TRANSPORT SCOTLAND
CÒMHDHAIL ALBA

A96 DUALLING
EAST OF HUNTLY TO ABERDEEN

A96 Dualling

East of Huntly to Aberdeen scheme

DMRB Stage 2 Scheme Assessment Report

Volume 3 - Part 4

Traffic and Economic Assessment

December 2020

transport.gov.scot/projects/a96-dualling-inverness-to-aberdeen/a96-east-of-huntly-to-aberdeen

A96 Dualling East of Huntly to Aberdeen

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

A96PEA-AMAR-GEN-SWI-RP-ZM-000004

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

Prepared by:
AmeyArup JV
Precision House
McNeill Drive
Eurocentral
Motherwell
ML1 4UR

Contents

24 Modelling

24.1 Introduction

24.1.1 This chapter sets out the modelling approach for the traffic and economic assessment of the route options. The assessment uses the A96 Corridor Road Assignment Model (A96 CRAM), a highway assignment model which represents the road network within the A96 Dualling Programme's area of influence.

24.1.2 The A96 CRAM is informed by the Transport Model for Scotland (TMfS14) and the Transport and Economic Land-use Model of Scotland (TELMoS14), which forecast multi-modal responses to network and land use changes at the national level. The traffic outputs from these national models have been used to inform the A96 CRAM, which uses a more detailed traffic network and zone disaggregation for the A96 corridor.

24.1.3 The A96 CRAM has a base model year of 2012. TAG Unit M4[1] recommends additional forecast years between the scheme opening year and the design year are modelled in order to obtain a more accurate understanding of the profile of costs and benefits, particularly where non-linear features exist, such as demand growth or supply constraints. Therefore, the forecast model years used in the assessment are:

- 2030, the assumed opening year;
- 2037, an intermediate year; and
- 2045, the design year representing 15 years after opening.

24.1.4 The A96 CRAM has been used to compare the route options in terms of performance indicators such as changes to traffic flows (Annual Average Daily Traffic, AADT), vehicle speeds, journey times and travel distances. The A96 CRAM outputs were entered into the Transport Users Benefit Appraisal (TUBA, v1.9.13) software to identify the economic benefits of each option. The model outputs were also input into the Cost and Benefit to Accidents – Light Touch (COBALT, v2013.2) software to identify the predicted impact that the end-to-end options would have on accidents in the study area. The monetised values of these impacts are included in the economic assessment.

24.1.5 Traffic flow outputs from the A96 CRAM were also used in the environmental appraisal of options as presented in Volume 2, Part 3 Environmental Assessment.

24.2 A96 Corridor Road Assignment Model (A96 CRAM)

24.2.1 The A96 CRAM is a strategic model of traffic behaviour on the A96 Aberdeen to Inverness corridor. The Fully Modelled Area (FMA) represents the area over which the A96 Dualling Programme (Inverness to Aberdeen) has influence. This is sub-divided into an Area of Detailed Modelling (AoDM), where significant impacts from the dualling scheme are certain, and the rest of the FMA, where impacts of the dualling are considered to be quite likely but relatively weak in magnitude. The FMA is represented by somewhat larger zones and less network detail than the AoDM. Beyond the FMA, where the impacts of dualling the A96 are considered to

[1] Transport Analysis Guidance (TAG) Unit M4 – Forecasting and Uncertainty, Department for Transport, May 2019

be negligible, the External Area is modelled as a skeletal network of strategic links in the north of Scotland between the Dornoch Firth and the Firth of Tay.

24.2.2 TMfS14 was used to determine the area of influence of the proposed dual carriageway between Aberdeen and Inverness. Figure 24.1 shows the extents of the detailed modelled area in the A96 CRAM (as denoted by the blue dashed line). The A96 CRAM represents, in detail, the full A96 corridor between Raigmore Interchange in Inverness and Haudagain Roundabout in Aberdeen. This includes relevant parallel routes, adjoining roads and local roads where they provide alternative or feeder routes to the A96, or where the effects of the proposed dualling scheme occur.

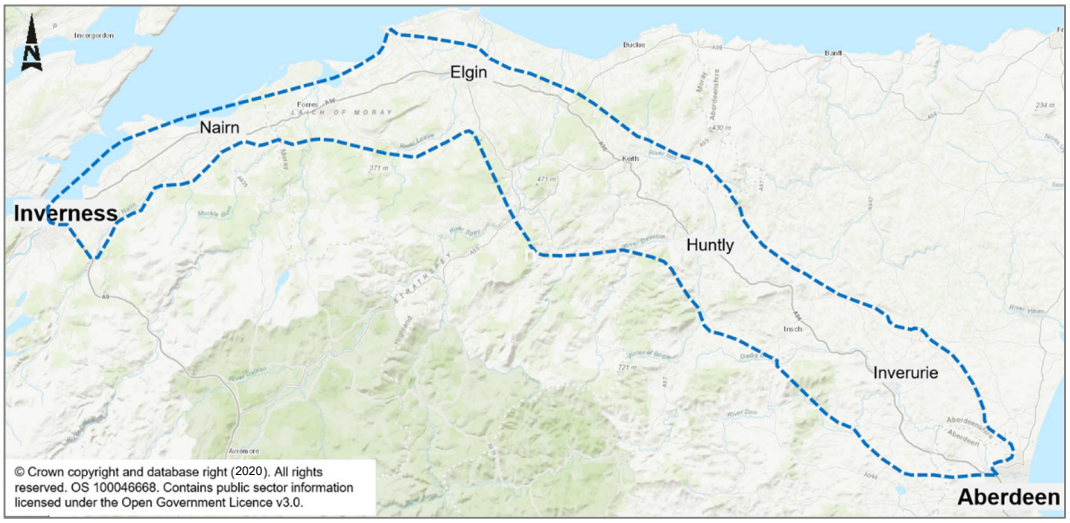

Figure 24.1 A96 CRAM v1.4 Detailed Modelled Area

24.2.3 The A96 CRAM was issued as version 1.0 in 2015. There have been subsequent updates to the model and the version of the A96 CRAM used in this assessment is v1.4, which was issued in December 2018 by AECOM in their role as Transport Scotland's Lead Traffic and Economic Advisor (LTEA) for the A96 Dualling Programme.

24.2.4 Further traffic surveys were undertaken in Autumn 2019. These surveys were used by AmeyArup to check the modelled response to the full opening of the Aberdeen Western Peripheral Route (AWPR) in February 2019. A comparison between the observed and modelled traffic behaviour confirmed that the A96 CRAM v1.4 forecast models reflect the observed traffic re-routeing associated with the opening of the AWPR. The key functions of A96 CRAM in the scheme assessment are:

- Forecasting future year traffic flows both with and without an A96 dualling scheme;
- Testing the operational performance of forecast models by predicting journey times, congestion and delays throughout the network both with and without an A96 dualling scheme;
- Providing traffic flow and vehicle speed outputs for use in the noise and air quality assessment of options; and
- Providing traffic flow, journey time and distance outputs for use in the calculation of Transport Economic Efficiency (TEE) in TUBA, and accident cost savings in COBALT.

24.2.5 An Assignment Model Validation Report (AMVR) was completed in February 2019 which documents the processes used to develop the model network and demand matrices, the methods of calibration employed and the calibration and validation of the model.

24.3 Zoning System

24.3.1 The zoning system in the A96 CRAM is based on that of TMfS14 but disaggregated by sub-dividing zones using 2011 Scotland Census Data Zones and Output Areas. The number of zones, 656, is therefore greater than for the corresponding national model, with the greatest levels of disaggregation and resolution in the detailed modelled area along the A96 corridor.

24.3.2 Zone boundaries are drawn to limit their population, trip attraction and trip production such that they do not load excess volumes of traffic onto the network at a single point. Adjacent differences in land use are also used to divide zones as is severance by, for example, rivers and railway lines.

24.4 User Classes

24.4.1 Five user classes are specified in the A96 CRAM. Each user class uses different routeing assumptions based on their sensitivity to time and distance and are subject to different road traffic restrictions including speed limits. The five user classes are:

- UC1 Car (trip for employer's business);
- UC2 Car (trip for commuting);
- UC3 Car (other non-work trip);
- UC4 Light goods vehicle; and
- UC5 Heavy goods vehicle.

24.4.2 Scheduled bus routes in the A96 corridor are also coded into the model with fixed routes and frequencies.

24.5 Modelled Periods

24.5.1 The A96 CRAM v1.4 represents four discrete one-hour time periods on a typical weekday, Monday to Thursday:

- Early AM peak hour (07:00 to 08:00);
- AM peak hour (08:00 to 09:00);
- Interpeak hour (an average hour between 10:00 and 16:00); and
- PM peak hour (17:00 to 18:00).

24.5.2 The Early AM peak hour model was incorporated in A96 CRAM v1.4 in response to observations that, on the A96 between Huntly and Kintore, the busiest traffic flow in the morning occurs between 07:00 and 08:00 rather than the more common 08:00 to 09:00 period in the AM peak.

24.5.3 The A96 CRAM applies demand in terms of Passenger Car Units (PCU), where 1 PCU is equivalent to one car. As heavy goods vehicles and buses occupy more road space than a car, vehicles in UC5, heavy goods vehicles, have been assigned

a value of 2.35 PCU per vehicle[2], and buses have been assigned a value of 2.5 PCU per vehicle. Light goods vehicles, UC4, have been assigned a value of 1 PCU per vehicle.

24.5.4 Factors for converting the modelled hourly flows to Annual Average Weekday Traffic (AAWT) and AADT values were calculated using Annual Average Hourly Flows (AAHF) from 11 Automatic Traffic Counter (ATC) sites along the A96 between East of Huntly and the AWPR. The AADT is typically lower than the AAWT as it is the average daily traffic over both weekdays and weekends, and weekends typically have lower traffic levels than weekdays. The conversion factors for uplifting the one hour modelled periods to AAWT and AADT are shown in Table 24.1.

Table 24.1 Factors for Converting One-hour Model Results to AAWT and AADT

Time Period	Hours Covered	A96 CRAM One-hour Model	12-hour AAWT Factor (07:00 to 19:00)	24-hour AAWT Factor	24-hour AADT Factor
AM peak	07:00 – 08:00	Early AM Peak	1.000	1.000	0.934
	08:00 – 10:00	AM Peak	1.820	1.820	1.700
Inter-peak	10:00 – 16:00	Inter-peak	6.000	6.000	5.604
PM peak	16:00 – 19:00	PM Peak	2.690	2.690	2.513
Off-peak	19:00 – 07:00	Inter-peak	-	3.333	3.113

24.5.5 As there is not an off-peak model representing 19:00 to 07:00, this time period is included by applying an additional factor to the inter-peak model. Basing the off-peak on the inter-peak avoids the impacts of tidal flows that are present in the peak period models. This twelve-hour time period is represented by 3.333 times the inter-peak hour.

24.5.6 The AAWT values are calculated by multiplying each of the four average one-hour traffic flow values by an appropriate factor for the AM peak, inter-peak, PM peak and off-peak. The AM peak period (07:00 – 10:00) is represented by the Early AM Peak hour, plus an appropriate factor multiplying the AM Peak hour. The PM peak period (16:00 – 19:00) is represented by an appropriate factor multiplying the PM Peak hour. The Inter-peak period (10:00 – 16:00) is six times the Inter-peak hour. The Off-peak period (19:00 – 07:00) is represented by an appropriate factor multiplying the Inter-peak hour. The AAWT is then calculated by summing the four periods together. The 24-hour AADT values are calculated by multiplying the 24-hour AAWT values by 0.934.

24.6 Future Year Forecasting

24.6.1 The A96 CRAM is used to forecast traffic demands in the years 2030, 2037 and 2045 for use in the scheme assessment. There are three different types of forecast year scenarios: the Do-Minimum and two Do-Something scenarios. The two Do-

[2] A96 Corridor Road Assignment Model (A96 CRAM) - Assignment Model Validation Report (A96 CRAM v1.4), AECOM, February 2019

Something scenarios are known as the Economic scenario and the Environmental scenario. These three forecast scenarios are described in more detail below.

24.7 Do-Minimum Scenario

24.7.1 The Do-Minimum scenario provides a baseline for each of the end-to-end options to be compared against.

24.7.2 The Do-Minimum scenario does not include the A96 Dualling Programme, but reflects the transport network in 2012 and transport schemes that are classed as 'near certain' or 'more than likely' in accordance with Scottish Transport Appraisal Guidance (STAG).

24.7.3 Table 24.2 sets out the transport schemes included in the Do-Minimum scenario for the A96 Dualling East of Huntly to Aberdeen scheme DMRB Stage 2 Assessment.

Table 24.2 Do-Minimum Schemes

Schemes included in the Do-Minimum
Queensferry Crossing (Forth Replacement Crossing)
M8/M73/M74 Motorway Improvements
A96 Inveramsay Bridge
A68 Pathhead to Tynehead Junction
A702 Candymill Bend and Edmonstone Brae
A96 Lackghie
A75 Dunragit Bypass Scheme
A75 Hardgrove to Kinmount Scheme
A82 Crianlarich Bypass
A82 Pulpit Rock Scheme
Glasgow East End Regeneration Route Phase 3 (Clyde Gateway Route)
Portstown Link Road
Third Don Crossing
Soutra South to Oxton
Dundee Waterfront
Dyce Drive Link Road (part of Dyce Park and Ride)
Aberdeen Western Peripheral Route / Balmedie to Tipperty
Speed limit changes on A96 at Pitmachie
A90/A96 Haudagain Roundabout Improvement
Inverness West Link (Stage 1 and Stage 2)
M8 J29A Bishopton Junction
M9 Winchburgh Junction

24.7.4 As the A96 CRAM is a highway assignment model, changes in transport infrastructure that are not road-based schemes, such as the Aberdeen to Inverness rail improvement project, are not reflected in the A96 CRAM network. Public transport schemes are however reflected in the forecast traffic demand derived from TELMoS14 and TMfS14. The Do-Minimum forecast traffic demands are presented in Chapter 25 - Traffic Assessment.

24.8 Do-Something Scenarios

24.8.1 Two Do-Something scenarios have been developed based on the differing requirements for different assessments.

The Do-Something Economic Scenario

24.8.2 The Do-Something Economic scenario incorporates all the Do-Minimum scenario transport schemes and also includes the proposed dual carriageway alignment for each of the route options between the east of Huntly and Kintore (Gauchhill Junction, i.e. it does not include any changes to the existing A96 dual carriageway between Gauchhill junction and Craibstone Roundabout). For the purposes of this report, the route options on the section between east of Huntly and Kintore will be referred to as 'the scheme'. The scheme is modelled to tie into the existing A96 single carriageway at a location to the east of Huntly at its western end, and the existing A96 dual carriageway at Kintore (Gauchhill Junction) at its eastern end. Volume 1, Part 1, Chapter 1, Section 1.1 (Scheme Background) provides further details of the scheme. An assessment of the existing dual carriageway section between Kintore and the A96 junction with the AWPR at Craibstone will be reported on separately when the DMRB Stage 2 route option assessment for that section is taken forward.

24.8.3 The Economic scenario uses the same set of demands as the Do-Minimum scenario and incorporates the route options between the East of Huntly and Kintore. This fixed demand assumes that there is no new induced traffic as a result of the scheme. This standard approach ensures that benefits in the economic assessment are directly attributable to the dualling of the A96 East of Huntly to Kintore section only. The traffic and economic assessment undertaken as part of the DMRB Stage 2 Assessment has been carried out using the Economic scenario model.

The Do-Something Environmental Scenario

24.8.4 The Do-Something Environmental scenario incorporates all the A96 Do-Minimum scenario transport schemes. It also includes a dual carriageway for the full A96 Dualling Programme between Inverness and Aberdeen. This incorporates the Preferred Options for both the A96 Dualling Inverness to Nairn (including Nairn Bypass) scheme and the A96 Dualling Hardmuir to Fochabers scheme, and an indicative route for the A96 Dualling Fochabers to East of Huntly scheme. The A96 Dualling East of Huntly to Aberdeen scheme is represented by each of the end-to-end options for the section between East of Huntly and Kintore.

24.8.5 This results in additional induced traffic in response to the faster journey times and increased overtaking opportunities of the full A96 Dualling Programme. The level of this induced demand is forecast by the national models and incorporated into the A96 CRAM forecast demands. The Do-Something Environmental scenario therefore includes the demand associated with the full dualling programme and represents maximum impact in terms of traffic flows for the environmental and design assessments.

24.8.6 Table 24.3 shows the dualling schemes included in the Do-Minimum and Do-Something models.

Table 24.3 Schemes Included in the Do-Minimum and Do-Something Scenarios

Models	A96 Dualling Schemes			
	Inverness to Nairn (including Nairn Bypass)	Hardmuir to Fochabers (Western Section)	Fochabers to East of Huntly (Central Section)	East of Huntly to Aberdeen (Eastern Section)
Do-Minimum	No	No	No	No
Do-Something (Economic)	No	No	No	Yes
Do-Something (Environmental)	Yes	Yes	Yes	Yes

Note: For the purpose of this report, the A96 Dualling East of Huntly to Aberdeen scheme is represented by each of the end-to-end options between East of Huntly and Kintore

24.9 Forecast Demand (Trip Matrix) Scenarios

Refined Core Scenario

24.9.1 The original Core forecast demands for the economic and environmental scenarios in the A96 CRAM v1.4 have been developed by AECOM from TMfS14 and TELMoS14. This incorporates traffic growth associated with developments identified by Local Authorities.

24.9.2 In this original Core scenario, the development trips in the Inverurie area are distributed across the A96 CRAM zones that represent Inverurie rather than being allocated to the specific zones closest to the development sites. The largest development sites in the Inverurie area are the major housing developments at Portstown and Uryside, and the large mixed-use development at Crichie. Therefore, a Refined Core demand scenario was created by allocating the forecast development trips for the Portstown, Uryside and Crichie development sites to A96 CRAM zones that are located closest to the development sites.

24.9.3 The Refined Core demand scenario results in a more accurate representation of the location of trips associated with the major developments in the Inverurie area. The Refined Core scenario involves no change to the total number of trips, only a refinement to the origin and destination of development trips within Inverurie. The Refined Core scenario has been used to carry out the economic and environmental assessments for this scheme.

Northern Inverurie Sensitivity Test

24.9.4 A review of traffic survey data from 2019 identified that the A96 CRAM v1.4 may over-represent traffic on the B9001 north of Inverurie, while under-representing traffic on the nearby B9170. Therefore, any A96 dualling option which attracts traffic from the B9001 may attract more traffic and hence more benefits than it should. Conversely, any option which attracts trips from the B9170 may attract less traffic and hence lower benefits than it should.

24.9.5 In response, a Northern Inverurie Sensitivity Test was undertaken of the Refined Core scenario. The Northern Inverurie Sensitivity Test was developed by changing the demand matrix in the Inverurie area and moving the network connection in one of the demand zones, to reallocate traffic from the B9001 to the B9170. Changes

to demands were made separately for each direction in each of the four A96 CRAM modelled time periods. The Sensitivity test includes the same volume of traffic as the Refined Core scenario but has adjusted the traffic volumes on the B9001 and B9170 north of Inverurie to reflect the observed traffic flows on these routes. The Northern Inverurie Sensitivity Test is referred henceforth as the Sensitivity test and results reported in Chapter 25.

24.10 Summary

24.10.1 The A96 CRAM v1.4 has been used to carry out the traffic and economic assessment of the scheme. This uses TMfS14 and TELMoS14 to derive forecast traffic flows for the years 2030, 2037 and 2045.

24.10.2 The Do-Minimum has been developed with both the Refined Core demand matrices and the Sensitivity test demand matrices.

24.10.3 For the Do-Something, two different demand scenarios have been developed for the Economic and Environmental assessments. The Economic scenario uses the same traffic demand matrices as the Do-Minimum (i.e. a fixed demand assessment) and incorporates the route options between the East of Huntly and Kintore. The Environmental scenario includes a dual carriageway for the full A96 Dualling Programme between Inverness and Aberdeen (for the A96 Dualling East of Huntly to Aberdeen scheme, the route options are between the East of Huntly and Kintore). The Environmental scenario therefore includes the demand associated with the full dualling. Each of these Do-Something scenarios is tested using both the Refined Core and the Sensitivity test demand matrices. This results in four different versions of the A96 CRAM:

- Economic Refined Core scenario;
- Economic Sensitivity test scenario;
- Environmental Refined Core scenario; and
- Environmental Sensitivity test scenario.

24.10.4 For the environmental assessment of air quality and noise impacts, traffic figures from the A96 CRAM v1.4 Environmental Refined Core scenario are considered in detail in Volume 2, Part 3 Environmental Assessment.

24.10.5 The A96 CRAM v1.4 Environmental scenarios are also used to assist the design process. This ensures that the new dual carriageway and its junctions have sufficient capacity to accommodate induced traffic resulting from the dualling of the A96 from Inverness to Aberdeen.

25 Traffic Assessment

25.1 Introduction

25.1.1 This chapter presents the performance of the end-to-end options in terms of traffic volumes and journey times. The six route options described in Volume 1, Part 1, Chapter 3, Section 3.11 (Remaining Better Performing Options) combine to form eight end-to-end options as listed below and presented in Table 25.1. The distances for each of the end-to-end options are the end-to-end distances between East of Huntly and Kintore (Gauchhill Junction):

- Cyan-Pink-Violet (C-P-V) 40.9km;
- Cyan-Pink-Orange (C-P-O) 38.3km;
- Cyan-Brown-Violet (C-Br-V) 42.0km;
- Cyan-Brown-Orange (C-Br-O) 39.4km;
- Red-Pink-Violet (R-P-V) 39.9km;
- Red-Pink-Orange (R-P-O) 37.2km;
- Red-Brown-Violet (R-Br-V) 40.9km; and
- Red-Brown-Orange (R-Br-O) 38.3km.

Table 25.1 Combination of Route Options to form End-to-End Options for the Traffic and Economic Assessment

Geographical Section		
East of Huntly to Colpy	**Colpy to Pitcaple**	**Pitcaple to Kintore**
Cyan	Pink	Violet
		Orange
	Brown	Violet
		Orange
Red	Pink	Violet
		Orange
	Brown	Violet
		Orange

25.1.2 Figure 25.1 shows the route options split over three geographical sections, and the locations of their associated grade-separated junctions.

25.1.3 The traffic impacts of the end-to-end options were assessed using the A96 CRAM v1.4 Refined Core (Economic) scenario and are discussed in Sections 25.2 to 25.5. The journey time savings on the new dual carriageway for the end-to-end options were compared with the Do-Minimum scenario between East of Huntly and Kintore (Gauchhill Junction). The effect of the end-to-end options on the traffic flows on the existing A96 and the volume of traffic attracted by the new dual carriageway are also discussed. Typically, this is discussed by the effect that a particular route option has as part of an overall end-to-end option.

25.1.4 Figures 25.7 to 25.24 (Volume 5) present the Refined Core (Economic) forecast AADTs at key locations on the road network for the Do-Minimum scenario and each of the eight end-to-end options in the Do-Something (Economic) scenarios.

25.1.5 The traffic and environmental impacts of the Sensitivity test are discussed in Section 25.6 and the economic impacts are discussed in Section 26.5.

25.1.6 Figures 25.25 to 25.42 (Volume 5) present the AADT values at key locations for the Do-Minimum scenario and each of the eight end-to-end options, using outputs from the Sensitivity test (Economic) models.

25.1.7 Throughout the sections which follow, traffic volumes quoted refer to the two-way AADT, reported in vehicles per day (vpd) for the 2030 opening year.

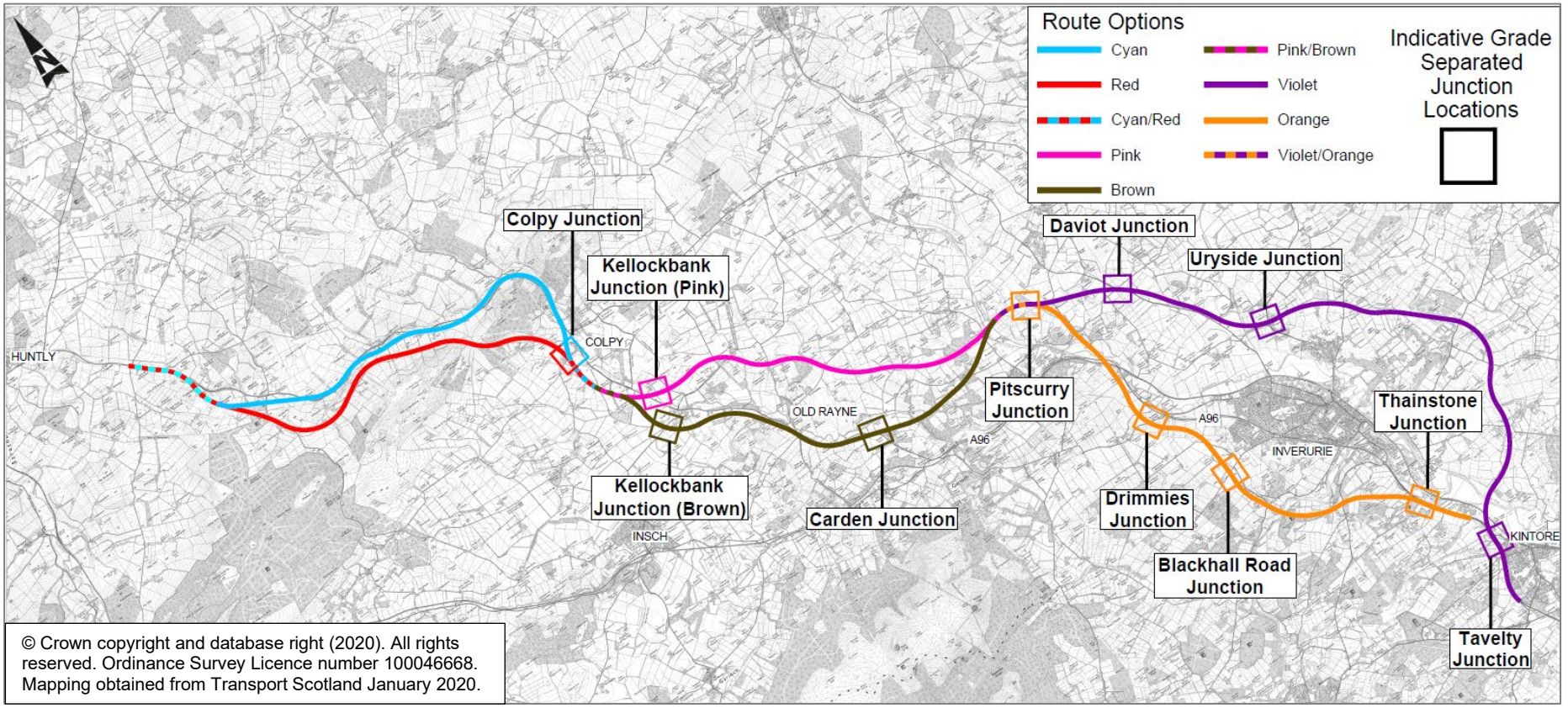

Figure 25.1 Route Options and Junction Locations

25.2 East of Huntly to Colpy Route Options

25.2.1 The following section describes the traffic performance predicted for the Cyan and Red route options when either route option forms part of the overall end-to-end options.

25.2.2 Table 25.2 shows the proposed junction names, types and locations for the Cyan and Red route options on the East of Huntly to Colpy geographical section of the scheme. Both the Cyan and Red route options have a single junction, located at Colpy.

Table 25.2 Proposed Junctions between East of Huntly and Colpy

Route Option	Junction Type	Junction Name and Location
Cyan 1 Junction	Grade separated junction – eastbound exit from A96 and westbound entry to A96 only	Colpy Junction, 130m from the existing A96/A920 Junction
Red 1 Junction	Grade separated junction – eastbound exit from A96 and westbound entry to A96 only	Colpy Junction, 440m from the existing A96/A920 Junction

25.2.3 Figure 25.2 shows the traffic flows on the Cyan and Red route options generated by all eight end-to-end options. It also shows the forecast traffic flows on the existing A96 in the Do-Minimum, and the traffic flows on the existing A96 for each of the eight end-to-end options.

25.2.4 The minimum and maximum two-way AADT values on the Cyan and Red route options and the corresponding two-way AADT values for the existing A96 between East of Huntly and Colpy are shown in Table 25.3.

Table 25.3 Minimum and maximum two-way AADT on the Cyan and Red route options and on the A96 between East of Huntly and Colpy

Location of AADT on Route Options and the Existing A96	Do Min (vpd)	Cyan Route Option		Red Route Option	
		Min Flow (vpd)	Max Flow (vpd)	Min Flow (vpd)	Max Flow (vpd)
Proposed dual carriageway between East of Huntly and Colpy	-	14,000	14,800	14,200	14,900
Existing A96 between East of Huntly and Colpy	13,700	100 -99%	300 -98%	100 -99%	300 -98%

Note: The percentages represent the change in traffic flow compared with the Do-Min

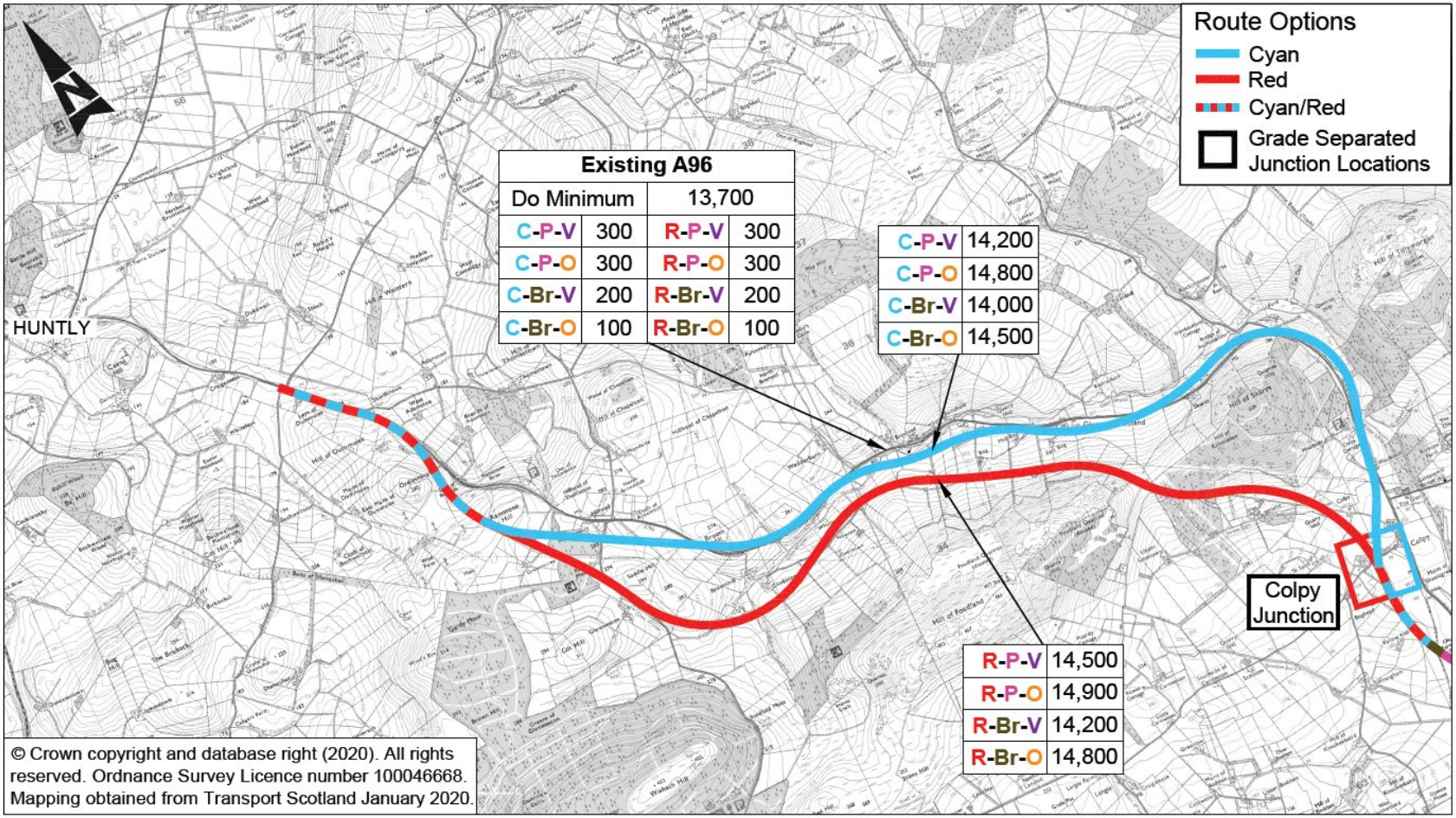

Figure 25.2 2030 Two-way AADT between junctions for the Cyan and Red route options and the existing A96

25.2.5 Between East of Huntly and Colpy, the Cyan route option attracts between 14,000vpd and 14,800vpd , depending on the route options it links with to form an end-to-end option. Similarly, the Red route option attracts between 14,200vpd and 14,900vpd.

25.2.6 Both the Cyan and Red route options remove 98% - 99% of traffic on the existing A96 between East of Huntly and Colpy, leaving at most 300vpd on the existing A96.

25.2.7 In summary, there is very little difference in traffic performance between the Cyan and Red route options when either forms part of the overall end-to-end options. The Red route option is slightly shorter and therefore attracts approximately 1% more traffic than Cyan (approximately 200vpd more).

25.3 Colpy to Pitcaple Route Options

25.3.1 The following section describes the traffic performance predicted for the Pink and Brown route options when either route option forms part of the overall end-to-end options.

25.3.2 Table 25.4 shows the proposed junction names, types and locations for the Pink and Brown route options on the Colpy to Pitcaple section of the scheme.

25.3.3 Both route options have a proposed junction at Kellockbank. The Brown route option also has a junction at Carden which serves the communities of Insch, Oyne, Old Rayne, Pitcaple, and Chapel of Garioch. An equivalent junction is not provided on the Pink route option since this route option is more remote from surrounding villages compared to the existing A96 which offers a more attractive route choice.

Table 25.4 Proposed Junctions between Colpy and Pitcaple

Route Option	Junction Type	Junction Name and Location
Pink 1 Junction	Grade separated junction – eastbound entry to A96 and westbound exit from A96 only	Kellockbank Junction (Pink), Existing A96 west of Kellockbank
Brown 2 Junctions	Grade separated junction – eastbound entry to A96 and westbound exit from A96 only	Kellockbank Junction (Brown), B992 west of Kellockbank
	Full grade separated junction – all movements to/from A96 catered for	Carden Junction, Existing A96 southeast of Pitmachie

25.3.4 Figure 25.3 shows the traffic flows on the Pink and Brown route options for the eight end-to-end options. It also shows the forecast traffic flows on the existing A96 in the Do-Minimum, and on the existing A96 for each of the eight end-to-end options.

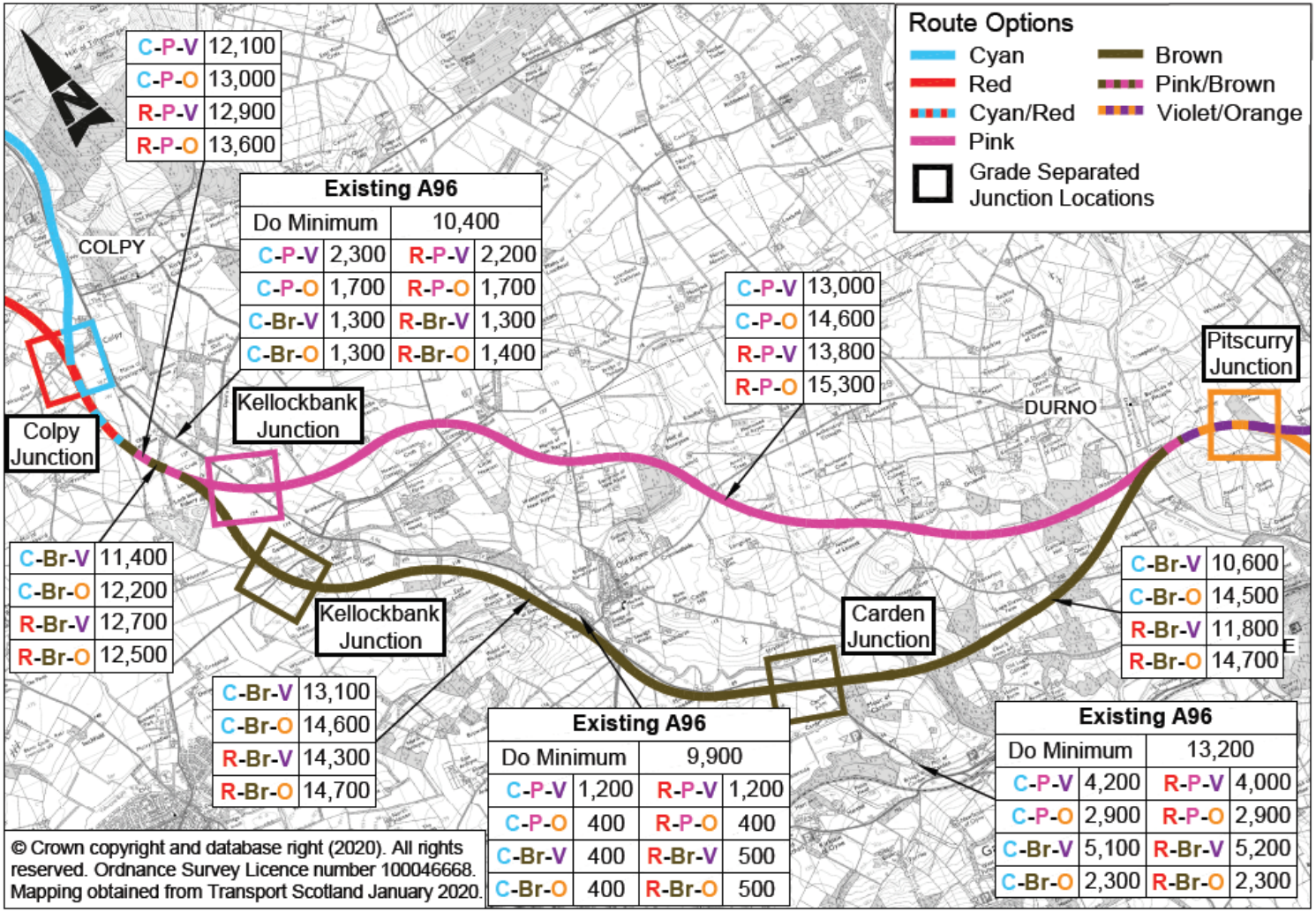

Figure 25.3 2030 Two-way AADT between junctions for the Pink and Brown route options and the existing A96

25.3.5 As the location and design of Colpy Junction on the Cyan route option is different from the location and design of Colpy junction on the Red route option, this influences the volume of traffic that is attracted to the Pink and Brown route options east of Colpy Junction.

25.3.6 The traffic volumes on the Pink and Brown route options are also affected by whether they connect, at their east end, to the Violet route option or to the Orange route option. Therefore, each of the possible route option combinations is considered separately below.

25.3.7 The two-way AADT values on the Pink and Brown route options when connected to the Orange route option are shown in Table 25.5. This shows the Pink route option attracts more traffic than the Brown route option. The Brown route option attracts between 12,200vpd and 14,700vpd, while the Pink route option attracts between 13,000vpd and 15,300vpd.

25.3.8 When connected to the Orange route option, the traffic flows either side of Carden Junction (on the Brown route option) are very similar. This is because only a small amount of traffic uses this junction (when connected to the Orange route option). For example, less than 700vpd use the east-facing slip roads.

Table 25.5 Minimum and maximum two-way AADT on the Pink and Brown route options when connected to the Orange route option

Location of AADT on Route Options	Pink Route Option		Brown Route Option	
	Min Flow (vpd)	Max Flow (vpd)	Min Flow (vpd)	Max Flow (vpd)
Colpy to Kellockbank	13,000	13,600	12,200	12,500
Kellockbank to Carden	-	-	14,600	14,700
Carden to Pitscurry	-	-	14,500	14,700
Kellockbank to Pitscurry	14,600	15,300	-	-

25.3.9 The corresponding two-way AADT values for the existing A96 and for other local A and B roads when the Pink and Brown route options are connected to the Orange route option are shown in Table 25.6 and Table 25.7 respectively.

Table 25.6 Minimum and maximum two-way AADT on the existing A96 when the Pink and Brown route options are connected to the Orange route option

Location of AADT on the Existing A96	Do Min (vpd)	Pink Route Option		Brown Route Option	
		Min Flow (vpd)	Max Flow (vpd)	Min Flow (vpd)	Max Flow (vpd)
Colpy to Kellockbank	10,400	1,700 -84%	1,700 -84%	1,300 -88%	1,400 -87%
Kellockbank to Oyne Fork	9,800	400 -96%	400 -96%	400 -96%	400 -96%
Oyne Fork to Pitcaple	13,100	2,900 -78%	2,900 -78%	2,300 -82%	2,300 -82%

Note: The percentages represent the change in traffic flow compared with the Do-Min

Table 25.7 Minimum and maximum two-way AADT on the local A and B roads when the Pink and Brown route options are connected to the Orange route option

Location of AADT on Local A and B Roads	Do Min (vpd)	Pink Route Option		Brown Route Option	
		Min Flow (vpd)	Max Flow (vpd)	Min Flow (vpd)	Max Flow (vpd)
A920 east of Colpy	4,300	800 -81%	1,300 -70%	1,900 -56%	2,000 -53%
B992 Insch to Kellockbank	1,500	2,500 +67%	2,500 +67%	3,200 +113%	3,300 +120%
B9002 Insch to Oyne Fork	3,200	2,200 -31%	2,200 -31%	1,500 -53%	1,600 -50%

Note: The percentages represent the change in traffic flow compared with the Do-Min

25.3.10 When connected to the Orange route option, the Brown route option removes more traffic than the Pink route option from the existing A96 between Colpy and Pitcaple. However, both the Pink and the Brown route options remove at least 78% of traffic from the existing A96 between Colpy and Pitcaple. The Brown route option removes more traffic from the existing A96 as it attracts more traffic to join the proposed dual carriageway at Kellockbank Junction via, for example, the B992 from Insch, Kennethmont and Auchleven. This traffic is removed from the B9002 between Insch and Oyne Fork as shown in Table 25.7.

25.3.11 When connected to the Orange route option, the Pink route option removes more traffic than the Brown route option from the A920 between Colpy and Oldmeldrum. The Brown route option reduces traffic on the A920 by between 53% and 56%, while the Pink route option reduces traffic on the A920 by between 70% and 81% as shown in Table 25.7.

25.3.12 The two-way AADT values on the Pink and Brown route options when connected to the Violet route option are shown in Table 25.8. This shows the Pink route option attracts more traffic than the Brown route option, except for the part of the Brown route option between Kellockbank Junction and Carden Junction. The Brown route option attracts between 10,600vpd and 14,300vpd, while the Pink route option attracts between 12,100vpd and 13,800vpd.

Table 25.8 Minimum and maximum two-way AADT on the Pink and Brown route options when connected to the Violet route option

Location of AADT on Route Options	Pink Route option		Brown Route Option	
	Min Flow (vpd)	Max Flow (vpd)	Min Flow (vpd)	Max Flow (vpd)
Colpy to Kellockbank	12,100	12,900	11,400	12,700
Kellockbank to Carden	-	-	13,100	14,300
Carden to Daviot	-	-	10,600	11,800
Kellockbank to Daviot	13,000	13,800	-	-

25.3.13 The corresponding two-way AADT values for the existing A96 and for other local A and B roads when the Pink and Brown route options are connected to the Violet route option are shown in Table 25.9 and Table 25.10 respectively.

25.3.14 Similar to when connected to the Orange route option, when connected to the Violet route option, the Brown route option removes more traffic than the Pink route option from the existing A96 between Colpy, Kellockbank and Oyne Fork. However, both the Pink and the Brown route options remove at least 78% of traffic from the existing A96 between Colpy, Kellockbank and Oyne Fork as shown in Table 25.9.

25.3.15 The Brown route option removes more traffic from the existing A96 as it attracts more traffic to join the proposed dual carriageway at Kellockbank Junction via, for example, the B992 from Insch, Kennethmont and Auchleven. This traffic is removed from the B9002 between Insch and Oyne Fork. The Brown route option attracts more traffic from the B992 as its junction at Kellockbank is closer to the existing A96/B992 junction at Kellockbank as shown in Table 25.10.

25.3.16 Between Oyne Fork and Pitcaple the traffic behaviour also changes as shown in Table 25.9. When connected to the Violet route option, the Pink route option removes more traffic than the Brown route option from the existing A96 between Oyne Fork and Pitcaple. This difference results from a significant volume of traffic using Carden Junction (on the Brown route option) to access the existing A96 rather than continue on the proposed dual-carriageway east of Carden Junction. As a result, the forecast traffic flows on the proposed dual carriageway are lower to the east of Carden Junction than to the west. This is because from Carden Junction, the existing A96 provides a shorter route to Inverurie than the Violet route option. An additional junction at Carden on the Pink route option would not have the same effect as the Pink route option is further from the existing A96. An additional junction at Carden on the Pink route option would not be used by a significant volume of traffic as it would be more attractive to remain on the proposed dual carriageway.

25.3.17 When connected to the Violet route option, the Pink route option removes more traffic than the Brown route option from the A920 between Colpy and Oldmeldrum. The Brown route option reduces traffic on the A920 by between 44% and 70%, while the Pink route option reduces traffic on the A920 by between 74% and 84%.

Table 25.9 Minimum and maximum two-way AADT on the existing A96 when the Pink and Brown route options are connected to the Violet route option

Location of AADT on the Existing A96	Do Min (vpd)	Pink Route Option		Brown Route Option	
		Min Flow (vpd)	Max Flow (vpd)	Min Flow (vpd)	Max Flow (vpd)
Colpy to Kellockbank	10,400	2,200 -79%	2,300 -78%	1,300 -88%	1,400 -87%
Kellockbank to Oyne Fork	9,800	1,100 -89%	1,200 -88%	400 -96%	400 -96%
Oyne Fork to Pitcaple	13,100	4,000 -69%	4,200 -68%	5,100 -61%	5,200 -60%

Note: The percentages represent the change in traffic flow compared with the Do-Min

Table 25.10 Minimum and maximum two-way AADT on the local A and B roads when the Pink and Brown route options are connected to the Violet route option

Location of AADT on Local A and B Roads	Do Min (vpd)	Pink Route Option		Brown Route Option	
		Min Flow (vpd)	Max Flow (vpd)	Min Flow (vpd)	Max Flow (vpd)
A920 east of Colpy	4,300	700 -84%	1,100 -74%	1,300 -70%	2,400 -44%
B992 Insch to Kellockbank	1,500	1,900 +27%	1,900 +27%	2,700 +80%	2,800 +87%
B9002 Insch to Oyne Fork	3,200	2,800 -13%	2,800 -13%	2,100 -34%	2,100 -34%

Note: The percentages represent the change in traffic flow compared with the Do-Min

25.3.18 In summary, whilst the Pink route option generally attracts greater volumes of traffic, the Brown route option offers greater connectivity to Insch and removes more traffic from the existing A96. This is because the Brown route option's junction at Kellockbank is closer to the existing A96/B992 junction at Kellockbank, hence it attracts more traffic to join the proposed dual-carriageway via, for example, the B992 from Insch, Kennethmont and Auchleven leading to a corresponding increase in traffic on the B992. Between Colpy and Pitcaple, both route options remove at least 60% of traffic from the existing A96.

25.3.19 The extra traffic attracted to the Pink route option is mainly from the A920. The Pink route option is about 1km shorter than the Brown route option and is therefore more attractive to trips such as those between Huntly and the A947 corridor or Dyce. When the Pink route option is connected to the Orange route option, this traffic uses the proposed dual-carriageway between Colpy Junction (on the Pink route option) and Pitscurry Junction (on the Orange route option), and minor roads, between Pitscurry Junction and Oldmeldrum and Dyce. When the Pink route option is connected to the Violet route option, this traffic uses the proposed dual-carriageway between Colpy Junction (on the Pink route option) and Daviot Junction (on the Violet route option), and local roads, between Daviot Junction and Oldmeldrum and Dyce.

25.4 Pitcaple to Kintore Route Options

25.4.1 The following section describes the traffic performance predicted for the Violet and Orange route options when either route option forms part of the overall end-to-end options.

25.4.2 Table 25.11 shows the proposed junction names, types and locations on the Violet and Orange route options for the Pitcaple to Kintore section of the scheme.

25.4.3 The Violet route option has three junctions at Daviot, Uryside and Tavelty. The Uryside Junction is split over two roads, the B9001 and the B9170. The western junction is located at the B9001 and has west facing slip roads. The eastern junction is located on the B9170 and has east facing slip roads. The Orange route option has four junctions at Pitscurry, Drimmies, Blackhall Road and Thainstone.

Table 25.11 Proposed Junctions between Pitcaple and Kintore

Route Options	Junction Type	Junction Name and Location
Violet 3 Junctions	Full grade separated junction – all movements to/from A96 catered for	Daviot Junction, B9001 south of Daviot
	Full grade separated junction split over B9001 and B9170 B9001 grade separated junction - westbound entry to A96 and westbound exit from A96 only B9170 grade separated junction- eastbound entry to A96 and eastbound exit from A96 only	Uryside Junction Uryside Junction West, B9001 north of Balhalgardy Uryside Junction East, B9170 north of Uryside
	Full grade separated junction – all movements to/from A96 catered for	Tavelty Junction, existing A96 west of Kintore
Orange 4 Junctions	Full grade separated junction – all movements to/from A96 catered for	Pitscurry Junction, south-west of Daviot
	Full grade separated junction – all movements to/from A96 catered for	Drimmies Junction, south-west of Drimmies
	Full grade separated junction – all movements to/from A96 catered for	Blackhall Road Junction, south of Inverurie
	Full grade separated junction – all movements to/from A96 catered for	Thainstone Junction, existing A96 at Thainstone

25.4.4 Pitscurry Junction on the Orange route option caters for trips between the B9001 and the proposed dual carriageway, avoiding the need for this traffic to route through Inverurie. This junction is not provided on the Violet route option as Daviot Junction on the B9001 performs the same function.

25.4.5 Figure 25.4 shows the traffic flows between the junctions on the Violet and Orange route options generated by all eight end-to-end options. It also shows the forecast traffic flows on the existing A96 in the Do-Minimum, and on the existing A96 for each of the eight end-to-end options.

25.4.6 The two-way AADT values on the Violet and Orange route options are shown in Table 25.12. The Orange route option attracts more traffic than the Violet route option. The Violet route option attracts between 13,500vpd and 18,400vpd, while the Orange route option attracts between 18,000vpd and 19,700vpd. The end-to-end options containing the Orange route option are about 2.6km shorter than the corresponding options containing the Violet route option. Therefore, the Orange route option attracts more traffic.

Table 25.12 Minimum and maximum two-way AADT on the Violet and Orange route options

Location of AADT on Route Options	Violet Route Option		Orange Route Option	
	Min Flow (vpd)	Max Flow (vpd)	Min Flow (vpd)	Max Flow (vpd)
Daviot to Uryside	16,600	18,400	-	-
Uryside to Tavelty	13,500	15,400	-	-
Pitscurry to Drimmies	-	-	19,200	19,600
Drimmies to Blackhall Road	-	-	19,100	19,700
Blackhall Road to Thainstone	-	-	18,000	18,500

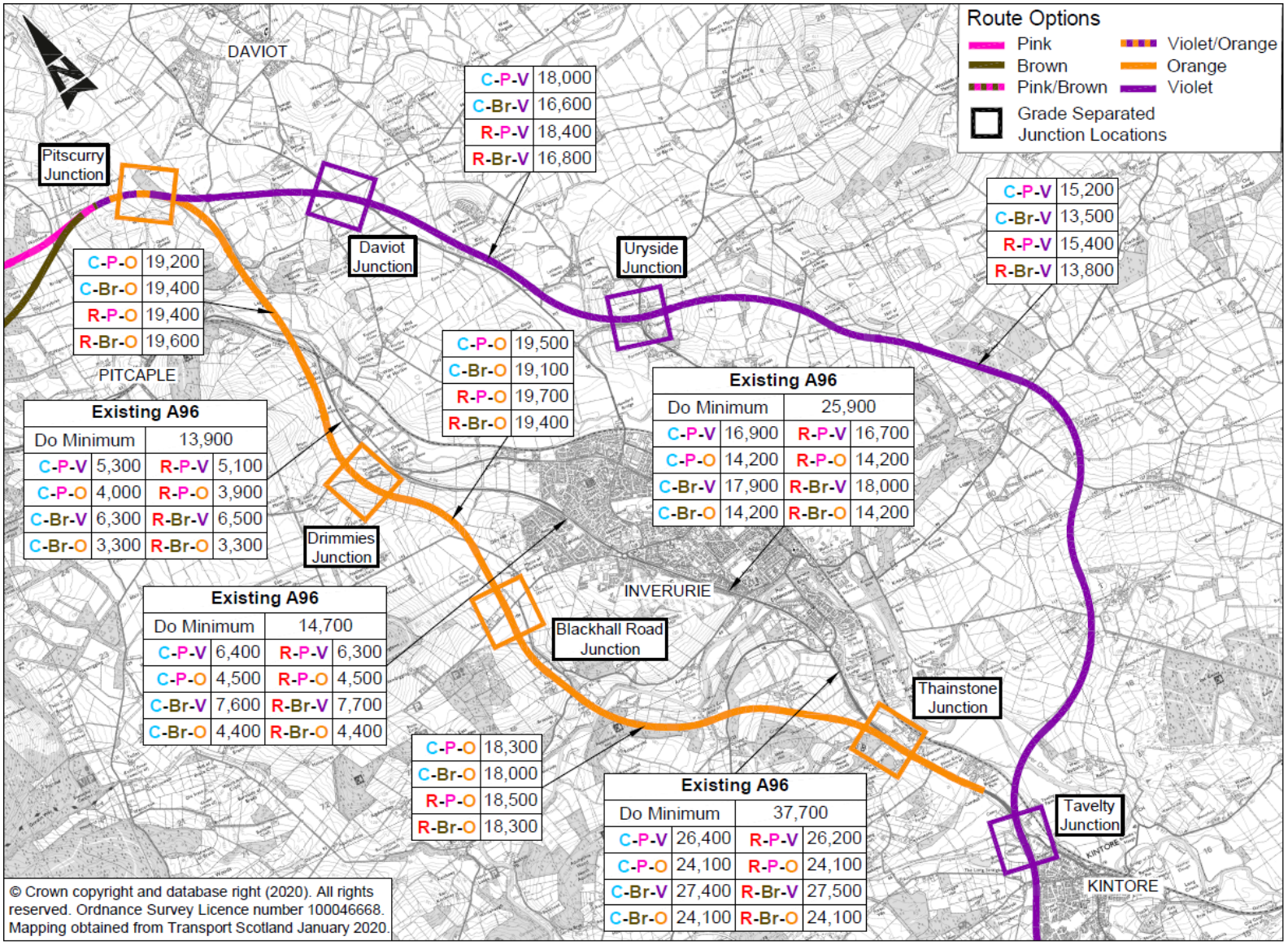

Figure 25.4 2030 Two-way AADT between junctions for the Violet and Orange route options and the existing A96

25.4.7 The corresponding AADT values for the existing A96 and for other local A and B roads are shown in Table 25.13 and Table 25.14 respectively. The Orange route option removes more traffic than the Violet route option from the existing A96 between Pitcaple and Thainstone Roundabout as shown in Table 25.13. Between Drimmies and Blackhall Roundabout the Violet route option removes between 48% and 57% of traffic from the existing A96, while the Orange route option removes between 69% and 70%. Between Blackhall Roundabout and Inverurie Roundabout the Violet route option removes between 31% and 36% of traffic from the existing A96, while the Orange route option removes 45%.

25.4.8 With both the Violet and Orange route options, the existing A96 continues to be used as a local distributor road for traffic between Inverurie and the east towards Aberdeen.

Table 25.13 Minimum and maximum two-way AADT on the existing A96 with the proposed Violet and Orange route options

Location of AADT on the Existing A96	Do Min (vpd)	Violet Route Option		Orange Route Option	
		Min Flow (vpd)	Max Flow (vpd)	Min Flow (vpd)	Max Flow (vpd)
Pitcaple to Drimmies	13,900	5,100 -63%	6,500 -53%	3,300 -76%	4,000 -71%
Drimmies to Blackhall Roundabout	14,700	6,300 -57%	7,700 -48%	4,400 -70%	4,500 -69%
Blackhall Roundabout to Inverurie Roundabout	25,900	16,700 -36%	18,000 -31%	14,200 -45%	14,200 -45%
Inverurie Roundabout to Thainstone Roundabout	37,700	26,200 -31%	27,500 -27%	24,100 -36%	24,100 -36%

Note: The percentages represent the change in traffic flow compared with the Do-Min

25.4.9 The Orange route option removes between 19% and 21% of traffic from the A947 (between Newmachar and Aberdeen) compared to the Violet route option which removes between 14% and 17% of traffic as shown in Table 25.14.

Table 25.14 Minimum and maximum two-way AADT on the local A and B roads with the proposed Violet and Orange route options

Location of AADT on Local A and B Roads	Do Min (vpd)	Violet Route Option		Orange Route Option	
		Min Flow (vpd)	Max Flow (vpd)	Min Flow (vpd)	Max Flow (vpd)
A947 Newmachar to Goval Junction	15,100	12,600 -17%	13,000 -14%	12,000 -21%	12,300 -19%
B9001 Inverurie to Portstown Link Road	15,800	12,900 -18%	13,000 -18%	11,400 -28%	11,400 -28%
B9170 Inverurie to Portstown Link Road	4,600	4,200 -9%	4,300 -7%	4,100 -11%	4,100 -11%

Note: The percentages represent the change in traffic flow compared with the Do-Min

25.4.10 The Violet route option attracts traffic travelling between Huntly and Dyce via the A920 and A947, with these trips leaving and joining the Violet route option at Daviot Junction. With the Orange route option, this traffic remains on the proposed dual carriageway as there are no junctions, other than Colpy, close to the A920.

25.4.11 With the Violet route option, traffic travelling between Colpy and southern and central Inverurie leaves the proposed dual carriageway at Carden Junction (on Brown) or at Colpy Junction (on Cyan or Red); therefore, avoiding the Violet route option and routeing via the existing A96 instead. With the Orange route option this traffic remains on the proposed dual carriageway until it reaches Inverurie.

25.4.12 When part of an end-to-end option, both the Violet and Orange route options remove a substantial volume of traffic that currently passes through Inverurie. This traffic currently routes via the B9001 or B9170 to the existing A96 or across the existing A96 to the Westgate area. On average, the Violet route option removes 55% of traffic (4,200vpd) routeing through Inverurie whilst the Orange route option removes 47% of traffic (3,600vpd) routeing through Inverurie.

25.4.13 With the Violet route option, traffic between the B9001 corridor north of Inverurie and the A96 east of Inverurie (e.g. Rothienorman to Aberdeen traffic) avoids passing through Inverurie. Instead, this traffic joins the Violet route option at Daviot Junction and bypasses Inverurie. The Violet route option also removes traffic between the B9170 corridor north of Inverurie and the A96 east of Inverurie (e.g. Oldmeldrum to Kintore traffic). Instead, this traffic joins the Violet route option at Uryside Junction and bypasses Inverurie. However, traffic travelling between the B9001 or B9170 and Westgate continues to route through Inverurie. These routeing changes are shown in Figure 25.5.

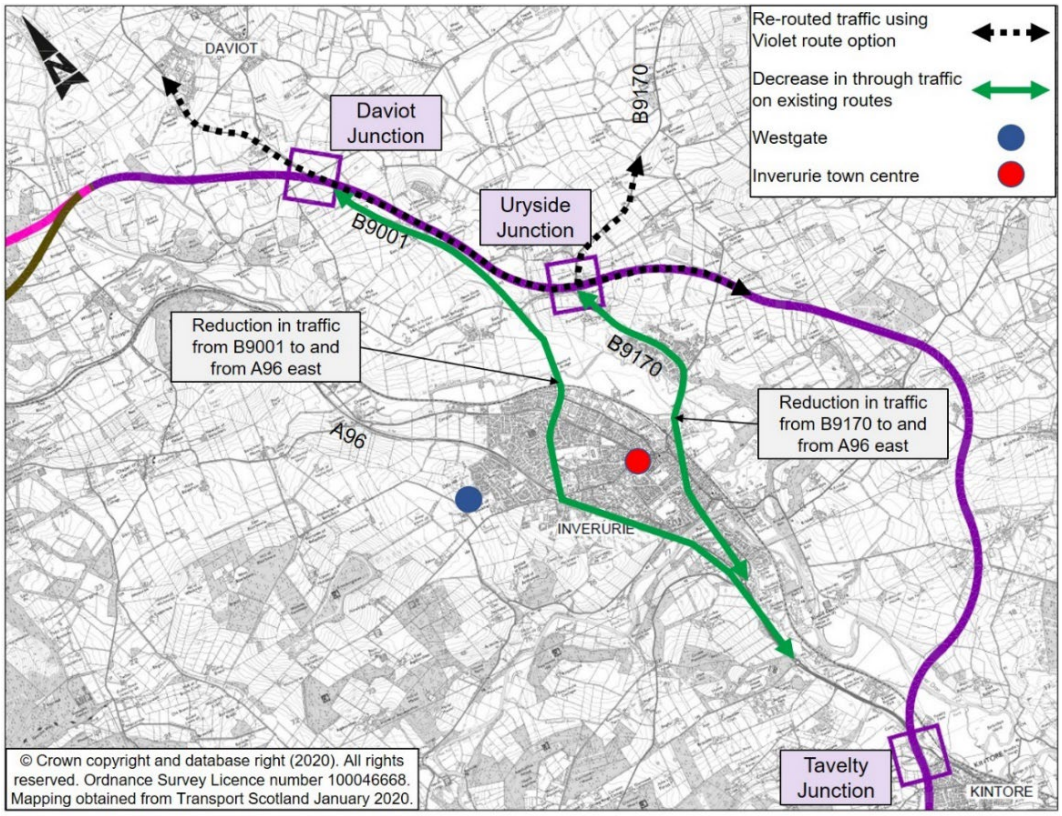

Figure 25.5 Reduction in traffic through Inverurie under the Violet route option

25.4.14 With the Orange route option, traffic between the B9001 corridor north of Inverurie and the A96 east of Inverurie (e.g. Rothienorman to Aberdeen traffic) avoids passing through Inverurie. Instead, this traffic joins the Orange route option at Pitscurry Junction and bypasses Inverurie.

25.4.15 The Orange route option also removes traffic travelling between the B9001 corridor north of Inverurie and the Westgate area or between the B9001 and the area of Inverurie near Blackhall Roundabout (e.g. Rothienorman to Westgate traffic). Instead, this traffic joins the Orange route option at Pitscurry Junction and accesses the Westgate area via Blackhall Road Junction, or accesses Inverurie via Drimmies Junction and Blackhall Roundabout. However, traffic travelling between the B9170 corridor and the A96 east of Inverurie continues to route through Inverurie. These routeing changes are shown in Figure 25.6.

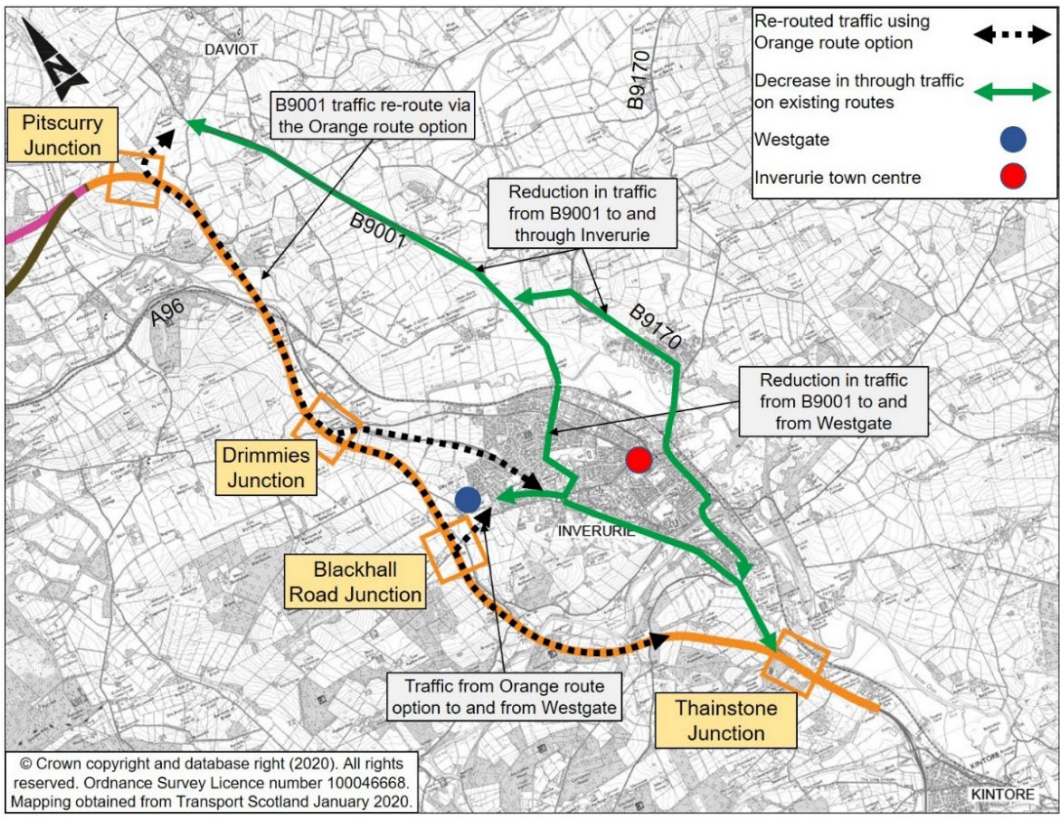

Figure 25.6 Reduction in traffic through Inverurie under the Orange route option

25.4.16 In summary, the Orange route option attracts a greater volume of traffic and removes more trips from the existing A96 and the A947 than the Violet route option when either route option forms part of an end-to-end option. The Violet route option removes more traffic routeing through Inverurie than the Orange route option, but both remove a substantial proportion of through traffic from Inverurie.

25.5 Journey Time Improvements

25.5.1 Table 25.15 shows the journey time savings for each of the end-to-end options compared to the Do-Minimum scenario. All of the journey times are between East of Huntly and Kintore (Gauchhill Junction) in the eastbound and westbound direction for each model time period – Early AM (EAM); AM peak; inter-peak (IP) and PM peak.

Table 25.15 Comparison of Journey Time Savings

End-to-end Option	Year	Do-Something Journey Time Savings (minutes : seconds)							
		Eastbound East of Huntly to Kintore				Westbound Kintore to East of Huntly			
		EAM	AM	IP	PM	EAM	AM	IP	PM
Cyan-Pink-Violet	2030	12:06	9:36	5:02	5:06	4:33	4:57	5:01	11:14
	2045	14:20	12:21	5:39	6:08	4:46	5:25	5:32	13:11
Cyan-Pink-Orange	2030	13:16	10:57	6:29	6:33	6:02	6:24	6:27	12:27
	2045	15:23	13:37	7:05	7:34	6:14	6:49	6:56	14:23
Cyan-Brown-Violet	2030	11:32	9:02	4:26	4:30	3:57	4:22	4:26	10:40
	2045	13:47	11:46	5:03	5:32	4:10	4:49	4:57	12:36
Cyan-Brown-Orange	2030	12:42	10:21	5:53	5:57	5:26	5:48	5:51	11:52
	2045	14:52	13:03	6:28	6:58	5:38	6:14	6:21	13:47
Red-Pink-Violet	2030	12:37	10:08	5:34	5:38	5:06	5:30	5:33	11:46
	2045	14:48	12:52	6:11	6:40	5:18	5:57	6:03	13:43
Red-Pink-Orange	2030	13:48	11:29	7:01	7:05	6:35	6:57	7:00	12:59
	2045	15:55	14:10	7:36	8:06	6:46	7:22	7:29	14:55
Red-Brown-Violet	2030	12:03	9:33	4:58	5:02	4:30	4:54	4:58	11:11
	2045	14:19	12:18	5:36	6:03	4:43	5:22	5:29	13:08
Red-Brown-Orange	2030	13:12	10:52	6:25	6:29	5:58	6:21	6:24	12:23
	2045	15:19	13:33	7:01	7:30	6:10	6:46	6:52	14:20

25.5.2 The journey time improvements are summarised in Table 25.16 for each direction of travel. The maximum eastbound journey time savings occur in the EAM, while the maximum westbound journey time savings occur in the PM peak.

Table 25.16 Summary of Journey Time Savings

End-to-End Option	Do-Something Journey Time Savings (minutes : seconds)			
	Eastbound East of Huntly to Kintore (EAM)		Westbound Kintore to East of Huntly (PM)	
	2030	2045	2030	2045
Cyan-Pink-Violet	12:06	14:20	11:14	13:11
Cyan-Pink-Orange	13:16	15:23	12:27	14:23
Cyan-Brown-Violet	11:32	13:47	10:40	12:36
Cyan-Brown-Orange	12:42	14:52	11:52	13:47
Red-Pink-Violet	12:37	14:48	11:46	13:43
Red-Pink-Orange	13:48	15:55	12:59	14:55
Red-Brown-Violet	12:03	14:19	11:11	13:08
Red-Brown-Orange	13:12	15:19	12:23	14:20

25.5.3 In the busiest hours, each of the end-to-end options delivers journey time savings of at least 10 mins 40 seconds westbound in the opening year (2030) and up to 15 minutes 55 seconds eastbound in the 2045 forecast year. The greatest journey time saving arises from the Red-Pink-Orange option, and the least journey time saving arises from the Cyan-Brown-Violet option.

25.5.4 The results show that the end-to-end options containing the Red route option, on average, produce journey time savings of approximately 30 seconds more than the corresponding end-to-end options containing the Cyan route option.

25.5.5 The end-to-end options containing the Pink route option produce, on average, journey time savings of approximately 35 seconds more than the corresponding end-to-end options containing the Brown route option.

25.5.6 The end-to-end options containing the Orange route option, on average, produce journey time savings of approximately 70 seconds more than the corresponding end-to-end options containing the Violet route option.

25.5.7 The differences in journey times are consistent with the Red, Pink and Orange route options being shorter than the Cyan, Brown and Violet route options respectively.

25.6 Sensitivity Test

25.6.1 A review of 2019 traffic survey data identified that the A96 CRAM v1.4 may over represent traffic on the B9001 north of Inverurie, while under-representing traffic on the nearby B9170. In response, a Sensitivity test was carried out to assess the performance of the end-to-end options with the adjustments to the demand matrices in the Inverurie area as described in Paragraphs 24.9.4 and 24.9.5. The Sensitivity test reallocates some trips from the B9001 to the B9170 to the north of Inverurie to reflect observed flows on these routes, but includes the same total volume of traffic as the Refined Core scenario.

25.6.2 The traffic impacts of this Sensitivity test are considered by comparing the traffic flows and journey time savings generated by the end-to-end options in the Refined

Core scenario with those generated under the Sensitivity test. The traffic impacts of the Sensitivity test are discussed in paragraphs 25.6.4 to 25.6.11 below. The economic impacts of the Sensitivity test are discussed in Section 26.5.

25.6.3 The change in traffic flows between the Refined Core scenario and the Sensitivity test was used to undertake a high-level review of the environmental impacts. Paragraphs 25.6.13 to 25.6.17 provide a summary of the effects of the Sensitivity test on the environmental topics (Air Quality, Noise and Vibration, and People and Communities) that use traffic outputs from the A96 CRAM v1.4.

Traffic Impacts of the Sensitivity Test

25.6.4 A greater volume of traffic travels to and from Inverurie via the B9170 in the Sensitivity test, so the existing congestion in the town centre, High Street and the approach to Port Elphinstone Roundabout increases in the Sensitivity test Do-Minimum scenario.

25.6.5 Table 25.17 shows the minimum and maximum two-way AADT in 2030 on the East of Huntly to Colpy, Colpy to Pitcaple, and Pitcaple to Kintore geographical sections for both the Refined Core (as shown in Figure 25.2, Figure 25.3 and Figure 25.4) and the Sensitivity test scenarios.

Table 25.17 2030 Refined Core and Sensitivity test - Comparison of minimum and maximum AADTs for each route

A96 Geographical Section	Route Options	Refined Core Scenario AADT		Sensitivity Test Scenario AADT	
		Min Flow (vpd)	Max Flow (vpd)	Min Flow (vpd)	Max Flow (vpd)
East of Huntly to Colpy	Cyan	14,000	14,800	14,000	14,800
	Red	14,200	14,900	14,200	14,900
Colpy to Pitcaple	Pink	12,100	15,300	12,100	15,400
	Brown	10,600	14,700	10,700	14,800
Pitcaple to Kintore	Violet	13,500	18,400	13,400	16,800
	Orange	18,000	19,700	17,800	19,000

25.6.6 Table 25.17 shows that there is no significant difference between the Refined Core and the Sensitivity test in terms of traffic attracted by the Cyan, Red, Pink or Brown route options. However, less traffic is attracted to both the Violet route option and the Orange route option in the Sensitivity test with more details provided in Table Table 25.18.

25.6.7 For the Violet route option, the main impact of the Sensitivity test is that the re-allocated traffic joins the Violet route option at Uryside Junction (where there is a junction between the B9170 and the proposed A96 dual carriageway) rather than Daviot Junction (where there is a junction between the B9001 and the proposed A96 dual carriageway). This means that there is less traffic on the Violet route option travelling between these two junctions. However, only a maximum of 200vpd no longer join the proposed dual carriageway at the Daviot or Uryside Junctions.

Table 25.18 2030 Refined Core and Sensitivity test - Comparison of minimum and maximum AADTs for the Violet and Orange route options

Location of AADT on Route Options	Refined Core		Difference between Sensitivity test and Refined Core	
	Min Flow (vpd)	Max Flow (vpd)	Min Flow (vpd)	Max Flow (vpd)
Violet -Daviot to Uryside (3.5km)	16,600	18,400	-1,500	-1,600
Violet -Uryside to Tavelty (10km)	13,500	15,400	-100	-200
Orange -Pitscurry to Drimmies (4km)	19,200	19,600	-1,100	-1,200
Orange -Drimmies to Blackhall Road (2.5km)	19,100	19,700	-500	-700
Orange -Blackhall Road to Thainstone (4km)	18,000	18,500	-200	-300

25.6.8 For the Orange route option, the reduction in traffic occurs because the Sensitivity test reallocates traffic from the B9001 (at Pitscurry Junction) to the B9170 which has no junction with the proposed dual carriageway. Therefore, there is a greater impact on the Orange route option, as the re-allocated traffic from the B9001 to the B9170 is instead required to use local roads to access the A96.

25.6.9 When part of an end-to-end option, while both the Violet and Orange route options remove less traffic from Inverurie in the Sensitivity test, a substantial volume of traffic that currently passes through Inverurie is still removed. This traffic currently routes via the B9001 or B9170 to the A96 or across the A96 to the Westgate area. On average, the Violet route option removes 51% of traffic (3,900vpd) routeing through Inverurie in the Sensitivity test compared with 55% (4,200vpd) for the Refined Core. On average, the Orange route option removes 41% of traffic (3,100vpd) routeing through Inverurie, in the Sensitivity test compared with 47% (3,600vpd) for the Refined Core.

25.6.10 Table 25.19 shows the journey time savings for the Sensitivity test and Table 25.20 shows a comparison of the Refined Core and Sensitivity test journey time savings in 2030 for the busiest hours. In the eastbound direction the busiest hour is the EAM, while in the westbound direction the busiest hour is the PM.

25.6.11 There is no significant difference between the Refined Core and Sensitivity test scenarios in terms of journey time savings in both directions of travel across the different time periods. In relation to the busiest hours, the EAM journey time savings are the same in both the Refined Core and the Sensitivity test scenarios. The PM peak journey time savings in the Sensitivity test are at most two seconds less than the Refined Core scenario.

Table 25.19 Comparison of Journey Time Savings (Sensitivity test)

End-to-end Option	Year	Do-Something Journey Time Savings (minutes : seconds)							
		Eastbound East of Huntly to Kintore				Westbound Kintore to East of Huntly			
		EAM	AM	IP	PM	EAM	AM	IP	PM
Cyan-Pink-Violet	2030	12:06	9:54	5:00	5:02	4:32	4:54	4:59	11:13
	2045	14:23	12:29	5:38	6:01	4:44	5:21	5:28	13:08
Cyan-Pink-Orange	2030	13:16	11:15	6:27	6:29	6:01	6:21	6:25	12:25
	2045	15:27	13:46	7:03	7:27	6:12	6:45	6:52	14:20
Cyan-Brown-Violet	2030	11:32	9:19	4:24	4:26	3:56	4:18	4:23	10:38
	2045	13:50	11:54	5:02	5:25	4:08	4:45	4:53	12:33
Cyan-Brown-Orange	2030	12:42	10:39	5:51	5:53	5:25	5:45	5:49	11:50
	2045	14:55	13:11	6:27	6:51	5:36	6:10	6:17	13:44
Red-Pink-Violet	2030	12:37	10:26	5:32	5:34	5:04	5:26	5:31	11:44
	2045	14:51	13:00	6:10	6:33	5:16	5:53	6:00	13:40
Red-Pink-Orange	2030	13:48	11:47	7:00	7:02	6:33	6:53	6:57	12:57
	2045	15:59	14:18	7:35	7:59	6:44	7:18	7:25	14:52
Red-Brown-Violet	2030	12:03	9:51	4:56	4:58	4:28	4:51	4:55	11:10
	2045	14:22	12:26	5:34	5:57	4:41	5:17	5:26	13:05
Red-Brown-Orange	2030	13:12	11:11	6:23	6:26	5:57	6:17	6:21	12:21
	2045	15:23	13:42	6:59	7:23	6:08	6:42	6:49	14:17

Table 25.20 Comparison of 2030 Journey Time Savings for the End-to-End Options

End-to-End Option	Do-Something Journey Time Savings (minutes : seconds)			
	Eastbound East of Huntly to Kintore 2030 (EAM)		Westbound Kintore to East of Huntly 2030 (PM)	
	Refined Core	Sensitivity	Refined Core	Sensitivity
Cyan-Pink-Violet	12:06	12:06	11:14	11:13
Cyan-Pink-Orange	13:16	13:16	12:27	12:25
Cyan-Brown-Violet	11:32	11:32	10:40	10:38
Cyan-Brown-Orange	12:42	12:42	11:52	11:50
Red-Pink-Violet	12:37	12:37	11:46	11:44
Red-Pink-Orange	13:48	13:48	12:59	12:57
Red-Brown-Violet	12:03	12:03	11:11	11:10
Red-Brown-Orange	13:12	13:12	12:23	12:21

Environmental Impacts of the Sensitivity Test

25.6.12 A high-level review of the impact of the Sensitivity test on the environment has also been undertaken with a focus on the topics directly affected by changes in traffic flows - Air Quality, Noise and Vibration and People and Communities. .

25.6.13 In terms of air quality, concentrations of NO_2 and PM_{10} at most of the worst-case receptor locations are likely to remain well below the UK air quality limit values of 40µg/m^3 and 18µg/m^3 respectively in the Sensitivity test for all end-to-end options. This is also the case with the Refined Core scenario.

25.6.14 The noise and vibration assessment using traffic flow volumes from the Sensitivity test models concludes that the comparative performance of the end-to-end options does not change.

25.6.15 The people and communities assessment shows that the Sensitivity test has only a very slight (unnoticeable) change in the impacts resulting from the Cyan, Red, Brown and Pink route options. For the Orange and Violet route options some affected roads (B9001 and B9170) have a more noticeable change in traffic volumes. However, these volumes do not change the conclusions of the assessment from the Refined Core scenario.

25.6.16 In conclusion the Sensitivity test does not impact on the conclusions of the air quality, noise and vibration or people and communities assessments detailed in Volume 2 Part 3, which are based on the Refined Core scenario.

25.7 Summary

25.7.1 Table 25.21 presents a summary of the 2030 forecast traffic flows and journey time savings for each of the eight end-to-end options appraised under the Refined Core scenario. The AADTs at key locations on each of the route options are presented by geographical section alongside the end-to-end journey time savings. The journey time savings are presented for the busiest hour in each direction of travel.

25.7.2 For seven out of the eight end-to-end options, the 2030 opening year AADT is consistent with the suggested flows for dual carriageway provision[3]. The exception is the Carden to Daviot section on the Cyan-Brown-Violet option where the flows are slightly less than the lower limit.

25.7.3 Both the Cyan and Red route options remove 98% - 99% of traffic on the existing A96 between East of Huntly and Colpy, leaving at most 300vpd on the existing A96.

25.7.4 Both the Pink and Brown route options remove at least 60% of traffic from the existing A96 between Colpy and Pitcaple. The Pink route option attracts a greater volume of traffic than the Brown route option.

25.7.5 With all end-to-end options, the existing A96 remains the main distributor road for traffic between Inverurie and the east towards Aberdeen.

[3] DMRB Volume 5 Section 1 Part 3 (TA 46/97) *Assessment and Preparation of Road Schemes* 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 an AADT of 11,000vpd to 39,000vpd. TA 46/97 remains applicable for trunk road projects in Scotland, although it was withdrawn from the DMRB in March 2020.

Table 25.21 Summary of Traffic Flows by Geographical Section and Journey Time Savings on End-to-End Options (Refined Core Scenario)

End-to-End Option	2030 Traffic Flows at Key Locations on the End-to-End Options (AADTs - vpd)												Do-Something Journey Time Savings (Min:Sec)	
		Colpy to Pitcaple (Pink and Brown)						Pitcaple to Kintore (Violet and Orange)						
	East of Huntly to Colpy (Cyan and Red)	Colpy to Kellockbank (Pink and Brown)	Kellockbank to Daviot (Pink connected to Violet)	Kellockbank to Pitscurry (Pink connected to Orange)	Kellockbank to Carden (Brown)	Carden to Daviot (Brown connected to Violet))	Carden to Pitscurry (Brown connected to Orange)	Daviot to Uryside (Violet)	Uryside to Tavelty (Violet)	Pitscurry to Drimmies (Orange)	Drimmies to Blackhall Road (Orange)	Blackhall Road to Thainstone (Orange)	East of Huntly to Kintore (EAM)	Kintore to East of Huntly (PM)
Cyan-Pink-Violet	14,200	12,100	13,000	-	-	-	-	18,000	15,200	-	-	-	12:06	11:14
Cyan-Pink-Orange	14,800	13,000	-	14,600	-	-	-	-	-	19,200	19,500	18,300	13:16	12:27
Cyan-Brown-Violet	14,000	11,400	-	-	13,100	10,600	-	16,600	13,500	-	-	-	11:32	10:40
Cyan-Brown-Orange	14,500	12,200	-	-	14,600	-	14,500	-	-	19,400	19,100	18,000	12:42	11:52
Red-Pink-Violet	14,500	12,900	13,800	-	-	-	-	18,400	15,400	-	-	-	12:37	11:46
Red-Pink-Orange	14,900	13,600	-	15,300	-	-	-	-	-	19,400	19,700	18,500	13:48	12:59
Red-Brown-Violet	14,200	12,700	-		14,300	11,800	-	16,800	13,800	-	-	-	12:03	11:11
Red-Brown-Orange	14,800	12,500	-	-	14,700	-	14,700	-	-	19,600	19,400	18,300	13:12	12:23

25.7.6 When compared to the Do-Minimum, the Violet route option removes around one third of traffic from the existing A96 between Blackhall and Inverurie roundabouts, whilst the Orange route option removes almost half the traffic. Both the Violet and the Orange route options also reduce the volume of traffic routeing through Inverurie from the north via the B9001 and B9170 to access the existing A96 or Westgate area to the south. On average, the Violet route option removes 55% of this through traffic, while the Orange route option removes 47% of this through traffic.

25.7.7 The Sensitivity test (see Section 25.6), which adjusts the allocation of trips on the B9001 and B9170 north of Inverurie, does not generate any significant differences in journey times between the route options when compared with the Refined Core scenario. There are no significant differences in traffic volumes, other than for the Orange and Violet route options. Both the Violet and Orange route options attract less traffic in the Sensitivity test than they do in the Refined Core scenario. There is a greater impact on the Orange route option as it only has a junction with the B9001 and not the B9170, while the Violet route option has junctions with both roads. The Orange route option continues to attract more traffic than the Violet route option, in keeping with the Refined Core scenario. In the Sensitivity test, while both the Violet and Orange route options remove less traffic from Inverurie, they still remove 51% and 41% of through traffic respectively.

25.7.8 The Sensitivity test does not change the overall comparative performance of the end-to-end options in traffic and environmental terms.

26 Economic Assessment

26.1 Introduction

26.1.1 This chapter presents the economic assessment of the eight end-to-end options that are formed by the combinations of the six route options as discussed in Section 25.1. The economic assessment monetises the traffic and road safety benefits of the scheme. This has been carried out using TUBA version 1.9.13 to quantify the traffic benefits, and COBALT 2013.2 software to monetise the accident savings.

26.2 Methodology of Appraisal

26.2.1 TUBA undertakes a matrix-based, zone-to-zone, appraisal using trip volume, time and distance matrices from a transport model, in this case the A96 CRAM v1.4. TUBA calculates the user benefits in journey time, fuel consumption, vehicle operating costs (VOC), charges[4], operator and government revenues and the scheme costs discounted to the 2010 present value year.

26.2.2 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 AADT flow. COBALT estimates the number of accidents in the Do-Minimum and Do-Something 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.

26.2.3 TUBA and COBALT allow a comparison between costs for Do-Minimum and Do-Something scenarios which provides an estimate of user and accident benefits in monetised terms. The assessment is carried out over the 60-year appraisal period, and all economic values are deflated to 2010 values and discounted to 2010 prices at 3.5% for the first 30 years and 3% thereafter.

26.2.4 The economic appraisal has been undertaken based on the Do-Something Economic scenario, as described in Chapter 25, Traffic Performance of Route Options. As outlined in Chapter 24, for the purposes of the economic assessment, the Scheme ties in to the existing A96 east of Huntly at the western end, and at Kintore (Gauchhill Junction) at the eastern end. The same traffic demand matrices are used in both the Do-Minimum and Do-Something (Economic) scenarios.

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

26.3 Cost Estimates

26.3.1 The estimated cost, inclusive of Optimism Bias and quantified risk, for each of the end-to-end options is described in Volume 1, Part 1, Chapter 3, Section 3.12. For the purpose of the economic assessment, the cost estimates for each of the six route options have been combined to provide the overall cost estimate for each of the eight end-to-end options. Construction has been assumed to commence in 2027 and be completed in 2030. Land costs and preparation costs are assumed to take place entirely in 2027. The construction and supervision spend profile for

[4] Tolls, parking charges etc.

the scheme is assumed to be 28.6% (or 2/7) in each of 2027, 2028 and 2029, and 14.2% (or 1/7) in 2030.

26.3.2 The costs for each of the eight end-to-end options are shown in Table 26.1, rounded to the nearest million. The costs are in 2018 Quarter 2 prices and exclude Value Added Tax (VAT). Cyan-Pink-Violet is the lowest cost end-to-end option and Red-Brown-Orange is the highest cost end-to end option.

Table 26.1 Estimated Costs for Combined End-to-End Options

End-to-End Option	End-to-End Costs
Cyan-Pink-Violet	£890m
Cyan-Pink-Orange	£899m
Cyan-Brown-Violet	£943m
Cyan-Brown-Orange	£933m
Red-Pink-Violet	£960m
Red-Pink-Orange	£970m
Red-Brown-Violet	£993m
Red-Brown-Orange	£1003m

Note: All costs in the above table are in 2018 Quarter 2 prices and exclude VAT

26.4 Economic Assessment of the Options

26.4.1 A comparison of transport economic benefits and costs for the end-to-end options, at 2010 values and prices, is set out in Table 26.2, the Analysis of Monetised Costs and Benefits (AMCB). The Present Value of Benefits (PVB) is the sum of the TUBA benefits and the COBALT accident benefits. The Net Present Value (NPV) is calculated by the Present Value of Costs (PVC) subtracted from the PVB. The PVB, PVC and NPV are shown rounded to the nearest million. The Benefit-Cost Ratio (BCR) is calculated by dividing the PVB by the PVC. Indexed BCRs are also presented, the highest BCR value being 100. This further illustrates the relative differences between the BCRs for the different end-to-end options.

26.4.2 Further details of the cost-benefit analysis results for each of the eight end-to-end options are provided in Appendix A26.1 to A26.8 (Volume 4a). This contains the Transport Economic Efficiency (TEE) tables, the Public Accounts tables, and the Analysis of Monetised Costs and Benefits (AMCB) tables. All the end-to-end options produce benefits in excess of £250m, with the Red-Pink-Orange option generating the highest level of economic benefit (£370m). The Cyan-Brown-Violet option delivers the least economic benefit of £250m which is only 68% of the benefits of the Red-Pink-Orange option.

26.4.3 In terms of PVC, Cyan-Pink-Violet is the lowest cost option (£496m) while Red-Brown-Orange is the highest cost option (£560m). The end-to-end options containing the Cyan route option are lower in cost than the corresponding end-to-end options containing the Red route option (between £28m and £40m lower) reflecting the complexity and volume of earthworks with the Red route option generating significantly more earthworks cost than the Cyan route option due to the large cutting at the Hill of Foudland.

Table 26.2 AMCB for the End-to-End Options (Refined Core Scenario)

End-to-End Option	Present Value of TUBA Benefits	Present Value of COBALT Accident Benefits	Total Present Value of Benefits (PVB)	Present Value of Costs (PVC)	Net Present Value (NPV)	BCR	Indexed BCR
Cyan-Pink-Violet	£223.9m	£49.9m	£274m	£496m	-£222m	0.55	79
Cyan-Pink-Orange	£288.9m	£60.9m	£350m	£501m	-£151m	0.70	100
Cyan-Brown-Violet	£203.0m	£47.2m	£250m	£526m	-£276m	0.48	68
Cyan-Brown-Orange	£269.5m	£58.7m	£328m	£521m	-£193m	0.63	90
Red-Pink-Violet	£243.7m	£52.8m	£297m	£535m	-£238m	0.56	79
Red-Pink-Orange	£307.4m	£62.6m	£370m	£541m	-£171m	0.68	98
Red-Brown-Violet	£223.3m	£49.2m	£273m	£554m	-£281m	0.49	71
Red-Brown-Orange	£292.9m	£61.1m	£354m	£560m	-£206m	0.63	90

Note: 2010 values and prices, discounted to 2010 at 3.5% for first 30 years and 3% thereafter

26.4.4 The end-to-end options containing the Cyan route option are longer and therefore attract slightly less traffic than the corresponding end-to-end options containing the Red route option. As a result, the Cyan route option delivers between £20m and £26m lower PVB than the corresponding end-to-end options containing the Red route option. However, those end-to-end options containing the Cyan route option cost between £28m and £40m less than the corresponding end-to-end options containing the Red route option. As a result, the end-to-end options containing the Cyan route option have a similar indexed BCR value to the corresponding end-to-end options containing the Red route option.

26.4.5 The end-to-end options containing the Pink route option offer between £16m and £24m higher PVB, and between £19m and £30m lower costs than the corresponding end-to-end options containing the Brown route option. This results in higher indexed BCR values (indexed BCR greater by between 8 and 11 percentage points) for those end-to-end options containing the Pink route option than the corresponding end-to-end options containing the Brown route option.

26.4.6 The greatest difference in benefits and least difference in costs occur between the Violet route option and the Orange route option. End-to-end options containing the Orange route option deliver between £73m and £81m higher PVB than the corresponding end-to-end options containing the Violet route option. The difference in cost between the Orange and Violet route options is only between £5m and £6m. As a result, end-to-end options containing the Orange route option have significantly higher indexed BCR values (indexed BCR values greater by between 19 and 22 percentage points) compared to the corresponding end-to-end options containing the Violet route option.

26.4.7 The Cyan-Pink-Orange option delivers the highest indexed BCR (100) followed by the Red-Pink-Orange option (98).

26.4.8 Table 26.3 shows the predicted savings in accidents and casualties for the end-to-end options over the 60-year appraisal period.

Table 26.3 Casualty Savings for the End-to-End Options

End-to-End Option	Casualty Savings				Total Accident Savings
	Fatal	Serious	Slight	Total	
Cyan-Pink-Violet	26	189	1,110	1,325	844
Cyan-Pink-Orange	31	229	1,371	1,631	1,045
Cyan-Brown-Violet	24	180	1,059	1,263	811
Cyan-Brown-Orange	30	221	1,313	1,564	1,002
Red-Pink-Violet	27	199	1,177	1,403	894
Red-Pink-Orange	32	235	1,412	1,679	1,075
Red-Brown-Violet	25	187	1,100	1,311	838
Red-Brown-Orange	31	230	1,379	1,639	1,053

26.4.9 All the end-to-end options are predicted to save in excess of 800 accidents and 1,200 casualties over the 60-year appraisal period. The Red-Pink-Orange option offers the greatest savings, generating 1,075 accident savings and 1,679 casualty savings.

26.4.10 Over the 60-year appraisal period, the end-to-end options containing the Cyan route option deliver between 3% and 6% lower casualty savings than the corresponding end-to-end options containing Red route option (between 48 and 78 less casualties).

26.4.11 The end-to-end options containing the Pink route option deliver between 2% and 7% higher casualty savings than the corresponding end-to-end options containing the Brown route option (between 40 and 92 more casualties).

26.4.12 The end-to-end options containing the Orange route option deliver between 20% and 25% higher casualty savings than the corresponding end-to-end options containing the Violet route option (between 276 and 328 more casualties).

26.4.13 The comparison between the casualty savings shows that the end-to-end options containing the Cyan and Pink route options offer similar safety benefits to the corresponding end-to-end options containing the Red and Brown route options. The end-to-end options containing the Orange route option offer significantly greater casualty savings than the corresponding end-to-end options containing the Violet route option.

26.4.14 It should be noted that the DMRB Stage 2 Assessment is a comparative exercise between the eight end-to end options in order to identify a Preferred Option. There are additional benefits generated by all the end-to-end options that have not been considered under the AMCB, including Wider Economic Impacts (WEIs) and driver frustration. The additional benefits are considered in Volume 3 Part 5, Chapter 28.5, Economic Performance of the Preferred Option.

26.5 Sensitivity Test

26.5.1 As noted in Paragraphs 24.9.4 and 24.9.5, a Sensitivity test was carried out to assess the economic performance of the end-to-end options with an adjustment to the trip matrices representing the traffic demands to the north of Inverurie.

26.5.2 Table 26.4 shows the comparison between the AMCB in the Refined Core and Sensitivity test scenarios for each of the end-to-end options. All costs and benefits are in 2010 values and total PVB, PVC and NPV rounded to the nearest million. The highest BCR in the Refined Core scenario is considered as 100 for indexing the BCR in the Sensitivity test. This provides an indication of the change in indexed BCR under the Sensitivity test compared with the Refined Core scenario. The actual BCR values for each end-to-end option in the Refined Core and Sensitivity test are also presented.

26.5.3 Similar to the traffic performance reported in Section 25.6, there is no significant different between the Refined Core scenario and the Sensitivity test in terms of economic performance of the end-to-end options.

Table 26.4 Comparison of AMCB for the End-to-End Options in the Refined Core and Sensitivity Test

End-to-End Option	Present Value of Benefits- TUBA		Accident Benefits- COBALT		Total Present Value of Benefits (PVB)		Present Value of Costs (PVC)	Net Present Value (NPV)		BCR		Indexed BCR	
	Refined Core	Sensitivity Test	Refined Core	Sensitivity Test	Refined Core	Sensitivity Test	Refined Core & Sensitivity	Refined Core	Sensitivity Test	Refined Core	Sensitivity Test	Refined Core	Sensitivity Test
Cyan-Pink-Violet	£223.9m	£231.2m	£49.9m	£49.7m	£274m	£281m	£496m	-£222m	-£215m	0.55	0.57	79	83
Cyan-Pink-Orange	£288.9m	£281.1m	£60.9m	£60.4m	£350m	£342m	£501m	-£151m	-£159m	0.70	0.68	100	100
Cyan-Brown-Violet	£203.0m	£208.1m	£47.2m	£47.0m	£250m	£255m	£526m	-£276m	-£271m	0.48	0.48	68	71
Cyan-Brown-Orange	£269.5m	£261.5m	£58.7m	£59.1m	£328m	£321m	£521m	-£193m	-£200m	0.63	0.62	90	90
Red-Pink-Violet	£243.7m	£248.2m	£52.8m	£52.6m	£297m	£301m	£535m	-£238m	-£234m	0.56	0.56	79	82
Red-Pink-Orange	£307.4m	£297.9m	£62.6m	£62.1m	£370m	£360m	£541m	-£171m	-£181m	0.68	0.67	98	97
Red-Brown-Violet	£223.3m	£228.0m	£49.2m	£49.1m	£273m	£277m	£554m	-£281m	-£277m	0.49	0.50	71	73
Red-Brown-Orange	£292.9m	£283.3m	£61.1m	£60.6m	£354m	£344m	£560m	-£206m	-£216m	0.63	0.61	90	90

26.5.4 In the Sensitivity test, the adjustment undertaken results in traffic being reallocated from the B9001 to the B9170. This increases congestion at the point where the B9170 enters Inverurie in the Do-Minimum Sensitivity test. The Violet route option attracts traffic from the B9170 (at Uryside Junction) that would in the Do-Minimum route through Inverurie. Therefore, the Violet route option provides greater congestion relief in Inverurie in the Sensitivity test compared with the Refined Core scenario.

26.5.5 With the Violet route option there is a reduction in traffic between Daviot Junction and Uryside Junction of 1,600vpd in the Sensitivity test, but as this is a short section of the Violet route option the economic impact is small.

26.5.6 In the Sensitivity test the Orange route option attracts 700 fewer trips per day than in the Refined Core scenario. The Orange route option does not attract traffic travelling between the B9170 and the A96 east of Inverurie as it does not have a junction with the B9170. As a result, in the Sensitivity test the end-to-end options that contain the Orange route option do not offer as much congestion relief in Inverurie compared to the Refined Core. The net result of these reallocated trips in the Sensitivity test is a slight reduction in the overall benefit of congestion relief in Inverurie generated by the Orange route option.

26.5.7 When compared with the Refined Core scenario, in the Sensitivity test the PVB slightly reduces by between £8m and £10m for the end-to-end options that contact the Orange route option. End-to-end options that contain the Violet route option increase by £4m to £7m in benefits under the Sensitivity test. Consequently, the end-to-end options containing the Violet route option deliver a slightly higher BCR under the Sensitivity test compared with the Refined Core scenario. Conversely, the end-to-end options containing the Orange route option deliver a slightly lower BCR compared with the Refined Core.

26.5.8 Although the BCR for end-to-end options with the Violet route option is slightly higher in the Sensitivity test, the end-to-end options with the Orange route option still perform better (between £59m and £67m more PVB) than the corresponding end-to-end options with the Violet route option.

26.5.9 The Sensitivity test slightly changes the scale of the benefits but does not materially change the overall comparative economic performance of the end-to-end options. The Cyan-Pink-Orange option continues to offer the highest economic performance in terms of value for money, whilst Cyan-Brown-Violet continues to offer the least value for money.

26.6 Summary

26.6.1 The economic assessment has been carried out to quantify the user benefits using TUBA version 1.9.13. TUBA uses traffic data outputs derived from the A96 CRAM. The impact of the end-to-end options on accidents savings has been evaluated by using COBALT version 2013.2. In each case the economic outputs have been deflated to 2010 values and discounted to 2010 prices.

26.6.2 The monetised economic and accidents benefits are compared with the scheme costs for each of the end-to-end options. BCR values are calculated then indexed (the highest indexed BCR being 100).

26.6.3 The economic analysis of the end-to-end options shows that the Cyan-Pink-Orange end-to-end option delivers the highest indexed BCR value, while the Cyan-Brown-Violet end-to-end option delivers the lowest indexed BCR value. In terms of the traffic performance of the individual route options, the Red, Pink and Orange route options perform better than the Cyan, Brown and Violet route options

respectively. However, the relatively lower cost of the Cyan route option compared to the Red route option results in similar indexed BCR values for the corresponding end-to-end options containing the Cyan and Red route options.

26.6.4 The Red-Pink-Orange option generates the highest accident benefits, reducing the number of road casualties by 1,679 over the 60-year appraisal period. The Cyan-Brown-Violet end-to-end option generates the lowest accident savings, reducing the number of road casualties by 1,263.

26.6.5 The significant difference in economic performance, and accident savings, between options is a result of some options being shorter and hence more attractive to traffic than others. The Cyan-Brown-Violet option offers the least benefit as it is the longest end-to-end option. This results in lower journey time savings attracting fewer vehicles onto the dual carriageway and less impact also on reducing casualties by taking less traffic off existing roads and onto the higher quality dual carriageway. In contrast the Red-Pink-Orange option, being the shortest end-to-end option provides the highest journey time savings and attracts more traffic away from lower standard single carriageway roads, and hence offers the highest economic benefit.

26.6.6 Although the scheme cost estimates are considered on an end-to-end basis, those options containing the Cyan route option are consistently less expensive than those containing the Red route option. Similarly, those containing the Pink route option are consistently less expensive than those containing the Brown route option. End-to-end options containing the Orange route option are slightly more expensive than those containing the Violet route option but provide better value, as they offer significantly greater benefits. As a result, end-to-end options containing the Orange route option have significantly higher indexed BCR values compared to the corresponding end-to-end options containing the Violet route option.

26.6.7 Taking account of the benefits and costs of the end-to-end options shown in Table 26.2, the Cyan-Pink-Orange option delivers the highest value for money with an indexed BCR of 100 (BCR value of 0.70) followed by the Red-Pink-Orange option with an indexed BCR of 98 (BCR value of 0.68).

26.6.8 The Sensitivity test does not materially change the overall comparative economic performance of the end-to-end options.

TRANSPORT SCOTLAND
CÒMHDHAIL ALBA

A96 DUALLING
EAST OF HUNTLY TO ABERDEEN

transport.gov.scot/projects/a96-dualling-inverness-to-aberdeen/a96-east-of-huntly-to-aberdeen