfields Development)	New rail station served by East Coast mainline services (+1 minute running time for current services)
3: AWPR A944 Slip Road	Left turn slip road from the Northbound off slip at the AWPR A944 intersection – bypassing roundabout
3**: Increase capacity at King George VI Bridge / Great Southern Rd**	Incorporate additional capacity through traffic signal control and additional lane approaches
3: Kingswells North Traffic Signals	Implement traffic signal control at Kingswells North roundabout
3: Ellon Link Road	Southern East-West Link Road between A920 and South Road (single carriageway)
3: A96/ Dyce Drive Link Road	Additional lane approach capacity at A96 / Dyce Drive Link Road traffic signal arrangement
3: Dyce Drive capacity upgrade from Pittmedden Rd to A947	Upgrade Dyce Drive to 4-lane distributor with signal control at east and west accesses.
3: A947 Riverview Drive to Dyce Drive capacity upgrade	Upgrade A947 section to 4-lane distributor, including 2 lane approach Southbound over River Don. A947 to B979 northbound slip road.
3: B977 AWPR approach: additional capacity	Increase southbound approach capacity at Goval Roundabout with partial increase in circulating capacity
3: Signalisation of A96 access junctions at Bucksburn	Signal controlled intersections at Bankhead Avenue, Greenburn Drive and Inverurie Road (Bankhead Avenue approach stopped up to A96 to create 3-armed signals)

5. TRANSPORT PLANNING OBJECTIVES

5.1 Regional & Local TPO's

5.1.1 A series of Transport Planning Objectives (TPO's) were generated based on the information gathered through the earlier problems and opportunities assessment reported in August 2018. These objectives were applied to identify intervention options, and are applied within this option appraisal to understand how the scheme Packages perform at both the regional and local level.

5.1.2 The Regional TPOs largely draw on indicators available at a regional level, while the Local Transport Planning Objectives cover aspects that can be considered at a corridor or 'hotspot' level. The indicators put forward take account of the wide variety of outputs that can be analysed from ASAM14 and the different types of data that are required to understand impacts in different areas, scales, and for different modes.

5.1.3 The Regional TPOs and Local TPOs are shown in Figure 3 to Figure 6, along with their linkages to the problems identified, and their indicators.

5.1.4 A Local Objective was not specified for the fifth Regional Objective '*Reduce the rates and severity of traffic accidents within the study area*'. It was considered that a regional level assessment of this objective would provide sufficient appraisal when combined with the 'Safety' STAG criteria assessment.

5.1.5 For each indicator, the option testing analysis compares each Package against the updated results for the Development Test Case scenario, to identify if the Package would:

- mitigate transport impacts and offer an improvement on the performance of the 2037 SDP Development Test Case; and
- demonstrate an improvement which was significant to reduce any detrimental impacts back down below or close to 2032 Reference Case levels.

5.1.6 The appraisal of the Packages against the Test Case and Reference Case scenarios is described in Section 6.

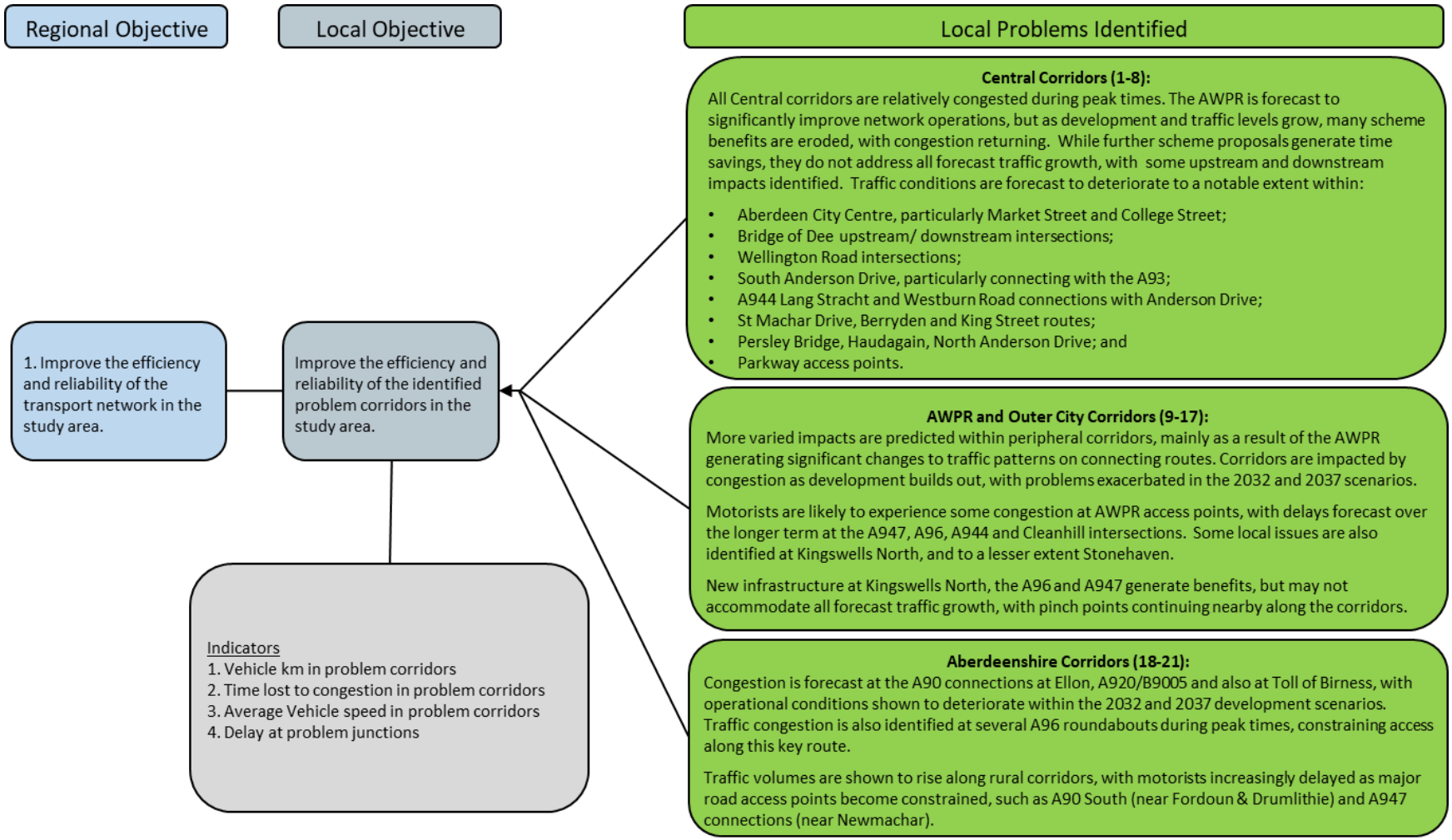

Figure 3. Local Transport Planning Objectives and KPIs for Regional Objective 1

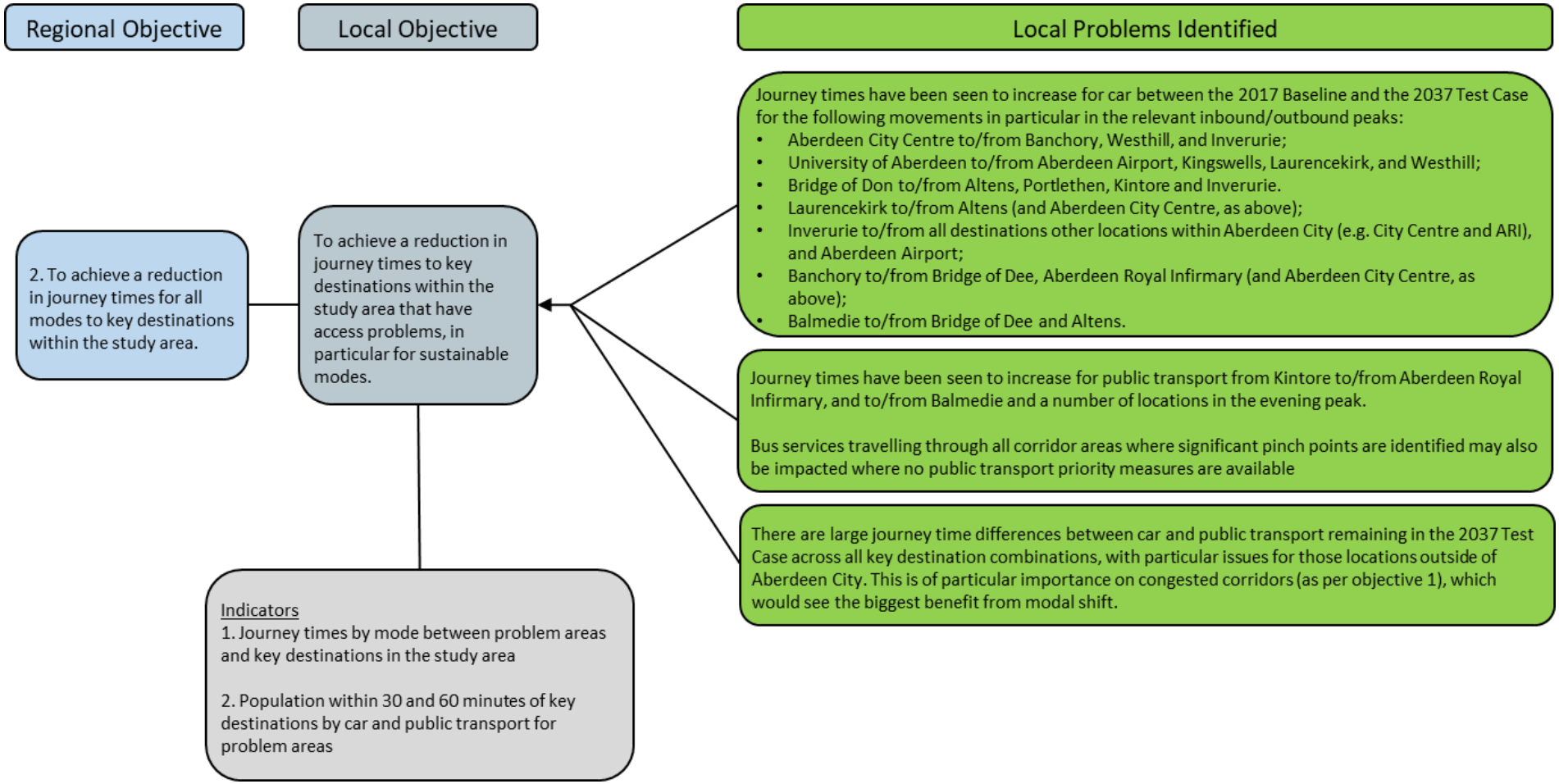

Figure 4. Local Transport Planning Objectives and KPIs for Regional Objective 2

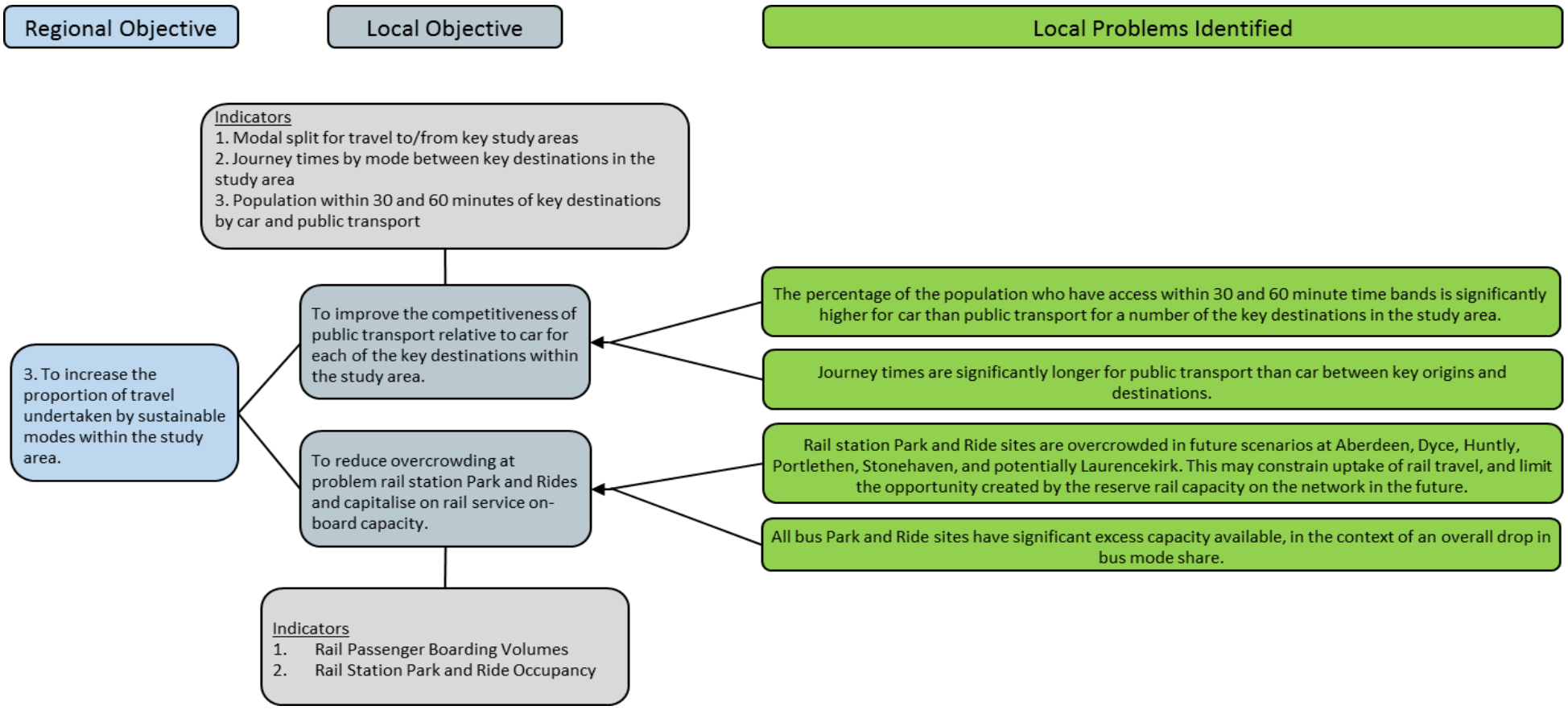

Figure 5. Local Transport Planning Objectives and KPIs for Regional Objective 3

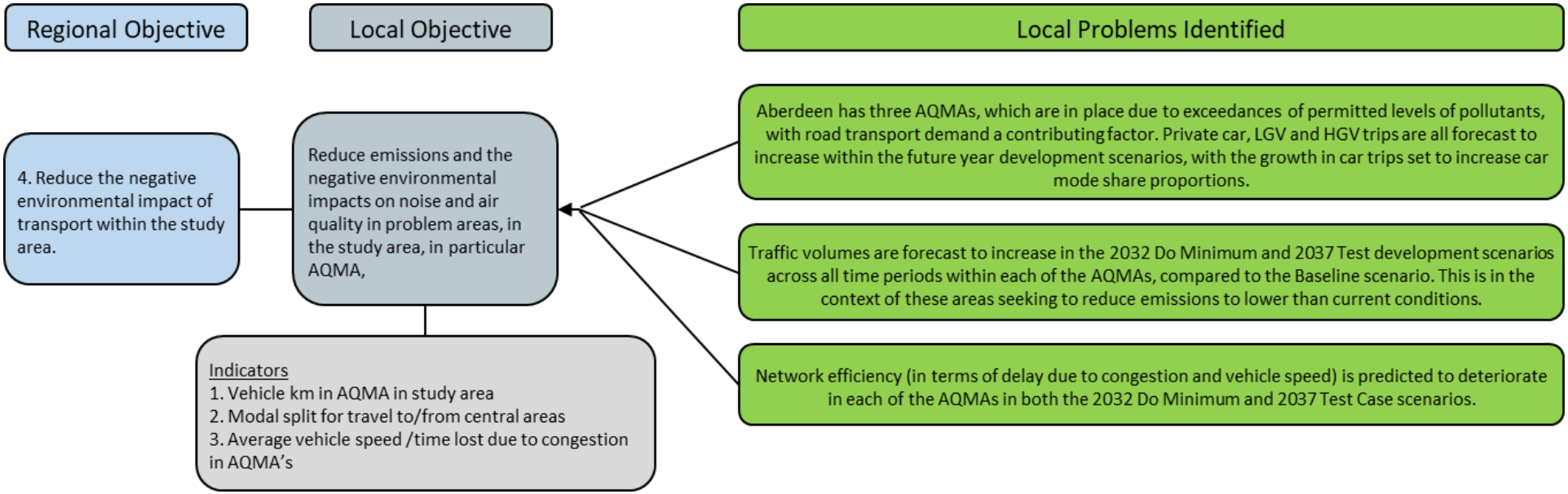

Figure 6. Local Transport Planning Objectives and KPIs for Regional Objective 4

6. IMPACT OF TEST PACKAGES: TPO APPRAISAL

6.1 Introduction

6.1.1 This section describes the predicted impact of the three Test Packages, using various key performance indicators to consider performance against the Transport Planning Objectives.

6.1.2 The regional level Transport Planning Objectives are considered along with their local level sub-objectives. These include:

- 1. Improve the efficiency and reliability of the transport network in the study area;
- 2. To achieve a reduction in journey times for all modes, to key destinations within the study area;
- 3. To increase the proportion of travel undertaken by sustainable transport modes within the study area;
- 4. Reduce the negative environmental impact of transport within the study area; and
- 5. Reduce the rates and severity of traffic accidents within the study area.

6.1.3 Regional analysis is undertaken across the whole study area and described at Aberdeenshire and Aberdeen City level. Local analysis is organised using transport corridors, which were grouped based on geography (i.e. covering 'Central' Aberdeen, 'AWPR and Outer City', or 'Aberdeenshire'). Highly local issues, such as network delay 'hotspots', are discussed within the corridor section summary, and described within Appendix A. Corridor coverage areas are detailed and illustrated in Section 2.4.

6.2 TPO 1: Efficiency and Reliability

6.2.1 This section considers the appraisal of the Test Packages against the following Regional Objective:

1. Improve the efficiency and reliability of the transport network in the study area.

- Local objective is as above, considering the key problem corridors.

6.2.2 The relevant indicators considered here include:

- Traffic volumes in total vehicle kilometres (regional and local levels);
- Time lost due to congestion (regional and local levels);
- Average vehicle speeds (regional and local levels); and
- Delay at problem junctions (local level).

Traffic Volumes: Total Vehicle kilometres

Regional Level

6.2.3 The forecast levels of road traffic travelling across the Aberdeen and Aberdeenshire road network are shown in Table 17 and Table 18 respectively (measured in vehicle kilometres (kms) per hour – Saturn Traffic Model 'Actual Flows').

6.2.4 The trip volume forecasts show that in Aberdeen City the traffic volumes increased from the 2037 Test Case in the AM and PM peaks for each of the three packages considered. A slight reduction is seen during the inter-peak. A similar pattern is evident for Aberdeenshire from the 2037 Test Case across all periods and all packages. A slightly larger increase is evident for package 3 in both the City and Shire.

6.2.5 Note that there is some fluctuation in traffic levels between the two Local Authority areas, as the schemes attract motorists to use different routes, including the AWPR. In total across both areas, there is an increase in traffic volumes in the range of around 2% in the peak period for each of the Packages compared to the 2037 Test Case, and around 6% compared to the Reference Case.

6.2.6 This demonstrates that the Packages would, at a regional level, produce higher overall traffic volumes, and tends to reflect the further attractiveness of road travel through journey time savings.

Table 17. Traffic Volumes in Aberdeen City – Total Vehicle km per Hour

	VEHICLE KILOMETRES PER HOUR			% CHANGE FROM TEST CASE		
Scenario	**AM Peak**	**Inter Peak**	**PM Peak**	**AM Peak**	**Inter Peak**	**PM Peak**
2032 Ref. Case	427,254	321,463	455,002	-2.6%	-4.3%	-2.6%
2037 Test Case	438,721	335,821	467,336	-	-	-
2037 Package 1	445,541	334,694	471,579	1.6%	-0.3%	0.9%
2037 Package 2	445,660	334,712	471,373	1.6%	-0.3%	0.9%
2037 Package 3	447,921	334,627	473,098	2.1%	-0.4%	1.2%

Table 18. Traffic Volumes in Aberdeenshire – Total Vehicle km per Hour

	VEHICLE KILOMETRES PER HOUR			% CHANGE FROM TEST CASE		
Scenario	**AM Peak**	**Inter Peak**	**PM Peak**	**AM Peak**	**Inter Peak**	**PM Peak**
2032 Ref. Case	1,065,146	737,147	1,182,338	-4.0%	-4.6%	-4.1%
2037 Test Case	1,109,850	773,076	1,232,778	-	-	-
2037 Package 1	1,132,594	779,896	1,257,333	2.0%	0.9%	2.0%
2037 Package 2	1,132,735	780,172	1,257,654	2.1%	0.9%	2.0%
2037 Package 3	1,134,183	779,723	1,262,445	2.2%	0.9%	2.4%

Local Level: Central Corridors (1-8)

6.2.7 Figure 7 and Figure 8 describe the overall volume of traffic travelling within each of the Central corridors for both the AM and PM peaks respectively (measured in vehicle kilometres per hour).

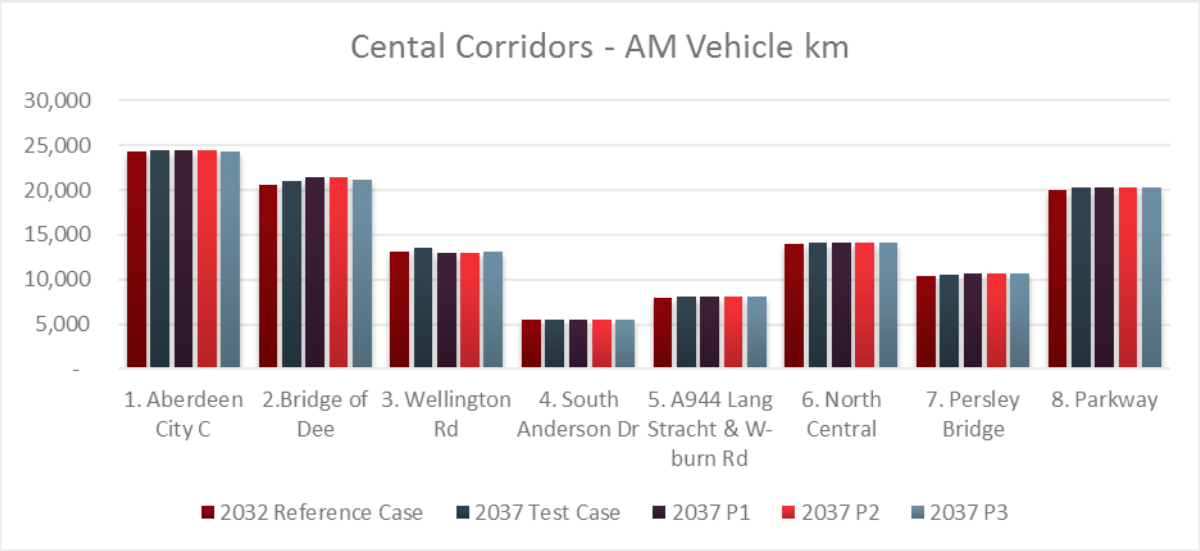

Figure 7. AM Peak Total Vehicle km for 'Central' Corridors

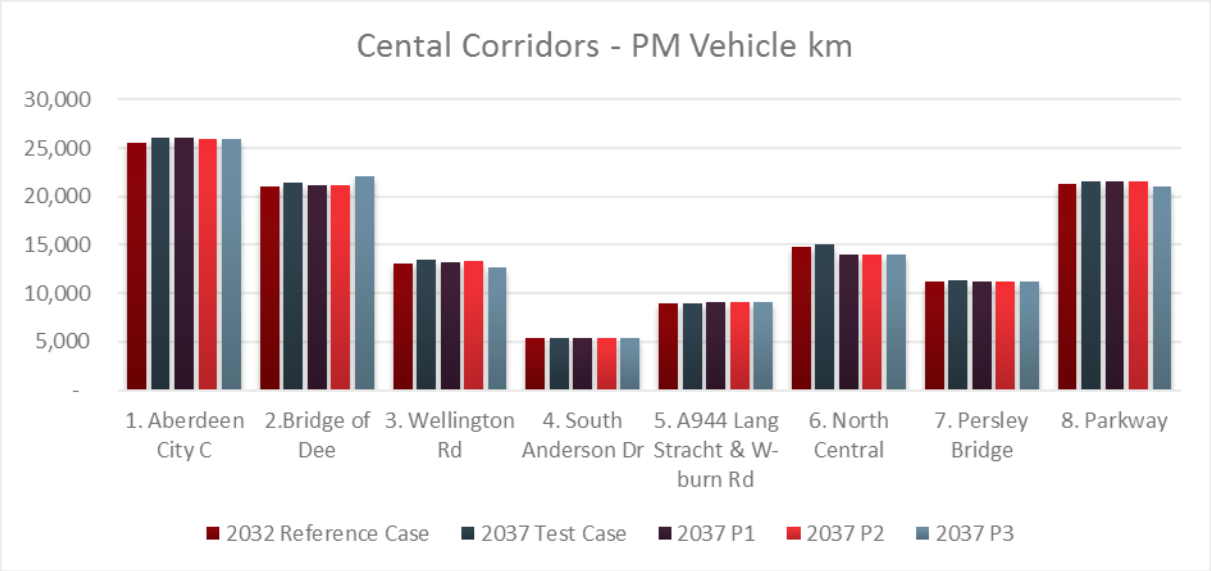

Figure 8. PM Peak Total Vehicle km for 'Central' Corridors

6.2.8 The charts show that the packages have no significant impact to the level of vehicle km in the majority of central corridors. The main changes from the Test Case, include:

- (2) Bridge of Dee vehicle km increase slightly in the AM as a result of the Packages, with the largest changes from Packages 1 and 2. In the PM, Packages 1 and 2 reduce slightly, but increase with Package 3;
- (3) Wellington road sees a drop in vehicle km for around 5% in the AM peak and 2% in the PM peak with packages 1 and 2. Package 3 offers around a 3% reduction in the AM and a 7% drop in the PM;
- (6) St Machar Drive, King Street sees little change in the AM peak, but around a 7% drop in the PM peak;
- (7) Persley Bridge sees around a 2% increase in the AM across all packages, and by 1% in the PM peak;
- (8) The Parkway sees negligible change in the AM peak, but Package 3 alone provides an impact in the PM peak of around a 2% reduction.

Local Level: AWPR and Outer City Corridors (9-17)

6.2.9 Figure 9 and Figure 10 show how traffic volumes on the AWPR and Outer City corridors are forecast to change in each case for both the AM and PM peak time periods respectively.

6.2.10 The Packages tend to have a larger impact on the AWPR and Outer City corridors than the central corridors. The main changes observed from the Test Case, include:

- (9) Parkhill - Bridge of Don sees an increase of around 2% in the AM peak from Packages 1 and 2, and a further increase of 5% from Package 3. In the PM, Package 1 offers a modest 1% reduction, Package 2 offers little change, but Package 3 sees around a 17% increase from the Test Case (as P3 schemes impact this area);
- (10) Stoneywood sees a slight increase in the AM and a slight decrease in the PM (around 1-2% in each case);
- (11) A96, Kirkhill, Airport sees a 4% increase in the AM peak with Packages 1 and 2, and a further 3% with Package 3. Little change is observed in the PM;
- (12) A944 Kingswells-Westhill sees an increase of around 4% in the AM peak from each Package, and around 6% in the PM peak;
- (13) AWPR: Charleston, A90 S, sees a reduction of around 2% in the AM peak and an increase of around 5% in the PM peak;
- (14) AWPR: Cleanhill sees around a 4% change in the AM peak from Packages 1 and 2, with a slight further increase from Package 3 (~1%). In the PM, however, there is a large increase of around 26% with Package 1, continuing with Packages 2 and 3;
- (15) AWPR: Deeside A93 sees a small decrease in the AM of 1-2% and a small increase of 1-2% in the PM;
- (16) AWPR: Kingswells North sees decrease from Package 3, of around 2% in the AM and 5% in the PM; and
- (17) AWPR: Stonehaven sees a slight increase in the AM (~1%) and a slight decrease in the PM (~1-2%) in all packages.

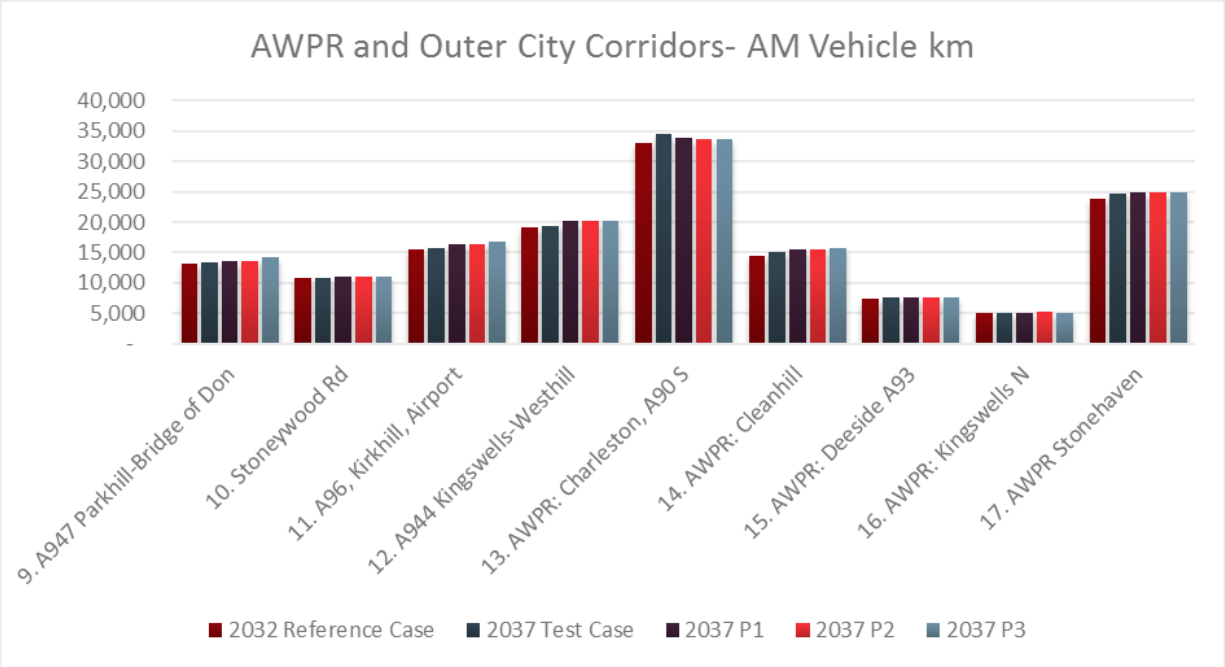

Figure 9. AM Peak Total Vehicle km for 'AWPR and Outer City' Corridors

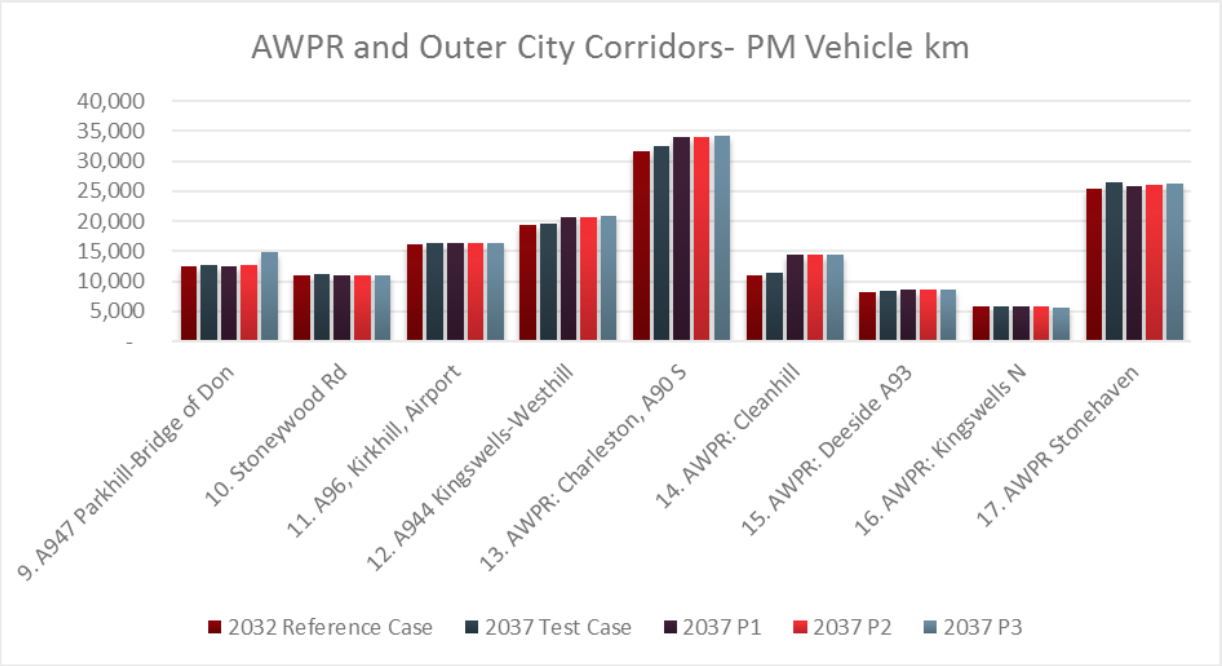

Figure 10. PM Peak Total Vehicle km for 'AWPR and Outer City' Corridors

6.2.11 The forecasting tends to generate a varied set of results, changing by time period and corridor. This trend reflects the nature of the Packages, where some schemes will provide additional capacity and generate a larger throughput of vehicles, and also divert traffic away from other congested areas.

Local Level: Aberdeenshire Corridors (18-21)

6.2.12 Figure 11 and Figure 12 show the forecast change in traffic volumes for each Package on the Aberdeenshire corridors for both the AM and PM peaks respectively

6.2.13 The main changes observed from the Test Case, include:

- (19) A96 Inverurie sees an increase of around 8% with Packages 1 and 2 and a further 3% with Package 3 in the AM. In the PM Packages 1 and 2 create a 9% increase, and around 7% in Package 3. These additional traffic volumes reflect the scale of the A96 Dualling scheme, which is likely to attract further motorists to the A96 corridor;
- (20) A90 North: Ellon sees a 10% increase for all packages in the AM. In the PM it shows a 9% increase with Packages 1 and 2 and a further 6% with Package 3; and
- (21) A947 Rural shows a 6% reduction in the AM peak from Packages 1 and 2, reduced to 5% by Package 3. In the PM, there is a modest 2% increase.

6.2.14 The additional Veh Kms forecast for the A96 and Ellon corridors indicate that the relevant scheme proposals are able to accommodate a higher level of vehicles through this part of the network.

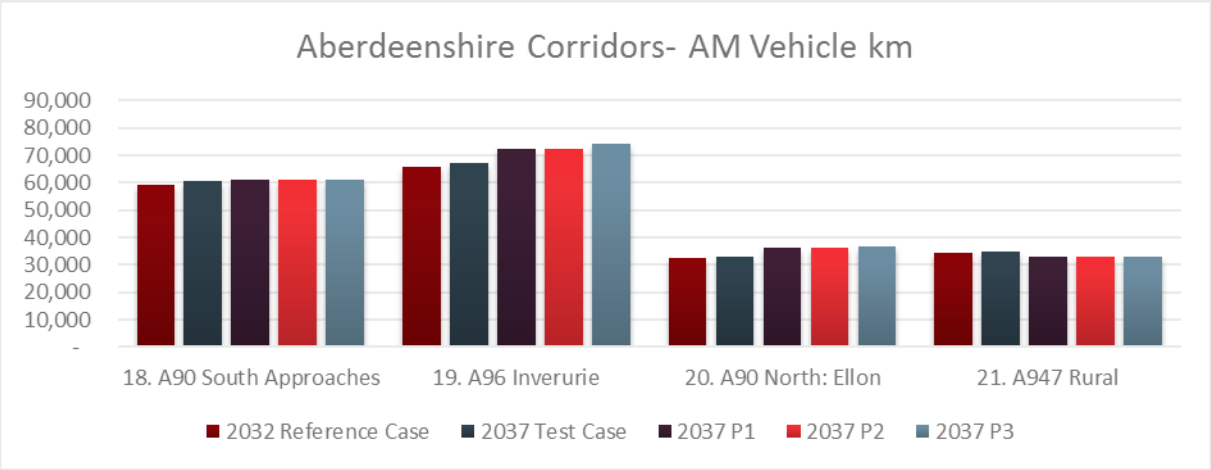

Figure 11. **AM Peak Total Vehicle kms for 'Aberdeenshire' Corridors**

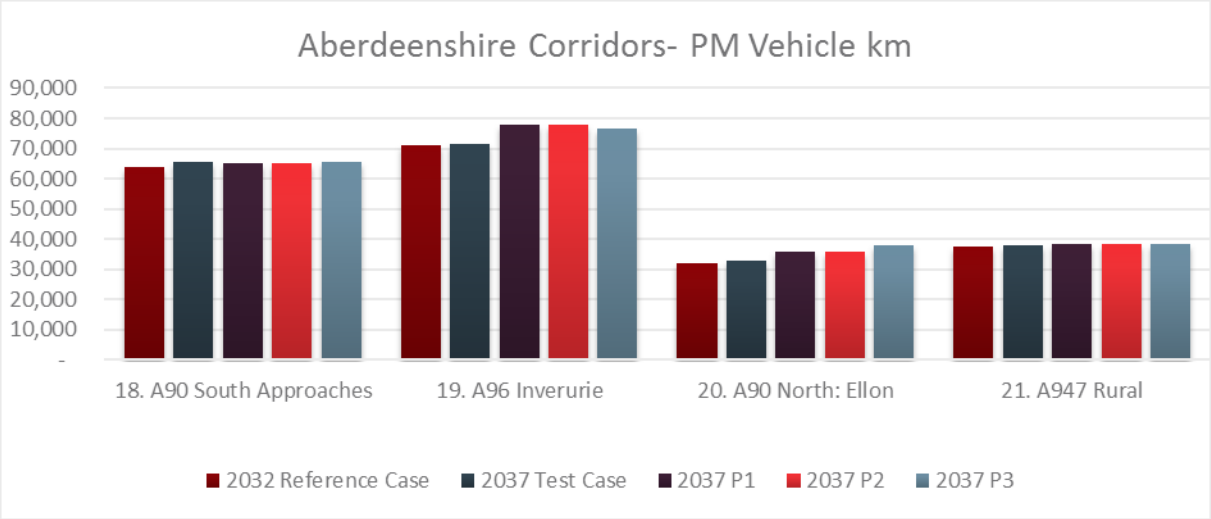

Figure 12. **PM Peak Total Vehicle kms for 'Aberdeenshire' Corridors**

Time Lost Due to Congestion

Regional Level

6.2.15 Regional level road network operational performance is considered by calculating the total vehicle time lost due to congestion (described in vehicle hours).

6.2.16 These statistics, covering Aberdeen City and Aberdeenshire are described in Table 19 and Table 20, and show that:

- Each package actually increases the time lost due to congestion in the AM peak and IP in Aberdeen City, with an overall decrease in the PM peak;
- There is a large improvement on the Aberdeenshire road network between the 2037 Test Case and each of the packages tested.

- Congestion remains heavier in the PM peak compared to the AM for each of the Test Packages, but does show greater improvement for each Package;
- Across the combined City and Shire areas, the overall level of congestion is reduced, with some of the major Aberdeenshire benefits off-set within the city.

6.2.17 Similarly to the vehicle kms analysis, the congestion results present some variation in the location of delays across the Authority areas. Within the AM Peak, some additional congestion is forecast around the edge of Aberdeen, as additional capacity improves the flow of traffic through Aberdeenshire (i.e. A96) towards Aberdeen, where some pinch points remain. However, at the region-wide level, an overall benefit is forecast.

Table 19. Total Time Lost Due to Congestion in Aberdeen City

	TOTAL TIME LOST DUE TO CONGESTION (HOURS)			% CHANGE FROM TEST CASE		
Scenario	**AM Peak**	**Inter Peak**	**PM Peak**	**AM Peak**	**Inter Peak**	**PM Peak**
2032 Ref. Case	6,050	3,071	7,951	-6.9%	-6.5%	-9.2%
2037 Test Case	6,498	3,284	8,753	-	-	-
2037 Package 1	6,763	3,337	8,559	4.1%	1.6%	-2.2%
2037 Package 2	6,747	3,331	8,569	3.8%	1.4%	-2.1%
2037 Package 3	6,782	3,376	8,448	4.4%	2.8%	-3.5%

Table 20. Total Time Lost Due to Congestion in Aberdeenshire

	TOTAL TIME LOST DUE TO CONGESTION (HOURS)			% CHANGE FROM TEST CASE		
Scenario	**AM Peak**	**Inter Peak**	**PM Peak**	**AM Peak**	**Inter Peak**	**PM Peak**
2032 Ref. Case	1,957	440	2,342	-13.6%	-11.7%	-7.3%
2037 Test Case	2,266	498	2,527	-	-	-
2037 Package 1	1,806	438	2,246	-20.3%	-12.1%	-11.1%
2037 Package 2	1,806	438	2,145	-20.3%	-12.0%	-15.1%
2037 Package 3	1,817	439	2,139	-19.8%	-11.9%	-15.4%

Local Level: Central Corridors (1-8)

6.2.18 Figure 13 and Figure 14 describe the predicted time lost due to congestion (measured in total vehicle hours delayed) for each of the Central corridors for both the AM and PM peak hours respectively.

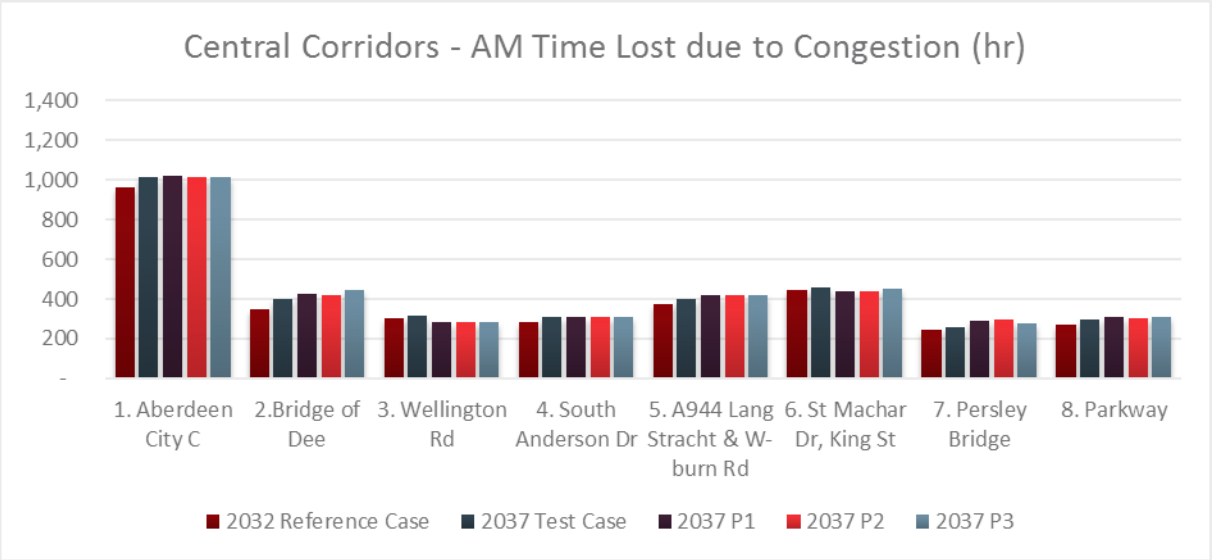

Figure 13. AM Peak Time Lost Due to Congestion (Hours) for 'Central' Corridors

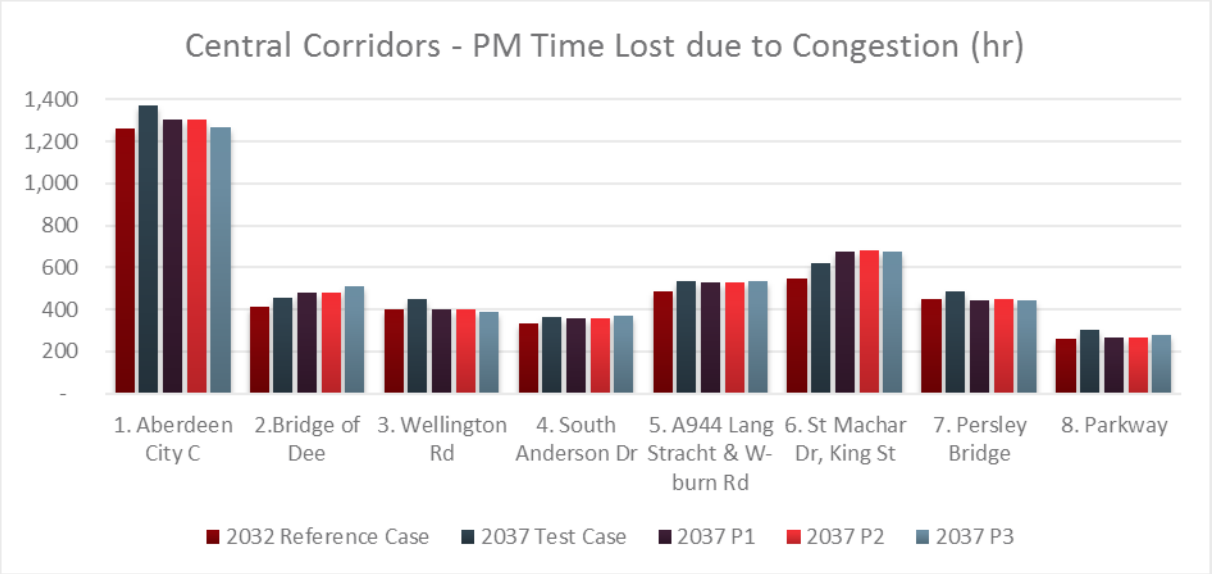

Figure 14. PM Peak Time Lost Due to Congestion (Hours) for 'Central' Corridors

6.2.19 The main changes observed from the Test Case, include:

- (1) Aberdeen City Centre sees little impact in the AM, but a 5% reduction in the PM peak from Packages 1 and 2, and a further 3% from Package 3;
- (2) Bridge of Dee sees an increase of 7% in the in the AM from Packages 1 and 2, and a further 6% from Package 3, with similar trends seen in the PM peak;
- (3) Wellington road sees a large 10% drop in both the AM and PM peaks with packages 1 and 2, with a further 4% drop offered from Package 3 in the PM peak;
- (4) South Anderson drive, sees a 2% increase with Packages 1 and 2, in the AM, but a positive PM impact (~2%);
- (5) A944 Lang Stracht & Westburn Rd sees a 4% increase in time lost in the AM, with a marginal benefit in the PM of ~1%.
- (6) St Machar Drive, King Street sees a 4% improvement in the AM peak from Packages 1 and 2, lessened by around 2% in Package 3. In the PM peak there is a large 9% increase, which is reduced slightly by Package 3 (~1%);

- (7) Persley Bridge sees a large increase in congestion in the AM peak, from Packages 1 and 2 (12-13%), which is reduced by 5% with Package 3. In the PM there is a large improvement of around 9% in Package 1 and a further marginal improvement by Package 3; and
- (8) Parkway sees a small increase of 3% with Package 1, and by 2% in Package 3 in the AM. In the PM however, there is a large benefit of 12% reduction in lost time, which deteriorates by Package 3 (~4%).

6.2.20 Although there are some benefits produced for the central corridors from each of the Packages, time savings are not consistent and generally not significant, with many corridors maintaining congestion levels similar to the Test Case Scenario. The response within the evening peak is more encouraging, with congestion reduced within the Wellington Road, City centre and Bridge of Don areas.

Local Level: AWPR and Outer City Corridors (9-17)

6.2.21 Figure 15 and Figure 16 describe the time lost due to congestion for each of the AWPR and Outer City corridors for both the AM and PM peaks respectively.

6.2.22 The main changes observed from the Test Case, include:

- (9) Parkhill - Bridge of Don sees an increase of around 5% and around 25% in the AM and PM peaks respectively, with the introduction of Package 1. However, Package 2 counters this impact, reducing delays slightly in the AM peak, but reducing more significantly in the PM by 30%, and then a further 8% from Package 3. This brings the time lost to below the Test Case and Reference Case in the PM;
- (10) Stoneywood sees an increase in the AM from Package 3 in the AM. A reduction in the PM of around 10% is seen with Package 1, which is eroded by Package 3, but with overall levels remaining below the Test and Reference cases;
- (11) A96, Kirkhill, Airport sees a 45% increase in congestion in the AM peak with Packages 1 and 2, reduced slightly by 10% with Package 3. In the PM there is a 5% increase from Packages 1 and 2, but this impact is alleviated in Package 3;
- (12) A944 Kingswells-Westhill sees an increase of around 9% in the AM peak from Package 1, which is offset by around 4% by Package 3. In the PM peak, there is an improvement of around 13% from Package 1 and a further 1% by Package 3;
- (13) AWPR: Charleston, A90 South, sees a reduction of around 13% in the AM peak from Package 1, with a slight erosion of this benefit from Package 3 (to 2.5%). In the PM there is a 1.5% increase in time lost, but this is offset by Package 3;
- (14) AWPR: Cleanhill sees a very large reduction of 48% in the AM peak from Packages 1 and 2. In the PM, there is large reduction of around 21% with Package 1, however, this is largely offset in Package 3 seeing this reduction drop to 7% from the Test Case and remaining slightly above Reference Case levels;
- (15) AWPR: Deeside A93 sees a 10% benefit in the AM from Package 1, however, this is more than offset by a 15% increase from Package 3. In the PM there is a 22% benefit from Package 1 and a further 7% benefit from Package 3;
- (16) AWPR: Kingswells North sees an increase from Package 3 (40%) in the AM, however, this is from a very low base of congestion. In the PM there is a 17% improvement from Package 1, carried through to the other Packages; and
- (17) AWPR: Stonehaven sees an increase in time lost in the AM (9%) for all packages. In the PM there is an increase of 7% from Package 1 and a further 6% from Package 3.

6.2.23 The analysis shows that the Packages generate some considerable time savings in several corridors. The AWPR A944, A947 and Cleanhill intersections see some significant reductions in congestion in all packages, particularly during the PM peak. However, the analysis demonstrates secondary impacts to the A96 and Kirkhill areas, and although mitigated to some extent in Package 3, shows congestion continuing at relatively high levels. Traffic delays at Stonehaven also deteriorate.

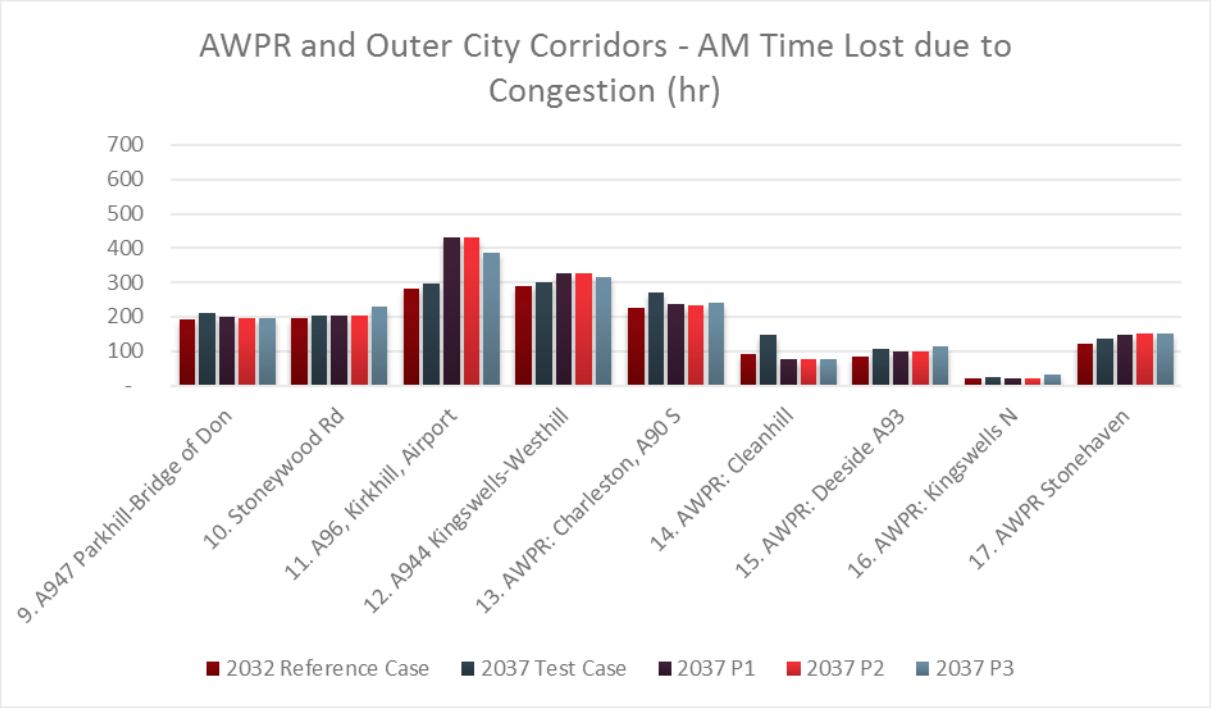

Figure 15. AM Time Lost Due to Congestion (Hours) for 'AWPR and Outer City' Corridors

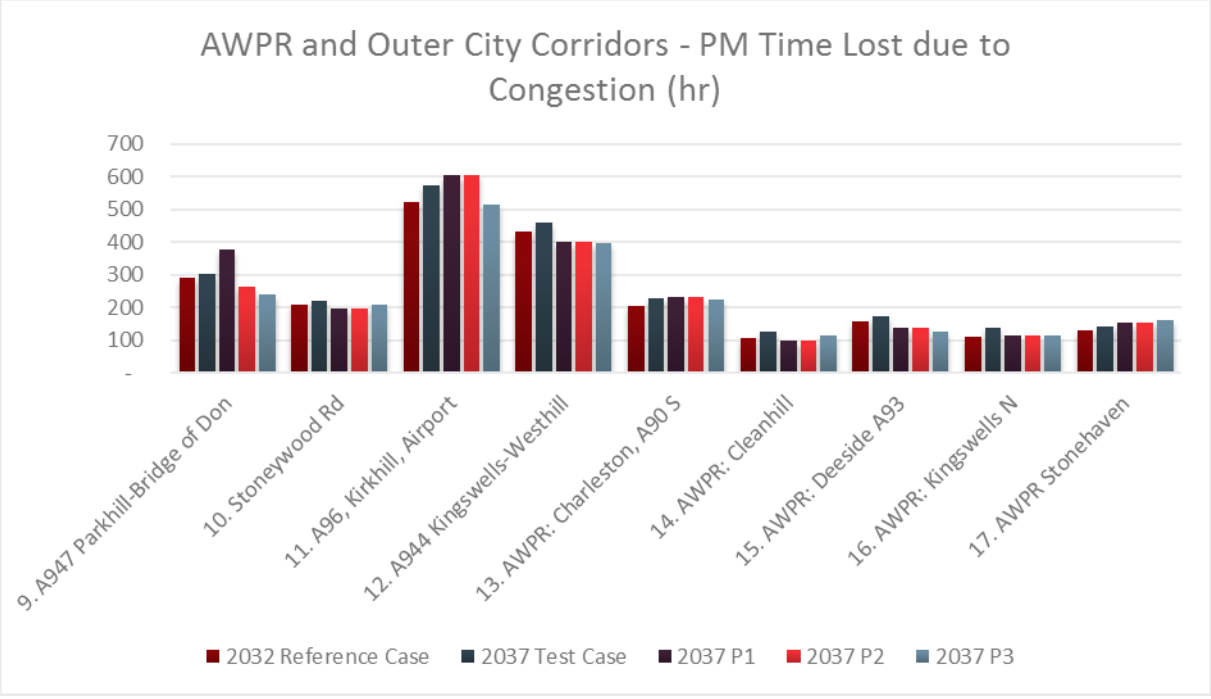

Figure 16. PM Time Lost Due to Congestion (Hours) for 'AWPR and Outer City' Corridors

Local Level: Aberdeenshire Corridors (18-21)

6.2.24 Figure 17 and Figure 18 show the time lost due to congestion on each of the Aberdeenshire corridors for both the AM and PM peaks respectively.

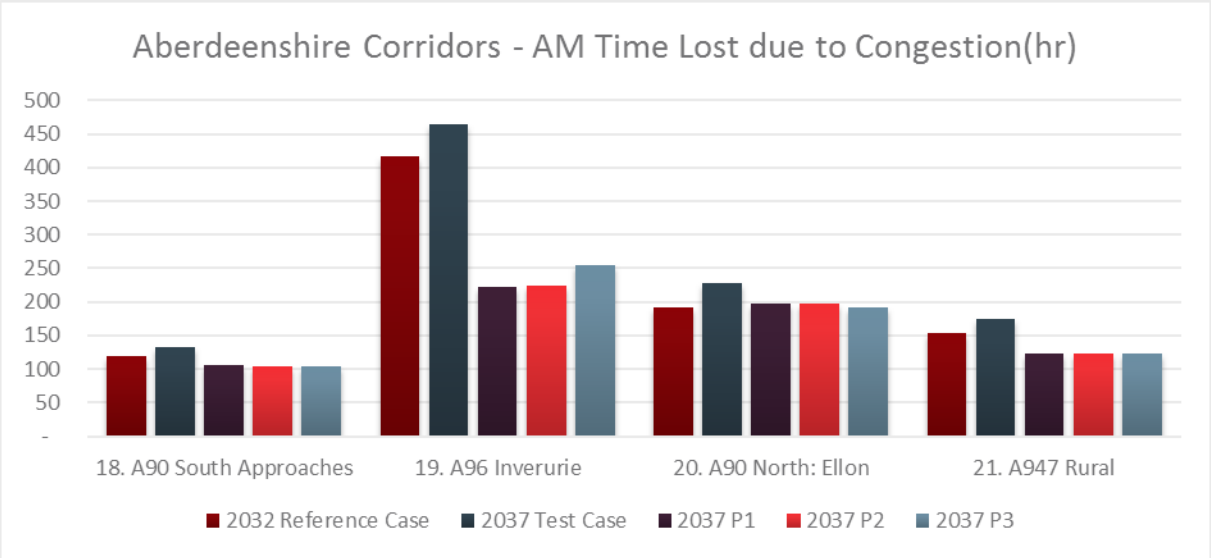

Figure 17. AM Time Lost Due to Congestion (Hours) for 'Aberdeenshire' Corridors

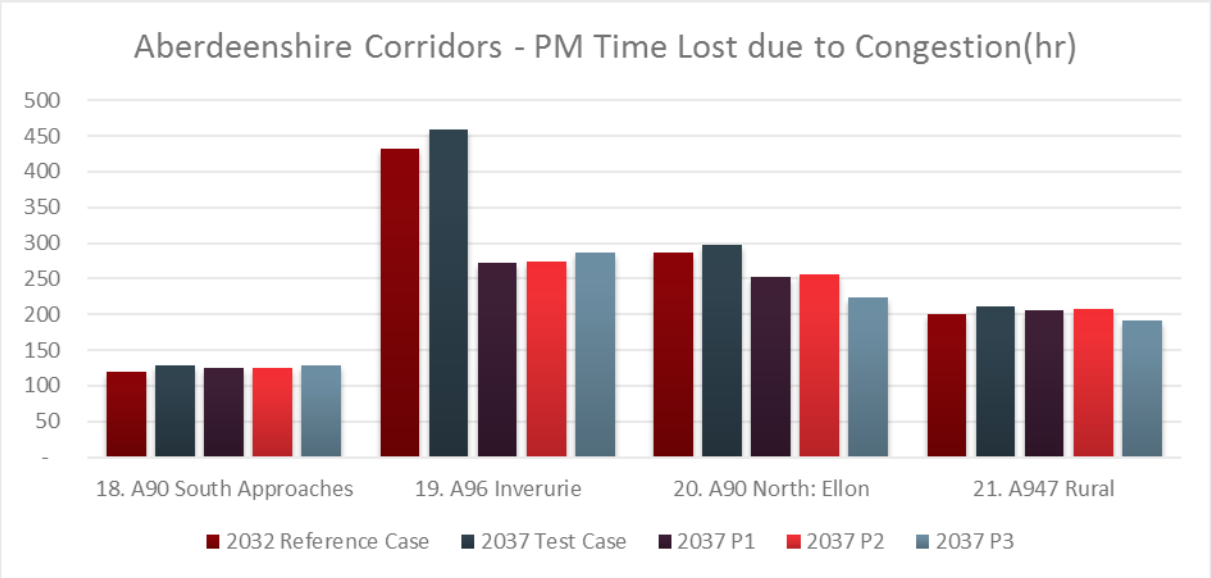

Figure 18. PM Time Lost Due to Congestion (Hours) for 'Aberdeenshire' Corridors

6.2.25 The main changes observed from the Test Case include:

- (18) A90 South Approaches sees strong improvement (21%) with Package 1 in the AM peak, with little change in the PM.
- (19) A96 Inverurie sees significant improvements - of around 52% with Package 1 in the AM, and in the PM Packages 1 creates a 41% reduction in time lost;
- (20) A90 North: Ellon sees a 13-16% reduction for all packages in the AM and PM, and a further 13% reduction with Package 3; and
- (21) A947 Rural shows a 30% reduction in the AM peak from Package 1, with less extensive time benefits shown in the PM peak.

Average Traffic Speed

Regional Level

6.2.26 The impacts to regional network operation are also seen in relation to the average traffic speed forecast across the road network. It can be seen from Table 21 and Table 22 that:

- Average speeds are reduced in the Test Packages in AM and IP periods across the Aberdeen city area when compared to the 2037 Test Case. They are increased slightly in the PM in each;
- In Aberdeenshire, average speeds are seen to rise through each of the Test Packages for each period when compared to the 2037 Test Case.
- Similar to the congestion results, the speed data shows some variation between Authority areas, but overall, demonstrates a region-wide benefit from each of the three Packages.

Table 21. Average Traffic Speed in Aberdeen City

	AVERAGE SPEED (KPH)			% CHANGE FROM TEST CASE		
Scenario	**AM Peak**	**Inter Peak**	**PM Peak**	**AM Peak**	**Inter Peak**	**PM Peak**
2032 Ref. Case	30.7	35.5	27.7	1.9%	0.5%	3.5%
2037 Test Case	30.1	35.3	26.8	0.0%	0.0%	0.0%
2037 Package 1	29.9	35.1	27.4	-0.7%	-0.7%	2.0%
2037 Package 2	29.9	35.1	27.3	-0.6%	-0.6%	1.9%
2037 Package 3	30.0	35.0	27.6	-0.4%	-1.0%	3.0%

Table 22. Average Traffic Speed in Aberdeenshire

	AVERAGE SPEED (KPH)			% CHANGE FROM TEST CASE		
Scenario	**AM Peak**	**Inter Peak**	**PM Peak**	**AM Peak**	**Inter Peak**	**PM Peak**
2032 Ref. Case	74.3	82.3	73.2	1.6%	0.3%	0.5%
2037 Test Case	73.2	82.0	72.8	0.0%	0.0%	0.0%
2037 Package 1	76.3	83.3	74.9	4.4%	1.5%	2.9%
2037 Package 2	76.4	83.3	75.4	4.4%	1.5%	3.5%
2037 Package 3	76.3	83.3	75.5	4.4%	1.5%	3.7%

Local Level: Central Corridors (1-8)

6.2.27 Figure 19 and Figure 20 demonstrate how average vehicle speeds are forecast to change within each of the Central corridors for both the AM and PM peaks respectively.

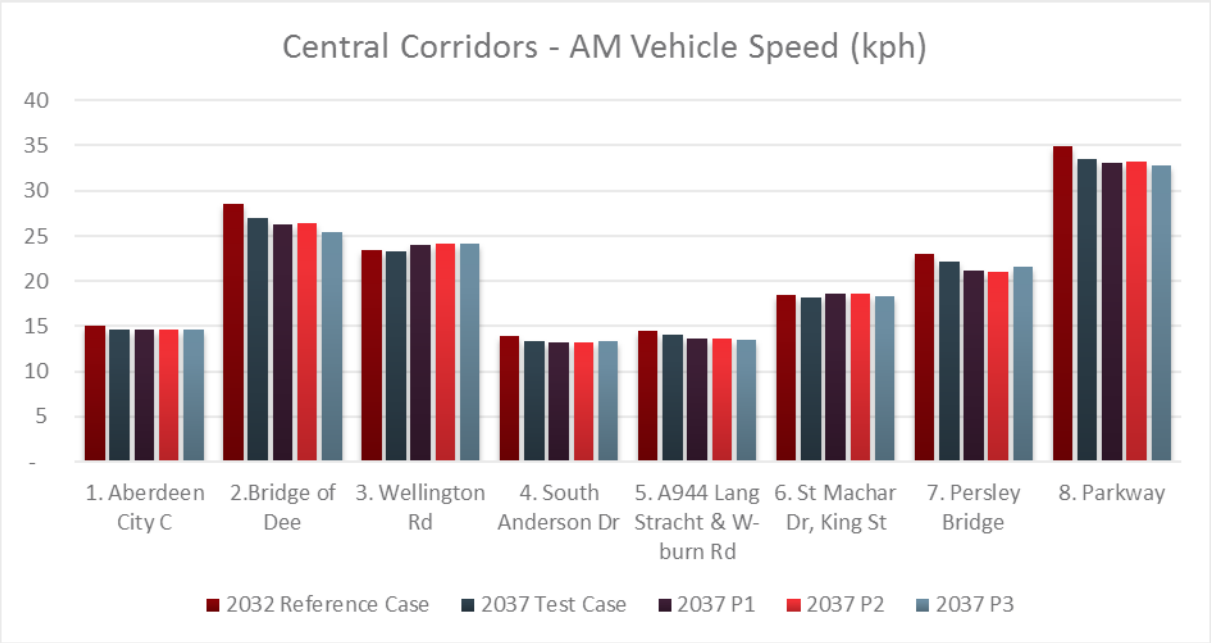

Figure 19. AM Peak Vehicle Speed (kph) for 'Central' Corridors

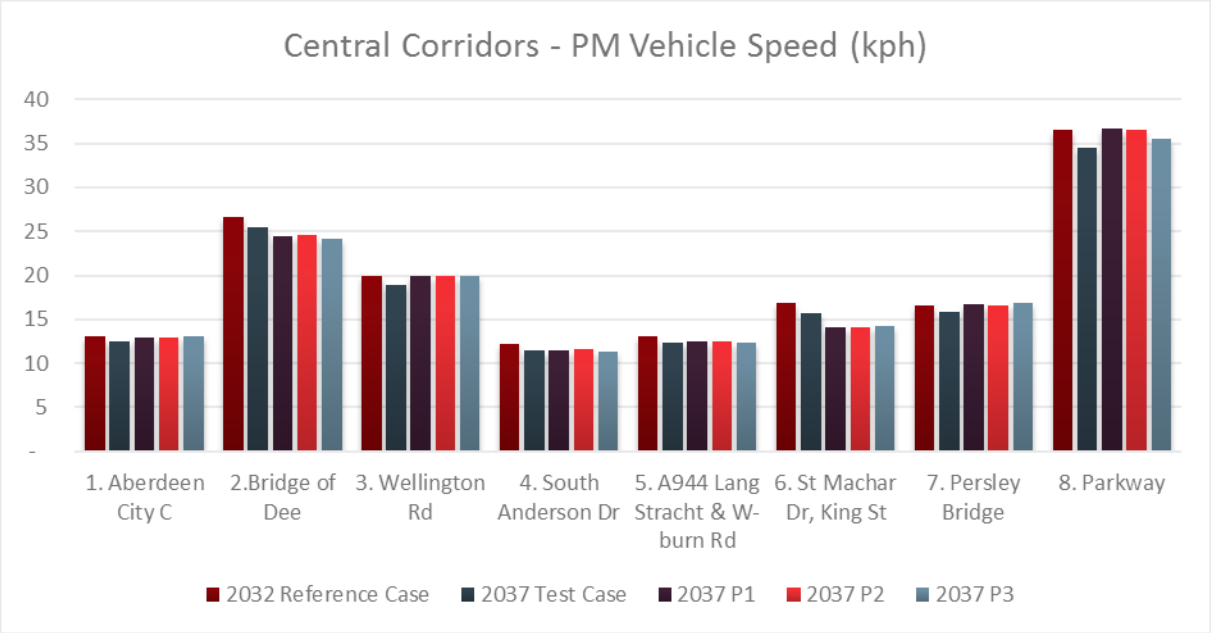

Figure 20. PM Peak Vehicle Speed (kph) for 'Central' Corridors

6.2.28 The main changes observed from the Test Case include:

- (1) Aberdeen City Centre sees little impact in the AM, but a 3% increase in speeds the PM peak from Package 1, and a further 2% from Package 3;
- (2) Bridge of Dee sees a reduction of 3% in the AM from Package 1, and a further 4% from Package 3. Similar reductions are seen in the PM peak;
- (3) Wellington Road sees a 3% and 6% rise in the AM and PM Peaks respectively;

- (6) St Machar Drive, King Street sees a 10% decrease in speeds during the PM Peak;
- (7) Persley Bridge sees a reduction in speed of around 5% in the AM peak from package 1, which is slightly improved (~3%) with Package 3. In the PM there is an improvement of 5% in Package 1, which is further improved by Package 3 (~1%);
- (8) Parkway sees a small reduction in speeds of 2% with Package 1. In the PM however, there is an increase in speed of 6%, which reduces slightly by Package 3.

Local Level: AWPR and Outer City Corridors (9-17)

6.2.29 Figure 21 and Figure 22 show the average vehicle speeds on each of the AWPR and Outer City corridors for both the AM and PM peaks respectively.

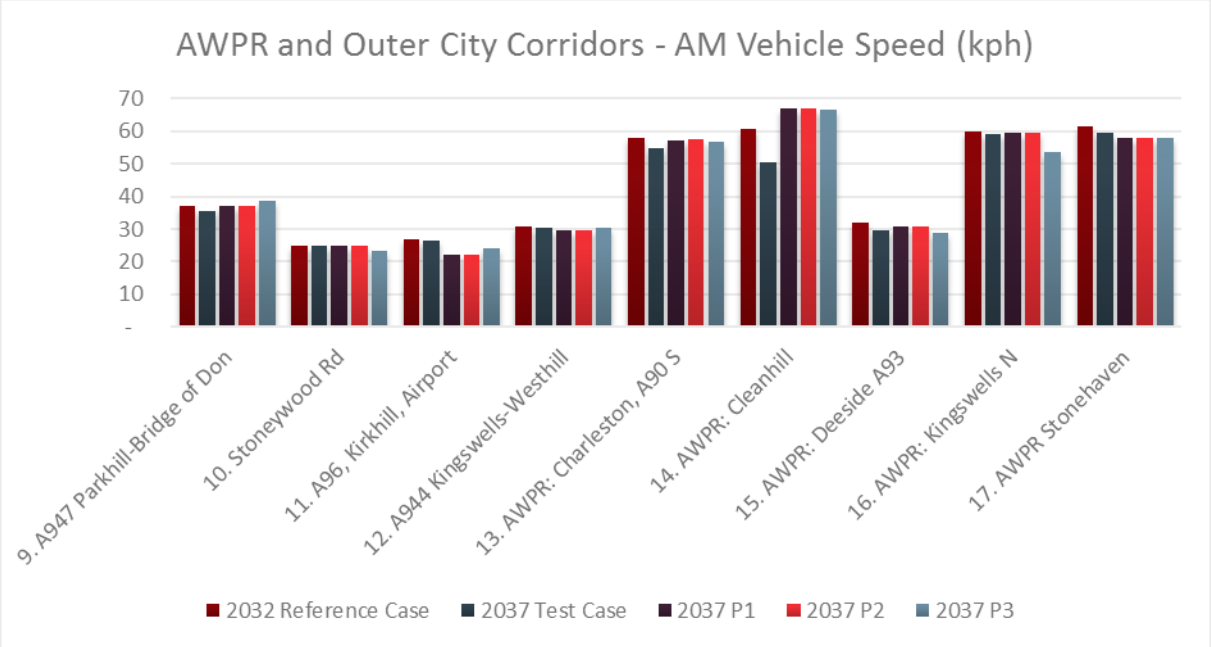

Figure 21. AM Peak Vehicle Speed (kph) for 'AWPR and Outer City' Corridors

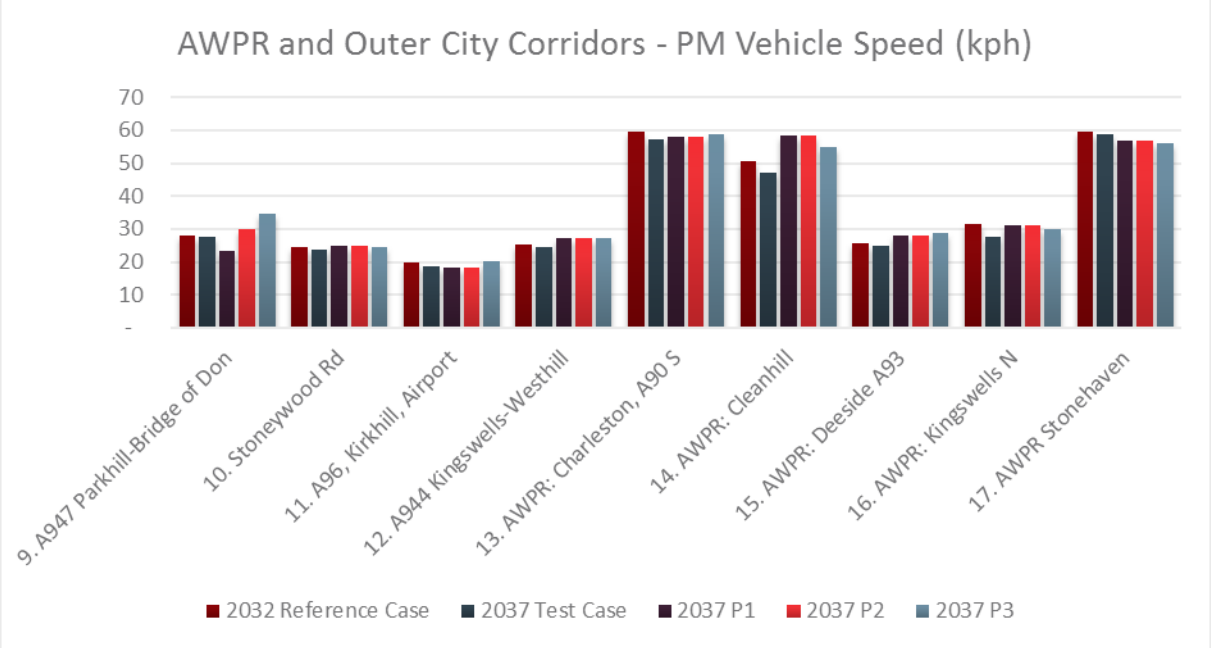

Figure 22. PM Peak Vehicle Speed (kph) for 'AWPR and Outer City' Corridors

6.2.30 The main changes observed from the Test Case, include:

- (9) Parkhill - Bridge of Don sees an increase in speeds of around 4% in the AM peak, but around a 15% drop in the PM peak with the introduction of Package 1. Package 2 increases speeds in the PM peak by around 27%, more than offsetting Package 1; Package 3 shows a 4% increase in speeds for the AM and 16% in the PM;
- (10) Stoneywood sees a decrease in speeds of around 6% in the AM from Package 3. In the PM, an increase of around 5% is seen with Package 1, which is eroded slightly by Package 3, but with overall speeds shown to increase above the Test and Reference Cases;
- (11) A96, Kirkhill, Airport sees a large 16% drop in speeds in the AM peak with Package 1. Speeds are increased further by 8% with Package 3. In the PM there is a 4% decrease from Package 1, but this is reversed by a 12% swing with Package 3 to increase speeds above the Test Case and back to Reference Case levels;
- (12) A944 Kingswells-Westhill sees a decrease in speeds of around 2% in the AM peak from Package 1, which is offset by a 3% increase by Package 3. In the PM peak, there is an increase of around 11% from Package 1 and a further 1% by Package 3;
- (13) AWPR: Charleston, A90 South, sees an increase of 5% in the AM peak from Package 1, with a slight erosion of this benefit from Package 3 by 1%. In the PM there is a 2% increase in speeds and a further 1% from Package 3;
- (14) AWPR: Cleanhill sees a very large increase in speeds of 33% in the AM peak from Package 1. In the PM, there is large increase of around 24% with Package 1. Although there is some deterioration in speeds in Package 3, speeds remain above Reference Case levels in both peak time periods;
- (15) AWPR: Deeside A93 sees a 3% increase in the AM from Package 1, however, this is more than offset by a 6% decrease from Package 3. In the PM there is a 14% increase in speeds from Package 1 and a further 3% increase from Package 3;
- (16) AWPR: Kingswells North sees a large decrease in speeds from Package 3 (10%) in the AM. In the PM there is a 12% increase resulting from Package 1, although Package 3 reduces this by around 3%; and
- (17) AWPR: Stonehaven sees a decrease in speed in the AM and PM (3%) for all packages.

Local Level: Aberdeenshire Corridors (18-21)

6.2.31 Figure 23 and Figure 24 show the change to average vehicle speeds on each of the Aberdeenshire corridors for both the AM and PM peaks respectively.

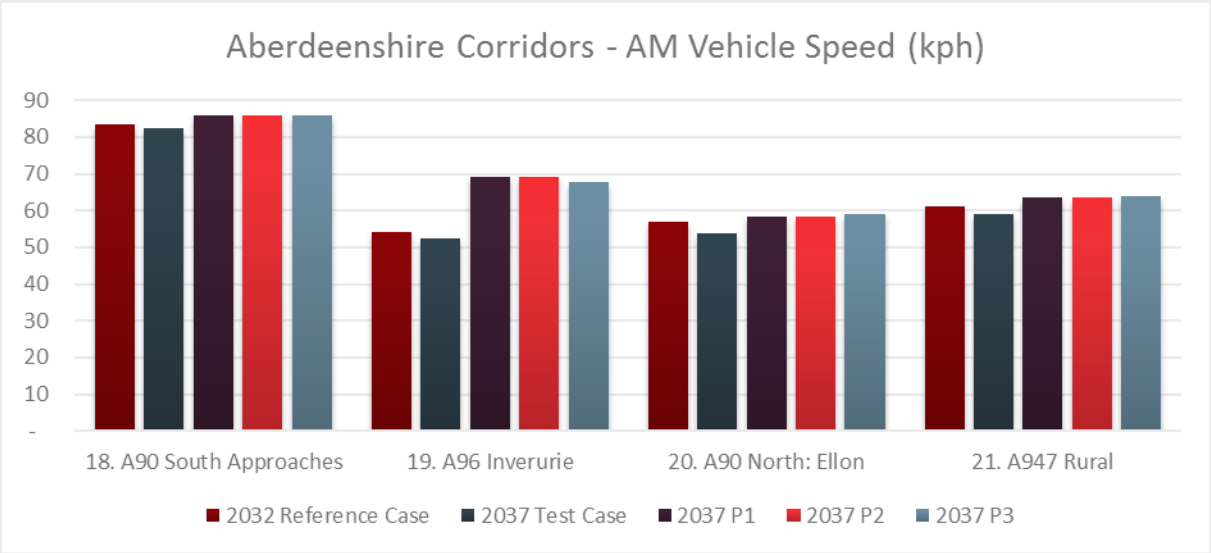

Figure 23. AM Peak Vehicle Speed (kph) for 'Aberdeenshire' Corridors

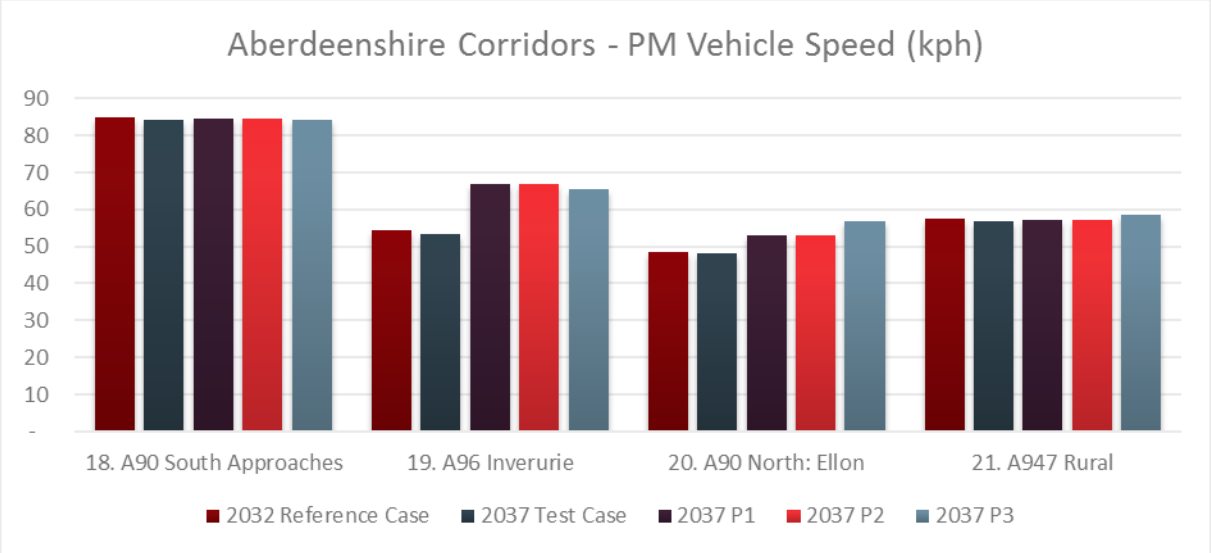

Figure 24. PM Peak Vehicle Speed (kph) for 'Aberdeenshire' Corridors

6.2.32 The main changes observed from the Test Case, include:

- (18) A90 South Approaches corridor sees speed increase (4%) with Package 1 in the AM peak, with little change in the PM;
- (19) A96 Inverurie sees an increase of speeds of around 32% with Package 1 in the AM and 25% in the PM;
- (20) A90 North: Ellon sees an 8% increase with Package 1 in the AM. In the PM an 11% increase is shown with Package 1, and a further 7% with Package 3; and
- (21) A947 Rural shows a 7% increase in the AM peak from Package 1.

Impact of Optimising the Network

6.2.33 To indicate the potential for further congestion relief across the network, a sensitivity test was undertaken to reflect measures which would monitor and subsequently aim to optimise traffic movements through the network. This would cater for the extensive changes to traffic volumes as new schemes are delivered and development is built out. The sensitivity test was carried out using Package 3, and the Saturn road modelling signal optimisation function, which allows signal timings to be automatically revised across the network to cater for forecast traffic. This process involves optimising traffic signal green times in accordance with changes in traffic volumes. Note that due to the characteristics of some intersection locations, delivering these type of benefits may involve more significant changes to signal staging or potentially re-working junction layouts.

6.2.34 Note that using this function does alter performance across the whole network, and tends to over-estimate benefits by moving away from the calibrated base model, and optimising locations which are less relevant. Although many benefits may not be realised, it is also the case that modelling may over-estimate impacts by not examining optimisation. The benefits produced here should therefore be treated with caution, and in reality, are likely to be less extensive than suggested.

6.2.35 Examining the optimised network scenario, the following observations can be made at the regional level:

- For **vehicle traffic volumes**, the optimised scenario showed higher vehicle flows during the peak hours within the Aberdeen City area (1-2%), but with little change in Aberdeenshire;
  For **time lost due to congestion**, optimisation is seen to have a notable positive effect. Where congestion was forecast to increase marginally in the AM and IP periods in Aberdeen City, figures are seen to drop by around 1 to 2% compared to the Test Case. During the PM Peak, larger benefits are seen of between 6 and 7% are shown. Improvements are also seen in Aberdeenshire figures, resulting in the total time lost across the whole study area improving by around a 7% in the AM and a 9% in the PM, compared to the Test Case. This does not quite achieve Reference Case levels in the AM (8.6%), but does go some way towards this, and Reference Case levels are achieved in the PM peak;
- For **average vehicle speeds**, we can see that the signal optimisation runs again improve conditions, with speeds increased even further above the Test Case and Reference Case in both the AM and PM across both the City and Shire areas. This is particularly beneficial for Aberdeen City, which previously saw a slight drop in speeds in the AM compare to the Test and Reference Cases.

6.2.36 In general, the level of change demonstrated within the optimisation scenario suggests that some further improvements to local operating conditions are possible.

Local Delays - Congestion Maps

6.2.37 The Congestion maps (contained within Appendix A) show the impact of the Packages on the problem junction locations across the study area. Maps representing the change in delays during the PM Peak in Aberdeen and Aberdeenshire respectively are illustrated in Figure 25 and Figure 26. The benefits and impacts illustrated by the congestion mapping are discussed within the following TPO summary section.

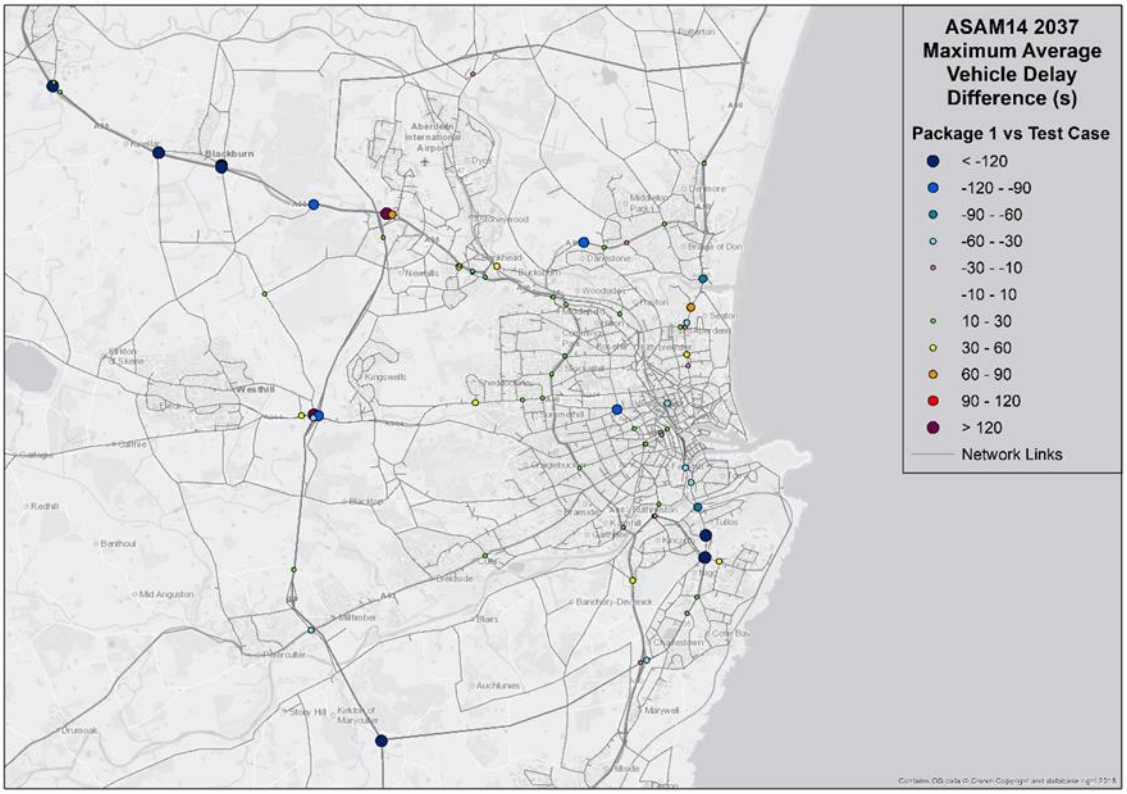

Figure 25. Change in Traffic Delays: Package 1 vrs SDP Test Case, PM Peak Aberdeen

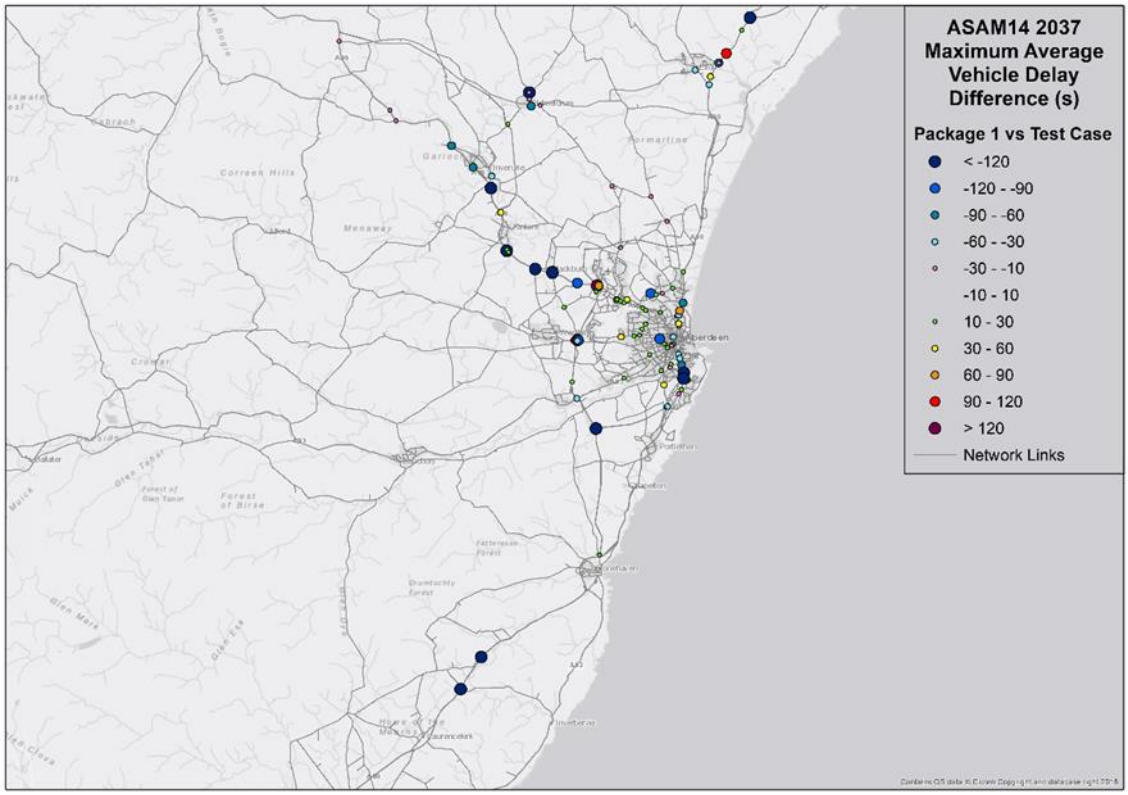

Figure 26. Change in Traffic Delays: Package 1 vrs SDP Test Case, PM Peak Aberdeenshire

TPO 1 Appraisal Summary – Network Efficiency

Regional Objective 1: Improve the efficiency and reliability of the transport network in the study area.

Local level objective: as above, considering the key problem corridors.

Regional Level

6.2.38 The appraisal demonstrates an overall network efficiency benefit at the region-wide level compared to the Test Case scenario, with the majority of time-savings associated with Package 1. Benefits vary geographically, with the majority observed in Aberdeenshire.

6.2.39 All packages result in higher average speeds than both the Test and Reference Case scenarios. Although network efficiency is improved, nil detriment against the Reference Case is not achieved for all indicators, such as congestion. No significant region-wide efficiency benefits are produced through Package 2, with less significant improvements shown by Package 3.

Local Level: Central Corridors (1-8)

6.2.40 For central corridors, the modelling indicates a relatively mixed set of outcomes, with congestion benefits and impacts varying between area and time period. Although packages do reduce congestion at several locations, congestion remains at above Reference Case levels for the majority of areas. There is some potential for greater time savings through a fuller review of future traffic flows to ensure available capacity is optimised to cater for the numerous proposals planned for the network.

6.2.41 The impact of the Test Packages on the problem areas where traffic conditions were forecast to '*deteriorate to a notable extent' within the SDP Test Case* (identified through the Objective setting process) are summarised below.

Aberdeen City Centre, particularly Market Street and College Street;

- Some congestion relief is shown across the city centre area, including the Market Street corridor within evening peak (packages 1 and 3), as schemes improve access to/from the AWPR motorists are drawn out of the city. Further potential savings through optimising the network to better cater for local movements. Considerable congestion remains significant, and some benefits could be diluted due to knock-on impacts of scheme interventions downstream.

Bridge of Dee upstream/ downstream intersections;

- No significant congestion reduction demonstrated, and therefore interaction between local junctions remains a potential issue.

Wellington Road intersections;

- Time savings are generated along this corridor with the additional capacity provided by Package 1. No significant congestion benefits identified by packages 2 and 3. Congestion is forecast to reduce below Reference Case levels, but some knock-on impacts to neighbouring junctions downstream.

Further work through micro simulation modelling may identify an optimised balance of capacity / traffic volumes using the southern corridors to access the city.

South Anderson Drive, particularly connecting with the A93;

- No significant benefits identified, with the A93 junction remaining pressurised in both the AM and PM peaks.

A944 Lang Stracht and Westburn Road connections with Anderson Drive;

- No overall congestion benefit identified, although some reduction in maximum delays, but with knock-on impacts to other intersections. Further potential for network optimisation due to number of traffic signals.

St Machar Drive, Berryden and King Street routes;

- Benefits within AM Peak reduce congestion down to Reference Case levels, but additional delays shown during evening Peak, with area remaining pressurised.

Persley Bridge, Haudagain, North Anderson Drive;

- Further impacts indicated during AM Peak (as more traffic flows into the area due to greater capacity upstream). Benefits demonstrated during PM peak, reducing congestion to below Reference Case levels (as other routes now offer more attractive option, due to congestion relief at AWPR junctions).

Parkway access points;

- Some minor benefits for motorists directly accessing the Parkway, but delays persist elsewhere within the morning peak. Congestion reduces within evening peak towards Reference Case levels.

Local Level: AWPR and Outer City Corridors (9-17)

6.2.42 For the AWPR and Outer City Corridors time benefits are shown to be greater than for central areas, with many of the problem areas being relieved past the Test Case and in some instances to or beyond Reference Case levels.

6.2.43 The impact of the Test Packages on the problem areas where traffic conditions were forecast to '*deteriorate to a notable extent*' are summarised below

Corridors are impacted by congestion as development builds out, with problems exacerbated in the 2032 and 2037 scenarios;

- Proposals along the AWPR corridor significantly improve the operation of access junctions, often to reduce congestion to below levels predicted within the Reference Case.

Motorists are likely to experience some congestion at AWPR access points, with delays forecast over the longer term at the A947, A96, A944 and Cleanhill intersections;

- The modelling demonstrates that Package 1 would reduce delays at Cleanhill to below Reference Case levels, with considerable improvement to junction operation with the introduction of traffic signals. Similarly, delays at the A944 intersection are shown to reduce with the adoption of signals (Package 1), and reduce further with the implementation of an additional slip road section in Package 3. The overall level of congestion drops to below Reference Case levels during the PM peak, but remains above this threshold during the AM Peak.

- Congestion at the A947 Parkhill area is seen to reduce in Package 1 during the AM Peak, with stronger benefits demonstrated within Package 3 across both peak periods. The A96 improvements would tend to attract some rural (A947) motorists away from this bottleneck, and the additional capacity brought through Package 3 improves the local operation of intersections. Although congestion is seen to reduce to below Reference Case levels, the modelling suggests that the Parkhill area would remain under pressure over the long term horizon.

- The A96 dual carriageway scheme attracts additional motorists to travel via this corridor to/from Aberdeen, with the grade separation of access points removing forecast pinch-points at Kintore and Blackburn. This diversion results in traffic levels increasing at the periphery of Aberdeen in and around the A96 AWPR / Dyce link road intersection, with additional delays highlighted in Package 1, in excess of Reference and Test Case levels.
  Package 3 is shown to mitigate some of these diversionary impacts, with congestion dropping to below Reference Case levels within the evening peak (benefiting from the combination of improvements in the A96 area and along the neighbouring alternative routes at the A947, Kingswells North and A944. However, despite these improvements, the modelling suggests that this area of the A96 remains the most significant pinch-point within the periphery of Aberdeen.

Local issues are identified at Kingswells North, and to a lesser extent Stonehaven;

- The modelling suggests that Package 1 would help alleviate the problems identified within the PM peak at Kingswells North, with congestion reducing towards Reference Case levels. With the Packages improving the accessibility of the AWPR, high traffic volumes along the Fastlink section are set to continue and potentially amplify the congestion impacts at the Stonehaven AWPR access point.

Local Level: Aberdeenshire Corridors (18-21)

6.2.44 For the Aberdeenshire Corridors some significant improvements are observed from the Packages tested, with congestion and delays generally seen to be reduced to well below Test Case and Reference Case levels, and with higher traffic volumes accommodated.

6.2.45 The problem areas identified through local objective setting are summarised below, along with the impact of the Test Packages:

Congestion is forecast at the A90 connections at Ellon, A920/B9005 and also at Toll of Birness, with operational conditions shown to deteriorate;

The schemes located in the A90 North / Ellon corridor within Package 1 are shown to significantly improve local operations at these pinch-points. The modelling highlights a reduction in congestion during peak times, with further benefits associated with the Ellon Link Road included in Package 3.
Overall, Package 1 reduces congestion to close to or below Reference Case levels, with further benefits realized through Package 3. The modelling suggests some residual congestion impacts as higher traffic levels are released downstream, but maintains an overall positive outcome for the area.

Traffic congestion is identified at several A96 roundabouts during peak times, constraining access along this key route;

- The appraisal demonstrates that the inclusion of the A96 dual carriageway within the Packages generates the most significant benefits of all corridors, with congestion falling well below Reference Case levels, and average speeds increasing to higher than those experienced today. These benefits reflect the diversion of motorists away from Inverurie, freeing up capacity for local movements, and the grade separation of junctions at Kintore and Blackburn, which reduce turning conflicts and provide more efficient access to the corridor. The modelling does though highlight some residual congestion impacts downstream, where the A96 connects to the AWPR.

Traffic volumes are shown to rise along rural corridors, with motorists increasingly delayed as major road access points become constrained, such as A90 South (near Fordoun & Drumlithie) and A947 connections (near Newmachar);

- The congestion results indicate that providing improved slip road connections along the A90 south corridor would reduce the excessive delays forecast in the Test Case down below Reference Case levels.

6.3 TPO 2: Reduce Journey Times to Key Destinations

6.3.1 This section considers the appraisal of the Test Packages against the following objective:

2. To achieve a reduction in journey times for all modes, to key destinations within the study area.

- Local objective is as above, for key destinations and in particular for sustainable modes.

6.3.2 The indicators considered here include:

- Actual journey times by mode between key destinations in the study area); and
- Population within 30 and 60 minutes of key destinations by car and public transport.

Journey Times to Key Destinations

Regional Level

6.3.3 Table 23 and Table 24 show the average journey time to travel between a selection of key destinations and origins during the AM Peak (inbound to destinations, travelling from both origins and destinations) and PM Peak (outbound from destinations, to both origins and destinations) for car and public transport respectively.

6.3.4 Note that the calculation of public transport journey times represent several journey segments, including passenger access/egress walk, wait and in-vehicle travel times. Key destination and origin movements include:

Destinations

- Aberdeen City Centre
- Altens Industrial Estate
- Robert Gordon University (RGU)
- Aberdeen Royal Infirmary (ARI)
- Aberdeen University
- Bridge of Don
- Aberdeen Airport

Origins

- Kingswells
- Westhill
- Peterculter
- Portlethen
- Stonehaven
- Laurencekirk
- Banchory
- Kintore
- Inverurie
- Balmedie
- Ellon

Table 23. Journey Times to/from Key Destinations by Car (minutes)

TIME PERIOD	2032 REF. CASE	2037 TEST CASE	2037 PACKAGE 1	2037 PACKAGE 2	2037 PACKAGE 3
AM Inbound	26.6	27.4	27.5	27.5	27.4
% Change from Test Case	-3.2%	-	0.3%	0.1%	0.0%
PM Outbound	29.7	30.8	29.8	29.4	29.3
% Change from Test Case	-3.3%	-	-3.2%	-4.5%	-4.7%
Average	**28.1**	**29.1**	**28.6**	**28.4**	**28.4**
% Change from Test Case	**-3.2%**	**-**	**-1.5%**	**-2.3%**	**-2.5%**

Table 24. Journey Times to/from Key Destinations by Public Transport (minutes)

TIME PERIOD	2032 REF. CASE	2037 TEST CASE	2037 PACKAGE 1	2037 PACKAGE 2	2037 PACKAGE 3
AM Inbound	71.7	72.1	71.4	71.6	71.7
% Change from Test Case	-0.5%	-	-0.9%	-0.7%	-0.6%
PM Outbound	75.8	76.2	74.9	75.2	75.4
% Change from Test Case	-0.5%	-	-1.7%	-1.3%	-1.0%
Average	**73.8**	**74.2**	**73.2**	**73.4**	**73.5**
% Change from Test Case	**-0.5%**	**-**	**-1.3%**	**-1.0%**	**-0.8%**

6.3.5 The analysis indicates that the Packages offer a benefit to both car and public transport journey times between key destinations, with the exception of the AM Peak time period.

6.3.6 It can be seen that car travel times are reduced (on average) by around 1.5% to 2.5% across the Packages compared to the Test Case, with Package 3 offering the most significant improvement. While this does not achieve journey times equivalent to the Reference Case, it goes some way towards this.

6.3.7 The AM Peak results suggest no overall benefit for these particular key destination movements, and therefore journey times would continue to be a problem. However, the PM Peak achieves a journey time benefit of almost 5% for Package 3, which improves on the Reference Case scenario.

6.3.8 For public transport, journey time benefits are relatively small, but generally consistent across the time periods and scenarios, improving on the Test Case and Reference Case scenario. The PM Peak sees the most significant improvement. In all Packages the journey times are reduced to better than both the Test Case and the Reference Case.

6.3.9 The impact of Package 3 appears to deteriorate public transport journey times slightly, which suggests that some additional public transport priority measures may be required.

6.3.10 Note that due to the origin and destination locations used for the analysis, many of the benefits from the new rail stations within Package 2 are not picked up at this regional level analysis. These benefits are discussed further below.

Local Level

6.3.11 Local level assessment focuses on the problem areas identified in the objective setting process, ensuring the performance of Packages are related back to the objectives. The following observations can be made regarding local road movements between key locations where the increase in car journey times was seen as a problem.

Aberdeen City Centre to/from Banchory, Westhill, and Inverurie;

- During the PM Peak the Package 1 modelling shows that road travel between the City Centre and Westhill improves by between 3%-6% during the PM Peak, between the City Centre and Banchory by 5%-6%, and 7% between the city centre and Inverurie. These benefits reflect the operational improvements at the AWPR access points and the A96 dual carriageway scheme.

University of Aberdeen to/from Aberdeen Airport, Kingswells, Laurencekirk, & Westhill;

- No significant overall improvements identified, although local operational benefits demonstrated along sections of each route (i.e. access to A90 South and at the A944 / AWPR intersection).

Bridge of Don to/from Altens, Portlethen, Kintore and Inverurie;

- There is considerable improvement to/from Kintore and Inverurie, with marginal changes for travelling to/from Portlethen and Stonehaven.

Laurencekirk to/from Altens (and Aberdeen City Centre, as above);

- Altens to Laurencekirk journey times are forecast to reduce by around 6% during PM Peak in Package 1, with further marginal benefits from Package 3.

Inverurie to/from all destinations other locations within Aberdeen City (e.g. City Centre and ARI), and Aberdeen Airport;

- For the key peak hour tidal directions, Package 1 road journey times between Inverurie and all key destinations reduce by 8% for inbound travel during the morning peak, and by -13% for outbound travel during the evening Peak. Road travel between Inverurie and the ARI reduces by 7% and to/from the Airport by 10% during the AM Peak, and by 10% and 16% respectively during the PM Peak. Further road journey time improvements of 4%-5% between Inverurie and the Airport are also shown within Package 3.

Banchory to/from Bridge of Dee, Aberdeen Royal Infirmary and Aberdeen City Centre;

- All Packages provide improvement of around 5% during PM peak for travel to Banchory.

Balmedie to/from Bridge of Dee and Altens.

- All Packages offer considerable improvement for motorists leaving Altens within the PM Peak, and travelling to destinations such as Balmedie.

6.3.12 For problem areas identified during objective setting, the following observations can be made regarding local public transport journey times between key locations:

Problem - Journey times increase for public transport from Kintore to/from Aberdeen Royal Infirmary, and to/from Balmedie and a number of locations in the evening peak.

- The modelling indicates that PT travel times between the ARI and Kintore would reduce by 4% within the PM Peak (Package 1). PT travel times to Balmedie are seen to improve by 3% during evening peak.

Problem – Bus services travelling through significant pinch points may also be impacted where no public transport priority measures are available.

- The PT journey time savings suggest that the bus priority measures contained within Package 1 benefit PT travel times. The new rail stations proposed in Package 2 reduce PT travel times by approximately 12% from the Newtonhill, Cove and Bucksburn passenger catchments, providing an alternative uncongested PT option for travelers able to access rail services within these specific areas.

Problem – There are large journey time differences between car and public transport across all key destination combinations, with particular issues for Aberdeenshire.

- The modelling continues to show that on average, public transport journey times remain relatively uncompetitive compared with private car travel, with no significant journey time improvements occurring between modes. However, the new rail services included within Package 2, do show a significant improvement in public transport journey times from the new station catchments across the rail network, including to access the city centre. Package 2 therefore expands the competitiveness of rail travel to the city centre for a wider population base.

Population Accessibility to Key Destinations by Car and Public Transport

Regional Level

6.3.13 Accessibility analysis was undertaken for both public transport and car connectivity, calculating average journey times to key destinations and the percentage of the population who have access to these areas within 30 minutes and 60 minutes or greater during the AM peak. Statistics provide an average journey time for all movements within a Local Authority to these areas. Whilst average figures can mask local variations, they do provide a general picture for how accessibility is changing. A selection of local variations are discussed to give context to the regional values.

6.3.14 Note that public transport journey times reflect the full journey, including the walk and wait time elements. Key destinations include:

- Aberdeen Airport;
- Aberdeen City Centre, Union Square;
- Aberdeen Royal Infirmary (ARI);
- Aberdeen University;
- Robert Gordon University (RGU);
- Altens and Badentoy (Portlethen) Industrial Estates and Westhill Business Park;
- Bridge of Don Science Park / Exhibition Centre; and
- Ellon and Inverurie.

6.3.15 Accessibility figures for the AM peak are provided in Table 25.

Table 25. % of Population with Access to Key Destinations within the AM Peak

LA	SCENARIO	AVERAGE % OF POPULATION WITHIN 30 MINUTES JOURNEY TIME		AVERAGE % OF POPULATION WITHIN 30 TO 60 MINUTES JOURNEY TIME		AVERAGE % OF POPULATION GREATER THAN 60MINS JOURNEY TIME	
		Car	PT	Car	PT	Car	PT
Aberdeen City	AM 2032 Reference	86.2%	6.8%	13.8%	30.0%	0.0%	63.2%
	AM 2037 Test	85.1%	6.6%	14.9%	30.1%	0.0%	63.2%
	Package 1	84.9%	6.8%	15.1%	30.7%	0.0%	62.5%
	Package 2	85.0%	6.8%	15.0%	30.8%	0.0%	62.4%
	Package 3	84.9%	6.8%	15.1%	30.8%	0.0%	62.4%
Aberdeenshire	AM 2032 Reference	28.1%	0.3%	55.6%	2.8%	16.3%	97.0%
	AM 2037 Test	26.4%	0.3%	55.5%	2.8%	18.1%	96.9%
	Package 1	28.1%	0.3%	57.7%	2.8%	14.2%	97.0%
	Package 2	28.1%	0.3%	57.8%	2.8%	14.1%	97.0%
	Package 3	28.2%	0.3%	57.6%	2.8%	14.2%	96.9%

6.3.16 Whilst the figures at a regional level show only very small changes (partly due to the averaging/masking effect across the destinations, the large sample, and the journey time 'banding' effect), the following statements can be made:

- For residents within Aberdeen city, there is a marginal shift to longer journey times by car on average across the key destinations, and across all packages compared to the Test Case. There is a slight improvement for public transport accessibility, with packages 2 and 3 seeing the largest improvements.

- For residents in Aberdeenshire, there is an improvement in the average % of the population within 30 minutes (+1.7 to 1.8 percentage points) and 60 minute (+2.1 to 2.3 percentage points) journey time bandings across the key destinations compared to the Test Case. No change is seen for public transport access.

Local Level

6.3.17 The impact of the three Packages on access to each of the key destinations is described separately in Table 26. The accessibility results generally indicate similar impacts across each of the Packages to these specific destinations.

Table 26. Summary of Changes to Accessibility to Key Destinations in the AM Peak

DESTINATION	FROM	IMPACT ON HIGHWAY ACCESS – PACKAGES COMPARED TO TEST CASE	IMPACT ON PUBLIC TRANSPORT ACCESS – PACKAGES COMPARED TO TEST CASE
Aberdeen Airport	City	Minor disbenefit ~1% shift	No change
	Shire	Moderate benefit – 8% point shift from 60+ minutes to within 30 and 60 minutes (~4% each).	Minor disbenefit ~1% shift
Aberdeen City Centre Union Square	City	Minor disbenefit ~1% shift	Minor benefit ~2% shift
	Shire	Minor benefit ~ 3% shift	Negligible change <0.5%
Aberdeen Royal Infirmary	City	Minor disbenefit ~1% shift	Minor benefit ~1% shift
	Shire	Moderate benefit ~5% shift	No change
Aberdeen University	City	Minor disbenefit ~1% shift	Minor benefit ~1% shift
	Shire	Moderate benefit ~6% shift	No change
Altens Centre	City	Minor benefit ~ 3% shift	Minor benefit ~ 3% shift
	Shire	Minor benefit ~1% shift	No change
Baydentoy (Portlethen)	City	Minor disbenefit of ~1% shift, in Package 1, improved by ~1% in Package 3.	No change
	Shire	Minor benefit ~ 3% shift	No change
Bridge of Don Science Park / Exhibition Centre	City	Minor disbenefit ~1% shift	Minor benefit ~ 3% shift
	Shire	Moderate benefit ~ 3% shift	No change
Ellon Centre	City	Negligible change <0.5%	No change
	Shire	Minor benefit ~ 3% shift in Package 1 with further 1% in Package 3.	No change
Inverurie Centre	City	Minor benefit ~1-2% shift	No change
	Shire	Minor benefit ~1% shift	No change
Robert Gordon University	City	Minor disbenefit ~1% shift	No change
	Shire	Minor benefit ~2% shift	No change
Westhill Business Park	City	Minor disbenefit ~1% shift	Minor disbenefit ~1% shift
	Shire	Moderate benefit – 10% point shift from 60+ minutes to within 30 (~8%) and 60 minutes (~2%).	Negligible change <0.5%

Regional Level

6.3.18 Package 1 is shown to reduce overall road journey times to/from key destinations by an average of 1.5% during the peak hours, with further improvements suggested within Packages 2 and 3 (up to a 2.5% reduction). Although the Packages do not improve journey times back to the Reference Case overall, benefits within the PM peak are more significant, returning journey times to Reference Case levels when viewed in isolation.

6.3.19 Public transport journey times are seen to improve marginally across the Packages to a level that is better than the Reference Case. Benefits from delivering new rail stations would offer further improvements for these rail passenger catchments.

6.3.20 In terms of the % of population with access to key locations by car, there is a marginal disbenefit for Aberdeen City residents. Public transport sees a slight improvement, returning towards the Reference Case level. For Aberdeenshire residents there is a small improvement in access for both car and public transport, again to marginally better than the Reference Case.

6.3.21 While journey time improvements are not determined by the modelling for active modes, the provision of active travel measures within Package 1 can be assumed to either ensure nil-detriment or a marginal improvement to journey times.

Local Level

6.3.22 In general, although journey times are seen to reduce down for many key movements (with journey times associated with Inverurie, Kintore, Westhill and Ellon falling below Reference Case levels), further mitigation would be required to return the time to travel between all Key Destinations to those seen within the Reference Case.

6.3.23 At a local level, journey times for public transport are seen to improve for key movements, with bus priority measures contained within Package 1 showing a benefit to public transport travel times. The new rail stations proposed in Package 2 reduce PT travel times by approximately 12% from the Newtonhill, Cove and Bucksburn catchments.

6.3.24 Public transport journey times do remain relatively uncompetitive compared with private car travel, with no significant journey time improvements occurring between modes (with localised impacts at the new rail stations being the exception to this).

6.3.25 In terms of population catchment analysis, the largest benefits are seen for Aberdeenshire residents for access to areas such as Aberdeen Airport, Aberdeen Royal Infirmary, Aberdeen University, and Westhill Business park by car. For public transport, some minor benefits are seen for Aberdeen City residents for access to Aberdeen City Centre, Altens, and Bridge of Don Science Park / Exhibition Centre.

6.4 TPO 3: Increasing Travel by Sustainable Modes

6.4.1 This section considers the appraisal of the Test Packages against the following Regional Objective:

3. To increase the proportion of travel undertaken by sustainable transport modes within the study area;

- Local objective to improve the competitiveness of public transport relative to car; and
- To reduce overcrowding at problem rail station park and rides and capitalise on rail service on-board capacity.

6.4.2 The indicators considered here include:

- Volume of vehicular trips (for context on mode share);
- Mode share for travel (regional and local levels);
- Rail and bus passenger boarding volumes and capacity (Regional)
- Station park and ride occupancy (local level);
- Journey times between key destinations (local level);
- Population within 30 and 60 minutes of key destinations by car and public transport (local level); and
- Active travel potential (regional level).

Volume of Vehicular Trips

6.4.3 Table 27 shows the volume of car and PT passenger trips made in the study area for each scenario at the 12 hour level.

Table 27. Volume of Trips by Mode (ASAM14 Modelled Area)

MODE	PERIOD	2032 REF CASE	2037 TEST CASE	PACKAGE 1	PACKAGE 2	PACKAGE 3	% CHANGE		
							Test Case to Package 1	Package 1 to 2	Package 2 to 3
Car	AM	80,727	83,453	83,061	83,084	83,102	-0.5%	0.0%	0.0%
	IP	59,462	61,413	61,116	61,161	61,160	-0.5%	0.1%	0.0%
	PM	95,552	98,315	97,830	97,851	97,878	-0.5%	0.0%	0.0%
	12 Hour	**832,722**	**859,251**	**855,101**	**855,490**	**855,605**	**-0.5%**	**0.0%**	**0.0%**
Public Transport (Bus & Rail)	AM	11,120	11,479	11,503	11,621	11,599	0.2%	1.0%	-0.2%
	IP	8,166	8,373	8,408	8,544	8,546	0.4%	1.6%	0.0%
	PM	11,884	12,232	12,267	12,385	12,367	0.3%	1.0%	-0.1%
	12 Hour	**102,593**	**105,487**	**105,831**	**107,200**	**107,115**	**0.3%**	**1.3%**	-0.1%

6.4.4 The following observations can be made in relation to car and PT trip forecasting:

- Package 1 – Compared to the Test Case, there is a 0.5% decrease in car trips and 0.3% increase in public transport (bus and rail) trips. The reduction in car trips largely relates to trip matrix adjustments reflecting mode shift of short distance trips due to active travel measures in several corridors;
- Package 2 – Compared to Package 1 there is a 1.3% increase in public transport trip volumes, resulting from the introduction of the new rail stations at Bucksburn, Newtonhill and Cove; and
- Package 3 – no significant change in public transport trips identified.

Mode Share

Regional Level

6.4.5 Figure 27 shows mode share analysis for car and PT trips modelled in each scenario.

6.4.6 It shows a very marginal reduction (0.1%) in car mode share within Package 1, with public transport mode share increasing slightly to match the Reference Case. Packages 2 and 3 show a further 0.1% swing from car to public transport compared to Package 1, mostly due to the attractiveness of new rail stations introduced to the network.

6.4.7 While not available from the modelling, there is also an assumed increase in active travel mode share in each of the Packages (due to new infrastructure).

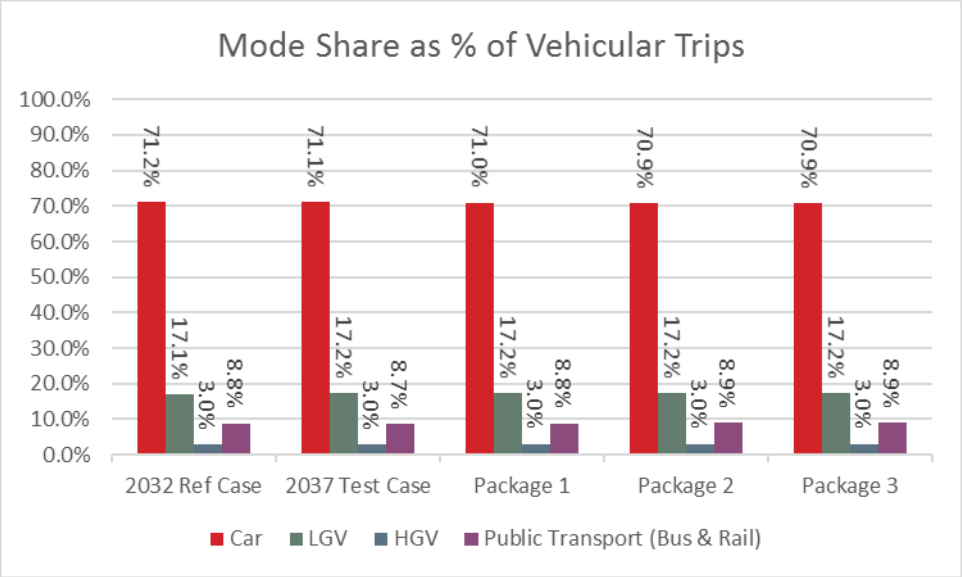

Figure 27. 12-hour Total Vehicular Mode Split (ASAM14 Modelled Area)

6.4.8 In summary, the packages create marginal changes to mode share levels, with a slight reduction in car travel and subsequent increase in public transport use. Active travel is assumed to increase in all packages, due to active travel measures introduced in Package 1, resulting in a reduction in vehicular trips overall compared to the Test Case.

Local Level

6.4.9 More locally, marginal increases in public transport mode share are forecast in the city centre, of between 0.1% to 0.2%. Active travel mode share is assumed to increase as part of the Package 1 scheme measures.

Regional Level

6.4.10 Table 28 shows the public transport boardings for each test package over a 12 hour period, while Table 29 shows the change from the Test Case in actual and percentage terms. It should be noted that as these figures represent boardings, rather than trips, they are higher than the overall public transport trip volumes seen earlier in this section. This is due to the multi-leg trip effect on boardings.

Table 28. Public Transport Passenger Boardings

MODE	2032 REF. CASE	2037 TEST CASE	2037 PACKAGE 1	2037 PACKAGE 2	2037 PACKAGE 3
Rail	20,334	21,366	21,311	23,375	23,369
Bus (non-Orbital)	95,867	98,699	100,458	99,689	99,552
Bus - Orbital	10,047	10,315	10,412	10,496	10,412
Bus Total	**105,915**	**109,013**	**110,870**	**110,185**	**109,964**
Total	**126,249**	**130,380**	**132,181**	**133,560**	**133,333**

Table 29. Public Transport Passenger Boardings – Change from Test Case (Actual & %)

MODE	2032 REF. CASE		2037 TEST CASE		2037 PACKAGE 1		2037 PACKAGE 2		2037 PACKAGE 3	
	Actual	%	Actual	%	Actual	%	Actual	%	Actual	%
Rail	-1,032	-5%	-	-	-55	0%	2,009	9%	2,003	9%
Bus (non-Orbital)	-2,832	-3%	-	-	1,760	2%	990	1%	853	1%
Bus - Orbital	-267	-3%	-	-	97	1%	182	2%	98	1%
Bus Total	-3,099	-3%	-	-	1,857	2%	1,171	1%	951	1%
Total	-4,131	-3%	-	-	1,801	1%	3,180	2%	2,953	2%

6.4.11 The Package 1 test shows a small increase in non-orbital bus boardings (~1,800), and marginal changes in orbital bus and rail boardings when compared to the Test Case. This is likely to result from the improved cross city connections, and bus priority measures introduced in this package.

6.4.12 The Package 2 test shows a small increase in non-orbital bus boardings (~1000), a marginal increase in orbital bus boardings (~180), and an increase of around 9% in rail boardings (~2000) when compared to the 2037 Test Case. This reflects the new rail stations introduced at Bucksburn, Newtonhill and Cove.

6.4.13 Package 3 produces very similar results to Package 2, but with a lower increase in orbital bus boardings when compared to the Test Case.

Regional Level

6.4.14 Rail service passenger loadings are considered to highlight any issues with overcrowding on the rail network. While well used rail services are generally seen as positive in terms of an alternative to car use, overcrowding will ultimately limit the positive impact rail can have on facilitating sustainable travel behaviours by limiting rail's mode share potential.

6.4.15 Table 30 shows rail seating capacity and forecast passenger numbers on the East Coast Main Line (ECML) between Portlethen and Aberdeen. The equivalent data for the Inverness Line between Aberdeen and Dyce is presented in Table 31.

Table 30. AM & PM Rail Seating Capacity Loading (East Coast Mainline, Portlethen-Aberdeen)

	AM PEAK- INBOUND			PM PEAK - OUTBOUND		
Scenario	**Seating Capacity**	**Passengers**	**% Seated Capacity**	**Seating Capacity**	**Passengers**	**% Seated Capacity**
2032 Reference Case	875	612	70%	961	682	71%
2037 Test Case	875	647	74%	961	721	75%
2037 Package 1	875	642	73%	961	719	75%
2037 Package 2	875	739	84%	961	805	84%
2037 Package 3	875	736	84%	961	805	84%

6.4.16 Although Package 1 sees little change from the Test Case, Packages 2 and 3 see an increase in rail passenger numbers along the ECML, which is generally positive in making use of the additional rail assets provided. Although passenger loading remains below the available capacity, the significant rise in passengers may start to pressurise the most popular services, with further monitoring in future years potentially required.

Table 31. AM & PM Rail Seating Capacity Loading (Inverness Line, Aberdeen-Dyce)

	AM PEAK- INBOUND			PM PEAK - OUTBOUND		
Scenario	**Seating Capacity**	**Passengers**	**% Seated Capacity**	**Seating Capacity**	**Passengers**	**% Seated Capacity**
2017 Baseline	557	385	69%	595	370	62%
2032 Reference Case	1000	620	62%	1104	557	50%
2037 Test Case	1000	653	65%	1104	591	54%
2037 Package 1	1000	654	65%	1104	589	53%
2037 Package 2	1000	716	72%	1104	661	60%
2037 Package 3	1000	706	71%	1104	658	60%

6.4.17 Package 1 sees little change from the 2037 Test Case. Packages 2 and 3 shows utilisation of the additional Rail Revolution capacity with utilisation rates of seated capacity rising by around 6-7% points in both the AM and PM peaks. The Inverness line loadings therefore remain below the available capacity.

Local Level

6.4.18 Car parking occupancy levels at rail stations was considered to examine capacity issues. Station parking can play an important role in improving access to rail services and encouraging modal shift. However, overloaded station parking may lead to potential rail patronage being lost, or can lead to parking issues on roads surrounding station car parks.

6.4.19 Table 32 describes the AM peak car park occupancy at each station, and the percentage of capacity occupied (≥80% are highlighted in orange, ≥100% in red). It can be seen that:

- A number of station car parks are either at capacity or are expected to be at or over capacity in the Reference Case, and Test Case scenarios, namely Aberdeen, Dyce, Huntly, Portlethen, Stonehaven, and Laurencekirk[2];
- Around 50 spaces have been provided at Stonehaven, Portlethen, and Huntly in each of the Test Packages, and just over 100 at Dyce. This additional capacity produces a drop in occupancy rates.
- Some minor re-allocational changes are seen in the number of those parking, largely in Packages 2 and 3, with the introduction of the additional stations at Bucksburn, Cove, and Newtonhill (with Bucksburn and Cove shown to be over capacity).

Table 32. Rail Station Car Park Occupancy

STATION	2032 REF. CASE		2037 TEST CASE		2037 PACKAGE 1		2037 PACKAGE 2		2037 PACKAGE 3	
	Occupancy/	%	Occupancy/	%	Occupancy/	%	Occupancy/	%	Occupancy/	%
Aberdeen	202	107%	207	110%	208	111%	193	103%	193	103%
Dyce	137	137%	142	142%	146	70%	131	63%	132	63%
Huntly	43	158%	45	168%	45	59%	45	59%	45	58%
Insch	35	80%	37	84%	36	82%	36	81%	35	80%
Inverurie	108	63%	114	67%	111	65%	109	64%	107	63%
Portlethen	39	139%	43	152%	46	59%	28	36%	28	36%
Stonehaven	78	166%	81	172%	85	87%	79	82%	79	81%
Keith	60	68%	61	69%	59	67%	58	66%	58	66%
Laurencekirk	40	58%	42	60%	41	58%	40	57%	40	57%
Kintore	0	-	124	74%	133	80%	132	79%	129	78%
Bucksburn	0	-	0	0%	0	0%	149	199%	149	199%
Cove	0	-	0	0%	0	0%	141	188%	138	184%
Newtonhill	0	-	0	0%	0	0%	53	71%	53	70%
Total	**742**	**97%**	**895**	**96%**	**909**	**77%**	**1196**	**85%**	**1186**	**84%**

[2] Note that while Laurencekirk station is not highlighted as over-capacity here, the current level of parking utilisation at Laurencekirk is less certain and may require re-basing within the modelling.

Bus-based Park and Ride

Local Level

6.4.20 Equivalent parking occupancy figures were considered at bus-based Park and Ride sites, as per Table 33. Again, these sites can play a positive role in facilitating access to public transport services and encouraging modal shift.

6.4.21 The analysis demonstrates that each of the Packages offer little impact on the occupancy levels of the Park and Ride sites.

Table 33. Bus Park and Ride Car Park Occupancy

SITE	2032 REF. CASE		2037 TEST CASE		2037 PACKAGE 1		2037 PACKAGE 2		2037 PACKAGE 3	
	Occupancy/	%	Occupancy/	%	Occupancy/	%	Occupancy/	%	Occupancy/	%
Bridge of Don	151	23%	169	26%	167	26%	167	26%	167	26%
Ellon	113	32%	114	33%	114	33%	113	32%	113	32%
Kingswells	150	17%	153	17%	145	16%	145	16%	145	16%
A96	96	10%	110	11%	108	11%	110	11%	110	11%
Oldmeldrum	8	20%	8	21%	8	21%	8	20%	8	20%
Total	**518**	**18%**	**554**	**19%**	**541**	**18%**	**543**	**18%**	**543**	**18%**

Active Travel Potential

6.4.22 While the potential for active travel is not analysed within the modelling, the measures provided in Package 1 can be assumed to improve the situation for active modes and encourage active travel use. It can be assumed to either ensure nil-detriment or a marginal improvement to the potential for active travel.

Other Indicators

6.4.23 Indicator analysis is as described in Section 6.3 for:

- Journey times between key destinations (local level); and
- Population within 30 and 60 minutes of key destinations by car and public transport (local level).

6.4.24 A summary of the key points from these indicators for this TPO are described in the TPO 3 Appraisal Summary section below.

Regional Level

6.4.25 The level of car trip making is shown to reduce marginally and increase slightly for public transport within Package 1. A larger increase in public transport trips is demonstrated within Package 2 as a result of the new rail stations (in excess of Reference Case levels).

6.4.26 Active travel is assumed to increase in all packages, due to active travel measures introduced in Package 1, resulting in a reduction in vehicular trips overall compared to the Test Case and Reference Case scenarios. The measures can be assumed to either ensure nil-detriment or a marginal improvement to the potential for active travel.

6.4.27 Package 1 shows marginal increases in bus boardings through the introduction of bus priority measures. Package 2 demonstrates a significant rise in rail boardings, which increases public transport boardings above both Test Case and Reference Case levels.

6.4.28 There are no significant impacts identified in terms of rail passenger capacity.

Local Level

6.4.29 Marginal increases in public transport mode share for car are seen in the city centre.

6.4.30 Parking capacity upgrades at station car parks are shown to relieve capacity pressures at the problem stations. The car parks at new stations are shown to be popular, with Cove and Bucksburn potentially at capacity.

6.4.31 Journey times for public transport are seen to improve for key movements, with bus priority measures contained within Package 1 showing a benefit to public transport travel times.

6.4.32 New rail stations proposed in Package 2 reduce PT travel times by approximately 12% from the Newtonhill, Cove and Bucksburn catchments. However, public transport journey times and accessibility are shown to remain relatively uncompetitive compared with private car travel.

6.5 TPO 4: Reduce Environmental Impact

6.5.1 This section considers the appraisal of the Test Packages against the following Regional Objective:

4. Reduce the negative environmental impact of transport within the study area.

- Local objective to reduce environmental impact in problems areas, in particular the AQMAs.

6.5.2 The indicators considered here include:

- Total vehicle km in the study area (regional level) and AQMA (local level);
- Mode share for travel in the study area (regional level) and city centre (local level);
- Average vehicle speed in the study area (regional level) and AQMA (local level); and
- Total time lost due to congestion in the study area (regional level) and AQMA (local level).

Regional Impacts

6.5.3 Through analysing the earlier regional traffic analysis included within Section 6.1 the following statements can be made relating to environmental impacts:

- In terms of total vehicle km travelled by road, there is an increase in the range of 1 to 2% in the peak period for each of the Test Packages compared to the Test Case, and around 5 to 6% compared to the Reference Case.
- The packages create little change to vehicular mode share, with a slight reduction in car use and an increase in public transport use.
- Average speeds decrease marginally in the AM and IP periods in the Aberdeen City area compared to the Test Case. In the PM Peak and in all periods in the Aberdeenshire area, speeds are increased, suggesting a better flow of traffic.
- This pattern is mirrored by the time lost due to congestion figures, which is reduced overall across the combined City and Shire areas.

6.5.4 Generally, the comparisons above suggest the Packages create a mixed impact on greenhouse gas (GHG) emissions across the full study area. A reduction in emissions may stem from reduced trip volumes, a move towards active modes and public transport, and an improved flow of traffic volumes. However, the overall rise in vehicle km travelled, and associated additional emissions is likely to offset these benefits.

Local Emissions Impacts

6.5.5 Air Quality Management Areas (AQMAs) are considered in terms of traffic volumes, leading to changes in emissions of pollutants (such as particulates and nitrogen oxides). Changes in traffic volumes are also likely to impact noise and vibration pollution. There are three AQMAs currently active in the study area, including:

- Aberdeen City Centre (≈represented by corridor 1 in the analysis presented earlier);
- Anderson Drive (≈ represented by corridors 4, 5 and 7); and
- Wellington Road (≈ represented by corridor 3).

Traffic Volumes - Vehicle km

6.5.6 Figure 28 and Figure 29 show the vehicle flows for the corridors which have been selected to approximately represent potential traffic volumes through each AQMA.

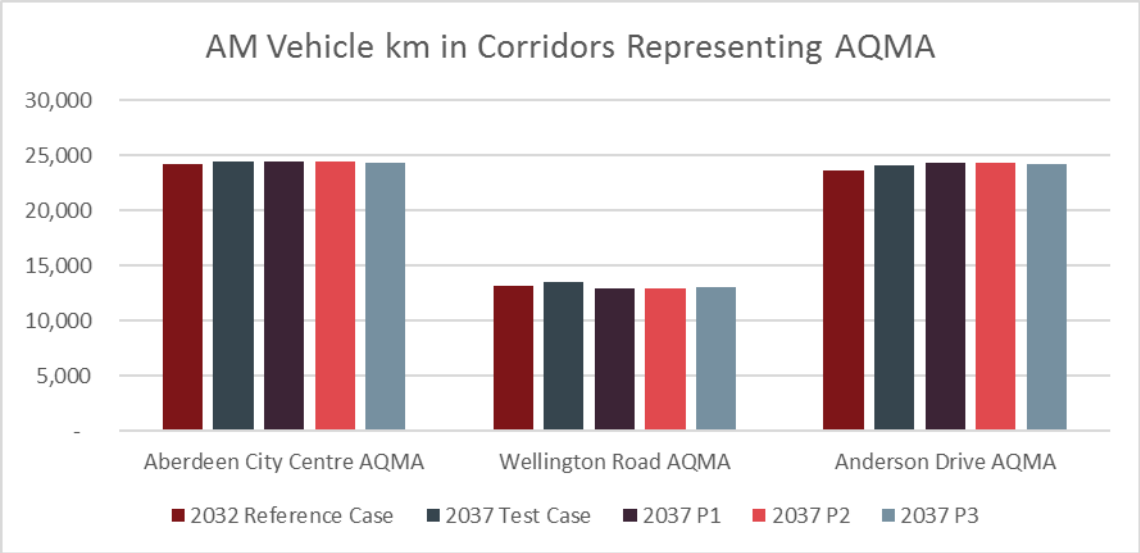

Figure 28. AM Peak Vehicle km in Corridors Representing Aberdeen AQMAs

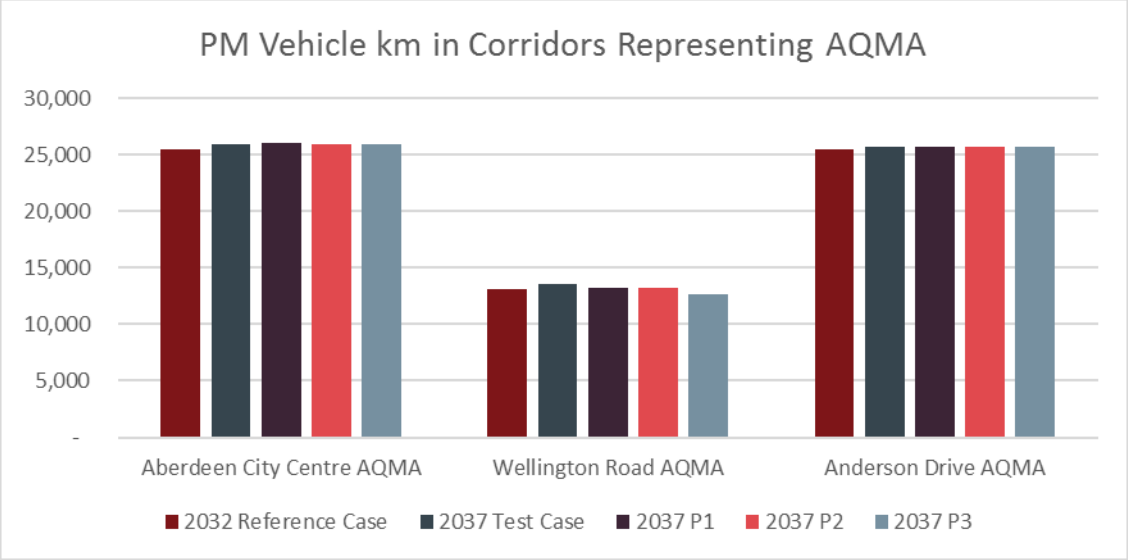

Figure 29. PM Peak Vehicle km in Corridors Representing Aberdeen AQMAs

6.5.7 For Aberdeen city centre, it can be seen there are negligible changes between the Packages and the Test Case (<0.5% variance).

6.5.8 For Wellington Road, there are improvements in both the AM (-5% in Packages 1 and 2, -4% in Package 3) and PM peaks (-2% in Packages 1 and 2, -7% in Package 3) compared to the Test Case.

6.5.9 For Anderson Drive, there are small increases in vehicle km in the AM peak (~1% in all packages), and a negligible improvement (<0.5% variance) in the PM peaks in each Package compared to the Test Case.

Vehicle Speed

6.5.10 Figure 30 and Figure 31 show average vehicle speed forecasts for the corridors selected to represent traffic flows through AQMAs. Higher average speeds suggest more freely flowing traffic, and a potential reduction in 'wasted' fuel burn spent in congestion.

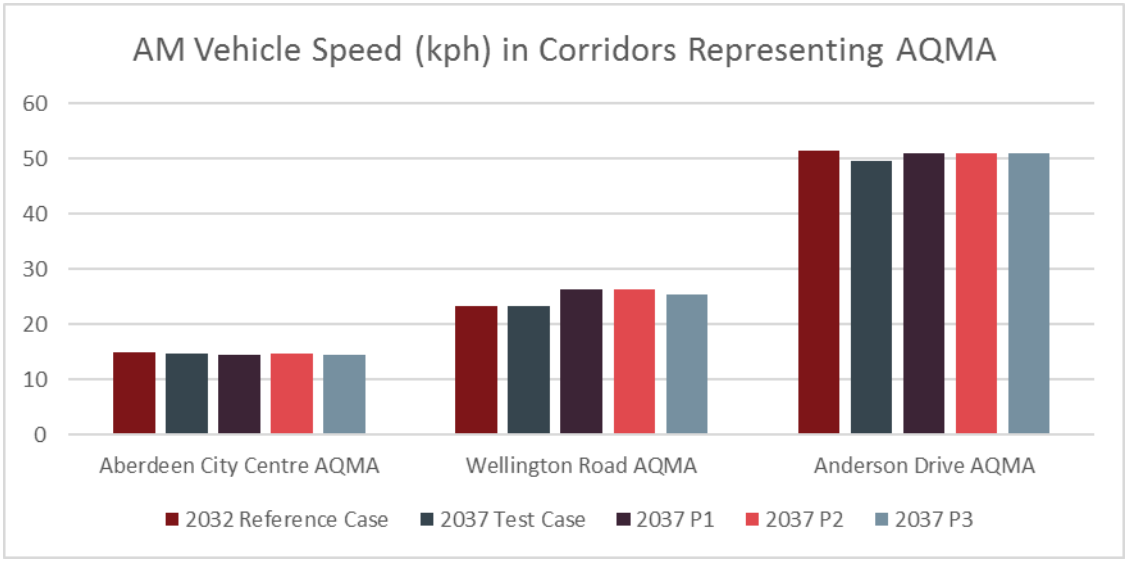

Figure 30. AM Peak Vehicle Speeds in Corridors Representing Aberdeen AQMAs

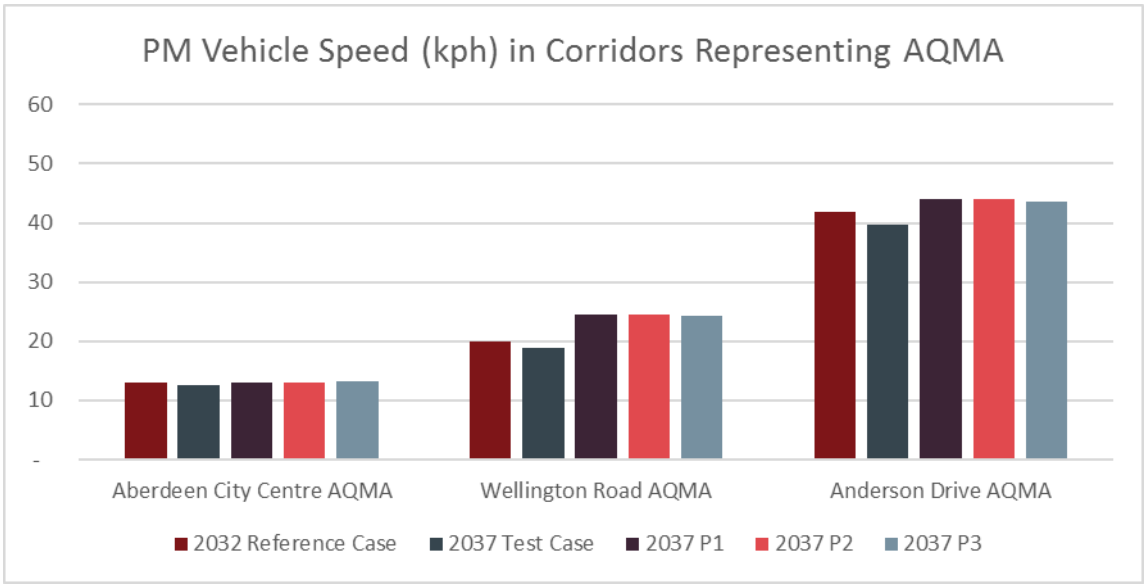

Figure 31. PM Peak Vehicle Speeds in Corridors Representing Aberdeen AQMAs

6.5.11 For Aberdeen city centre, there is negligible changes from the Packages (<0.5% variance) in the AM, whereas speeds increase by 3-5% across the packages during the PM Peak.

6.5.12 For Wellington Road, speeds increase in the AM Peak compared to the Test Case (13% in Packages 1 and 2, reducing to 9% in Package 3). The PM peak shows a large 30% increase in speed which brings the average speed to above Reference Case levels.

6.5.13 For Anderson Drive, there are small increases in speed in the AM peak (~3% in all packages), and around a 10-11% increase in average speeds in the PM peaks in each Package compared to the Test Case.

Time lost Due to Congestion

6.5.14 Figure 32 and Figure 33 show congestion forecasts for the corridors selected to approximately represent potential traffic flows through each of the AQMAs.

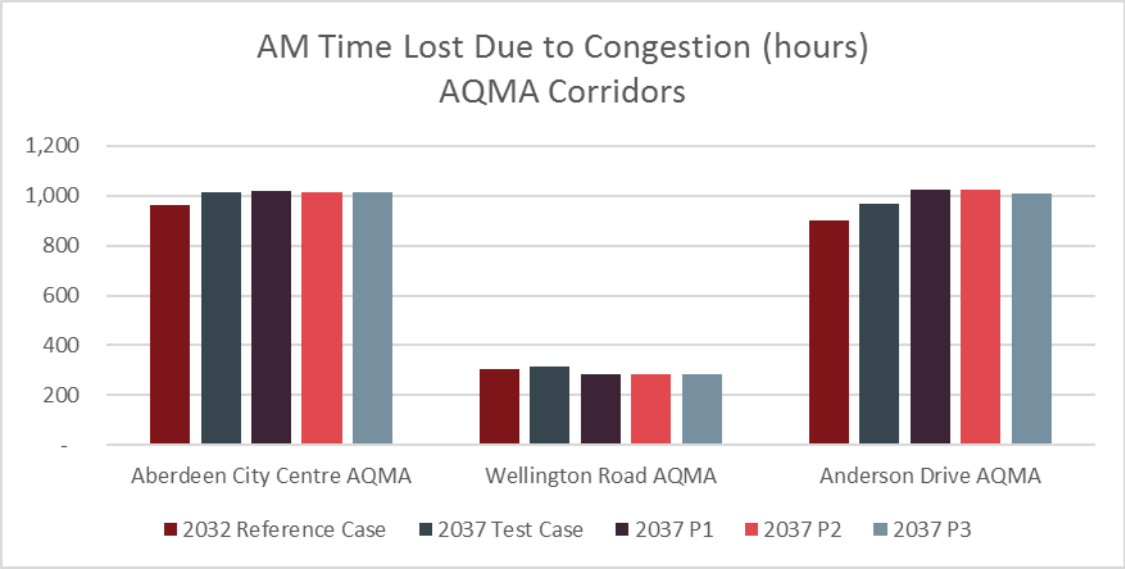

Figure 32. AM Time Lost Due to Congestion in Corridors Representing Aberdeen AQMAs

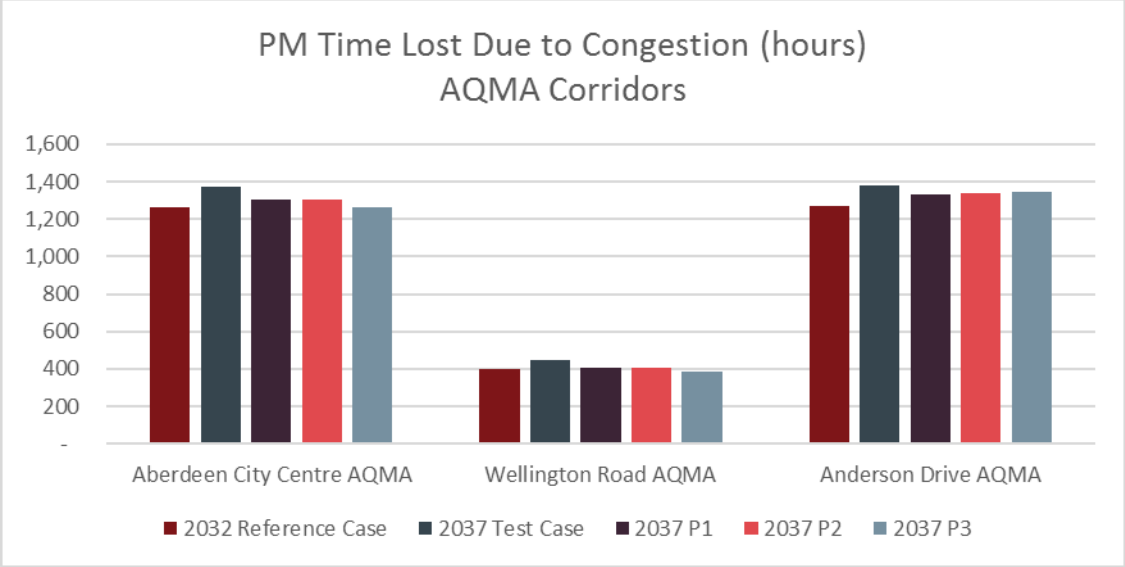

Figure 33. PM Time Lost Due to Congestion in Corridors Representing Aberdeen AQMAs

6.5.15 For Aberdeen city centre, only negligible changes are seen during the AM Peak. In the PM Peak congestion reduces by 5% in Package 1, and 8% in Package 3 compared to the Test Case. Congestion does not, however, fall below the Reference Case level.

6.5.16 For Wellington Road, there are reductions in the AM and PM Peaks of 10% across all packages compared which congestion levels below the Reference Case.

6.5.17 For Anderson Drive, there are increases in congestion in the AM peak (4-5% in all Packages), and around a 2-3% reduction in congestion during the PM peak in each Package compared to the Test Case.

TPO 4 Appraisal Summary - Environment

6.5.18 Analysis suggests a mixed response to the impact of greenhouse gas (GHG) emissions across the region. Although higher average speeds are demonstrated, with some congestion reduction, which suggests more freely flowing traffic, overall traffic volumes are forecast to increase, which would increase emissions. Based on this response, a more neutral impact to GHG emissions from the Packages is considered.

6.5.19 Local impacts to AQMAs vary by location, with traffic volumes only shown to reduce significantly along Wellington Road, with a corresponding drop in congestion. Delays in the City Centre and Anderson Drive corridor remain above Reference Case levels.

6.5.20 Note that the study does not consider the impact of any Low Emission Zone proposals that are to be developed and introduced.

6.6 TPO 5: Reduce the Rates and Severity of Traffic Accidents

6.6.1 This section appraises the Test Packages against the following Regional Objective:

5. Reduce the rates and severity of traffic accidents within the study area.

6.6.2 The indicators considered here include:

- Total vehicle km in the study area; and
- Mode share for travel in the study area.

6.6.3 Regional traffic volume statistics offer an insight into the potential change in road safety. In general, higher road network traffic flows may increase the risk and incidence of accidents. However, where travel is switched to roads of a better standard, or away from more urban areas, there is potential to reduce accidents.

6.6.4 As presented in Section 6.2, the road network sees an increase in total vehicle km travelled of around 2% in the peak periods for each of the Test Packages compared to the 2037 Test Case, and around 6% compared to the Reference Case. Much of the increase in traffic levels are associated with improvements to major road corridors, with new infrastructure (i.e. A96 Dualling) designed to accommodate higher traffic volumes.

6.6.5 There is no significant change in mode share demonstrated.

TPO 5 Appraisal Summary - Safety

6.6.6 Despite the overall increase to traffic levels, it is considered that the Packages may have a minor positive impact on safety. While traffic volumes increase, much of this is associated with roads of new and higher standards, potentially shifting motorists away from higher risk users, such as cyclists and pedestrians.

6.6.7 Specific scheme impacts in relation to safety are considered further in the wider STAG criteria assessment in Section 7.4.

6.7 Objectives Appraisal Scoring

6.7.1 The TPOs are scored using a seven point scale (-3 to +3) for each Package in Table 34. Scoring reflects the analysis discussed throughout Section 6, comparing each Package against the Reference Case and SDP Test Case scenarios.

Table 34. Transport Planning Objective Scoring Table

TRANSPORT PLANNING OBJECTIVE	PACKAGE		
	1	2	3
1. Improve the efficiency and reliability of the transport network in the study area.	**+2**	**+2**	**+2**
Local objective: improve the efficiency and reliability of the identified problem corridors in the study area.	+2	+2	+2
2. To achieve a reduction in journey times for all modes, to key destinations within the study area.	**+1**	**+1**	**+1**
Local objective: to achieve a reduction in journey times to key destinations within the study area that have access problems, in particular for sustainable modes.	+1	+2	+2
3. To increase the proportion of travel undertaken by sustainable transport modes within the study area.	**+1**	**+1**	**+1**
Local objective: to improve the competitiveness of public transport relative to car, for each of the key destinations within the study area,	0	+1	+1
Local objective: to reduce overcrowding at problem rail station car parks and capitalise on rail service on-board capacity.	+1	+1	+1
4. Reduce the negative environmental impact of transport within the study area.	**0**	**0**	**0**
Local objective: to reduce emissions and negative environmental impacts on noise and air quality in problem areas, in particular AQMAs.	0	0	0
5. Reduce the rates and severity of traffic accidents within the study area.	**+1**	**+1**	**+1**
No local objective			

7. IMPACT OF TEST PACKAGES: STAG CRITERIA APPRAISAL

7.1 Introduction

7.1.1 The following section describes the appraisal of the Packages against the relevant STAG criteria, including Economy, Environment, Safety, Accessibility and Social Inclusion. The Deliverability of the Packages and the Cost to Government are also discussed.

7.2 STAG Criteria – Economy

7.2.1 The impact of the Option Packages to the economy (Transport Economic Efficiency) can be indicated through predicted travel time savings. Table 35 and Table 36 describe the total change in road travel time and congested time respectively. These statistics indicate that the option Packages would generate an overall regional time saving, benefiting the economy.

7.2.2 Note that the Packages are forecast to increase vehicle kilometres by around 2%, but despite attracting this additional traffic to the network, an overall time saving is demonstrated in the majority of time periods (compared to the Test Case).

Table 35. Total Road Network Travel Time in Aberdeen City & Aberdeenshire

	TOTAL TRAFFIC TIME (HOURS)			% CHANGE FROM TEST CASE		
Scenario	**AM Peak**	**Inter Peak**	**PM Peak**	**AM Peak**	**Inter Peak**	**PM Peak**
2032 Ref. Case	28,267	18,014	32,558	-5%	-5%	-5%
2037 Test Case	29,761	18,929	34,365			
2037 Package 1	29,757	18,899	34,025	0.0%	-0.2%	-1.0%
2037 Package 2	29,745	18,898	33,935	-0.1%	-0.2%	-1.3%
2037 Package 3	29,808	18,929	33,858	0.2%	0.0%	-1.5%

Table 36. Total Road Congested Travel Time in Aberdeen City & Aberdeenshire

	TOTAL TRAFFIC TIME (HOURS)			% CHANGE FROM TEST CASE		
Scenario	**AM Peak**	**Inter Peak**	**PM Peak**	**AM Peak**	**Inter Peak**	**PM Peak**
2032 Ref. Case	8,007	3,511	10,293	-9%	-7%	-9%
2037 Test Case	8,764	3,782	11,280			
2037 Package 1	8,569	3,774	10,805	-2.2%	-0.2%	-4.2%
2037 Package 2	8,553	3,769	10,714	-2.4%	-0.3%	-5.0%
2037 Package 3	8,600	3,815	10,586	-1.9%	0.9%	-6.1%

7.2.3 A positive economic benefit is demonstrated for public transport by comparing the PT travel time statistics described earlier in Table 35. These show a 1%-2% saving in PT journey times to/from key destinations, (compared to the Test Case) with the majority of benefits generated by Package 1, and further, rail specific benefits generated by Package 2.

7.2.4 The packages contain a range of mitigation options which would benefit the SDP Strategic Development Areas (SDA's). The A96 Dualling scheme in particular would provide a significant change in road capacity and relief for the Inverurie area. Scheme options planned for the Ellon corridor area have been shown to provide relief to the bottlenecks along the A90 North route. These type of measures and subsequent congestion relief would be anticipated to help attract investment into these growth areas.

7.2.5 The congestion mapping analysis has shown specific congestion relief for AWPR access points, particularly within Package 1 (i.e. Cleanhill and A944 intersections). These type of operational improvements would be expected to improve journey time reliability for this key route and help support the development of major developments located within the corridor.

7.3 STAG Criteria – Environment

7.3.1 Traffic-related environmental impacts are covered previously within the assessment of TPOs. The main conclusions include:

- An overall increase in vehicle kms travelled, which indicates a potential subsequent rise in greenhouse gas emissions;
- An overall increase in vehicle speeds and reduction in congestion, suggesting that motorists are able to drive more efficiently, and potentially minimising impacts to greenhouse gas emissions; and
- A reduction in vehicle kms and congestion in the Wellington Road AQMA, with lower traffic volumes and more efficient vehicle speeds potentially benefiting air quality.

7.3.2 The A96 dualling is expected to divert motorists away from built up areas and also provide more free-flowing operation through the grade separation of intersections. Improved accessibility along the AWPR corridor, is shown to attract motorists away from more centrally located routes. Although not all designated as AQMA's, these type of measures also have the potential to reduce harmful emissions and improve air quality in some urban areas.

7.3.3 The Packages contain a broad-range of infrastructure which has the potential to impact the surrounding land environment, particularly for the large-scale A96 Dualling scheme. It is noted that with the exception of the A96 scheme, Ellon Link Road and Dyce Drive distributor, the majority of other road proposals are less significant in scale and mainly relate to junction improvements, which could potentially be accommodated within or close to existing road boundaries.

7.4 STAG Criteria – Safety

Safety

7.4.1 The modelling analysis assessed safety impacts through the TPOs using the vehicle kms statistic. This showed an overall increase in traffic levels across the region, which would generally indicate a subsequent increase in road traffic accidents. However, many of the 'new' vehicle kms are likely to be associated with roads designed to accommodate higher traffic levels, with less interaction with other road users (such as the A96 dualling and AWPR). Other potential safety impacts associated with the option Packages include:

- Closure of at-grade junctions and provision of several grade separated access points improving and providing safer access along the A96;
- Diversion and relief of traffic onto the Ellon link road, and safer access points at the Toll of Birness to access the A90 / A952;
- Improved slip road access along the A90 providing safer connections to this high speed route;
- Provision of several signal control intersections enabling greater management of traffic and reducing conflict; and
- Cycle scheme infrastructure promoting safer routes for cycling.

Security

7.4.2 In terms of security, proposals would generally be anticipated to improve security for some public transport users through new stations contained in Package 2. New station infrastructure is likely to have elements such as CCTV, best practice landscaping, entrances and exits. It is probable that these investments would improve on the current alternative bus facilities (currently) for those accessing services in the vicinity of the new stations.

7.4.3 New car parks and roads would be built to current standards, and would likely include good levels of landscaping, formal surveillance, and lighting and visibility.

7.4.4 Likewise, new active travel measures would be built to current standards, and likely improve many of the security aspects such as lighting and visibility.

7.4.5 Overall these types of measures are likely have a minor positive impact.

7.5 STAG Criteria – Integration

Transport Integration

7.5.1 The packages generally integrate well with other transport infrastructure and services. The following observations can be made:

Package 1

- cross city bus routes are designed to optimise integration on the bus network, providing connections between Anderson Drive services for example;
- bus priority could cause some conflict with existing road users, i.e. car;

- Rail parking is designed to allow greater rail integration;
- Improved ticketing and behavioural initiatives are assumed to improve transfer between modes and improve interchange times and perceptions;
- Optimising the network should improve the integration of new infrastructure with the existing network.

Package 2

- New stations will cause some additional stopping time to existing services, but will allow better access by walking and cycling by local residents, and by Park and Ride;

Package 3

- Implementing further traffic management should improve the integration of new infrastructure with the existing network.

Transport and Land-Use Integration

7.5.2 The packages contain a range of mitigation options which would integrate well with land use and benefit the SDP development areas. Strategic Development Areas (SDA's), as per the purpose of this appraisal.

7.5.3 For example, the A96 Dualling scheme in particular benefits the Inverurie area, which forms part of the A96 Strategic Development Area (SDA). This scheme also provides faster access to the Airport, which is an important regional hub.

7.5.4 Improved connections along the A90 South and A90 North corridors would support growth within these SDA's, by alleviating significant bottlenecks.

7.5.5 The congestion relief offered around the AWPR corridor improves connections in and around Aberdeen, and would help support many of the large development proposals located nearby. Ensuring the AWPR remains accessible would also help divert traffic from more central areas, supporting the City Centre Masterplan.

Policy Integration

7.5.6 The TPOs were developed in line with local, regional, and national policy, therefore the assessment of the TPOs largely covers the alignment with these policies. However, as a further measure to assess the appropriateness of the Packages in light of wider policies, the Policy Assessment Framework (PAF) spreadsheet tool, published by Transport Scotland, was used.

7.5.7 Alignment with high-level NTS objectives is shown in Figure 34. Note that Packages 2 and 3 receive the same scoring and so the line showing Package 2 is obscured.

7.5.8 Alignment with the second-tier objectives (from the STPR/NTS, and NPF) are shown in Figure 35. Again, Packages 2 and 3 receive the same scoring and so the line showing Package 2 is obscured.

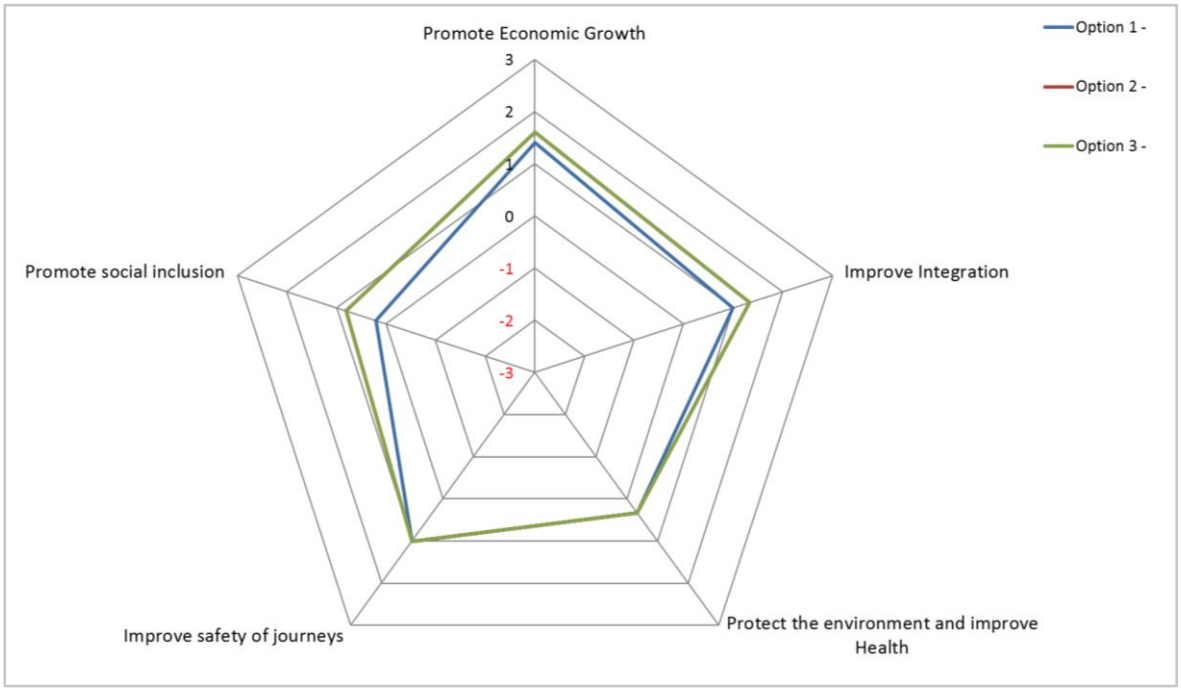

Figure 34. High Level NTS Objectives Alignment – PAF

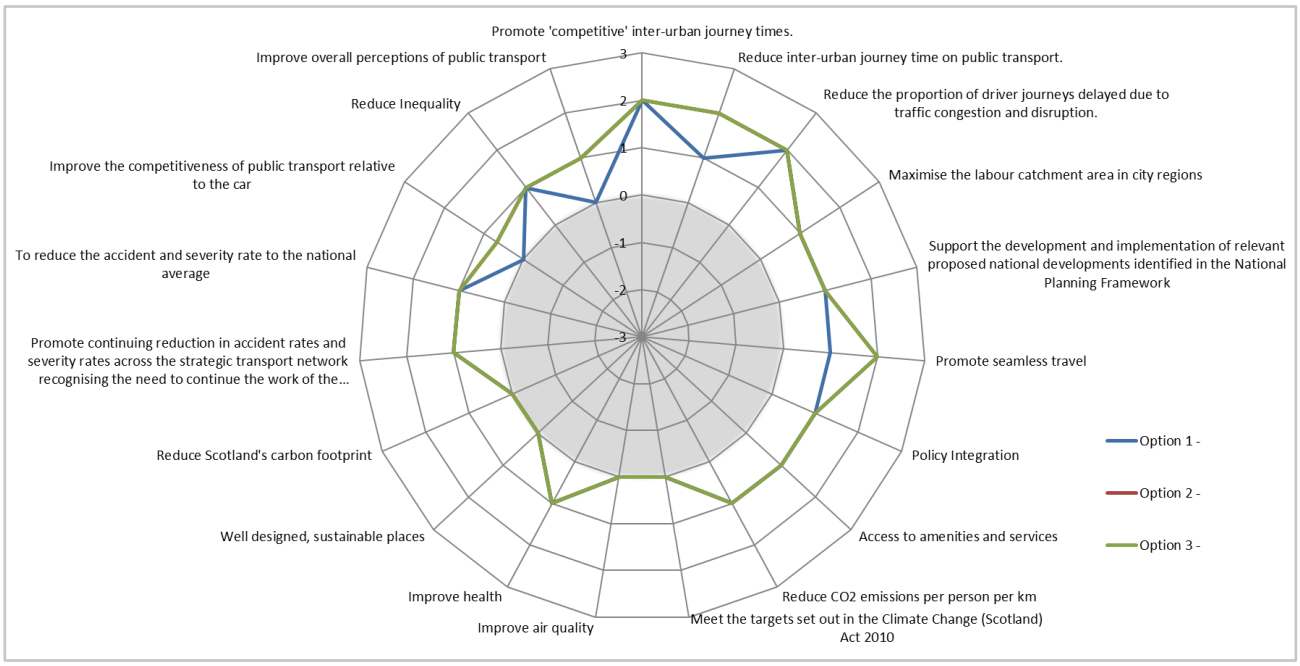

Figure 35. Second-tier Objectives Alignment - PAF

7.5.9 The assessment shows general alignment across most policy areas to a 'slight' extent, with some neutral and moderate aspects among these.

7.6 STAG Criteria – Accessibility and Social Inclusion

7.6.1 As outlined in Section 6.3, accessibility is seen to improve for car and public transport access, between key destinations in terms of journey time and the proportion of the population who have access within 30 and 60 minute time bandings. For public transport, although the improvements are relatively minor, these are improved to a level that is better than the Reference Case.

7.6.2 Improvements from the new rail stations in Package 2 enhance *public transport network coverage* for rail, and give local residents an additional sustainable mode choice. Overall they reduce public transport travel times by approximately 12% from the Newtonhill, Cove and Bucksburn catchments.

7.6.3 While journey time improvements have not been calculated for active modes, the provision of active travel measures within Package 1 will improve *local accessibility* by enhancing access by walking and cycling to services and facilities.

7.6.4 In terms of *comparative accessibility,* areas of deprivation were considered. Accessibility analysis was carried out for modelled zones which correspond to the most deprived areas in Aberdeen City and Aberdeenshire. Of the 20% most deprived datazones in Scotland[3], 28 of these are in the study area; these fall within 22 of the ASAM14 modelled zones. Car and public transport accessibility for these zones to key destinations are shown in Table 37.

7.6.5 In terms of rural comparative accessibility, it can be seen in Table 37 that those living outwith Aberdeen City, and generally in more rural areas, have much poorer public transport access than those within the city. However, the Packages are shown to achieve most benefit in Aberdeenshire, and these more rural areas.

Table 37. % of Population in SIMD Zones with Access to Key Destinations in the AM Peak

LA	SCENARIO	% OF POPULATION WITHIN 30 MINUTES JOURNEY TIME		% OF POPULATION WITHIN 30 TO 60 MINUTES JOURNEY TIME		% OF POPULATION GREATER THAN 60MINS JOURNEY TIME	
		Car	PT	Car	PT	Car	PT
SIMD Zones in Aberdeen City	AM 2032 Reference	86.1%	9.5%	13.9%	34.2%	0.0%	56.3%
	AM 2037 Test	86.1%	8.8%	13.9%	34.6%	0.0%	56.5%
	Package 1	85.6%	9.3%	14.4%	34.8%	0.0%	55.9%
	Package 2	85.6%	9.3%	14.4%	34.8%	0.0%	55.9%
	Package 3	85.6%	9.3%	14.4%	34.8%	0.0%	55.9%
SIMD Zones in Aberdeenshire	AM 2032 Reference	5.5%	0.0%	54.2%	0.0%	40.4%	100.0%
	AM 2037 Test	5.5%	0.0%	52.0%	0.0%	42.6%	100.0%
	Package 1	6.2%	0.0%	59.2%	0.0%	34.5%	100.0%
	Package 2	6.2%	0.0%	59.2%	0.0%	34.5%	100.0%
	Package 3	6.2%	0.0%	59.2%	0.0%	34.5%	100.0%

[3] Scottish Index of Multiple Deprivation, https://www.gov.scot/Topics/Statistics/SIMD, accessed on 27.06.2018

7.6.6 Compared to the total population accessibility statistics for Aberdeen City, the population for those from deprived areas with access to key destinations (average) was slightly worse for car travel in the Packages compared to the Test and Reference Cases. For public transport, however, the results were marginally better overall for each of the Packages compared to the Test Case and Reference Case.

7.6.7 Note that for Aberdeenshire, a number of the data zones were located far from Aberdeen (such as Peterhead and Fraserburgh harbour areas). Therefore, the reported SIMD journey times are much longer compared to the overall Aberdeenshire population statistics (as this added distance to access the key destinations, creating longer journey times for these zones). For the Aberdeenshire SIMD zones, access by public transport to the key destinations was not affected, however, car access was seen to improve to better than both the Test Case and Reference Case.

7.7 Deliverability

7.7.1 The deliverability of Option Packages 1-3 is discussed below in terms of feasibility and affordability of the proposed scheme options.

Package 1

7.7.2 Within Package 1 many proposed schemes are relatively small scale in nature and relate to junction improvements, some of which are being progressed through separate studies. There are potentially some minor feasibility issues associated with design, and how an alternative layout or signalisation would fit within the existing footprint or available land, and operate effectively with neighbouring junctions. Similar issues may arise in terms of expanding station car parks, where available land located nearby could be insufficient.

7.7.3 Although the A96 Dualling scheme presents both feasibility and deliverability issues, this scheme is a Government commitment and is progressing through relevant project stages. Therefore, it is considered that most uncertainty relates to the final chosen route option specification, rather than overall delivery.

7.7.4 Bus priority measures may also be challenging to implement without impacting the existing road network traffic capacity, and new land may not be available in the locations where priority measures would be most desirable. These feasibility issues may lead to a choice of prioritising bus services with some detriment to general traffic journey times, which may be less acceptable.

7.7.5 The behavioural initiatives reflect an improvement in public transport interchange and the desirability of the active travel mode. These proposals would need to be realised in sufficient quality/quantity to match the assumptions applied within the appraisal. For example, although a wide range of active travel routes are proposed across the City and Shire, there may still be a challenge to encourage sufficient motorists to change modes.

7.7.6 The affordability of packages is dependent on funding options, and if progressed through developer contributions, Packages would likely need to be small in nature for funding to fall within the limits of a contribution mechanism. Schemes contained within Package 1, (with the exception of the A96) generally fall within these requirements.

Package 2

7.7.7 Proposed rail stations present greater affordability issues in terms of funding, particularly if subsidy is required. An economic case would be required, and although the appraisal suggests some beneficial outcomes, stopping services at new stations impacts journey time for existing passengers, which may prove detrimental. Achievable train service patterns would also be dependent on available timetabling, which may be restrictive.

Package 3

7.7.8 Package 3 contains a mixture of road junction improvements, and also sections of new carriageway, including a link road at Ellon. Due to their overall scale, these schemes tend to present slightly higher deliverability and affordability issues than package 1.

7.8 Cost to Government

7.8.1 The scale of capital investment required to deliver each Package is discussed below.

7.8.2 With the exception of the A96 Dualling, the majority of proposed schemes included within Package 1 are relatively small scale in nature, and are regarded as low capital cost options. The A96 Dualling East of Huntly to Aberdeen is a large scale road scheme, and is therefore regarded as a significant high cost item within the package.

7.8.3 Package 2 includes three rail stations, connecting to existing rail services. Stations are regarded as moderate cost options.

7.8.4 Package 3 includes mostly low cost items, similar to Package 1, but with some low-to-moderate cost carriageway improvements. As Package 1 is regarded as more prioritised, financing Package 3 would be in addition to Package 1, and therefore more costly.

7.9 Summary of STAG Criteria Assessment Scoring

7.9.1 Assessment against the STAG criteria and deliverability is provided in Table 38.

Table 38. STAG Assessment Scoring

OBJECTIVE	PACKAGE		
	1	2	3
Economy	+2	+2	+2
Environment	-1	-1	-1
Safety	+1	+1	+1
Integration	+1	+2	+2
Accessibility and Social Inclusion	+1	+2	+2
Deliverability - Feasibility	2	1	1
Deliverability – Affordability	2	1	1

8. SUMMARY AND CONCLUSIONS

8.1.1 This study has provided an updated assessment of the latest development allocations proposed for Aberdeen City and Aberdeenshire. The traffic analysis demonstrates that the more significant housing allocations contained within the SDP Proposed Plan (August 2018) would generate higher traffic flows and generally amplify congestion impacts across the region. The distribution of impacts is shown to be generally similar to those reported earlier through the 2018 Cumulative Transport Appraisal.

Intervention Option Packages

8.1.2 The latest development proposals and subsequent traffic and travel forecasts have been applied to appraise three transport option Packages, each containing various infrastructure schemes and policy proposals to mitigate predicted development impacts. The Packages include:

- **Package 1:** Junction improvements, bus priority measures, active travel initiatives and the A96 Dualling East of Huntly to Aberdeen scheme;
- **Package 2:** As Package 1, and also including new rail stations and rail service connections at Bucksburn, Cove and Newtonhill;
- **Package 3:** As Package 2, and also including additional junction upgrades, carriageway improvements and new link roads.

8.1.3 The impact of these Packages were assessed against the SDP 'Test Case' scenario (which represents the impact of the build out of development proposals), and the 'Reference Case' scenario, which reflects the delivery of existing development only. The overall aim of the Packages was to improve network performance and reduce impacts down to, or below levels seen in the Reference Case - therefore fully mitigating the impact of development proposals (nil detriment).

Appraisal Outcomes

8.1.4 Package 1 demonstrates significant benefits within Aberdeenshire, with the A96 corridor in particular seeing substantial congestion relief and travel time savings. Benefits are also predicted along the A90 North and A90 South, with the majority of Aberdeenshire corridors being mitigated down to nil-detriment impact.

8.1.5 Package 1 also generates significant congestion relief in many peripheral areas of the city, particularly at the AWPR Cleanhill and A944 interchanges. However, several pinch-point locations are shown to remain pressurised at peak times, including the A96 / Airport, and A947 Parkhill areas.

8.1.6 Within central areas of Aberdeen, Package 1 is less effective, with no significant reduction in traffic delays, and many areas remaining congested. Some relief is though provided for along the Wellington Road corridor.

8.1.7 Package 1 generates public transport time savings through bus priority measures, and creates some minor mode shift impacts towards higher public transport use. The Package would also encourage more short distance trips to be made by active modes.

8.1.8 Although Package 2 does not produce region-wide or significant traffic-congestion benefits, the new rail stations do produce some significant time savings and accessibility benefits for new local rail catchment areas.

8.1.9 Package 3 provides further benefits for the Ellon area, and around the peripheral of Aberdeen at the A96 and A947 AWPR intersections. Benefits appear greater within the evening peak, with less relief identified during the morning peak period.

8.1.10 Overall, all Packages generate benefits compared to the Test Case scenario, with many areas seeing congestion reduce down to Reference Case levels. Several congestion pinch points do though remain, particularly within central Aberdeen, with further mitigation required to mitigate all predicted development impacts. There is also some evidence of secondary impacts being generated, as proposals improve local traffic operation, increasing the throughput of vehicles and knock-on impacts further downstream.

8.1.11 These appraisal findings can be used to determine the transport impacts associated with the Proposed Plan, understand the value of potential mitigation options, and ultimately support the delivery of the Aberdeen City and Shire SDP.

*

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Madrid, Rabat, Rome, Sofia, Tunis

Middle East:
Cairo, Dubai, Riyadh

Asia Pacific:
Bangkok, Beijing, Brisbane, Delhi, Hanoi, Hong Kong, Manila, Seoul, Shanghai, Singapore, Shenzhen, Taipei

Africa:
Abidjan, Douala, Johannesburg, Kinshasa, Libreville, Nairobi

Latin America:
Lima, Mexico, Rio de Janeiro, Santiago, São Paulo

North America:
Little Falls, Los Angeles, Montreal, New-York, Philadelphia, Washington

SYSTRA

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