TRANSPORT SCOTLAND
CÒMHDHAIL ALBA

A96 DUALLING
HARDMUIR TO FOCHABERS

A96 Dualling

Hardmuir to Fochabers scheme

DMRB Stage 2
Scheme Assessment Report

Volume 3 – Part 4
Traffic and Economic Assessment

December 2018

transport.gov.scot/project/
a96-hardmuir-fochabers

A96 Dualling Hardmuir to Fochabers

DMRB Stage 2 Scheme Assessment Report
Volume 3
Part 4 – Traffic and Economic Assessment

A96PHF-MMS-GEN-00000-RP-Z-00025

Revision Record

Ver No	Date	Originator	Checker	Approver	Status	Suitability
C01	Dec 2018	Various	Various	JMH	A2	Approved for Stage Complete

Prepared for:
Transport Scotland
Buchanan House, 58 Port Dundas Road
Glasgow, G4 0HF

Prepared by:
Mott MacDonald Sweco JV
2nd Floor Quay 2
139 Fountainbridge
Edinburgh, EH3 9QG

Contents Page

Part 5: Assessment Summary and Preferred Option Recommendation

Volume 4 - Appendices

Volume 5 - Engineering, Environmental and Traffic Figures

22. Modelling

22.1 Introduction

22.1.1. The traffic and economic assessment has been undertaken using the A96 Corridor Road Assignment Model (A96 CRAM). The A96 CRAM is a highway model that is used in conjunction with the national transport and land use models, Transport Model for Scotland (TMfS14) and Transport/Economic/Land-use Model of Scotland (TELMoS). The national models inform forecasts of changes in land use and travel demand and provide responses in relation to variable demand and mode choice. Outputs from TMfS/TELMoS are incorporated into the A96 CRAM model which has a finer level of zonal detail for predicting road traffic impacts arising from road network changes. The A96 CRAM has a base model year of 2012 and forecast model years used in the assessment are 2030, 2037 and 2045.

22.1.2. The A96 CRAM has been used to compare the options in terms of performance indicators such as changes to traffic flows, speeds, journey times and travel distances. These outputs were input to Transport Users Benefit Appraisal (TUBA, v1.9.11) software to identify the economic benefits of each option compared to the Do Minimum scenario. The model outputs were also input into Cost and Benefit to Accidents – Light Touch (COBALT) software to identify the predicted impact scheme options would have on accidents in the study area. The impact on accidents is monetised and included in the economic assessment. Output from the A96 CRAM was also used in the environmental appraisal of options as presented in Volume 2 of this report.

22.1.3. This chapter of the report describes key aspects of the transport model. Chapter 23 (Effects of Options) summarises the predicted traffic effects of the options considered. The economic performance of the various options is presented in Chapter 24 (Economic Performance of Options).

22.2 A96 Corridor Road Assignment Model (A96 CRAM)

22.2.1. The A96 CRAM represents the A96 corridor between the Raigmore Interchange in Inverness and Haudagain Roundabout in Aberdeen. The version of the model used in this assessment is A96 CRAM version 1.3, as issued by Transport Scotland's A96 Lead Traffic Economic Advisor (LTEA) in May 2018.

22.2.2. TMfS14 was used by the LTEA to determine the area of influence of the proposed dual carriageway between Aberdeen and Inverness; this defined the fully modelled area, as shown in Figure 22.1.

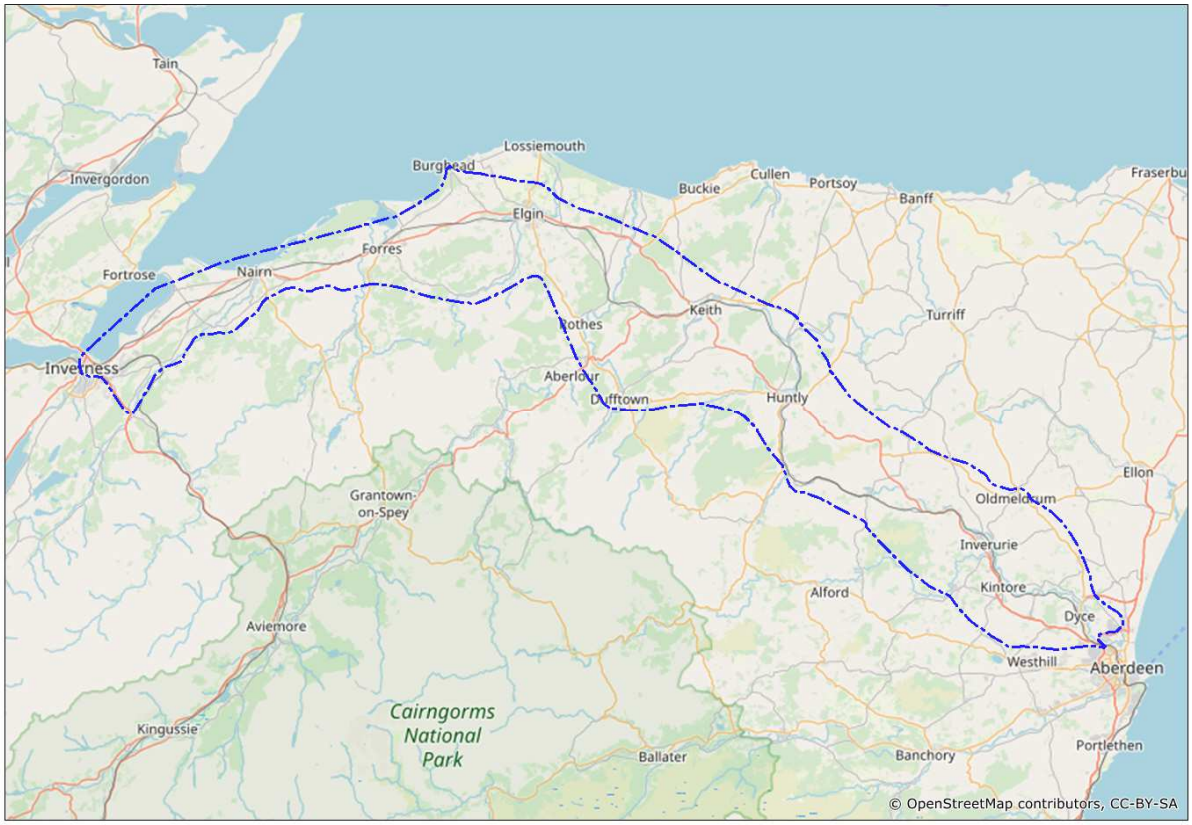

Figure 22.1: A96 CRAM Fully Modelled Area

22.2.3. The calibration and validation of the A96 CRAM 2012 base year model was completed in 2015 by Transport Scotland's LTEA consultants AECOM. An Assignment Model Validation Report (AMVR) was provided to Transport Scotland in November 2015 (and updated in January 2018) which documents the processes used to develop the modelled networks and matrices, the methods of calibration employed and the calibration and validation of the model.

22.2.4. A96 CRAM has been developed to provide the following key functions:

- Road traffic forecasting: producing road traffic flows for the Do Minimum scenario and the various A96 Dualling scheme options;
- Journey times: producing journey times for the Do Minimum scenario and the various scheme options;
- Option Testing: producing a consistent set of outputs for the various options tested;
- Noise and Air quality assessment: providing outputs from the model to enable the noise and air quality assessments to be undertaken; and
- Economic Assessment: providing outputs from the model to enable the economic assessment to be undertaken using the UK Department for Transport's (DfT) TUBA and assessment of accident savings using COBALT.

22.3 Zoning System

22.3.1. The zoning system for A96 CRAM has been derived from zoning used in TMfS14. There has been disaggregation of the TMfS14 zones to ensure that the model is of sufficient detail to assess the effects of the A96 schemes. This disaggregation has been based on the 2011 Scotland Census Data Zones and Output Areas and compatibility with the TMfS14 zoning system. Model zones have been defined according to land use, where possible, with clearly defined points of access onto the network. The A96 CRAM incorporates a total of 655 zones.

22.4 User Classes

22.4.1. Road based travel demand is assigned to the highway network using a volume averaged equilibrium assignment, in passenger car units (PCUs), for each of the following five vehicle user classes (UC):

- UC1 Cars (employers' business purpose);
- UC2 Cars (travel to work purpose);
- UC3 Cars (other purpose);
- UC4 Light Goods Vehicles (LGV); and
- UC5 Heavy Goods Vehicles (HGV).

22.4.2. In addition, scheduled bus routes along the corridor have been modelled as fixed flows.

22.5 Time Periods

22.5.1. The A96 CRAM represents a typical Monday to Thursday weekday in 2012. The modelled time periods are:

- AM peak hour between 08:00 and 09:00;
- Inter peak hour being the average of the six-hour period from 10:00 to 16:00; and
- PM peak hour between 17:00 and 18:00.

22.5.2. The derived Annual Average Daily Traffic (AADT) factors are:

- AM peak hour (08:00-09:00) to AM peak period (07:00-10:00) 2.61
- Inter peak hour to Inter peak period (10:00-16:00) 6.00
- PM peak hour (17:00-18:00) to PM peak period (16:00-19:00) 2.70
- 12 hour weekday to 24 hour AADT factor[1] 1.10

22.5.3. As A96 CRAM applies demands in terms of PCUs, conversion factors based on 2.35 PCUs/veh and 2.5 PCUs/veh have been applied to UC5 and Buses respectively.

[1] The 12 to 24 hour AADT factor uses available data over 365 days to convert from the neutral modelled period to an annual average including weekends.

22.6 Future Year Forecasting

22.6.1. A three-tiered model forecasting approach has been adopted to take advantage of pre-existing national modelling tools (TELMoS and TMfS) and a local, A96 specific, assignment model (A96 CRAM). Essentially, this approach captures the traffic demand forecasting capabilities of TELMoS and TMfS but uses A96 CRAM to provide a greater degree of geographic disaggregation, and hence improved resolution, in order to generate more precise forecast of road traffic impacts along the A96 corridor.

22.6.2. TMfS, in conjunction with TELMoS, provides forecasts of changes in land use and travel demand over time. The main purpose of TMfS in the context of the A96 Dualling assessment is to provide strategic outputs for use in the A96 Dualling Programme level analysis and to provide travel demand forecasts that can be fed down to lower tier models. A96 CRAM provides a finer level detail of the road traffic impacts arising from the A96 Dualling Programme.

22.7 Do Minimum Network

22.7.1. The 'Do Minimum' provides a description of the scenario that would exist if the A96 Dualling programme proposals were not implemented but all other committed land use and transport schemes were completed. WebTAG[2] and Scottish Transport Appraisal Guidance (STAG) guidance recommends inclusion of only those schemes or developments in the core scenario that are either 'near certain' or 'more than likely'. Section 2.3 of STAG states *'The options generated must be appraised against a Do Minimum option that includes transport improvement commitments that have policy and funding approval and from which it would be difficult to withdraw'*.

22.7.2. For economic, environmental and design assessment of schemes forming part of the A96 Dualling Programme, the Do Minimum A96 CRAM network is assumed to be as it was in 2012 (the base model year) plus a set of infrastructure projects agreed with Transport Scotland, Highland Council, Moray Council, Aberdeenshire Council, and Aberdeen City Council, as shown in Table 22.1 below.

[2]Online guidance documents for transport appraisal - Department of Transport May 2018

Table 22.1: Do Minimum Road Schemes

Road Scheme	Year of Inclusion
Queensferry Crossing (Forth Replacement Crossing)	2017
M8 / M73 / M74 Motorway Improvements	2017
A96 Inveramsay Bridge	2017
A68 Pathhead to Tynehead Junction	2017
A702 Candymill Bend and Edmonstone Brae	2017
A95 Lackghie	2017
A75 Dunragit Bypass Scheme	2017
A75 Hardgrove to Kinmount Scheme	2017
A82 Crianlarich Bypass	2017
A82 Pulpit Rock Scheme	2017
Glasgow East End Regeneration Route Phase 3 (Clyde Gateway Route)	2017
Portstown Link Road	2017
Third Don Crossing	2017
Soutra South to Oxton	2017
Dundee Waterfront	2017
Dyce Drive Link Road (part of Dyce Park and Ride)	2017
Aberdeen Western Peripheral Route (AWPR) / Balmedie to Tipperty	2018
Speed limit changes on A96 at Pitmachie	2022
A90/A96 Haudagain Roundabout Improvement	2022
Inverness West Link (both Stage 1 and Stage 2)	2022
M8 J29a Bishopton Junction	2022
M9 Winchburgh Junction	2027

22.8 Do Something Network

22.8.1. Two Do Something scenarios have been created based on the differing requirements for different assessments:

- The Do Something 'Economic' scenario involves model coding representing dualling of the A96 between Hardmuir and Fochabers only. The scheme is modelled to tie-in to the existing A96 at either end. Demands are assumed to be fixed between the Do Minimum and the Do Something Economic'; there is assumed to be no induced traffic as a result of the scheme. This approach ensures that benefits in the economic assessment are directly attributable to the dualling of the Hardmuir to Fochabers section only.
- The Do Something 'Environment & Design' scenario involves model coding representing dualling of the A96 between the full programme route from Aberdeen to Inverness. Forecast demands for Do Something 'Environment & Design' allow for induced traffic as a result of the full dualling scheme based on TMfS/TELMoS responses to faster journey times and increased capacity. This provides a maximum impact scenario in terms of traffic flows for environmental and design assessment.

Table 22.2: Schemes included in the Do Minimum and Do Something Scenarios

	A96 Schemes			
	A96 Inverness to Nairn (including Nairn Bypass)	**A96 Hardmuir to Fochabers (Western Section)**	**A96 Central Section**	**A96 Eastern Section**
Do Minimum	N	N	N	N
Do Something 'Economic'	N	Y	N	N
Do Something 'Environment & Design'	Y	Y	Y	Y

22.9 Summary

22.9.1. The A96 CRAM model has been used to provide existing and future forecast traffic flows. Details of the model development, calibration and validation are set out in the Assignment Model Validation Report, January 2018. Network assumptions have been presented in relation to the Do Minimum scenario, including committed road infrastructure projects.

22.9.2. Two separate Do Something scenarios for economic assessment and environmental and design assessments have been developed. The approach to traffic forecasting has been presented based on use of TMfS / TELMoS and A96 CRAM to derive traffic flows in forecast years of 2030, 2037 and 2045.

23. Effects of Route Options

23.1 Introduction

23.1.1. For the purpose of traffic appraisal of the sections described in Volume 1, Chapter 3 (Development of Route Options), assumptions have been made in modelling connections to adjacent sections of the A96 Dualling Hardmuir to Fochabers Scheme. The following combinations identified in Table 23.1 below have been chosen in order to generate the highest traffic flows in the particular section being appraised (it is particularly relevant to use the highest available predictions in noise and air quality assessments).

Table 23.1: Assumed Combinations for Traffic Testing

Option Being Appraised	Hardmuir to Hillhead Section	Hillhead to Lhanbryde Section	Lhanbryde to East of Fochabers Section
Hardmuir to Hillhead North	North Option	South Option	South Option
Hardmuir to Hillhead South	South Option		
Hillhead to Lhanbryde North	South Option	North Option	North Option
Hillhead to Lhanbryde South		South Option	
Lhanbryde to East of Fochabers North	North Option	North Option	North Option
Lhanbryde to East of Fochabers South			South Option

23.2 Hardmuir to Hillhead Options

23.2.1. Figure 23.1 (Volume 5) presents the proposed alignments for the two options in this geographical section and two way annual average daily traffic (AADT) flows at key locations. The scheme junctions are summarised in Table 23.2 below.

Table 23.2: Hardmuir to Hillhead Junction Strategy

Option	No. of Junctions	Junction Location
Hardmuir to Hillhead North Option	2	Existing A96 West of Forres (Forres West)
		Existing A96 East of Forres (Forres East)
Hardmuir to Hillhead South Option	3	Existing A96 West of Forres (Forres West)
		A940 (Forres South)
		Existing A96 East of Forres (Forres East)

23.2.2. At opening year 2030 between Forres West and Forres East junctions, the options attract high traffic volumes of approximately 17,600 (North Option) and 18,400-19,200 (South Option) vehicles per day, consistent with a dual carriageway provision[3]. There are significant reductions on the existing A96 for both options, at key locations such as Forres railway station which reduces from 14,100 to 3,800 and Brodie village 16,200 to 1,300 vehicles per day. There are no significant changes in Forres High Street, with traffic flows being at 3,400 vehicles per day for both options. The A940 junction changes the traffic patterns in the area with reductions on the A940 within Forres from 4,900 to 3,400 vehicles per day.

23.2.3. In addition to traffic flows, journey times have also been examined in both directions for both options. These are presented in Tables 23.3, 23.4 and 23.5 below.

Table 23.3: Hardmuir to Hillhead Journey Times (AM Peak)

Option	DM 2045 Existing A96 (mm:ss)	North Option 2045 New A96 (mm:ss)	South Option 2045 New A96 (mm:ss)
Hardmuir to Hillhead	14:10	09:10	10:00
Hillhead to Hardmuir	12:50	09:00	10:20

Table 23.4: Hardmuir to Hillhead Journey Times (Inter Peak)

Option	DM 2045 Existing A96 (mm:ss)	North Option 2045 New A96 (mm:ss)	South Option 2045 New A96 (mm:ss)
Hardmuir to Hillhead	12:30	09:00	09:50
Hillhead to Hardmuir	13:00	09:00	10:30

[3] DMRB TA46/97 provides an indication of the range of opening year traffic flows over which a particular carriageway standard is likely to be economically justified. For a two-lane dual carriageway this is 11,000 to 39,000 vehicles per day.

Table 23.5: Hardmuir to Hillhead Journey Times (PM Peak)

Option	DM 2045 Existing A96 (mm:ss)	North Option 2045 New A96 (mm:ss)	South Option 2045 New A96 (mm:ss)
Hardmuir to Hillhead	13:50	09:00	10:00
Hillhead to Hardmuir	15:20	09:10	10:40

23.2.4. In the AM peak both options are predicted to save between approximately two and five minutes in each direction when compared to the Do Minimum scenario. The North Option is approximately one minute quicker than the South Option, owing to the shorter, more direct route, taken around Forres. Similar journey time savings are evident is the PM peak with a consistent finding that the North Option performs better.

23.3 Hillhead to Lhanbryde Options

23.3.1. Figure 23.2 (Volume 5) presents the alignments for the two options in this geographical section and traffic flows at key locations. The junction locations are summarised in Table 23.6 below.

Table 23.6: Hillhead to Lhanbryde Junction Strategy

Option	No. of Junctions	Junction Location
Hillhead to Lhanbryde North Option	3	Existing A96 near Newton (Elgin West)
		A941 north of Elgin (Elgin North)
		Existing A96 East of Elgin (Elgin East)
Hillhead to Lhanbryde South Option	3	South-west of Elgin with link to existing A96 (Elgin West)
		A941 south of Elgin (Elgin South)
		South of Lhanbryde with link to existing A96 (Elgin East)

23.3.2. At opening year 2030 between Elgin West and Elgin East junctions, the options attract high traffic volumes of approximately 15,400 (North Option) and 13,600 – 16,000 (South Option) vehicles per day, consistent with a dual carriageway provision[4]. Traffic flows in Elgin on the existing A96 are relatively consistent between the two options at key locations, such as at Alexandra Road, west of the A941, from 20,800 to 17,300 (North Option) and 17,100 (South Option) vehicles per day. At Alves the daily traffic flow reduces from 18,700 to 2,700 (North

[4] DMRB TA46/97 provides an indication of the range of opening year traffic flows over which a particular carriageway standard is likely to be economically justified. For a two-lane dual carriageway this is 11,000 to 39,000 vehicles per day.

Option) and 3,600 (South Option) vehicles per day. In each case the central junctions change the traffic patterns in the area. The North Option attracts more traffic from the Lossiemouth area with traffic flows raising from 9,600 to 11,600 vehicles per day on the A941. For the South Option, the central junction results in minor changes in traffic patterns in the area with the A941 traffic flows reducing from 5,400 to 5,000 vehicles per day.

23.3.3. Journey times have also been examined in both directions for each option for the three modelled time periods. These are presented in Tables 23.7, 23.8 and 23.9 below.

Table 23.7: Hillhead to Lhanbryde Journey Times (AM Peak)

Option	DM 2045 Existing A96 (mm:ss)	North Option 2045 New A96 (mm:ss)	South Option 2045 New A96 (mm:ss)
Hillhead to Lhanbryde	25:30	13:30	12:00
Lhanbryde to Hillhead	24:40	13:20	11:50

Table 23.8: Hillhead to Lhanbryde Journey Times (Inter Peak)

Option	DM 2045 Existing A96 (mm:ss)	North Option 2045 New A96 (mm:ss)	South Option 2045 New A96 (mm:ss)
Hillhead to Lhanbryde	22:00	13:20	11:40
Lhanbryde to Hillhead	21:50	13:20	11:50

Table 23.89 Hillhead to Lhanbryde Journey Times (PM Peak)

Option	DM 2045 Existing A96 (mm:ss)	North Option 2045 New A96 (mm:ss)	South Option 2045 New A96 (mm:ss)
Hillhead to Lhanbryde	24:50	13:30	11:50
Lhanbryde to Hillhead	27:00	13:50	12:20

23.3.4. In the AM peak both options are predicted to save between approximately 11 to 14 minutes in each direction when compared to the Do Minimum scenario. The South Option is approximately one and a half minutes quicker than the North Option, owing to the shorter, more direct route taken around Elgin. Similar journey time savings are evident is the PM peak with a consistent finding that the South Option performs better.

23.4 Lhanbryde to East of Fochabers Options

23.4.1. Figure 23.3 (Volume 5) presents the proposed alignments for the two options in this geographical section and AADT figures at key locations. The junction locations are summarised in Table 23.10 below.

Table 23.10: Lhanbryde to East of Fochabers Junction Strategy

Option	No. of Junctions	Junction Locations
Lhanbryde to East of Fochabers North Option	2	B9105 south of Mosstodloch (Mosstodloch)
		Existing A96 / A98 junction at Fochabers (Fochabers)
Lhanbryde to East of Fochabers South Option	2	Southwest of Mosstodloch with link road to existing A96 (Mosstodloch)
		Existing A96 south of Fochabers (Fochabers)

23.4.2. At opening year 2030 between Mosstodloch and Fochabers junctions, the options attract high traffic volumes of approximately 23,200 (North Option) and 21,700 (South Option) vehicles per day, consistent with a dual carriageway provision[5]. There are significant reductions on the existing A96 for both options, such as at the River Spey bridge which reduces from 19,100 to 1,600 (North Option) and 3,200 (South Option) vehicles per day. Due to the online section at Fochabers for the North Option, this results in a change in the traffic flow on Fochabers High Street from 700 (Do Minimum) to 1,100 (North Option) and 600 (South Option) vehicles per day. Traffic on the A98 remains consistent between the options at around 10,000 vehicles per day.

23.4.3. Journey times have also been examined in both directions for both options, for the three modelled time periods. These are presented in Tables 23.11, 23.12 and 23.13.

Table 23.11: Lhanbryde to East of Fochabers Journey Times (AM Peak)

Option	DM 2045 Existing A96 (mm:ss)	North Option 2045 New A96 (mm:ss)	South Option 2045 New A96 (mm:ss)
Hillhead to East of Fochabers	10:20	06:20	06:20
East of Fochabers to Hillhead	11:20	06:20	06:20

[5] DMRB TA46/97 provides an indication of the range of opening year traffic flows over which a particular carriageway standard is likely to be economically justified. For a two-lane dual carriageway this is 11,000 to 39,000 vehicles per day.

Table 23.12: Lhanbryde to East of Fochabers Journey Times (Inter Peak)

Option	DM 2045 Existing A96 (mm:ss)	North Option 2045 New A96 (mm:ss)	South Option 2045 New A96 (mm:ss)
Hillhead to East of Fochabers	09:40	06:20	06:10
East of Fochabers to Hillhead	10:10	06:20	06:10

Table 23.13: Lhanbryde to East of Fochabers Journey Times (PM Peak)

Option	DM 2045 Existing A96 (mm:ss)	North Option 2045 New A96 (mm:ss)	South Option 2045 New A96 (mm:ss)
Hillhead to East of Fochabers	11:00	06:30	06:20
East of Fochabers to Hillhead	12:00	06:30	06:30

23.4.4. In the AM peak both options are predicted to save between approximately four to five minutes in each direction, when compared to the Do Minimum scenario. There is no journey time savings difference between the North and South Option. Similar journey time savings are evident is the PM peak.

23.5 Summary

23.5.1. This chapter has set out the forecast traffic flows and journey times for each of the three sections appraised. A summary of the main traffic flows on the proposed A96 and average journey time savings can be seen in Table 23.14.

Table 23.14: Summary of Traffic Flows and Journey Times Saved

	2030 Traffic Flows on Proposed A96 (vehicles per day)		Average Journey Time Saved (AM Peak) (mm:ss)	
	North Option	South Option	North Option	South Option
Hardmuir to Hillhead	17,600	18,400-19,200	04:25	03:20
Hillhead to Lhanbryde	15,400	16,000-13,600	11:40	13:10
Lhanbryde to East of Fochabers	23,200	21,700	04:30	04:30

Hardmuir to Hillhead

23.5.2. Both the North and South Option are expected to create a significant transfer of traffic from the existing A96 in Forres. In the AM peak both options are predicted to save between approximately two to five minutes in each direction, when compared to the Do Minimum

scenario. The North Option is approximately one minute quicker than the South Option, owing to the shorter, more direct route taken around Forres.

Hillhead to Lhanbryde

23.5.3. A large transfer of traffic occurs from the existing A96 in both the North and South Options. Within Elgin, the reduction in traffic is consistent between the two options as trips continue to use local roads for origins and destinations within the town. In the AM peak both options are predicted to save between approximately 11 to 14 minutes in each direction when compared to the Do Minimum scenario. The South Option is approximately one and a half minutes quicker than the North Option, owing to the shorter, more direct route taken around Elgin. There is less variability in journey times in both directions across the time periods modelled in comparison to the Do Minimum, which is indicative of bypassing an urban centre using a higher standard strategic road.

Lhanbryde to East of Fochabers

23.5.4. The two options attract high traffic volumes. In the AM peak both options are predicted to save between approximately four to five minutes in each direction, when compared to the Do Minimum scenario. There is no difference in journey time savings between the North and South Options.

24. Economic Performance of Route Options

24.1 Introduction

24.1.1. The economic assessment of the sections described in Volume 1, Chapter 3 (Development of Route Options) has been carried out using Transport Users Benefit Appraisal (TUBA) version 1.9.11 developed by the Department for Transport (DfT). In addition the impact of options on accident potential has been assessed using the DfT's Cost and Benefit to Accidents – Light Touch (COBALT) 2013.2 software.

24.1.2. Assumptions have been made in modelling combination of options to assess a particular section. The following combinations identified in Table 24.1 below have been chosen in order to generate the highest traffic flows.

Table 24.1: Assumed combinations for economic testing

Option Being Appraised	Hardmuir to Hillhead Section	Hillhead to Lhanbryde Section	Lhanbryde to East of Fochabers Section
Hardmuir to Hillhead North	North Option	South Option	South Option
Hardmuir to Hillhead South	South Option		
Hillhead to Lhanbryde North	South Option	North Option	North Option
Hillhead to Lhanbryde South		South Option	
Lhanbryde to East of Fochabers North	North Option	North Option	North Option
Lhanbryde to East of Fochabers South			South Option

24.2 Methodology

24.2.1. TUBA undertakes a matrix-based (i.e. zone-to-zone) appraisal using trip, time and distance matrices from a transport model, in this case: A96 Corridor Road Assignment Model (A96 CRAM). TUBA calculates the user benefits in time, fuel vehicle operating costs (VOC), non-fuel VOC and charge; operator and government revenues; and the scheme costs, discounted to the present value year.

24.2.2. Benefits due to changes in accident costs are calculated separately in COBALT. Inputs to COBALT are link-based, with each link being assigned a distance, type, speed limit and Annual Average Daily Traffic (AADT) flow. COBALT estimates the number of accidents in the Do Something and Do Minimum scenarios across a defined network for the appraisal period. This assessment has used the COBALT default UK national accident combined link and junction accident rates for each road type.

24.2.3. TUBA and COBALT allow a comparison between costs for Do Minimum and Do Something scenarios which provides an estimate of user and accident benefit in monetised terms over the appraisal period.

24.2.4. Economic appraisal has been undertaken based on the Do Something 'Economic' scenario, as described in Chapter 23 (Effects of Options). For the purposes of appraisal, this assumes the scheme ties in to the existing A96 at either end of the A96 Dualling Hardmuir to Fochabers scheme, only this section is dualled and that demands are fixed between Do Minimum and Do Something scenarios.

24.2.5. Scheme opening is assumed to be 2030, with transport model forecasts also prepared for 2037 and the 2045 design year (15 years after opening). The full appraisal period runs to 2089 in order to calculate the 60 year benefit stream.

24.3 Scheme Cost Estimates

24.3.1. The estimated costs of each of options is described in Volume 1, Chapter 3 (Development of Route Options), Section 3.6. For the purpose of the economic assessment, construction has been assumed to commence in 2027 and be completed in 2030. The construction spend profile for all options was assumed to be:

- 2027 – 30%
- 2028 – 34%
- 2029 – 33%
- 2030 – 3%

24.3.2. The scheme cost estimates are presented in Table 24.2 below.

Table 24.2: Estimated Costs

	Cost of option	Cost of end-to-end scheme including assumed combinations (ref Table 24.1)
Hardmuir to Hillhead North	£279.6m	£860m
Hardmuir to Hillhead South	£263.8m	£844m
Hillhead to Lhanbryde North	£354.3m	£830m
Hillhead to Lhanbryde South	£329.6m	£806m
Lhanbryde to East of Fochabers North	£212.3m	£846m
Lhanbryde to East of Fochabers South	£250.5m	£884m

Note: All costs in the above table are in 2018 Q1 prices and exclude VAT

24.4 Hardmuir to Hillhead Economic Assessment

24.4.1. A comparison of transport economic efficiency (TEE) for Hardmuir to Hillhead options is set out in Table 24.3 below. This shows the North Option provides best value having Net Present Value (NPV) higher than the South Option by £22m.

Table 24.3: TEE for Hardmuir to Hillhead Options

	North Option including assumed combinations (ref Table 24.1)	South Option including assumed combinations (ref Table 24.1)	Best Value
Present Value of Benefits - TUBA	£446m	£418m	-
Accident Benefits - COBALT	£118m	£115m	-
Total Present Value Benefits (PVB)	£564m	£533m	North PVB greater by £31m
Present Value of Costs (PVC)	£482m	£473m	North PVC greater by £9m
Net Present Value (NPV)	£82m	£60m	North NPV greater by £22m

Note: 2010 values and prices, discounted to 2010 at 3.5% for first 30 years and 3% thereafter, market prices unit of account.

24.4.2. Table 24.4 below shows the estimated savings in casualties for the Hardmuir to Hillhead options. This shows the North Option saves more over the 60 year evaluation period.

Table 24.4: Casualty Savings for Hardmuir to Hillhead Options

	North Option including assumed combinations (ref Table 24.1)	South Option including assumed combinations (ref Table 24.1)	Difference
Fatal	46	46	-
Serious	420	411	9
Slight	3,058	2,936	123

24.5 Hillhead to Lhanbryde Economic Assessment

24.5.1. A comparison of TEE for the Hillhead to Lhanbryde options is set out in Table 24.5 below. This shows the South Option provides best value having an NPV higher than the North Option by £46m.

Table 24.5: TEE for Hillhead to Lhanbryde Options

	North Option including assumed combinations (ref Table 24.1)	South Option including assumed combinations (ref Table 24.1)	Best Value
Present Value of Benefits - TUBA	£407m	£434m	-
Accident Benefits - COBALT	£112m	£117m	-
Total Present Value Benefits (PVB)	£519m	£551m	South PVB greater by £32m
Present Value of Costs (PVC)	£466m	£452m	North PVC greater by £14m
Net Present Value (NPV)	£53m	£99m	South NPV greater by £46m

Note: above table refers to 2010 values and prices, discounted to 2010 at 3.5% for first 30 years and 3% thereafter, market prices unit of account.

24.5.2. Table 24.6 below shows estimated savings in casualties for the Hillhead to Lhanbryde options. This shows the South Option saves more accidents over the 60 year evaluation period.

Table 24.6: Casualty Savings for Hillhead to Lhanbryde Options

	North Option including assumed combinations (ref Table 24.1)	South Option including assumed combinations (ref Table 24.1)	Difference
Fatal	46	47	1
Serious	403	418	15
Slight	2,835	2,971	135

24.6 Lhanbryde to East of Fochabers Economic Assessment

24.6.1. The economic performance results of Lhanbryde to East Fochabers options are presented in Table 24.7 below. This shows the North and South Options have similar NPVs.

Table 24.7: TEE for Lhanbryde to East of Fochabers Options

	North Option including assumed combinations (ref Table 24.1)	South Option including assumed combinations (ref Table 24.1)	Best Value
Present Value of Benefits (TUBA)	£426m	£445m	-
Accident Benefits (COBALT)	£114m	£115m	-
Total Present Value Benefits (PVB)	£540m	£561m	South PVB greater by £21m
Present Value of Costs (PVC)	£475m	£496m	South PVC greater by £21m
Net Present Value (NPV)	£65m	£65m	NPV are similar

Note: above table refers to 2010 values and prices, discounted to 2010 at 3.5% for first 30 years and 3% thereafter, market prices unit of account.

24.6.2. Table 24.8 below shows estimated savings in casualties for the Lhanbryde to East of Fochabers options. This shows the South Option saves more accidents over the 60 year evaluation period.

Table 24.8: Casualty Savings for Lhanbryde to East of Fochabers Options

	North Option including assumed combinations (ref Table 24.1)	South Option including assumed combinations (ref Table 24.1)	Difference
Fatal	44	45	1
Serious	409	412	3
Slight	2,943	2,956	13

24.7 Summary

24.7.1. This chapter presents the methodology and assessment of the economic performance of shortlisted options for the A96 Dualling Hardmuir to Fochabers scheme.

24.7.2. The economic evaluation program TUBA has been used for the evaluation, as it is able to assess the economic effects of redistribution of trips due to journey cost changes resulting from the introduction of a road scheme. Traffic data for input to TUBA has been derived from the A96 CRAM. COBALT has been used to assess the impact each option has on accidents.

24.7.3. In this process end-to-end results are generated and it is the comparison of Net Present Values (NPVs) between North and South Options that is relevant in reporting favoured options.

- For the Hardmuir to Hillhead section, the North Option provides best value with the NPV exceeding that for the South Option by £22m.
- For the Hillhead to Lhanbryde section, the South Option provides best value with the NPV exceeding that for the North Option by £46m.
- For the Lhanbryde to East of Fochabers section, the North and South Options provide similar NPVs.

TRANSPORT SCOTLAND
CÒMHDHAIL ALBA

A96 DUALLING
HARDMUIR TO FOCHABERS

Further copies of this document are available, on request, in audio and visual formats.
Any enquiries regarding this document/publication should be sent to us at:
info@transport.gov.scot

This document is also available on the Transport Scotland website: **transport.gov.scot**

Published by Transport Scotland December 2018.

transport.gov.scot/project/a96-hardmuir-fochabers