FRASERBURGH & PETERHEAD TO ABERDEEN STRATEGIC TRANSPORT STUDY: STAG 1 PLUS REPORT EXECUTIVE SUMMARY

SYSTRA

FRASERBURGH & PETERHEAD TO ABERDEEN STRATEGIC TRANSPORT STUDY: STAG 1 PLUS

SCOTTISH TRANSPORT APPRAISAL GUIDANCE REPORT

IDENTIFICATION TABLE	
Client/Project owner	NESTRANS
Project	Fraserburgh & Peterhead to Aberdeen Strategic Transport Study: STAG 1 Plus
Study	Scottish Transport Appraisal Guidance Report
Type of document	Executive Summary
Date	27/10/2017
File name	Fraserburgh & Peterhead to Aberdeen Strategic Transport Study - STAG 1 Plus Report.docx
Reference number	GB01T17A67_20171027
Number of pages	23

APPROVAL

Version	Name		Position	Date	Modifications
1	Author	David Murtagh	Senior Transportation Consultant	02/05/2017	
	Checked by	Gordon Ross	Market Director – Engineering	02/05/2017	
	Approved by	Bob Nicol	Transportation Director	02/05/2017	
2	Author	David Murtagh	Senior Transportation Consultant	23/08/2017	Addition of economic modelling analysis and re-ordering of report structure
	Checked by	Malcolm Neil	Associate Director	23/08/2017	
	Approved by	Bob Nicol	Transportation Director	23/08/2017	
3	**Author**	David Murtagh	Senior Transportation Consultant	09/10/2017	Addition of Executive Summary
	Checked by	Bob Nicol	Transportation Director	11/10/2017	
	Approved by	Bob Nicol	Transportation Director	11/10/2017	

TABLE OF CONTENTS

EXECUTIVE SUMMARY	**5**
INTRODUCTION	5
OPTION PACKAGE FOR APPRAISAL	6
OPTION PACKAGE COST ESTIMATES	9
PHASED DELIVERY OF THE OPTION PACKAGE	11
DATA ANALYSIS	13
BASELINE DATA REVIEW	13
ANALYSIS OF 2017 TRAFFIC SURVEY DATA	14
TRAFFIC MODELLING OF THE OPTION PACKAGE	16
ECONOMIC APPRAISAL OF THE OPTION PACKAGE	18
STAG APPRAISAL	20
STUDY CONCLUSIONS	22

LIST OF FIGURES

Figure 0.1 :Option Package Interventions 10
Figure 0.2 : STAG 7-Point Scale 20

LIST OF TABLES

Table 0.1 : Estimated Construction Costs (at 2017 prices) 9
Table 0.2 : Phased Delivery of Option Package 12
Table 0.3 : Interventions excluded from phased Option Package 12
Table 0.4 : 13 Hour Two-Way All Vehicle Flow and HGV Totals 14
Table 0.5 : Calculated 2017 AADT Flows 15
Table 0.6 : Tests for Economic Appraisal 18
Table 0.7 : Economic Evaluation Summary (Low Growth) 19
Table 0.8 : Economic Evaluation Summary (High Growth) 19
Table 0.9 : Overall Appraisal Summary, Scores and Risk Ratings 21

EXECUTIVE SUMMARY

Introduction

In 2015 SIAS Limited (SIAS), Peter Brett Associates LLP (PBA), and Energised Environments (the Consultant Team) were appointed by Nestrans to undertake the Fraserburgh and Peterhead to Aberdeen Strategic Transport Study. The purpose of the study was ***to identify and examine the options for improving strategic transport connections between Fraserburgh, Peterhead, and Aberdeen including incorporating the Energetica Corridor***.

The study was undertaken in line with the *Scottish Transport Appraisal Guidance (STAG)* and a STAG Part 1 Appraisal Report was submitted in March 2016.

The Report (*Fraserburgh & Peterhead to Aberdeen Strategic Transport Study: Part 1 Appraisal Report (SIAS, PBA & Energised Environments SIAS Ref. 77919, March 2016)*), appraised a wide range of options including road, rail and bus opportunities to improve strategic travel options within the corridor. The Report presented two option packages: Road and Bus Option Package, and Rail and Bus Option Package.

SYSTRA Limited (SYSTRA, previously SIAS Limited) were commissioned in February 2017 to further develop the road based elements of the Road and Bus Option Package with the study looking to:

- Define the Road Option Package detail in preparation for a STAG Part 2 Appraisal
- Undertake a review of all supporting data from the STAG Part 1 Appraisal
- Provide new data analysis to inform the study and help define the Option Package
- Undertake a STAG appraisal on the Option Package to ensure the option measures are suitable to be taken forward

Option Package for Appraisal

The Part 1 Appraisal report recommended a range of interventions that should be included in a road Option Package to improve strategic transport connections between Fraserburgh, Peterhead, and Aberdeen. A review of the Baseline data used in the Part 1 Appraisal, analysis of additional and current traffic data and future year transport and economic modelling of the proposed interventions has allowed for an Option Package to be fully defined for appraisal.

The final Option Package comprises of the following interventions.

A90(T)/B9005 Ellon Bypass Roundabout

It is proposed that the existing roundabout at the A90(T)/B9005 to the south of Ellon is increased in size to a 60m diameter roundabout with an increase to two lanes on the northbound exit to the A90(T) Ellon Bypass.

The improved roundabout will be clearly marked as a two lane roundabout and the improvements will increase capacity, provide a northbound acceleration lane to the A90(T) Ellon bypass and ensure that the roundabout operates well if high levels of local development are realised.

The roundabout improvements are designed to tie in with the provision of any future dual carriageway on the A90(T) Ellon bypass.

A90(T)/A984 Ellon Bypass Roundabout

There are two proposed designs for the A90(T)/A948 roundabout at the north of Ellon. Both designs increase the roundabout diameter to 60m and provide two lanes on all entry and exits arms. An additional option has been designed with an additional left turn filter lane for northbound A90(T) traffic to Ellon.

Currently a one lane roundabout, the improvements will significantly increase capacity and ensure that the roundabout operates well if high levels of local development are realised, particularly in north Ellon.

The roundabout improvements are designed to tie in with the provision of any future dual carriageway on the A90(T) Ellon bypass and the A90(T) to the Toll of Birness.

A90(T)/A952, The Toll of Birness junction

Two options for junction improvements are proposed for consideration in the STAG Appraisal process.

- A new two lane 3-arm roundabout with a 50m diameter and two lanes on all entry and exits.
- A new grade separated junction with the A90(T) at grade and the A952 southbound traffic joining the A90(T) southbound via an overbridge and merging on a new dual carriageway

The roundabout option has been designed to tie into any upgrade of the A90(T) from Ellon to the Toll of Birness but can be provided independently of this.

The grade separated junction option requires the A90(T) between Ellon and the Toll of Birness to be upgraded to a dual carriageway.

A90(T)/A952 Cortes

A new roundabout is proposed for the A90(T)/A952 Cortes junction, replacing the existing priority junction. The roundabout will have a 45m diameter and will have short two lane entries on all approach arms.

A90(T) – Ellon Bypass

The A90(T) Ellon Bypass is a single lane section of road of approximately 2km in length between the B9005/A90(T) roundabout and A948/A90(T) roundabout. The A90(T) Ellon Bypass has a key environmental and physical constraint impacting on any upgrading of the route, namely the River Ythan, with a single lane bridge currently spanning the river. Given the likely cost, complexity and potential environmental impacts of constructing a new bridge or altering the existing bridge to accommodate two lanes in both directions, three proposed A90(T) Ellon Bypass upgrades have been taken forward for appraisal representing a phased approach to dual carriageway upgrade:

1. Dual carriageway on the southern A90(T) Ellon Bypass (B9005 to River Ythan bridge). The existing one lane carriageway will continue across the bridge and on northern section of the A90(T) Ellon Bypass
2. Dual carriageway on the southern and northern sides of the A90(T) Ellon Bypass narrowing to one lane for existing River Ythan bridge
3. Full dual carriageway for the entire length of the A90(T) Ellon Bypass, including widening the existing bridge

A90(T) – Ellon to Toll of Birness

The A90(T) between Ellon (A90(T)/A948 roundabout) and Toll of Birness (A90(T)/A952) is a single carriageway section of road of approximately 5km in length. It is proposed that this section of the A90(T) is upgraded to a dual carriageway for the full length of the section.

The two proposed junction designs for A90/A952 Toll of Birness have been designed to tie in with a dual carriageway.

Overtaking sections and overtaking lanes on the A90(T) and A952

Traffic data analysis highlighted that the A90(T) north of Toll of Birness and the A952 have traffic flows within recommended limits for a single carriageway road and that dualling of these routes cannot be justified based on traffic levels.

Traffic surveys noted the high proportion of HGVs on the A90(T) and the lack of overtaking opportunities can impact on journey time reliability and may increase driver frustration resulting in the potential for dangerous overtaking manoeuvres and increased accident risks.

The provision of overtaking sections or lanes will allow for safe overtaking thereby improving journey time reliability and road safety.

Overtaking sections can be described as existing sections of single lane, two way carriageway road where the combination of horizontal and vertical alignment, visibility and width provision is such that clear opportunities for overtaking can occur.

Overtaking lanes can be described as a section of road on which two lanes are provided in one direction to facilitate overtaking, with opposing traffic confined to one lane.

Analysis of the A90(T) and the A952 between Toll of Birness and Cortes has been undertaken to identify that the following sections of the route will benefit from overtaking lanes:

- A90(T) between Longhaven and Boddam
- A925 south of Ardallie
- A952 south of New Leeds
- A952 south of Cortes junction

Safety improvements on the A90(T) and A952

The Option Package proposes a series of road measures aimed at improving safety for road users on the A90(T) and the A952.

Safety for road users will be improved through the proposed junction improvements at Toll of Birness and Cortes, the proposed dual carriageway upgrades and the provision of overtaking lanes.

In addition to these, the following range of interventions will aim to further increase road safety:

- Provision for right turn refuges at as to be defined locations on the A90(T) and A952
- Targeted accident reduction measures on the A90(T) south of Fraserburgh and Peterhead, such as skid-resistant surfaces or speed limit changes
- Road realignment (where possible)
- Bypass of Mintlaw on A952
- Minor safety improvement measures such as improved signage, road markings, barriers, etc.

There are a number of locations on the A90(T) and the A952 where a right turn refuge could be provided, however, without detailed traffic data at these locations, it is not currently possible to accurately define locations where such a setup is required.

Anti-skid surface improvements have been made to the route in recent years and anecdotally these locations have seen a reduction in accidents. The Option Package does not include any specific locations for surface improvements but generally recommend that such improvements are continually monitored as an ongoing concern by the route managers.

Other safety measures, such as speed limit reductions at to be defined locations, improved signage or road markings have again not specifically been included in the Option Package for appraisal but, again, will be included in the range of recommended safety improvements that could be made on the routes.

The Part 1 Appraisal highlighted the potential need for a bypass of Mintlaw on the A952 primarily due to the proposed housing allocation in Mintlaw and the surrounding area with a Mintlaw bypass provided as a potential solution to possible future road safety concerns. As the impact of the proposed housing allocation has not be considered in detail at this stage, a Mintlaw Bypass has been considered in the Option Package simply as a possible future transport scheme and not as a more detailed design concept.

The interventions in the Option Package are shown in **Error! Reference source not found.** below.

Option Package Cost Estimates

A cost estimation exercise was undertaken for all the Option Package measures (excluding safety measures). Construction cost estimates were based on all elements normally encountered for "similar" typical projects. Table 0.1 provides estimated costs for all measures included in the Option Package.

Table 0.1 : Estimated Construction Costs (at 2017 prices)

Option Package Measure	Approximate Cost (£s)
A90 Ellon Bypass southern dual carriageway (Option 1)	£6,000,000
A90 Ellon Bypass dual carriageway & narrow bridge (Option 2)	£9,000,000
A90 Ellon Bypass full length dual carriageway (Option 3)	£18,000,000
A90 Ellon to Toll of Birness dual carriageway	£19,000,000
A90/B9005 roundabout	£200,000
A90/A948 roundabout	£1,200,000
A90/A948 roundabout (A90 NB left filter lane)	£1,400,000
A90/A952 Toll of Birness roundabout	£970,000
A90/A952 Toll of Birness grade separated junction	£8,200,000
A90/A952 Cortes junction roundabout	£900,000
Overtaking lane (2+1) A90 (Toll of Birness to Peterhead)	£2,400,000
Overtaking lane (2+1) A952 (Toll of Birness to Mintlaw)	£1,200,000
Overtaking lane (2+1) A952 (Mintlaw to Cortes)	£3,600,000

Figure 0.1 :Option Package Interventions

Phased Delivery of the Option Package

If the study is taken forward to the STAG Part 2 stage, it may be desirable to refine the Option Package further based on the data analysis results and the appraisal outcomes.

A low cost Option Package could be presented as the first phase of improvements. This study has found that the relatively low cost interventions at key junctions on the A90(T) would provide significant benefit with all junction upgrades designed to be compatible with any further route upgrades.

A medium term Option Package may provide a dual carriageway to the A90(T) between the A90T(T)/A948 and the Toll of Birness with the analysis and appraisal highlighting the potential journey time reliability and safety improvements that may be realised from this intervention.

A longer term or higher cost Option Package may include phased dualling of the A90(T) Ellon Bypass. The data analysis and option appraisal has shown that benefit may only be realised from this intervention under high levels of traffic growth and upgrading of the A90(T) Ellon Bypass may have significant environmental impacts depending of the level of proposed dualling.

Throughout the proposed phasing of these measures, it is recommended that interventions such as overtaking sections or safety improvements are also phased in by targeting specific locations that would benefit from such measures throughout the lifetime of the full phasing programme.

Taking into account data analysis and appraisal exercises undertaken for this study, the Option Package has been split into three distinct packages representing a phased approach to delivery and is detailed in Table 0.2.

Table 0.2 : Phased Delivery of Option Package

Delivery Phase	Intervention	Justification for inclusion
1 - Short Term	A90/B9005 roundabout A90/A948 roundabout (left filter option) A90/A952 Toll of Birness roundabout A90/A952 Cortes roundabout Targeted overtaking sections on A90 and A952 Targeted safety improvements A90 and A952	Economic analysis showed there to be significant benefits in delivering A90(T) junction upgrades and that they can be constructed at a relatively low additional cost. Targeted overtaking and safety improvements are considered attainable and desirable short term measures that meet the study aims
2 - Medium Term	A90 Ellon to Toll of Birness dual carriageway Additional overtaking sections on A90 and A952 Additional safety improvements A90 and A952	The provision of a dual carriageway would improve strategic connectivity north of Ellon and increase journey time reliability and corridor safety - key aims of the study.
3 - Long Term	A90 Ellon Bypass partial dualling (Option 1 or Option 2)	Dualling the A90(T) Ellon Bypass would complete the upgrade of the A90(T) to the Toll of Birness

The interventions not included in Table 0.2 have not been rejected from the overall Option Package but rather the analysis has identified a more suitable alternative intervention that will deliver similar benefit or have less negative impact on the study area.

Those interventions excluded from the phased Option Package are detailed in Table 0.3. It should also be noted that the proposed grade separated junction at the Toll of Birness and the proposed full length dualling of the A90(T) could still be delivered after phase 3 if deemed to be more suitable interventions. This report does not seek to fully exclude any intervention from the final Option Package but instead presents the appraisal for decisions makers such that they can make informed choices as to which options to progress.

Table 0.3 : Interventions excluded from phased Option Package

Interventions	Justification for exclusion
A90/A948 roundabout (no left filter lane)	The addition of a northbound left filter lane on the A90 Ellon Bypass provides significant benefit at a relatively low cost
A90/A952 Toll of Birness grade separated roundabout	The roundabout option at the Toll of Birness has been shown to provide the same benefits as the grade separated junction at a significantly lower cost
A90 Ellon Bypass full length dual carriageway	The option is likely to negatively impact the sensitive environmental area at the River Ythan and is considerably higher in cost to other A90 Ellon Bypass options

Data Analysis

To help define the Option Package the following analysis has been undertaken:

- A review of Baseline data
- 2017 traffic survey data analysis
- Traffic modelling of proposed interventions
- Economic appraisal of proposed interventions

This extensive and wide ranging analysis, allowed for the proposed interventions in the Option Package to be appraised and tested to ensure that the final recommended set of road based interventions fully addressed the key problems of the study area.

Baseline Data Review

The 2015 Baseline Report for the study (*Fraserburgh & Peterhead to Aberdeen Strategic Transport Study: Baseline Report Final, SIAS Ref. 77322, August 2015*) detailed all the background data that has been collected, collated and analysed to provide context for the study and allow for an informed appraisal of all options to be undertaken.

As part of this STAG 1 Plus study, it is important that cognisance was taken of the Baseline Data, and as in the Part 1 Appraisal, the Baseline data forms the basis for the Option Package appraisal. As such, the road focussed Baseline data was reviewed and summarised to provide context to the development of a detailed option package.

The Baseline Report provided extensive analysis of a wide range of traffic data for the strategic road network including analysis of:

- Historic and current traffic flows at key locations
- Heavy Goods Vehicle flows
- Journey times and journey speeds on key strategic routes
- Future year traffic flow forecasts
- Future Heavy Goods Vehicles traffic forecasts
- Future year journey time forecasts
- Accident statistics

Full details of the analysis is found in the Baseline Report. Key findings directly related to the proposed measures in the Option Package are:

- Analysis of the traffic on the A90(T) showed that the flow on the route between Ellon and the Toll of Birness is in excess of that recommended for a single carriageway.
- Average speeds on the A90(T) and A952 are considerably lower than the posted speed limits. The single carriageway nature of the route with a lack of overtaking opportunity means platooning is common-place and many vehicles are obligated to travel well below the signposted speed limit.

- There is a high proportion of heavy goods vehicles (HGVs) on the A90(T) that reduce journey time reliability and the lack of overtaking opportunities can increase driver frustration leading to potential accidents on the route.
- Four sections of the strategic road network in the Study Area have a higher than expected proportion of fatal accidents.

Analysis of 2017 Traffic Survey Data

As part of the STAG 1 Plus study, Nestrans commissioned 13hr (06:00 – 19:00) Turn Count and Queue Length Traffic Surveys, undertaken in February 2017, at the following four junctions on the A90(T):

- A90(T)/B9005
- A90(T)/A948
- A90(T)/A952 Toll of Birness junction
- A90(T)/A952 Cortes junction

The data was collated and analysed with a number of key findings helping to inform the Option Package.

The traffic data highlighted the high volume of traffic on the A90(T) at Ellon (>13,000 vehicles over the 13 hour survey period) and the decrease in traffic on the A90(T) as the route heads north from Ellon. After Ellon, at the Toll of Birness, traffic splits approximately 60%:40% between the A90(T) to Peterhead and the A952 to Fraserburgh, respectively.

There is a high volume of HGVs on the A90(T) from south of Ellon to the Toll of Birness with up to 11% of all traffic classed as HGVs, or over 1000 HGVs over the 13hr survey period.

The total two-way all vehicle flow, total HGV two-way flow and percentage of HGVs on the A90(T) and A952 is shown in Table 0.4 below.

Table 0.4 : 13 Hour Two-Way All Vehicle Flow and HGV Totals

Location	2-way flow	Total HGVs	% of HGVs
A90 South of Ellon Bypass/B9005 Junction	15983	1457	9%
A90 Ellon Bypass	12296	1317	11%
A90 North of Ellon Bypass/A949 Junction	13323	1228	9%
A90 South of Toll of Birness	13095	1228	9%
A90 North of Toll of Birness	7733	875	11%
A952 North of Toll of Birness	5424	371	7%
A952 South of Cortes Junction	3937	277	7%
A90 South of Cortes Junction	3845	205	5%
A90 North of Cortes Junction	7387	448	6%

A key finding from the 2015 Baseline Report was that analysis of Annual Average Daily Traffic (AADT) flows on the A90(T) showed that, in accordance with published guidance (*DMRB* 5.1 TA 46/97), flows on the route between Ellon and the Toll of Birness were in excess of that recommended for a single carriageway. This evidence supported the option

measure for extending the A90(T) dual carriageway from Ellon to Toll of Birness. The AADT used 2014 traffic flow data from the Scottish Road Traffic Database (SRTDb).

To supplement this finding, AADT was calculated on A90(T) and A952 from the 2017 traffic survey data, as shown in Table 0.5

Table 0.5 : Calculated 2017 AADT Flows

Location	AADT
A90(T) South of A90(T)/B9005	17925
A90(T) Ellon Bypass	13779
A90(T) between A90(T)/A949 and the Toll of Birness	14962
A90(T) North of Toll of Birness	8831
A952 North of Toll of Birness	6095
A952 South of Cortes Junction	4561
A90(T) South of Cortes Junction	4473
A90(T) North of Cortes Junction	8804

The guidelines state that if AADT flows on a two-way, single lane carriageway exceed 13,000 vehicles, an alternative method of providing additional capacity should be considered. The AADT calculations show that flows on the A90(T) Ellon Bypass and A90(T) between Ellon and the Toll of Birness exceed 13,000 vehicles and, therefore, exceed the recommended capacity of a single carriageway.

North of Toll of Birness, on both the A90(T) and A952, calculated AADT drops below 13,000 vehicles to 8,200 vehicles and 5,700 vehicles respectively. As reflected in the Baseline Report and the 2014 traffic data analysis, the 2017 evidence suggest that the current standard of road class is sufficient beyond Toll of Birness.

Traffic Modelling of the Option Package

S-Paramics microsimulation software has been utilised to test the operation of a number of the proposed interventions on the A90(T), as defined in the Option Package. Changes in network operation through the provision of road based interventions has been assessed with two separate modelling exercises undertaken:

- 2023 A90(T) Ellon to the Toll of Birness corridor model
- 2023 A90(T)/A952 Cortes junction model

Aberdeenshire Council have a future year 2023 Ellon S-Paramics model and this was used as the starting point for all transport modelling. The 2023 model predicted that high levels of traffic growth would occur, based on Local Development Plan assumptions, and therefore it allowed the proposed transport interventions to be tested under high traffic volumes.

The aim of the S-Paramics modelling was to inform, but not define, the development of the Option Package measures, particularly with regard to the design of new proposed junction.

2023 A90(T) Ellon to the Toll of Birness Corridor Model

The 2023 A90(T) Ellon to the Toll of Birness corridor model included the following transport interventions from the Option Package:

- A90(T) Ellon Bypass northern and southern dual carriageway with narrowing for existing River Ythan bridge.
- Dual carriageway on the A90(T) between Ellon and the Toll of Birness
- Upgrades to the A90(T)/B9005 roundabout
- Upgrades to the A90(T)/A948 roundabout with two options modelled:
  - Two lane approaches in all arms
  - Three lane approach from the A90(T) southern approach (2 lanes in remaining arms)
- Junction upgrades at the Toll of Birness, with two options modelled:
  - new two lane roundabout
  - new two lane roundabout

The modelling was used to assess the impacts of these proposed interventions on average journey times and average queue lengths. Key findings from the Ellon to the Toll of Birness traffic modelling were:

- Junction improvements at the Toll of Birness are required to reduce the significant congestion seen on the A952 southbound if predicted high traffic growth is realised
- Without junction improvements at the Toll of Birness, traffic from the A952 may attempt to take unsafe gaps to enter the A90(T) leading to a potential for increased accidents

- Both the proposed roundabout and the grade separated junction options at the Toll of Birness perform similarly with comparable improvements in journey time and reductions in queue length.
- Junction improvements at the Toll of Birness increases traffic reaching the A90(T) Ellon Bypass/A948 roundabout and mitigation here should take account of this.
- The proposed road interventions are shown to provide benefits to journey times and queue lengths on the A90(T) and A952 corridor in 2023 modelled traffic conditions with journey time savings of up to 30 minutes for southbound traffic on the A952.

2023 A90(T)/A952 Cortes Junction Model

The STAG Part 1 appraisal recommended junction improvements at the A90(T)/A952 Cortes junction. No previous microsimulation modelling of the Cortes junction has been undertaken but given the availability of 2017 junction survey data, an S-Paramics model of Cortes junction was created to test the operation of the proposed roundabout.

The 2017 traffic survey data shows there to be minimal queueing at the junction and the primary reason for testing the introduction of the roundabout is to address safety concerns at the junctions with the proposed roundabout allowing for safer turning movements for all approaches to the junction.

The modelling results show that the proposed roundabout operates well and does not negatively impact on congestion with minimal queueing observed in the 2023 model when compared to the 2017 observed queue lengths.

Economic Appraisal of the Option Package

In order to provide a relative comparison of the impact and benefit of all proposed interventions and to help define the final Option Package, an economic appraisal exercise was undertaken using Transport Scotland's Programme for Economic Assessment of Road Schemes (PEARS).

For the economic appraisal exercise, a number of test scenarios were created from the proposed interventions. The proposed interventions were combined in a manner that might reflect a possible phased approach to road improvements, such that the minimum level of intervention required to provide suitable improvements to journey times, queue levels and safety was defined as Economic Test 1. Each subsequent test built on Test 1 so that 9 tests were identified to be taken forward for economic appraisal. The order of the economic tests was defined by the combined cost of each intervention and by taking cognisance of any logical construction order. The tests for Economic Appraisal and their estimated costs are defined in Table 0.6.

Table 0.6 : Tests for Economic Appraisal

	Interventions								
Option Test	A90/B9005 roundabout £200,000	A90/A948 roundabout £1,400,000	A90/A952 Toll of Birness roundabout £970,000	A90/A952 Toll of Birness grade separated junction £8,200,000	A90 Ellon to Toll of Birness dual carriageway £19,000,000	A90 Ellon Bypass southern dual carriageway £6,000,000	A90 Ellon Bypass dual carriageway & narrow bridge £9,000,000	A90 Ellon Bypass full length dual carriageway £18,000,000	Total Costs(£M)
1	✓	✓	✓						£2.57
2a	✓	✓	✓		✓				£21.57
2b	✓	✓		✓	✓				£28.80
3a	✓	✓	✓		✓	✓			£27.57
3b	✓	✓		✓	✓	✓			£34.80
4a	✓	✓	✓		✓		✓		£30.57
4b	✓	✓		✓	✓		✓		£37.80
5a	✓	✓	✓		✓			✓	£39.57
5b	✓	✓		✓	✓			✓	£46.80

Economic modelling requires forecast traffic information to assess the level of benefit over the lifetime of a scheme. Traffic forecasts were derived from the Aberdeen Sub Area Model (ASAM4a), and used to create 2018 and 2033 future year traffic models of all 9 option test model.

To provide further robustness to the outputs from the economic appraisal, the economic modelling was undertaken using both low growth and high growth traffic assumptions.

The low growth modelling can be considered to represent a conservative estimation on likely growth to 2033 and any benefits seen in the economic modelling can be interpreted as representing the interventions that give value for money in the short to medium term.

The high growth modelling represents a scenario where traffic conditions can be considered 'worst case'. Any benefits seen in the economic modelling would indicate that the interventions would operate satisfactorily if high levels of growth are realised at any point in the future.

The evaluation summary table for each economic test with low growth forecasts is presented in Table 0.7 and with high growth forecasts in Table 0.8.

Table 0.7 : Economic Evaluation Summary (Low Growth)

Option Test	Approx. Cost (£M)	BCR	PVB(£M)	NPV (£M)	PVC (£M)
1	£2.57	1.90	£3.82	£1.81	£2.01
2a	£21.57	0.52	£8.75	-£8.09	£16.84
2b	£28.80	0.51	£11.42	-£10.91	£22.33
3a	£27.57	0.41	£8.77	-£12.77	£21.53
3b	£34.80	0.42	£11.44	-£15.74	£27.18
4a	£30.57	0.38	£8.99	-£14.88	£23.87
4b	£37.80	0.39	£11.59	-£17.93	£29.52
5a	£39.57	0.30	£9.18	-£21.73	£30.90
5b	£46.80	0.32	£11.81	-£24.73	£36.55

Table 0.8 : Economic Evaluation Summary (High Growth)

Option Test	Approx. Cost (£M)	BCR	PVB(£M)	NPV (£M)	PVC (£M)
1	£2.57	56.20	£112.79	£110.78	£2.01
2a	£21.57	7.25	£122.05	£105.21	£16.84
2b	£28.80	5.66	£127.34	£104.85	£22.49
3a	£27.57	5.69	£122.57	£101.04	£21.53
3b	£34.80	4.70	£127.69	£100.51	£27.18
4a	£30.57	5.17	£123.54	£99.66	£23.87
4b	£37.80	4.33	£127.96	£98.44	£29.52
5a	£39.57	4.01	£123.80	£92.90	£30.90
5b	£46.80	3.51	£128.25	£91.70	£36.55

Key results from the Economic Appraisal of the Option Packages were:

- Test 1 (lowest cost option) can be considered the most economically viable set of interventions due to the journey time savings realised at relatively low cost. This is true under both low and high traffic growth forecasts.
- Under low growth assumptions, upgrading the A90(T) from A90(T)/A948 to the Toll of Birness to a dual carriageway does not provide high economic benefit.
- The provision of a grade separated junction under the low growth assumptions could be considered economically viable in isolation but as this is unlikely to be deliverable without a dual carriageway, the combined scheme does not provide enough benefit to cover its cost.
- Under high growth assumptions all interventions could be considered economically viable with the proposed interventions offering a return on investment and ensuring that there is sufficient capacity in the network to accommodate high levels of future demand.
- The full dualling of the A90(T) Ellon Bypass does not provide enough benefit to be considered economically viable under low or high growth assumptions.

STAG Appraisal

With the Option Package detail defined, the fully phased Option Package was appraised using the STAG methodology to confirm that it still met the study's Transport Planning Objectives and is suitable to be taken forward for a STAG Part 2 Appraisal in the future.

The Option Package was appraised against:

- The Transport Planning Objectives
- The STAG Criteria
- The Risk Criteria of Feasibility, Affordability and Public Acceptability
- Established Policy Directives

A qualitative appraisal of the Option Package was undertaken based on the STAG seven point scale which considers the relevant size and scale of impacts. For each objective or criteria a score between -3 and 3 was given, as shown in the colour scale in Figure 0.2

-3	-2	-1	0	1	2	3
Major Cost or Negative Impacts	Moderate Cost or Negative Impact	Minor Cost or Negative Impact	No Benefit or Impact	Minor Benefit	Moderate Benefit	Major Benefit

Figure 0.2 : STAG 7-Point Scale

The results of the appraisal of the Option Package against the Transport Planning Objectives, the STAG criteria and the Feasibility, Affordability and Public Acceptability criteria is summarised in Table 0.9. The Option Package is shown to score favourably against the appraisal guidance set out in STAG with the measures considered suitable to be taken forward for a STAG Part 2 Appraisal.

Table 0.9 : Overall Appraisal Summary, Scores and Risk Ratings

Transport Planning Objectives						STAG Criteria						Risk Rating		
TPO1	TPO2	TPO3	TPO4	TPO5	TPO6									
Reduce journey times between North-East communities and the Aberdeen conurbation	Increase journey time reliability and predictability between North-East communities and the Aberdeen conurbation	Reduce accidents on the A90(T) and A952	Increase strategic travel choice between North-East communities and the Aberdeen conurbation	Increase direct public transport connectivity between North-East communities and the main trip attractors within the Aberdeen conurbation	Increase mode share for non-car based modes between North-East communities and the Aberdeen conurbation	Environment	Safety	Economy	Integration	Accessibility & Social Inclusion	Fit with National Established Policy Directives	Feasibility	Affordability	Public Acceptability
2	2	2	1	1	0	-1	3	3	2	1	1	Medium	Medium	Low

Study Conclusions

By building on the initial findings from the STAG Part 1 study through design, data analysis and option appraisal, a road based Option Package to improve safety and connectivity between Fraserburgh, Peterhead and Aberdeen has been further defined.

The study has found that a comprehensive range of road based interventions can be designed to have their construction order phased and that lower cost and low complexity schemes can provide significant initial benefit to road users in the area. As local development increases, further interventions to improve road safety and journey time reliability have been designed and can be introduced to accommodate any resulting increase in traffic using key strategic routes of the A90(T) and the A952.

SYSTRA provides advice on transport, to central, regional and local government, agencies, developers, operators and financiers.

A diverse group of results-oriented people, we are part of a strong team of professionals worldwide. Through client business planning, customer research and strategy development we create solutions that work for real people in the real world.

For more information visit www.systra.co.uk

Birmingham
5th Floor, Lancaster House, Newhall St,
Birmingham, B3 1NQ
T: +44 (0)121 233 7680 F: +44 (0)121 233 7681

Dublin
2nd Floor, Riverview House, 21-23 City Quay
Dublin 2,Ireland
T: +353 (0)1 542 6000 F: +353 (0)1 542 6001

Edinburgh
Prospect House, 5 Thistle Street, Edinburgh EH2 1DF
United Kingdom
T: +44 (0)131 220 6966

Glasgow
Seventh Floor, 124 St Vincent Street
Glasgow G2 5HF United Kingdom
T: +44 (0)141 225 4400

Lille
86 Boulevard Carnot, 59000 Lille, France
T: +33 (0)3 74 07 00 F: +33 (0)1 53 17 36 01

London
Seventh Floor, 15 Old Bailey
London EC4M 7EF United Kingdom
T: +44 (0)20 7529 6500 F: +44 (0)20 3427 6274

Lyon
11, rue de la République, 69001 Lyon, France
T: +33 (0)4 72 10 29 29 F: +33 (0)4 72 10 29 28

Manchester
25th Floor, City Tower, Piccadilly Plaza
Manchester M1 4BT United Kingdom
T: +44 (0)161 236 0282 F: +44 (0)161 236 0095

Marseille
76, rue de la République, 13002 Marseille, France
T: +33 (0)4 91 37 35 15 F: +33 (0)4 91 91 90 14

Newcastle
PO Box 438, Newcastle upon Tyne, NE3 9BT
United Kingdom
T: +44 (0)191 2136157

Paris
72 rue Henry Farman, 75015 Paris, France
T: +33 (0)1 53 17 36 00 F: +33 (0)1 53 17 36 01

Woking
Dukes Court, Duke Street
Woking, Surrey GU21 5BH United Kingdom
T: +44 (0)1483 728051 F: +44 (0)1483 755207

Hong Kong
14th Floor West, Warwick House, TaiKoo Place,
979 King's Road, Island East, Hong Kong
T: +852 2529 7037 F: +852 2527 8490

Shenzhen
Room 905, Excellence Mansion, No.98, No.1 Fuhua Road,
Futian Central Zone, Shenzhen, PRC, Post Code：518048
T：+86 755 3336 1898 F：+86 755 3336 2060

Shenzhen - Beijing Branch Office
Room 1503, Block C, He Qiao Mansion, No. 8 Guanghua Road,
Chaoyang District, Beijing, PRC, Post Code：100026
T：+86 10 8557 0116 F：+86 10 8557 0126

Beijing Joint Venture
Room 1507, Main Building, No. 60, Nan Li Shi Road,
Xi Cheng District, Beijing, PRC, Post Code：100045
T：+86 10 8807 3718 F：+86 10 6804 3744

Mumbai
Antriksh, Unit no. 301, 3rd Floor, CTS Nos.
773, 773/1 to 7, Makwana Road, Marol, Andheri East ,
Mumbai 400069
T: +91 22 2647 3134
B 307, Great Eastern Summit Sector - 15, CBD Belapur Navi
Mumbai - 400 614
T: +91 22 2757 2745

New Delhi
5th Floor Guru Angad Bhawan, 71 Nehru Place, New Delhi
110019
T: +91 11 2641 3310

Noida
3/F, C-131, Sector 2, Noida-201301, U.P.
T: +91 120 432 6999

Singapore
25 Seah Street #04-01 Singapore 188381
T：+65 6227 3252 F：+65 6423 0178

Thailand
37th Floor, Unit F, Payatai Plaza Building,128/404-405 Payathai
Road, Rajthewee, Bangkok 10400, Thailand
T：+662 216 6652 F：+662 216 6651

Vietnam
5/F Perfect Building, Le Thi Hong Gam St, District 1,
Ho Chi Minh City, Vietnam
T：+84 8 3821 7183 F：+84 8 3821 6967

SYSTRA