A82 Tarbet to Inverarnan Upgrade

DMRB Stage 1: Traffic and Economic Appraisal Report

Transport Scotland

March 2014

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DMRB Stage 1: Traffic and Economic Appraisal Report

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Appendices

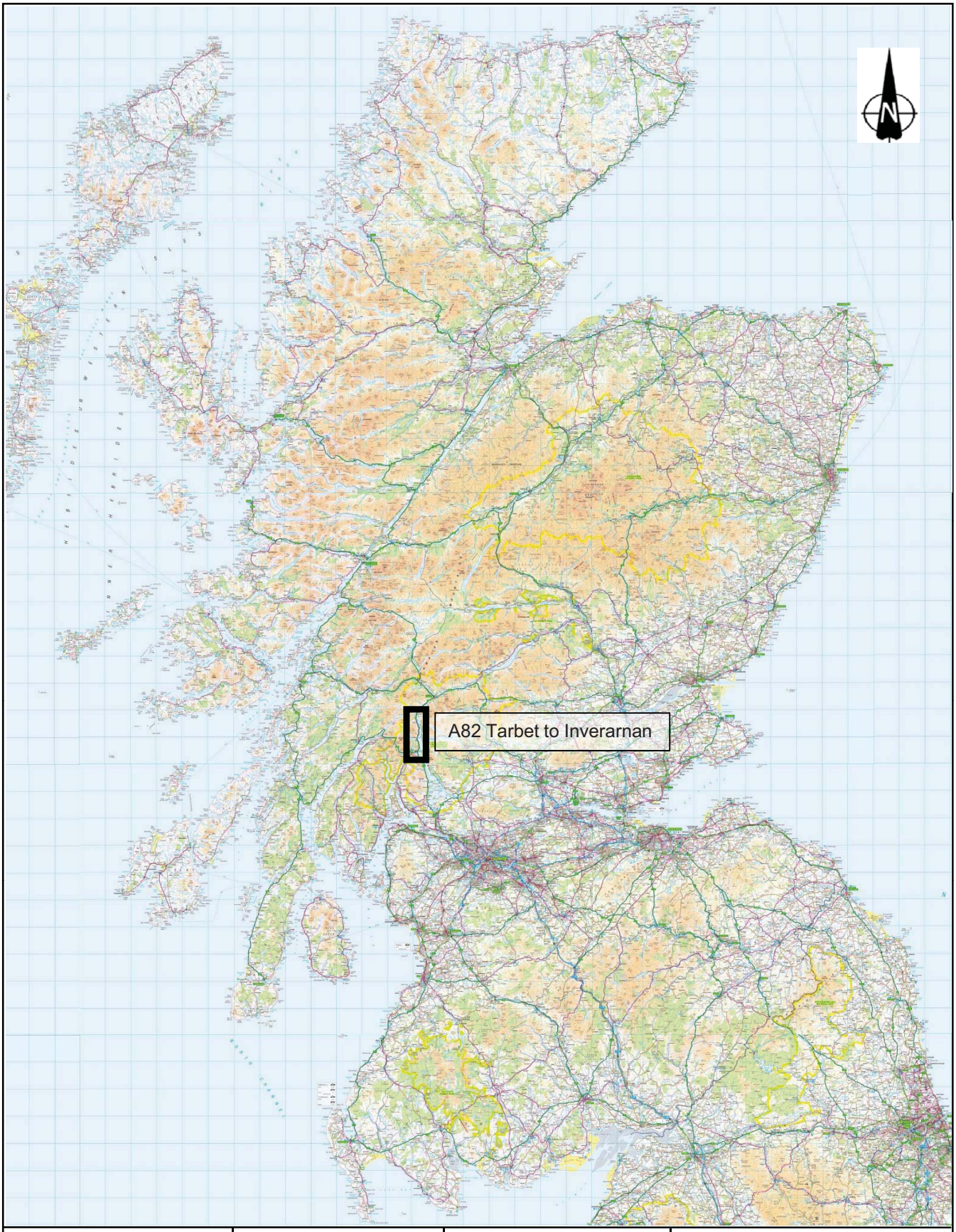
1 Introduction

CH2M HILL Fairhurst Joint Venture (CFJV) was appointed by Transport Scotland in June 2013, under the commission 'A82 Tarbet to Inverarnan A Single Supplier Framework Agreement for Provision of the Design, Investigative and Environmental Services', to carry out the necessary works to complete a Design Manual for Roads and Bridges (DMRB) Stage 1 and Stage 2 Assessments for the proposed upgrade of the A82 Trunk Road between Tarbet and Inverarnan.

The general location of the A82 upgrade is shown in Figure 1.1.

1.1 Purpose of the Traffic and Economic Appraisal Report

This report presents a traffic and economic appraisal of the three Corridor Options considered as part of the DMRB Stage 1 Scheme Assessment, in accordance with the requirements set out in the DMRB.



Key

A82 Tarbet to Inverarnan Upgrade

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A82 Tarbet to Inverarnan Upgrade

General Location Plan
Figure 1.1

2 Traffic Surveys and Data Collection

A detailed programme of traffic surveys and data collection was undertaken to assist in establishing current traffic volumes, turning movements, traffic patterns, and journey times within the area that could potentially be impacted by the upgrade options.

The location of the impact area is presented in Figure 2.1.

2.1 Permanent Automatic Traffic Counter Data

Traffic flow data from permanent Automatic Traffic Counter (ATC) sites within the impact area has been obtained from Transport Scotland's Scottish Road Traffic Database (SRTDb). The data provides hourly traffic flows for each day (where available) within the period January 2006 to June 2013 on the A82 and A83.

The locations of the permanent ATC sites are presented in Figure 2.2. A summary highlighting the 12-hour, 16-hour and 24-hour Annual Average Week Day Traffic (AAWDT) in 2012 as well as the Average Week Day Traffic (AWDT) flows during the peak holiday period (16th July 2012 to 15th August 2012) recorded by the ATCs is presented in Table 2.1.

Table 2.1: ATC data summary (2-Way Flows in 2012)

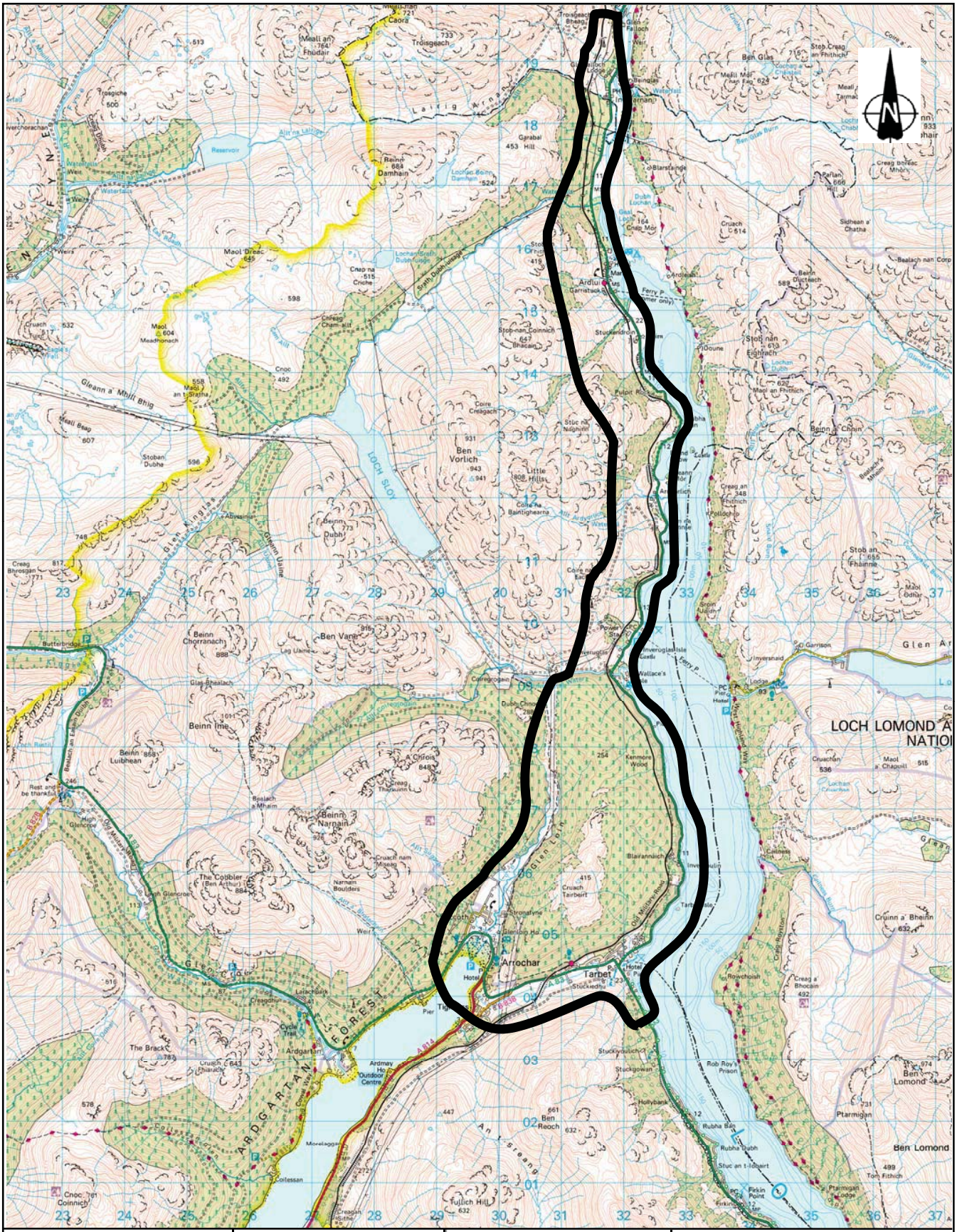
Counter	Location	AAWDT			AWDT
		12-hour	16-hour	24-hour	24-hour (16th Jul – 15th Aug)
A82					
ATC08119	South of Tarbet	5,910	6,794	7,014	9,133
ATCCS001	North of Tarbet	2,753	3,164	3,262	4,794
A83					
ATC08104	West of Tarbet	3,854	4,385	4,569	5,459
ATC08090	West of Arrochar	3,635	4,130	4,318	5,195
JTC08338	West of Arrochar	3,111	3,528	3,678	4,398

Full details of the traffic flow data collected from the permanent ATC sites is presented in Appendix A.

2.2 Temporary Automatic Traffic Counter Data

Traffic flow data from a temporary Automatic Traffic Counter (ATC) site was collected through Transport Scotland's Data Collection Commission at a single location. The temporary ATC was installed on the A814 at Arrochar for 7 days from 27th October 2013. The location of the temporary ATC is presented in Figure 2.2.

A summary of 12-hour, 16-hour and 24-hour traffic flows recorded by the temporary ATC is presented in Table 2.2



Key

Impact area

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Impact Area

Figure 2.1

Key

▲ **Permanent ATC Location**

△ **Temporary ATC Location**

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ATC Site Locations
Figure 2.2

Table 2.2: Temporary ATC data summary (2-way flows)

Day	12-hour flow (07:00 – 19:00)	16-hour flow (06:00 – 22:00)	24-hour flow (00:00 – 24:00)
Sunday, 27th Oct	736	845	882
Monday, 28th Oct	957	1,084	1,114
Tuesday, 29th Oct	976	1,150	1,188
Wednesday, 30th Oct	932	1,054	1,109
Thursday, 31st Oct	972	1,107	1,164
Friday, 1st Nov	942	1,076	1,135
Saturday, 2nd Nov	915	1,025	1,092
Average 5 Day	**956**	**1,094**	**1,142**
Average 7 Day	**919**	**1,049**	**1,098**

Full details of the traffic flow data collected from the temporary ATC site is presented in Appendix A.

2.3 Turning Count Surveys

Turning count data was collected through Transport Scotland's Data Collection Commission at the following locations within the study area on Wednesday, 30th October 2013:

- Site 1 – A82 / A83 Junction, Tarbet;
- Site 2 – A83 / A814 Junction, Arrochar;
- Site 3 – A82 / Loch Lomond Holiday Park Junction; and
- Site 4 – A82 / Ardlui Hotel Junction.

The locations of the turning count surveys are presented in Figure 2.3. Surveys were undertaken using video footage, providing data in 5 minute intervals between 07:00 and 19:00 for the following classifications:

- Cars;
- Light Good Vehicles (LGV);
- Other Goods Vehicles 1 (OGV1);
- Other Goods Vehicles 2 (OGV2); and
- Passenger Service Vehicles (PSV).

A summary of the information collected on the day of survey is presented in Table 2.3

Key

▭ (MCC) Location

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Manual Classified Count (MCC) Locations

Figure 2.3

Table 2.3: Turning count summary

Site	Location	12-hr traffic flow (07:00 – 19:00)
Site 1	A82 (S) to A82 (N)	917
	A82 (S) to A83 (W)	1,503
	A83 (W) to A82 (S)	1,622
	A83 (W) to A82 (N)	245
	A82 (N) to A82 (S)	1,112
	A82 (N) to A83 (W)	218
Site 2	A83 (E) to A83 (W)	1,447
	A83 (E) to A814	144
	A83 (W) to A83 (E)	1,597
	A83 (W) to A814	311
	A814 to A83 (W)	310
	A814 to A83 (E)	165
Site 3	A82 (S) to Holiday Park	13
	Holiday Park to A82 (S)	19
	A82 (N) to Holiday Park	7
	Holiday Park to A82 (N)	5
Site 4	A82 (S) to Ardlui	99
	Ardlui to A82 (S)	100
	A82 (N) to Ardlui	34
	Ardlui to A82 (N)	35

Full details of the turning count surveys are presented in Appendix B.

2.4 Journey Time Surveys

Journey time surveys were undertaken through Transport Scotland's Data Collection Commission along the A82 and A83 routes within the study area in October 2013. Two journey routes were surveyed as follows:

- Route 1 – A82 from Sloy Power Station to North of Inverarnan; and
- Route 2 – A82 from South of Tarbet to Sloy Power Station via the A83 west of Arrochar.

Surveys were undertaken on Tuesday, 29th and Wednesday, 30th October 2013 between 07:00 and 19:00, using the moving observer method in line with the Design Manual for Roads and Bridges (DMRB) Volume 12, Section 2, Part 1, Chapter 3.2.25. Journey times were recorded using in car video and utilised Global Positioning System (GPS) data logging to record the position of each vehicle in 1 second intervals during each journey time run.

The extents of the journey routes are presented in Figures 2.4a and 2.4b and a summary of the information collected on the day of survey is presented in Tables 2.4a and 2.4b for the A82 and A83 respectively.

Table 2.4a: Journey time survey summary (A82)

Timing points	Average journey time (mins:secs)	
	NB / WB	SB / EB
Route 1		
1-2	2:43	2 :56
2-3	1:36	1:32
3-4	2:35	2:38
4-5	2:00	1:56
5-6	2:44	2:19
6-7	0:38	0:34
7-8	0:05	0:04
Route 2		
1-2	0:20	0:21
2-10	0:47	0:48
10-11	4:57	4:48
11-12	0:40	0:35

► J1 JT Measurement Point

○► J1 JT Speed Limit Measurement Point

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A82 Tarbet to Inverarnan Upgrade

Journey Time Survey
Route 1
Figure 2.4a

J1 JT Measurement Point

J1 JT Speed Limit Measurement Point

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Journey Time Survey
Route 2
Figure 2.4b

Table 2.4b: Journey time survey summary (A83)

Timing points	Average journey time (mins:secs)	
	NB / WB	SB / EB
Route 2		
2-3	1:13	1:17
3-4	0:45	0:43
4-5	0:15	0:13
5-6	0:38	0:33
6-7	0:56	0:52
7-8	0:03	0:02
8-9	0:34	0:36
Total	**4:24**	**4:16**

Full details of the journey time surveys are presented in Appendix C.

2.5 Automatic Number Plate Recognition Surveys

Automatic Number Plate Recognition (ANPR) data was collected through Transport Scotland's Data Collection Commission in August and October 2013. Surveys were undertaken using video footage for the period 07:00 to 19:00 recording the time and classification of each vehicle passing each of the survey cameras.

2.5.1 August 2013 Surveys

Surveys were undertaken on Friday 9th, Saturday 10th and Sunday 11th August, within the school holiday period, to validate the operational constraints along the existing A82 route.

ANPR cameras were located on the A82, between Tarbet and Inverarnan, at the following locations:

- Site 1 – 30/60mph speed limit change point north of Tarbet;
- Site 2 – Pulpit Rock Temporary Signals (South);
- Site 3 – Pulpit Rock Temporary Signals (North); and
- Site 4 – Bridge at Inverarnan (South of Drovers Inn).

The locations of the ANPR cameras are presented in Figure 2.5.

The number of recorded vehicles, the number of recorded registrations and the sample rate are presented in Table 2.5a. Table 2.5b presents the number of matched registrations and the match rate between adjacent sites (i.e. Site 1 to Site 2, Site 2 to Site 3, etc.).

Key

▲ **ANPR Camera Location**

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August 2013 Automatic Number Plate Recognition (ANPR) Camera Locations

Figure 2.5

Table 2.5a: ANPR sample rate summary (Friday, 9th to Sunday, 11th August 2013)

Site	No. of recorded vehicles (overhead cameras)		No. of recorded reg. (sample rate (%) = reg / vehs)	
	NB	SB	NB	SB
Friday, 9th August 2013				
Site 1	2,666	2,281	2,644 (99.2%)	2,265 (99.3%)
Site 2	2,512	2,334	2,494 (99.3%)	2,251 (96.4%)
Site 3	2,503	2,345	2,475 (98.9%)	2,308 (98.4%)
Site 4	2,419	2,455	2,339 (96.7%)	2,415 (98.4%)
Saturday, 10th August 2013				
Site 1	3,408	2,965	3,397 (99.7%)	2,952 (99.6%)
Site 2	3,275	2,992	3,256 (99.4%)	2,987 (99.8%)
Site 3	3,253	2,954	3,248 (99.8%)	2,954 (100%)
Site 4	3,156	3,131	3,066 (97.1%)	3,070 (98.1%)
Sunday, 11th August 2013				
Site 1	2,058	2,381	2,056 (99.9%)	2,377 (99.8%)
Site 2	1,917	2,518	1,911 (99.7%)	2,470 (98.1%)
Site 3	1,911	2,472	1,909 (99.9%)	2,461 (99.6%)
Site 4	1,886	2,587	1,834 (97.2%)	2,584 (99.9%)

Table 2.5b: ANPR match rate summary (Friday, 9th to Sunday, 11th August 2013)

	No. of matched reg. (match rate (%) = matched reg. / recorded reg. at origin)			
	Site 1	**Site 2**	Site 3	Site 4
Friday, 9th August 2013				
Site 1	-	2,409 (91.9%)	-	-
Site 2	1,974 (85.5%)	-	2,375 (95.2%)	-
Site 3	-	1,958 (87%)	-	2,098 (84.8%)
Site 4	-	-	1,958 (86.4%)	-
Saturday, 10th August 2013				
Site 1	-	3,035 (89.3%)	-	-
Site 2	2,324 (78.7%)	-	2,967 (91.1%)	-
Site 3	-	2,380 (79.7%)	-	2,790 (85.9%)
Site 4	-	-	2,743 (92.9%)	-
Sunday, 11th August 2013				
Site 1	-	1,803 (87.7%)	-	-
Site 2	2,300 (93.5%)	-	1,818 (95.1%)	-
Site 3	-	2,318 (93.8%)	-	1,533 (80.3%)
Site 4	-	-	2,220 (93.4%)	-

It can be seen from Table 2.5a that registration plates were recorded for over 96% of vehicles that passed each survey camera. Of those registrations recorded, the match rates range from 78.7% to 95.2% with values typically in excess of 85% as shown in Table 2.5b.

Full details of the ANPR data collected in August 2013 is presented in Appendix D.

2.5.2 October 2013 Surveys

Surveys were undertaken on Thursday, 31st October to confirm typical journey times and traffic patterns within the impact area.

ANPR cameras were located at the following locations:

- Site 1 – A82, 30/60mph speed limit change point south of Tarbet;
- Site 2 – A814, south of A83 Junction;
- Site 3 – A83, 60/40mph speed limit change point of Arrochar;
- Site 4 – A82, south of Sloy Power Station; and
- Site 5 – A82, south of Glen Falloch.

The locations of the ANPR cameras are presented Figure 2.6.

The number of registration plates that were recorded on the day of survey, the number of vehicles recorded, the sample rate, the number of matched registrations and the match rate are presented in Table 2.6

Table 2.6: ANPR sample rate summary (Thursday, 31st October 2013)

Site	No. of recorded vehicles (overhead cameras)		No. of recorded reg. (sample rate (%) = Reg / vehs)		No. of matched reg. (match rate (%) = matched reg. / recorded reg. at origin)	
	NB / WB	SB / EB	NB / WB	SB / EB	NB / WB	SB / EB
Site 1	2,530	2,884	2,133 (84%)	2,670 (93%)	966 (45.3%)	1,150 (43.1%)
Site 2	508	465	477 (94%)	434 (93%)	199 (41.7%)	232 (53.5%)
Site 3	1,719	1,556	1,579 (92%)	640 (41%)	1,030 (65.2%)	414 (61.7%)
Site 4	1,015	1,241	1,218 (98%)	935 (92%)	1,097 (90.1%)	501 (53.6%)
Site 5	921	1,171	871 (95%)	1,069 (91%)	347 (39.8%)	957 (89.5%)

It can be seen from Table 2.6 that the number of registration plates recorded were generally over 91% of vehicles that passed each survey camera. Due to adverse weather conditions on the day of survey, which caused issues recording registration plates, match rates are generally low. Of those registrations recorded, the match rates range from 39.8% to 90.1% with values typically between 40% and 65%.

Full details of the ANPR data collected in October 2013 is presented in Appendix D.

Key

▲ **ANPR Camera Location**

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October 2013 Automatic Number Plate Recognition (ANPR) Camera Locations
Figure 2.6

2.6 Accident Data

Accident data, obtained from Transport Scotland provides a record of accident dates, severity and causation factors within the period January 2000 to December 2012 within the impact area.

A summary of the accidents occurring on the A82 and A83 within the impact area, by severity, is presented in Table 2.7 and in Figure 2.7.

Table 2.7: Accident numbers within the impact area (2000 – 2012)

Year	Accident severity			
	Fatal	Serious	Slight	Total
2000	0	14	14	28
2001	0	2	10	12
2002	1	6	12	19
2003	3	5	9	17
2004	0	4	3	7
2005	1	2	5	8
2006	1	6	6	13
2007	2	2	11	15
2008	3	4	9	16
2009	0	4	13	17
2010	0	4	8	12
2011	0	5	11	16
2012	0	5	12	17


Arrochar
Tarbet
Tighness
Ardgartan
ARDGARTAN FOREST
LOCH LOMOND
Ben Lomond
Ben Vorlich
Beinn Narnain
The Cobbler
Ben Reoch
Fullich Hill
Ben Vane
Beinn Ime
Beinn Chorranach
Beinn Luibhean
Beinn Damhain
Garabal Hill
Ben Glas
Cruach Tairbeirt
Inveruglas
Succoth
Butterbridge
Glen Croe
Glen Loin
Loch Sloy
Loch Lomond
Key
Fatal
Serious
Slight (Minor)
Client
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CH2MHILL
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Impact Area Accidents
2000 – 2012
Figure 2.7
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3 Existing Traffic Conditions

This section outlines the existing traffic conditions on the A82 between Tarbet and Inverarnan.

3.1 A82 Tarbet to Inverarnan Description

3.1.1 Traffic Flows

Data obtained from the SRTDb indicates that the Average Annual Daily Traffic (AADT) flow on the A82 between Tarbet and Inverarnan in 2012 was 3,600 vehicles. Due to the nature of the route, which attracts a number of tourists, traffic flows increase significantly during the summer months with traffic flows in 2012 of up to 9,100 vehicles in a single day.

The monthly variation in average daily traffic flows for the section of the A82 between Tarbet and Inverarnan is shown in Figure 3.1.

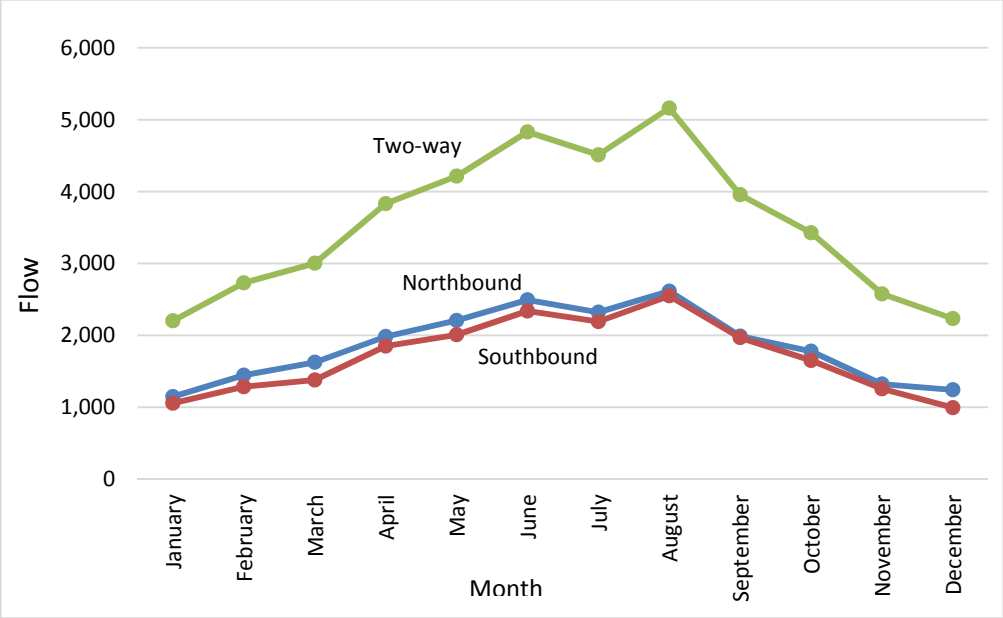

Figure 3.1: Monthly average daily traffic flows (2012)

Whilst Figure 3.1 indicates that the average daily flow in July 2012 is lower than in June 2012, an examination of monthly average daily traffic flows for the ten year period between 2003 and 2012 has confirmed that the July and August summer months normally contain higher monthly average daily traffic flows than the rest of the year.

Average daily traffic flows profiles for weekdays and weekends in 2012 are presented in Figures 3.2a and 3.2b respectively.

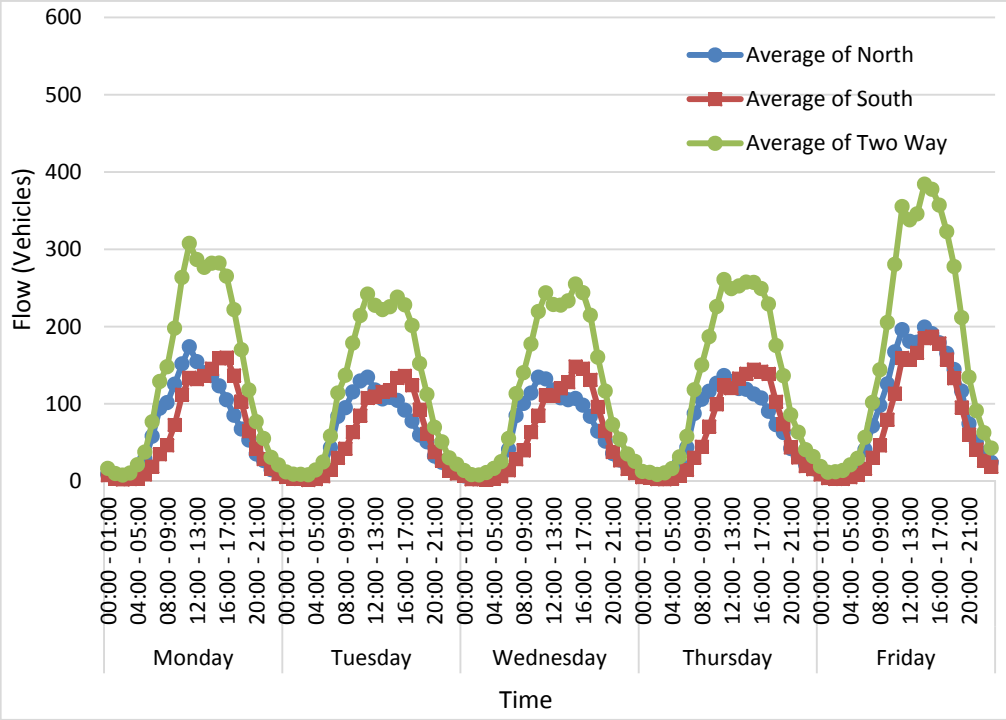

Figure 3.2a: Average daily traffic flow profile (weekdays)

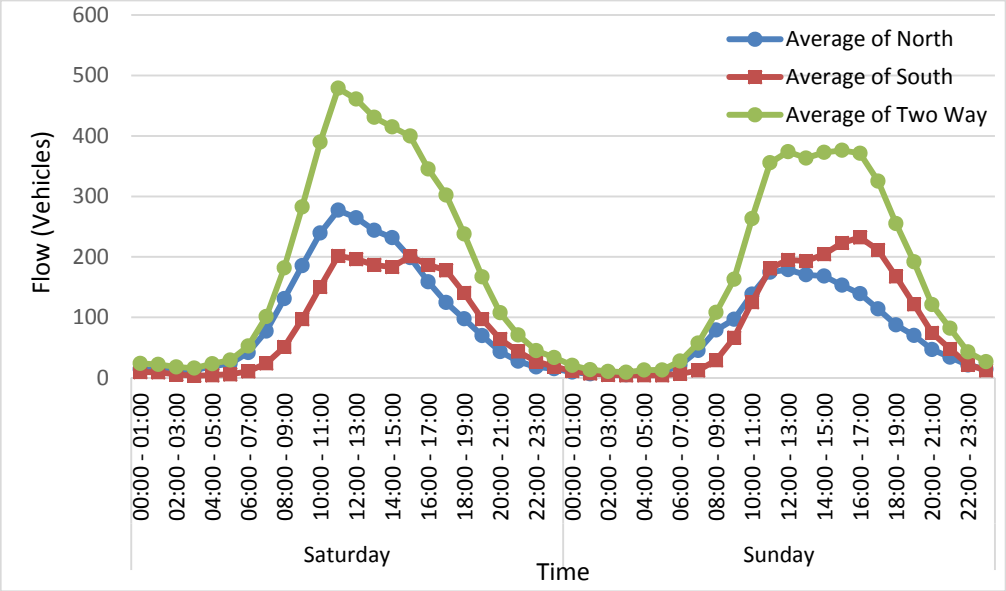

Figure 3.2b: Average daily traffic flow profile (weekends)

Average flow levels during the weekend are typically higher than average weekday levels with the route experiencing higher flows on Saturday morning in the northbound direction of travel and Sunday afternoon in the southbound direction. This suggests that a number of leisure trips between the Central Belt and north west Scotland take place during the weekend.

3.1.2 Vehicle Composition

The 12-hour vehicle composition observed on 31st October 2013 was recorded as follows:

- Cars – 72.7%
- Light Good Vehicles (LGV) – 19.1%
- Other Goods Vehicles 1 (OGV1) – 3.3%
- Other Goods Vehicles 2 (OGV2) – 3.7%
- Passenger Service Vehicles (PSV) – 1.3%

3.1.3 Journey Times and Vehicle Speeds

Whilst the route from Tarbet to Inverarnan is designated as national speed limit - 60 miles per hour (mph), the alignment does not allow vehicles to attain such speeds without compromising safety. Traffic volumes are relatively low compared to the capacity of the road and the low average speed is as a result of alignment constraints and limited overtaking opportunities. Vehicle platooning is also evident, leading to unreliable journey times and the potential for driver frustration.

Vehicle journey times between Tarbet and Inverarnan (from the speed limit sign, east of Tarbet to the road bridge on the southern approach to Inverarnan) were recorded in August 2013 (within the school holiday period) and those for Friday, 9th August 2013 are presented in Figure 3.3.

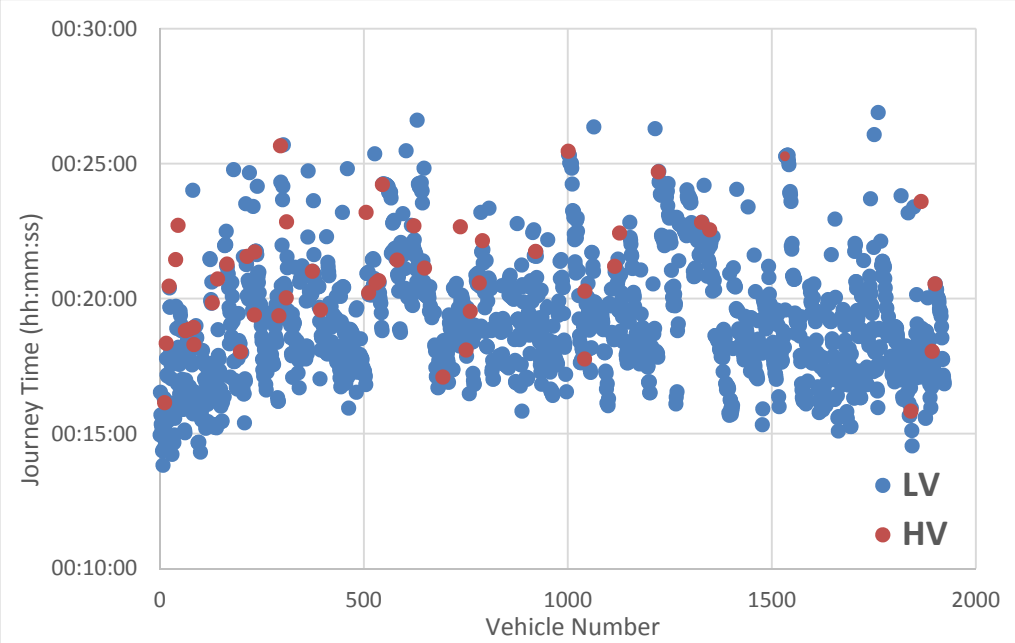

Figure 3.3: Vehicle journey times (Tarbet to Inverarnan)

As indicated in Figure 3.3, journey times between Tarbet and Inverarnan on the 9th August 2013 varied between 14 and 26 minutes. The time to travel in free flow conditions (assumed to be around 7am) was approximately 15 minutes, which equates to an average speed of approximately 40mph. The average journey time between Tarbet and Inverarnan was around 19.5 minutes, which equates to

approximately 27 mph. This includes the time taken to negotiate the traffic signals at Pulpit Rock.

In order to isolate the effect of the traffic signals at Pulpit Rock, a summary of the average journey times observed on the sections of the route from Tarbet to south of Pulpit Rock and from north of Pulpit Rock to Inverarnan during the August 2013 surveys is presented in Table 3.1a.

Table 3.1a: Average observed journey times (August 2013)

	Friday (9th Aug 2013)	Saturday (10th Aug 2013)	Sunday (11th Aug 2013)
Tarbet to South of Pulpit Rock	11.14	11.46	11.13
North of Pulpit Rock to Inverarnan	4.25	4.27	4.30

The values presented in Table 3.1a indicate that average observed journey time from Tarbet to south of Pulpit Rock was greater on Saturday, compared with that on both Friday and Sunday. This can be explained, at least in part, by the higher level of traffic using the route on the Saturday. Average journey times from north of Pulpit Rock to Inverarnan were fairly consistent, reflecting the less constrained nature of the route to the north of Pulpit Rock.

Journey times recorded in October 2013 over similar extents, using the moving observer method, are presented in Table 3.1b.

Table 3.1b: Average observed journey times (October2013)

	Tuesday/Wednesday (29th/30th Oct 2013)
Tarbet to South of Pulpit Rock	9:54
North of Pulpit Rock to Inverarnan	4.30

Whilst the journey times recorded in August and October 2013 are not directly comparable, they suggest that journey times from Tarbet to south of Pulpit Rock in October are lower than those during the busy August summer period, as expected. Differences from north of Pulpit Rock to Inverarnan are less pronounced with journey times in August and October broadly similar.

3.1.4 Accidents

A review of accident data for the A82 between Tarbet and Inverarnan covering the period 2008 to 2012 indicates that killed or serious injury (KSI) accident rates are over four times the national average. A summary of accident numbers on the A82 by severity is presented in Table 3.2 below.

Table 3.2: Accident numbers on the A82 Tarbet to Inverarnan (2008 – 2012)

Year	Accident Severity			
	Fatal	Serious	Slight	Total
2008	3	2	6	11
2009	0	3	7	10
2010	0	4	5	9
2011	0	4	8	12
2012	0	3	8	11
Total	**3**	**16**	**34**	**53**

It can be seen from the summary above that annual accident numbers between Tarbet and Inverarnan have been fairly consistent over the past 5-years, totalling 53 personal injury accidents – 3 of which were fatal, 16 serious and 34 minor. Ten accidents involved a motorcycle, 9 of which resulted in a fatal or serious personal injury.

The location of accidents on the A82 between Tarbet and Inverarnan is shown in Figure 3.4. Accidents are generally spread along the route, however, clusters are evident at the sharp bend in the vicinity of Inveruglas Holiday Park and at Pulpit Rock.

Of the 53 accidents, 28 (52.8%) occurred on a bend and 15 (28.3%) involved a vehicle leaving the road and hitting an object.

The main contributory factors are illustrated in Figure 3.5.

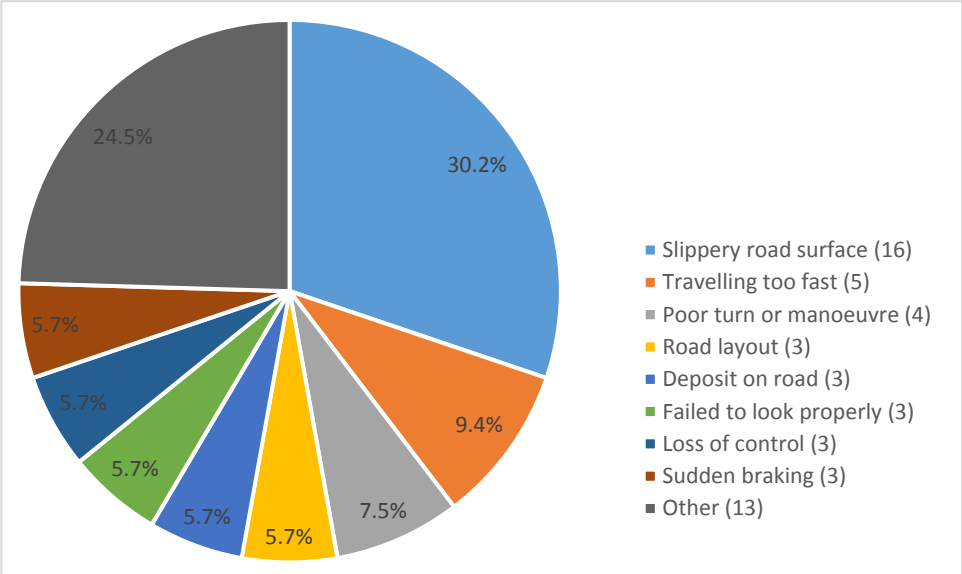

Figure 3.5: Main accident contributory factors (Tarbet to Inverarnan)

Key

○ Fatal

○ Serious

○ Slight (Minor)

Client

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A82 Tarbet to Inverarnan Upgrade

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A82 Accidents
2008 – 2012
Figure 3.4

4 Base Model Development

A NESA11 Base model has been developed using the data collected as part of a programme of traffic surveys undertaken in October 2013, supplemented by Automatic Traffic Count (ATC) data.

4.1 Base Network Definition

The NESA Base network was defined to include the routes that are likely to experience a change in conditions as a result of the proposed upgrade. The modelled network therefore consists of the A82 route from Tarbet to Inverarnan and the A83 from Tarbet to west of Arrochar.

The extent of the highway network included in the NESA Base model, including the location of the network links and nodes, is shown in Figure 4.1. The key Base network characteristics, including link type, length and current speed limits, are shown in Tables 4.1a and 4.1b.

Table 4.1a: Base network description – A82 Tarbet to Inverarnan

Node ref.	Length (km)	Speed limit (mph)	Link description
A82 Tarbet to South of Pulpit Rock			
95 100	0.250	30	Urban - single 7.3m
100 105	0.335	30	Urban - single 6.0m
105 110	0.248	30	Urban - single 6.0m
110 115	0.817	60	Rural - poor single 6.0m
115 120	3.600	60	Rural - poor single 6.0m
120 125	0.467	60	Rural - poor single 6.0m
125 130	0.084	60	Rural - poor single 6.0m
130 135	1.330	60	Rural - poor single 6.0m
135 140	1.691	60	Rural - poor single 6.0m
Pulpit Rock			
140 145	0.510	60	Rural - poor single 6.0m


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Tighnabruaich
LOCH LOMOND
ARDGARTAN FOREST
Ben Lomond
Ben Vorlich
Beinn Narnain
The Cobbler
Ben Reoch
Ben Glas
Beinn Damhain
Beinn Ime
Beinn Luibhean
Beinn Chorranach
Ben Vane
Glen Croe
Glen Loin
Loch Sloy
Loch Lomond
Key
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Zone
Do-Nothing Link
Client
TRANSPORT SCOTLAND
The Scottish Government
A82 Tarbet to Inverarnan Upgrade
CH2MHILL
FAIRHURST
CH2M Hill Fairhurst JV
NESA Base
Node Diagram
Figure 4.1
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Table 4.1a: Base network description – A82 Tarbet to Inverarnan (Continued)

Node ref.	Length (km)	Speed limit (mph)	Link description
A82 North of Pulpit Rock to Inverarnan			
145 150	0.501	60	Rural - poor single 6.0m
150 155	0.800	60	Rural - poor single 6.0m
155 160	0.711	60	Rural - poor single 6.0m
160 165	0.182	60	Rural - poor single 6.0m
165 170	0.207	60	Rural - poor single 6.0m
170 175	0.801	60	Rural - poor single 6.0m
175 180	1.770	60	Rural - poor single 6.0m
180 185	1.037	60	Rural - poor single 6.0m
185 190	0.293	60	Rural - poor single 6.0m
190 195	0.166	60	Rural - poor single 6.0m
195 200	0.279	60	Rural - poor single 6.0m
200 205	0.204	60	Rural - poor single 6.0m

Table 4.1b: Base Network Description – A83 Tarbet to Arrochar

Node ref.	Length (km)	Speed limit (mph)	Link description
A83 Tarbet to Arrochar			
100 300	0.719	30	Urban - single 6.0m
300 305	0.283	30	Urban - single 6.0m
305 310	0.847	60	Rural - poor single 6.0m
310 315	0.300	60	Rural - poor single 6.0m
315 325	0.493	30	Urban - single 6.0m
325 330	0.638	30	Urban - single 6.0m
330 335	0.042	30	Urban - single 6.0m
335 340	0.499	40	Urban - single 6.0m

4.2 Traffic Flows

Traffic flow levels on the A82, A83 and A814 have been derived from available turning count data and permanent ATC data. Turning proportions at the A82/A83 Tarbet junction and the A83/A814 Arrochar junction have been defined based on turning count data collected in October 2013.

As ATC data for 2012 represents the most recent complete data, this was used to define traffic flow factors to adjust 12-hour turning count flows on the day of survey to 12-hour AAWDT flows for 2013.

As the 12-hour AWDT flow in October 2012 was approximately 3.4% lower than the 2012 12-hour AAWDT flow, based on the traffic flow data from the permanent ATC located north of Tarbet on the A82 (ATCCS001), a traffic flow adjustment factor of

1.034 was applied to the A82/A83 Tarbet junction flows to derive equivalent 12-hour AAWDT flows for 2013.

Examination of the traffic flow data recorded by the permanent ATC located west of Tarbet on the A83 (ATC08104) indicates that the 12-hour AWDT flow in October 2012 was approximately 0.7% lower than the 2012 12-hour AAWDT flow. A traffic flow adjustment factor of 1.007 was therefore applied to the A83/A814 Arrochar junction flows to derive equivalent 12-hour AAWDT flows for 2013.

Based on the turning count data recorded in October 2013 and the permanent ATC data, the 12-hour AAWDT flows on the A82, A83 and A814 in 2013 are predicted to be as follows:

- A82 (South of Tarbet) Northbound – 2,501 vehicles
  Southbound – 2,826 vehicles
- A82 (North of Inverarnan) Northbound – 1,127 vehicles
  Southbound – 1,294 vehicles
- A83 (West of Arrochar) Westbound – 1,769 vehicles
  Eastbound – 1,921 vehicles
- A814 (South of Arrochar) Northbound – 478 vehicles
  Southbound – 458 vehicles

4.2.1 Traffic Adjustment Factors (E- Factor, M-Factor & Seasonality Index)

The data available from counter ATCCS001, located on the A82 to the north of Tarbet, has been used to derive a local E-Factor, M-Factor and Seasonality Index.

The E-Factor measures the variation between 12-hour and 16-hour AWDT and the M-Factor converts the 16-hour AWDT flow to an Annual Flow.

The Seasonality Index measures the variation that occurs in daily traffic flows throughout the year and is defined as the ratio of the 24-hour AWDT for the peak holiday period (16th July to 15th August) to the 24-hour AAWDT.

An E-Factor of 1.15, M-Factor of 412 and Seasonality Index of 1.47 have been derived based on the following 2012 flows:

- 12-hour AAWDT – 2,753 vehicles;
- 16-hour AAWDT – 3,164 vehicles;
- 24-hour AAWDT – 3,262 vehicles;
- 24-hour AWDT (16th July to 15th August) – 4,794 vehicles; and
- Annual Flow – 1,302,068 vehicles.

4.2.2 Vehicle Composition

The vehicle composition used in the economic appraisal is based on the 12-hour weekday information collected on the A82 between Tarbet and Inverarnan in October 2013, which is as follows:

- Cars – 72.7%;
- Light Good Vehicles (LGV) – 19.1%;
- Other Goods Vehicles 1 (OGV1) – 3.3%;
- Other Goods Vehicles 2 (OGV2) – 3.7%; and
- Passenger Service Vehicles (PSV) – 1.3%.

4.3 Trip Matrix

4.3.1 Zoning System

To provide a reasonable representation of trip patterns within the impact area, the following seven zones were defined:

- Zone 1 – A82 south at Auchendarroch;
- Zone 2 – A82 north of Inverarnan;
- Zone 3 – A83, west of Arrochar;
- Zone 4 – A814 at three villages hall;
- Zone 5 – Loch Lomond Holiday Park;
- Zone 6 – Ardlui Hotel; and
- Zone 7 – Between Tarbet and Arrochar at Railway Station.

The locations of these zones are shown in Figure 4.1

4.3.2 Trip Matrix Building

ANPR surveys were undertaken in October 2013 to define typical trip patterns in the impact area. Due to adverse weather conditions on the day of survey, the percentage of matched plates at eight of the ten ANPR sites was below 66% (four of which were in the range 40 - 46%). As these sample rates are not considered sufficient to provide a suitable basis on which to derive robust trip patterns, trips between the seven modelled zones were estimated through consideration of the likely origin and destination of trips and applying the observed turning proportions to flows entering the network from each zone (in-flow).

The estimated 12-hour O-D proportions used in the model are presented in Table 4.2, which give rise to the 12-hour AAWDT all vehicle matrix presented in Table 4.3.


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Arrochar
Tighnabruaich
LOCH LOMOND
ARDGARTAN FOREST
Ben Lomond
Ben Vorlich
Beinn Narnain
The Cobbler
Ben Reoch
Ben Glas
Beinn Damhain
Beinn Ime
Beinn Luibhean
Beinn Chorranach
Ben Vane
Glen Croe
Glen Loin
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Table 4.2: Modelled 12-hour O-D proportions (all vehicles)

	1 A82 (S)	2 A82 (N)	3 A83	4 A814	5 LLHP	6 AH	7 T/A	Total
1 A82 (S)	0%	34%	48%	5%	0%	3%	9%	**100%**
2 A82 (N)	81%	0%	12%	1%	1%	3%	2%	**100%**
3 A83	62%	8%	0%	16%	0%	1%	13%	**100%**
4 A814	26%	4%	65%	0%	0%	0%	5%	**100%**
5 LLHP	66%	19%	10%	1%	0%	2%	2%	**100%**
6 AH	62%	26%	9%	1%	0%	0%	2%	**100%**
7 T/A	72%	10%	16%	2%	0%	1%	0%	**100%**

Notes: LLHP = Loch Lomond Holiday Park; AH = Ardlui Hotel; T/A = Tarbet/Arrochar

Table 4.3: Modelled 12-hour AAWDT (all vehicles)

	1 A82 (S)	2 A82 (N)	3 A83	4 A814	5 LLHP	6 AH	7 T/A	In-flow Total
1 A82 (S)	0	857	1,201	120	11	80	233	**2,501**
2 A82 (N)	1,047	0	159	16	7	35	31	**1,294**
3 A83	1,188	162	0	313	2	15	241	**1,921**
4 A814	123	17	312	0	0	2	25	**478**
5 LLHP	16	5	2	0	0	0	0	**25**
6 AH	86	36	13	1	1	0	3	**140**
7 T/A	366	50	82	8	1	5	0	**512**
Out-flow Total	**2,826**	**1,127**	**1,769**	**458**	**21**	**52**	**533**	

Notes: LLHP = Loch Lomond Holiday Park; AH = Ardlui Hotel; T/A = Tarbet/Arrochar

Five 12-hour 2013 AAWDT trip matrices were derived by manually applying the 12-hour vehicle composition to the AAWDT matrix and adjusting the flows to take into account the likely origin and destination of trips by vehicle type.

4.4 Model Calibration and Validation

The NESA Base model has been calibrated to the predicted traffic flows and turning movements and validated against observed journey times.

4.4.1 Trip Assignment

As there are no competing routes in the Base network for traffic reassignment, the model is considered to provide an accurate representation of typical traffic flows within the impact area based on the available information.

The GEH statistics presented in Table 4.4a for the 24-hour AADT flows on key links in the NESA Base model confirm the accuracy of the model assignment. As expected, the flow comparisons are all well within the recommended value of 5 set out in DMRB Volume 15, Table 9/2/1.

Table 4.4a: GEH Assignment Statistics (2013 24-Hour AADT)

Node ref.	Modelled flow	Predicted flow	GEH
110 115	3,350	3,344	0.11
310 315	4,392	4,384	0.13

In order to confirm the suitability of the predicted 2013 flows in the NESA Base model, the modelled 24-hour AADT flow on the key links has also been compared against the 2013 flows from the permanent ATCs. The GEH statistic for the key links are presented in Table 4.4b and show that the flow comparisons are all well within the recommended value of 5 set out in DMRB Volume 15, Table 9/2/1.

Table 4.4b: GEH Flow Suitability Statistics (2013 24-Hour AADT)

Node ref.	Modelled flow	Observed flow	GEH
110 115	3,350	3,330 *	0.35
310 315	4,392	4,459 ^	1.01

** based on data from ATCCS001*
^ based on data from ATC08104

The 2013 12-hour AAWDT and 24-hour AADT flows in the NESA Base model are shown in Figure 4.2.

4.5 Journey Times

Vehicle journey times along the two sections of the A82 route from Tarbet to south of Pulpit Rock and from north of Pulpit Rock to Inverarnan as well as on the A83 from Arrochar to Tarbet were recorded as part of the moving observer surveys undertaken in October 2013. These surveys were carried out between the hours of 07:00 and 19:00 on the 29th and 30th October 2013, avoiding the impact of the temporary traffic signals in place as part of the Pulpit Rock construction work.

For the purpose of the economic appraisal, the observed journey times (presented in Tables 2.4a and 2.4b) have been compared against journey times output from the model. Average model journey times along the A82 and A83 for all vehicles on the Base network in 2013 are shown in Tables 4.5a and 4.5b.

Table 4.5a: Base network journey times (2013) – A82

Node ref.	Average 2-way journey times (mins:secs)			
	Flow group 2	Flow group 3	Flow group 4	Ave of flow group 2 to 4
Tarbet to South of Pulpit Rock				
95 100*	0:27	0:29	0:31	0:29
100 105*	0:33	0:34	0:34	0:34
105 110	0:19	0:19	0:20	0:19
110 115	0:54	0:55	0:55	0:55
115 120	3:32	3:35	3:37	3:35
120 125	0:22	0:22	0:22	0:22
125 130	0:05	0:05	0:05	0:05
130 135	3:00	3:02	3:04	3:02
135 140	1:47	1:48	1:49	1:48
Total	**11:03**	**11:12**	**11:22**	**11:13**
North of Pulpit Rock to Inverarnan				
145 150	0:28	0:29	0:29	0:29
150 155	0:37	0:37	0:37	0:37
155 160	0:34	0:34	0:35	0:34
160 165	0:12	0:12	0:12	0:12
165 170	0:10	0:10	0:10	0:10
170 175	0:36	0:36	0:36	0:36
175 180	1:39	1:40	1:41	1:40
180 185	0.01	0.01	0.01	0.01
185 190	0.15	0.15	0.15	0.15
190 195	0.07	0.07	0.07	0.07
295 200	0.12	0.12	0.12	0.12
200 205	0.09	0.09	0.09	0.09
Total	**5:04**	**5:07**	**5:10**	**5:07**

*Notes: * includes junction delay*

Table 4.5b: Base network journey times (2013) – A83

Node Ref.	Average 2-Way Journey Times (mins:secs)			
	Flow Group 2	Flow Group 3	Flow Group 4	Ave of Flow Group 2 to 4
100 300	1:00	1:01	1:02	1:01
300 305	0:22	0:22	0:22	0:22
305 310	0:40	0:41	0:41	0:41
310 315	0:13	0:13	0:13	0:13
315 325	0:36	0:36	0:37	0:36
325 330	0:47	0:47	0:48	0:47
330 335	0:03	0:03	0:03	0:03
335 340	0:33	0:34	0:36	0:34
Total	**4:17**	**4:21**	**4:26**	**4:21**

A comparison between the model and observed times indicate that vehicles in the model are travelling slightly faster than those observed, with average modelled journey times of 11 minutes 13 seconds between Tarbet and Pulpit compared with an average observed time of 11 minutes 02 seconds (Route 2 timing points 10-11 and Route 1 timing points 1-2, 2-3). The difference of 11 seconds is less than 2%, which is well within the allowable limits set out in DMRB Volume 15, Table 9/2/1.

Between Pulpit Rock and Inverarnan, modelled journey times are 5 minutes 7 seconds, which can be compared favourably against an average observed time of 5 minutes 10 seconds (Route 1 timing points: 4-5, 5-6, 6-7, 7-8) resulting in a difference of 3 seconds (1%).

The average modelled journey times on the A83 between Tarbet and Arrochar in 2013 is around 4 minutes 21 seconds, which is comparable with the observed journey time of 4 minutes 20 seconds.

A comparison between the model and observed times is shown graphically in Figures 4.2a and 4.2b.

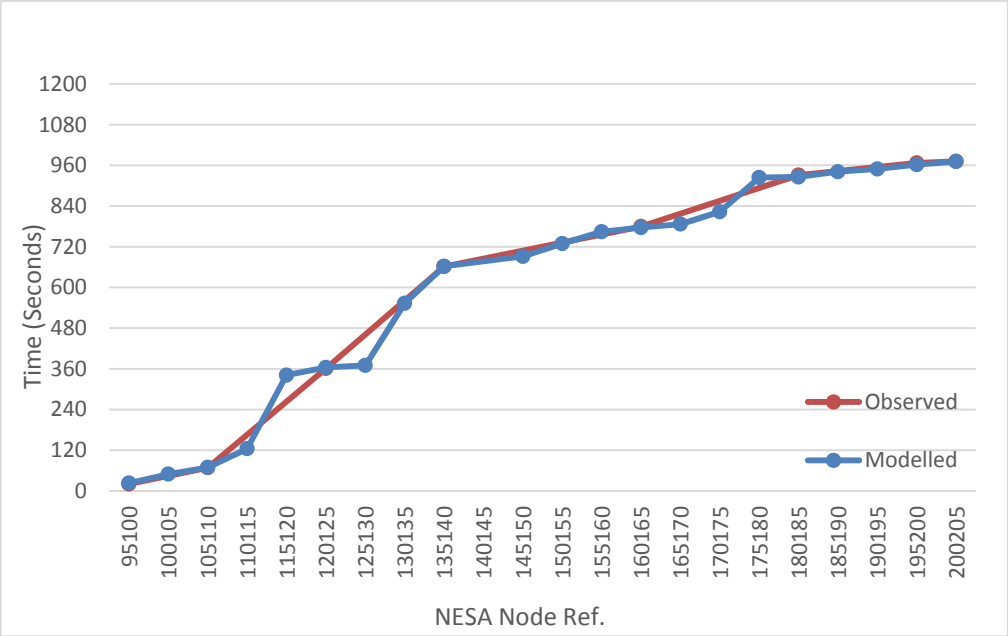

Figure 4.2a: Modelled vs observed flow – A82

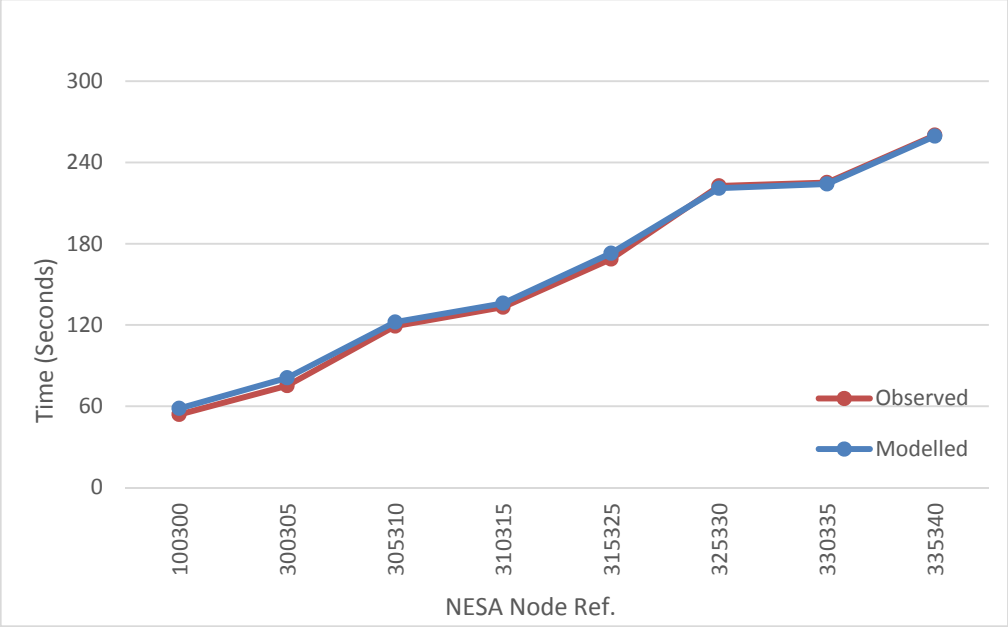

Figure 4.2b: Modelled vs observed flow – A83

Given the above, the Base model is considered to provide a reasonable basis on which to carry out a comparative assessment of the Corridor Options.

4.6 Local Accidents

The number and severity of accidents on the modelled links representing the A82 and A83, during the 5-year period from 2008 to 2012 inclusive, are shown in Tables 4.6a and 4.6b below.

Table 4.6a: Base Network – Distribution of Local Accidents (A82)

Node ref.	Accident severity (no.)			
	Fatal	Serious	Slight	Total
South of Tarbet				
95 100	0	1	1	2
A82 Tarbet to South of Pulpit Rock				
100 105	0	0	2	2
105 110	0	0	0	0
110 115	0	0	0	0
115 120	0	2	7	9
120 125	0	0	0	0
125 130	0	1	1	2
130 135	1	4	5	10
135 140	2	1	2	5
A82 Pulpit Rock to Inverarnan				
140 145	0	2	2	4
145 150	0	2	3	5
150 155	0	0	1	1
155 160	0	0	2	2
160 165	0	0	1	1
165 170	0	0	1	1
170 175	0	2	2	4
175 180	0	1	5	6
180 185	0	0	1	1
185 190	0	0	0	0
190 195	0	1	0	1
195 200	0	0	1	1
200 205	0	0	0	0

Table 4.6b: Base network – distribution of local accidents (A83)

Node ref.	Accident severity (no.)			
	Fatal	Serious	Slight	Total
A83 Tarbet to Arrochar				
100 300	0	1	4	5
300 220	0	0	0	0
300 305	0	0	0	0
305 310	0	1	1	2
310 315	0	0	0	0
320 325	0	0	0	0
315 325	0	0	2	2
325 330	0	1	4	5
330 335	0	0	0	0
335 340	0	2	0	2

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5 Future Conditions

For the purpose of appraising the economic impact of the Corridor Options, a Reference Case model has been developed, which provides the baseline conditions against which the Corridor Options have been appraised.

5.1 Reference Case

The Reference Case includes the proposed improvement at Pulpit Rock. The key Reference Case network characteristics, including link type, length and speed limits, are shown in Tables 5.1a and 5.1b. The extent of the highway network included in the Reference Case model, including the location of the network links and nodes, is shown in Figure 5.1.

Table 5.1a: Reference case – network description (A82)

Node ref.	Length (km)	Speed limit (mph)	Link description
A82 Tarbet to South of Pulpit Rock			
95 100	0.250	30	Urban - single 7.3m
100 105	0.335	30	Urban - single 6.0m
105 110	0.248	30	Urban - single 6.0m
110 115	0.817	60	Rural - poor single 6.0m
115 120	3.600	60	Rural - poor single 6.0m
120 125	0.467	60	Rural - poor single 6.0m
125 130	0.084	60	Rural - poor single 6.0m
130 135	1.330	60	Rural - poor single 6.0m
135 140	1.691	60	Rural - poor single 6.0m
A82 Pulpit Rock			
140 145	0.450	60	Rural - typical single 6.0m

Key

- Node
- 1 Zone
- Do-Nothing Link
- Reference Case Link

Client: Transport Scotland — The Scottish Government

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CH2M Hill Fairhurst JV

A82 Tarbet to Inverarnan Upgrade

NESA Reference Case Node Diagram
Figure 5.1

Table 5.1a: Reference case – network description (A82) (Cont.)

Node ref.	Length (km)	Speed limit (mph)	Link description
A82 North of Pulpit Rock to Inverarnan			
145 150	0.501	60	Rural - poor single 6.0m
150 155	0.800	60	Rural - poor single 6.0m
155 160	0.711	60	Rural - poor single 6.0m
160 165	0.182	60	Rural - poor single 6.0m
165 170	0.207	60	Rural - poor single 6.0m
170 175	0.801	60	Rural - poor single 6.0m
175 180	1.770	60	Rural - poor single 6.0m
180 185	1.037	60	Rural - poor single 6.0m
185 190	0.293	60	Rural - poor single 6.0m
190 195	0.166	60	Rural - poor single 6.0m
195 200	0.279	60	Rural - poor single 6.0m
200 205	0.204	60	Rural - poor single 6.0m

Table 5.1b: Reference case – Network description (A83)

Node ref.	Length (km)	Speed limit (mph)	Link description
A83 Tarbet to Arrochar			
100 300	0.719	30	Urban - single 6.0m
300 305	0.283	30	Urban - single 6.0m
305 310	0.847	60	Rural - poor single 6.0m
310 315	0.300	60	Rural - poor single 6.0m
315 325	0.493	30	Urban - single 6.0m
325 330	0.638	30	Urban - single 6.0m
330 335	0.042	30	Urban - single 6.0m
335 340	0.499	40	Urban - single 6.0m

5.2 Forecast Years

Forecast years are taken to be the predicted year of opening (2020) for the Tarbet to Inverarnan Upgrade and the design year of fifteen years after opening (2035).

5.2.1 Traffic Forecasts

The 24-hour annual average daily traffic flows recorded by the ATC at ATCCS001 on the A82 are presented in Figure 5.2 and indicate that traffic levels on the A82 have remained fairly consistent over the 10-year period from 2003 to 2012 inclusive.

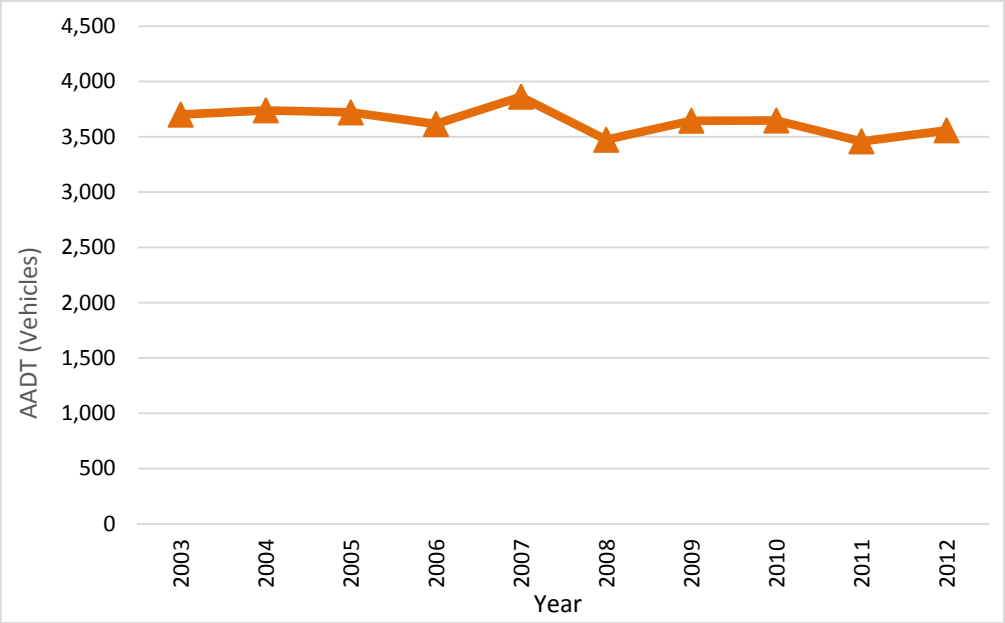


Figure 5.2: Annual average daily traffic flows (2003 to 2012)

The application of national road traffic forecasts (NRTF (1997)) under the central growth scenario has been used to assess the comparative impact of the A82 Corridor Options. It does not, however, seem unreasonable to assume that there will be little traffic growth between Tarbet and Inverarnan (at least in the short term) based on historic traffic data and the perceived unattractiveness of the route due to its constrained nature that gives rise to journey time variability.

To assess the impact of limited growth along the corridor, the application of NRTF (1997) traffic growth forecasts under the low growth scenario has been reported as a sensitivity test. This test may also be considered a proxy for a scenario whereby no growth continues for another five years, and thereafter traffic grows in line with central traffic growth projections. The forecast AADT flows on the A82 to 2031 under each of these scenarios is presented in Figure 5.3. Zero growth has been assumed post 2031 in line with NRTF (1997).

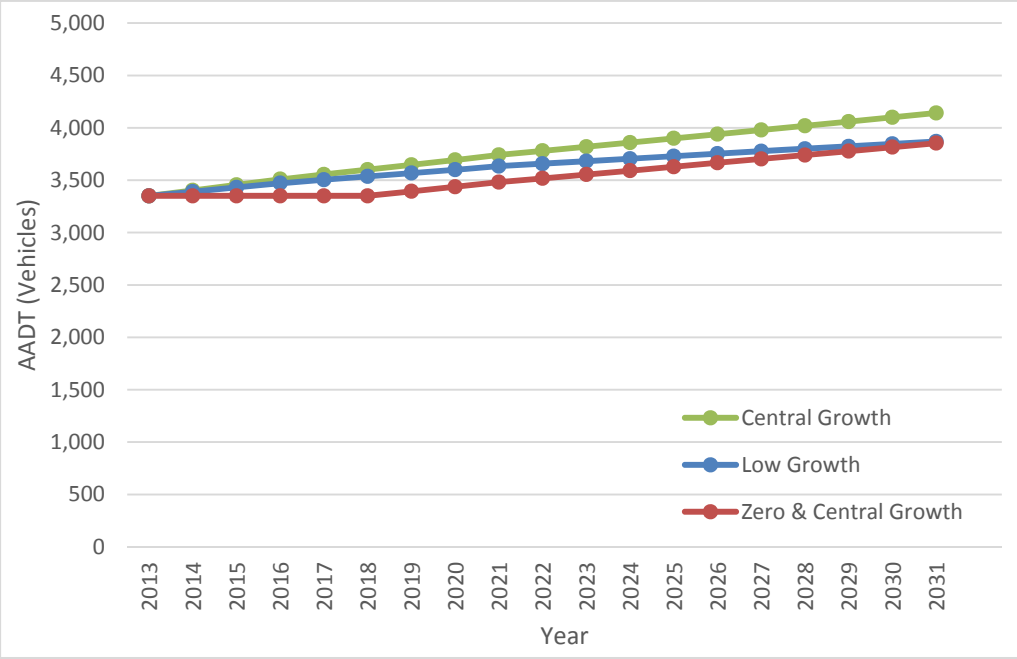


Figure 5.3: Forecast A82 AADT flow levels (2013 to 2031)

Cumulative traffic factors derived from the NRTF (1997) central traffic growth forecasts, as defined in NESA taking into account local traffic composition, are shown for key years in Table 5.2.

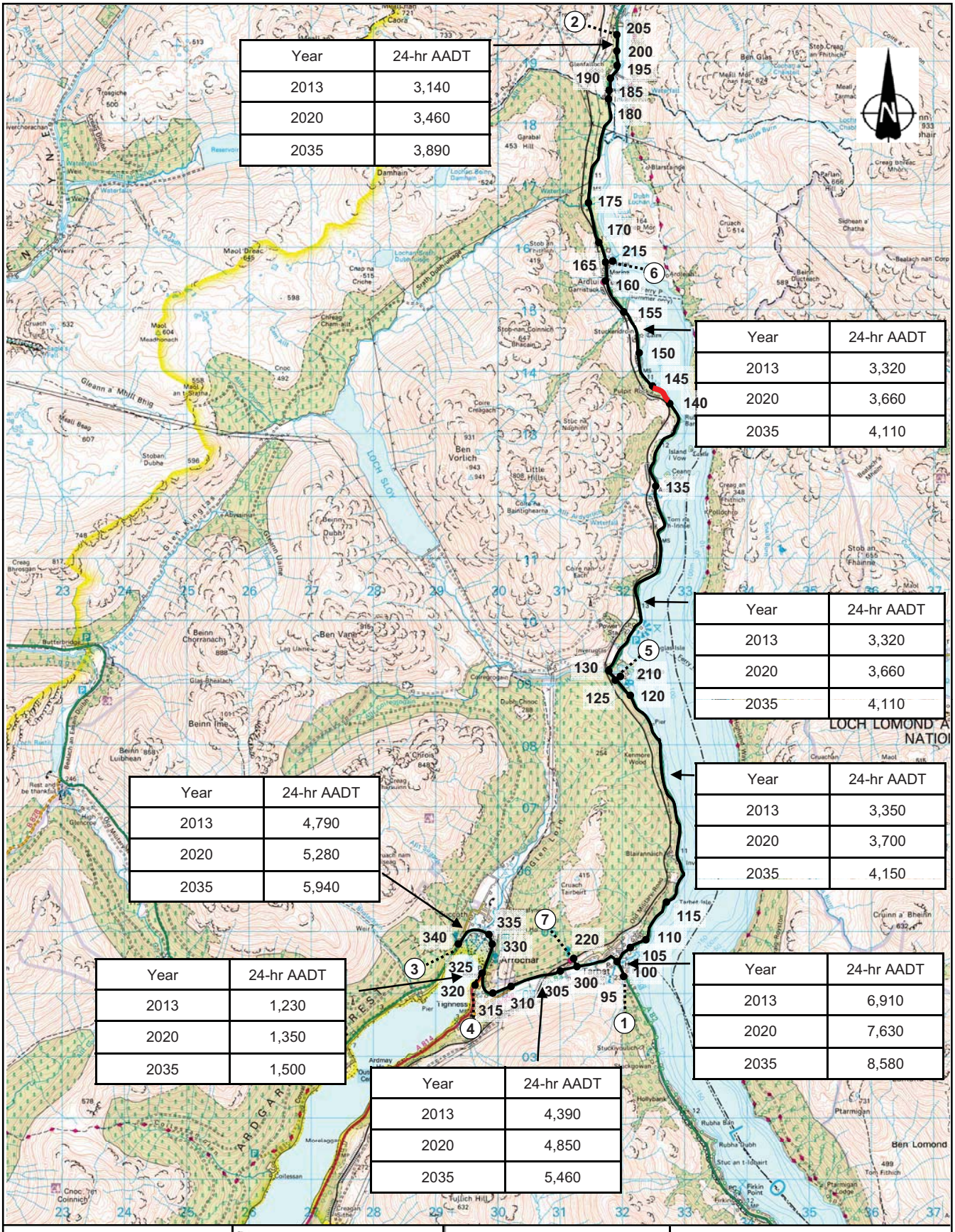
Table 5.2: NRTF central traffic growth factors

Year	Cumulative factor
2013	1.00
2020	1.10
2031	1.24
2032 to 2080	1.24

Traffic flows for the Reference Case network in the 2013 base year, 2020 and 2035, under central traffic growth forecasts, are shown in Figure 5.4.

5.2.2 Journey Times

Average journey times across modelled Flow Groups 2 to 4 for light vehicles on the Reference Case network in 2020 and 2035 are presented in Tables 5.3a and 5.3b.



Year	24-hr AADT
2013	3,140
2020	3,460
2035	3,890

Year	24-hr AADT
2013	3,320
2020	3,660
2035	4,110

Year	24-hr AADT
2013	3,320
2020	3,660
2035	4,110

Year	24-hr AADT
2013	3,350
2020	3,700
2035	4,150

Year	24-hr AADT
2013	4,790
2020	5,280
2035	5,940

Year	24-hr AADT
2013	6,910
2020	7,630
2035	8,580

Year	24-hr AADT
2013	1,230
2020	1,350
2035	1,500

Year	24-hr AADT
2013	4,390
2020	4,850
2035	5,460

Key

- Node
- Zone
- Do-Nothing Link
- Reference Case Link

Client: Transport Scotland — The Scottish Government

CH2M HILL FAIRHURST

CH2M Hill Fairhurst JV

A82 Tarbet to Inverarnan Upgrade

NESA Reference Case Traffic Flows 24-hr AADT
Figure 5.4

Table 5.3a: Reference case journey times (light vehicles) – Tarbet to Inverarnan

Node ref.	Journey times (mins:secs)	
	2020	2035
95 100*	0:30	0:31
100 105*	0:34	0:34
105 110	0:19	0:19
110 115	0:55	0:55
115 120	3:36	3:37
120 125	0:22	0:22
125 130	0:05	0:05
130 135	3:03	3:04
135 140	1:48	1:49
140 145	0:25	0:25
145 150	0:29	0:29
150 155	0:37	0:37
155 160	0:34	0:35
160 165	0:12	0:12
165 170	0:10	0:10
170 175	0:36	0:36
175 180	1:40	1:41
180 185	0:01	0:01
185 190	0:15	0:15
190 195	0:07	0:07
195 200	0:12	0:12
200 205	0:09	0:09
Total	**16:50**	**16:56**

*Notes: * includes junction delay*

Examination of the above information indicates that trips between Tarbet and Inverarnan would take 16 minutes 50 seconds in 2020, with a slight increase in 2035.

Table 5.3b: Reference case journey times (light vehicles) – Arrochar to Inverarnan

Node ref.	Journey times (mins:secs)	
	2020	2035
340 335	0:35	0:36
335 330	0:03	0:03
330 325	0:48	0:48
325 315	0:37	0:37
315 310	0:13	0:13
310 305	0:41	0:41
305 300	0:22	0:22
300 100	1:01	1:02
100 105*	0:36	0:36
105 110	0:19	0:19
110 to 205	15:25	15:30
Total	**20:45**	**20:53**

*Notes: * includes junction delay*

Examination of the above information indicates that trips between Arrochar and Inverarnan in 2020 would take 20 minutes 45 seconds in 2020, with a slight increase in 2035.

5.2.3 Network Capacity

The number of over-capacity links in the networks provides an indication of the traffic conditions on the A82.

Examination of the model results indicates that none of the modelled links in the Reference Case would exceed capacity under the central traffic growth scenario by the year 2035.

5.2.4 Road Safety

A total of 959 personal injury accidents were reported for the Reference Case in the NESA model, based on the application of local accident characteristics, over the 60-year assessment period under the central traffic growth scenario.

6 Effect of Options

6.1 Corridor Options

Typical alignments within the corridors shown in Figure 6.1 have been modelled in a series of Design networks.

6.2 Design Network Definition

The proposed Corridor Options comprise the following elements:

Corridor Option 1– A 16.4 kilometre on-line improvement of the existing A82 from Tarbet to Inverarnan.

Corridor Option 2– A 4.6 kilometre bypass of Tarbet from the A83 west of Arrochar to Inveruglas and 11.4 kilometre on-line improvement between Inveruglas and Inverarnan. At this stage, priority junctions at the tie-in points have been assumed.

Corridor Option 3– A 14.1 kilometre off-line corridor from the A83 west of Tarbet to a point approximately 1.5 kilometres north of Ardlui running primarily adjacent to the existing A82, and a 2.8 kilometre on-line improvement for the remainder of the corridor, to Inverarnan. At this stage, priority junctions at the tie-in points have been assumed.

For the purpose of the traffic and economic appraisal, it has been assumed that off-line sections of carriageway will be constructed to a better standard than can otherwise be provided on-line due to existing constraints. The design network descriptions are presented in Tables 6.1a to 6.3b.

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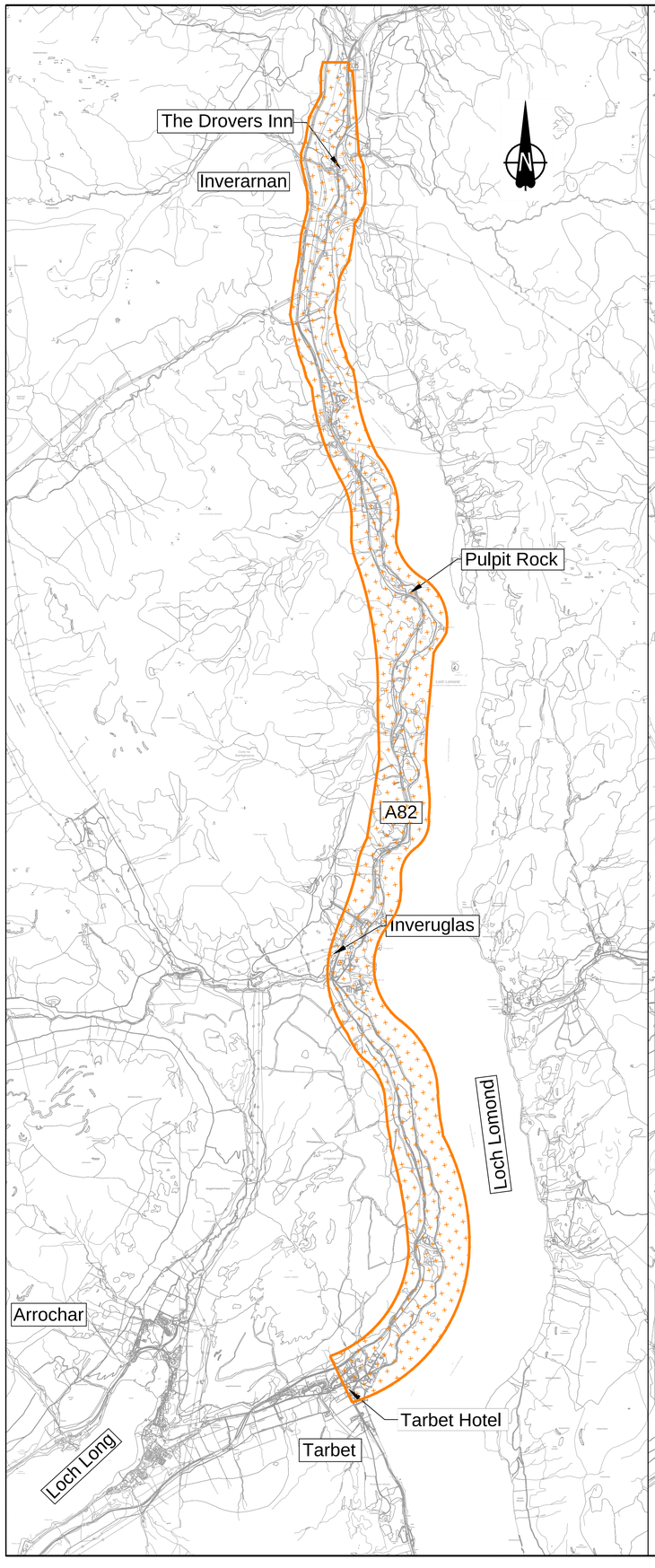

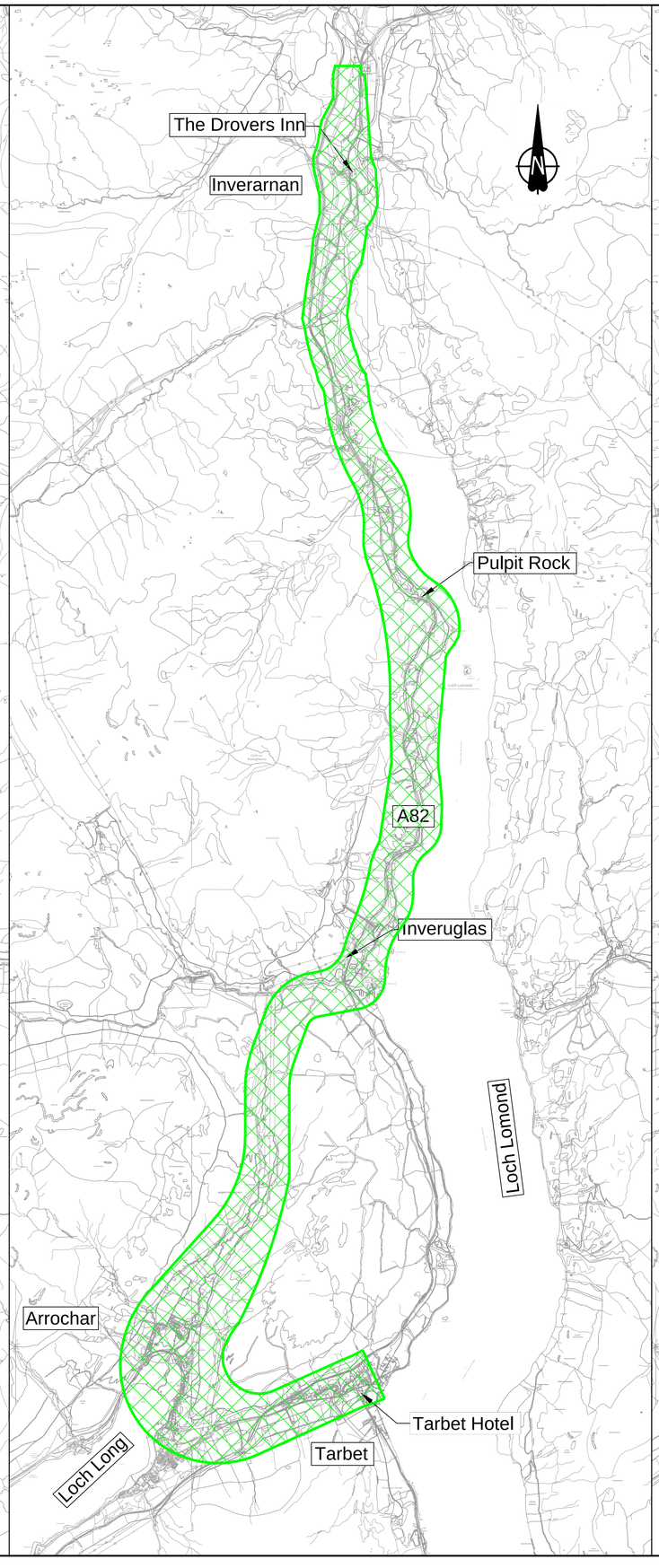

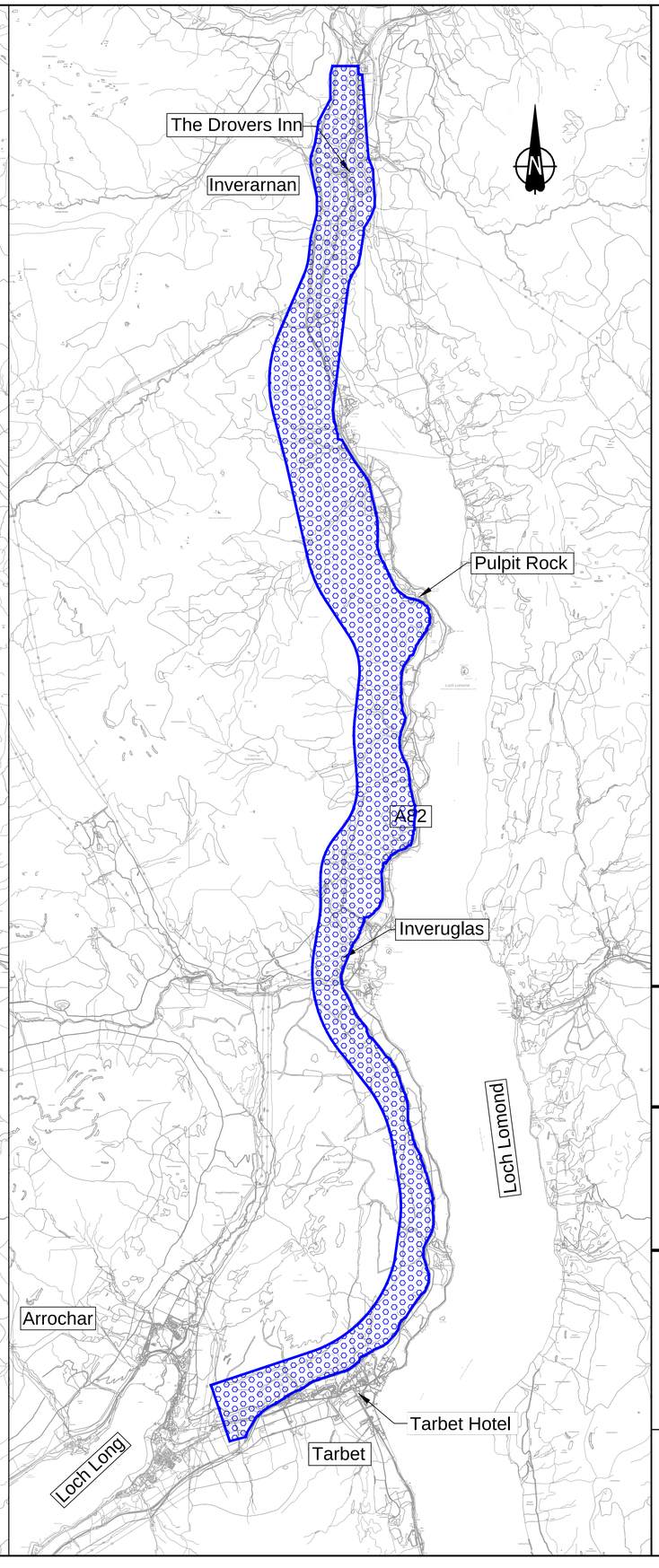

Key:

- Corridor 1
- Corridor 2
- Corridor 3

Project

A82 TARBET TO INVERARNAN UPGRADE

Drawing Title

CORRIDOR LOCATIONS

FIGURE 6.1

Client

Transport Scotland

The Scottish Government

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Table 6.1a: Design network description (corridor option 1) – Tarbet to Inverarnan

Node ref.	Length (km)	Speed limit (mph)	Link description
95 100	0.250	30	Urban – single 7.3m
100 105	0.335	30	Urban - single 6.0m
105 110	0.248	30	Urban - single 6.0m
110 115	0.817	60	Rural – typical single 6.0m
115 120	3.600	60	Rural – typical single 6.0m
120 125	0.467	60	Rural – typical single 6.0m
125 130	0.084	60	Rural – typical single 6.0m
130 135	3.330	60	Rural – typical single 6.0m
135 140	1.691	60	Rural – typical single 6.0m
140 145	0.450	60	Rural – typical single 6.0m
145 150	0.501	60	Rural – typical single 6.0m
150 155	0.800	60	Rural – typical single 6.0m
155 160	0.711	60	Rural – typical single 6.0m
160 165	0.182	60	Rural – typical single 6.0m
165 170	0.207	60	Rural – typical single 6.0m
170 175	0.801	60	Rural – typical single 6.0m
175 180	1.770	60	Rural – typical single 6.0m
180 185	0.037	60	Rural – typical single 6.0m
185 190	0.293	60	Rural – typical single 6.0m
190 195	0.166	60	Rural – typical single 6.0m
195 200	0.279	60	Rural – typical single 6.0m
200 205	0.204	60	Rural – typical single 6.0m

Table 6.1b: Design network descriptions (corridor option 1) – Arrochar to Inverarnan

Node ref.	Length (km)	Speed limit (mph)	Link description
340 335	0.499	40	Urban – single 6.0m
335 330	0.042	30	Urban – single 6.0m
330 325	0.638	30	Urban – single 6.0m
325 315	0.493	30	Urban – single 6.0m
315 310	0.300	60	Rural – poor single 6.0m
310 305	0.847	60	Rural – poor single 5.5m
305 300	0.283	30	Urban – single 6.0m
300 100	0.719	30	Urban – single 6.0m
100 105	0.335	30	Urban - single 6.0m
105 110	0.248	30	Urban - single 6.0m
110 115	0.817	60	Rural – typical single 6.0m
115 120	3.600	60	Rural – typical single 6.0m
120 125	0.467	60	Rural – typical single 6.0m
125 130	0.084	60	Rural – typical single 6.0m
130 135	3.330	60	Rural – typical single 6.0m
135 140	1.691	60	Rural – typical single 6.0m
140 145	0.450	60	Rural – typical single 6.0m
145 150	0.501	60	Rural – typical single 6.0m
150 155	0.800	60	Rural – typical single 6.0m
155 160	0.711	60	Rural – typical single 6.0m
160 165	0.182	60	Rural – typical single 6.0m
165 170	0.207	60	Rural – typical single 6.0m
170 175	0.801	60	Rural – typical single 6.0m
175 180	1.770	60	Rural – typical single 6.0m
180 185	0.037	60	Rural – typical single 6.0m
185 190	0.293	60	Rural – typical single 6.0m
190 195	0.166	60	Rural – typical single 6.0m
195 200	0.279	60	Rural – typical single 6.0m
200 205	0.204	60	Rural – typical single 6.0m

Table 6.2a: Design network descriptions (corridor option 2) – Tarbet to Inverarnan

Node ref.	Length (km)	Speed limit (mph)	Link description
95 100	0.250	30	Urban – single 7.3m
100 300	0.719	30	Urban – single 6.0m
300 305	0.283	30	Urban – single 6.0m
305 310	0.847	60	Rural – poor single 5.5m
310 315	0.300	60	Rural – poor single 6.0m
315 325	0.493	30	Urban – single 6.0m
325 330	0.638	30	Urban – single 6.0m
330 335	0.042	30	Urban – single 6.0m
335 500	0.249	40	Urban – single 6.0m
500 505	4.623	60	Rural – good single 7.3m
505 135	3.330	60	Rural – typical single 6.0m
135 140	1.691	60	Rural – typical single 6.0m
140 145	0.450	60	Rural – typical single 6.0m
145 150	0.501	60	Rural – typical single 6.0m
150 155	0.800	60	Rural – typical single 6.0m
155 160	0.711	60	Rural – typical single 6.0m
160 165	0.182	60	Rural – typical single 6.0m
165 170	0.127	60	Rural – typical single 6.0m
170 175	0.801	60	Rural – typical single 6.0m
175 180	1.770	60	Rural – typical single 6.0m
180 185	0.037	60	Rural – typical single 6.0m
185 190	0.293	60	Rural – typical single 6.0m
190 195	0.166	60	Rural – typical single 6.0m
195 200	0.279	60	Rural – typical single 6.0m
200 205	0.204	60	Rural – typical single 6.0m

Table 6.2b: Design network descriptions (corridor option 2) – Arrochar to Inverarnan

Node ref.	Length (km)	Speed limit (mph)	Link description
340 500	0.250	40	Urban – single 6.0m
500 505	4.623	60	Rural – good single 7.3m
505 135	3.330	60	Rural – typical single 6.0m
135 140	1.691	60	Rural – typical single 6.0m
140 145	0.450	60	Rural – typical single 6.0m
145 150	0.501	60	Rural – typical single 6.0m
150 155	0.800	60	Rural – typical single 6.0m
155 160	0.711	60	Rural – typical single 6.0m
160 165	0.182	60	Rural – typical single 6.0m
165 170	0.127	60	Rural – typical single 6.0m
170 175	0.801	60	Rural – typical single 6.0m
175 180	1.770	60	Rural – typical single 6.0m
180 185	0.037	60	Rural – typical single 6.0m
185 190	0.293	60	Rural – typical single 6.0m
190 195	0.166	60	Rural – typical single 6.0m
195 200	0.279	60	Rural – typical single 6.0m
200 205	0.204	60	Rural – typical single 6.0m

Table 6.3a: Design network descriptions (corridor option 3) – Tarbet to Inverarnan

Node ref.	Length (km)	Speed limit (mph)	Link description
95 100	0.250	30	Urban – single 7.3m
100 500	0.130	30	Rural - single 6.0m
500 505	14.018	60	Rural – good single 7.3m
505 180	1.770	60	Rural – typical single 6.0m
180 185	0.037	60	Rural – typical single 6.0m
185 190	0.293	60	Rural – typical single 6.0m
190 195	0.166	60	Rural – typical single 6.0m
195 200	0.279	60	Rural – typical single 6.0m
200 205	0.204	60	Rural – typical single 6.0m

Table 6.3b: Design network descriptions (corridor option 3) – Arrochar to Inverarnan

Node ref.	Length (km)	Speed limit (mph)	Link description
340 335	0.499	40	Urban – single 6.0m
335 330	0.042	30	Urban – single 6.0m
330 325	0.638	30	Urban – single 6.0m
325 315	0.493	30	Urban – single 6.0m
315 310	0.300	60	Rural – poor single 6.0m
310 305	0.847	60	Rural – poor single 5.5m
305 300	0.283	30	Urban – single 6.0m
300 500	0.589	30	Urban – single 6.0m
500 505	14.018	60	Rural – good single 7.3m
505 180	1.770	60	Rural – typical single 6.0m
180 185	0.037	60	Rural – typical single 6.0m
185 190	0.293	60	Rural – typical single 6.0m
190 195	0.166	60	Rural – typical single 6.0m
195 200	0.279	60	Rural – typical single 6.0m
200 205	0.204	60	Rural – typical single 6.0m

The proposed Corridor Options Design networks are shown in Figures 6.2a, 6.2b and 6.2c.

6.3 Operational Assessment

6.3.1 Traffic Flows

The 2-way 24-hour AADT traffic flows in the 2020 opening year and 2035 design year for the Design network for the Corridor Options, under NRTF (1997) central traffic growth forecasts are presented in Figures 6.3a, 6.3b and 6.3c.

Where there are competing routes, such as in Corridor Options 2 and 3, which provide sections of off-line carriageway bypassing parts of the existing A82, the new A82 corridor will be signposted as the strategic route. As such, for the purpose of the economic appraisal at this stage, it has been assumed that the new corridor will be used by the vast majority of road users, leaving a limited number of vehicles on bypassed sections of the A82.

Whilst it is acknowledged that the A82 upgrade could release an element of suppressed demand, this has not been considered at this stage as it is unlikely to have a significant impact on the comparative assessment of Corridor Options.

6.3.2 Journey Times

Savings in journey time are likely to be the most significant benefits resulting from the provision of the A82 upgrade. To provide a direct comparison between journey times on the Reference Case (reported in Tables 5.3a and 5.3b) and the Design networks, the average journey times across modelled Flow Groups 2 to 4 for each link in 2020 and 2035 are presented in Tables 6.4a to 6.6b.

Key

- Node
- 1 Zone
- Do-Nothing Link
- Do-Something Link

Client: Transport Scotland — The Scottish Government

CH2M HILL FAIRHURST

CH2M Hill Fairhurst JV

A82 Tarbet to Inverarnan Upgrade

NESA Option 1 Corridor
Online Option
Node Diagram
Figure 6.2a

Key

- Node
- 1 Zone
- Do-Nothing Link
- Do-Something Link

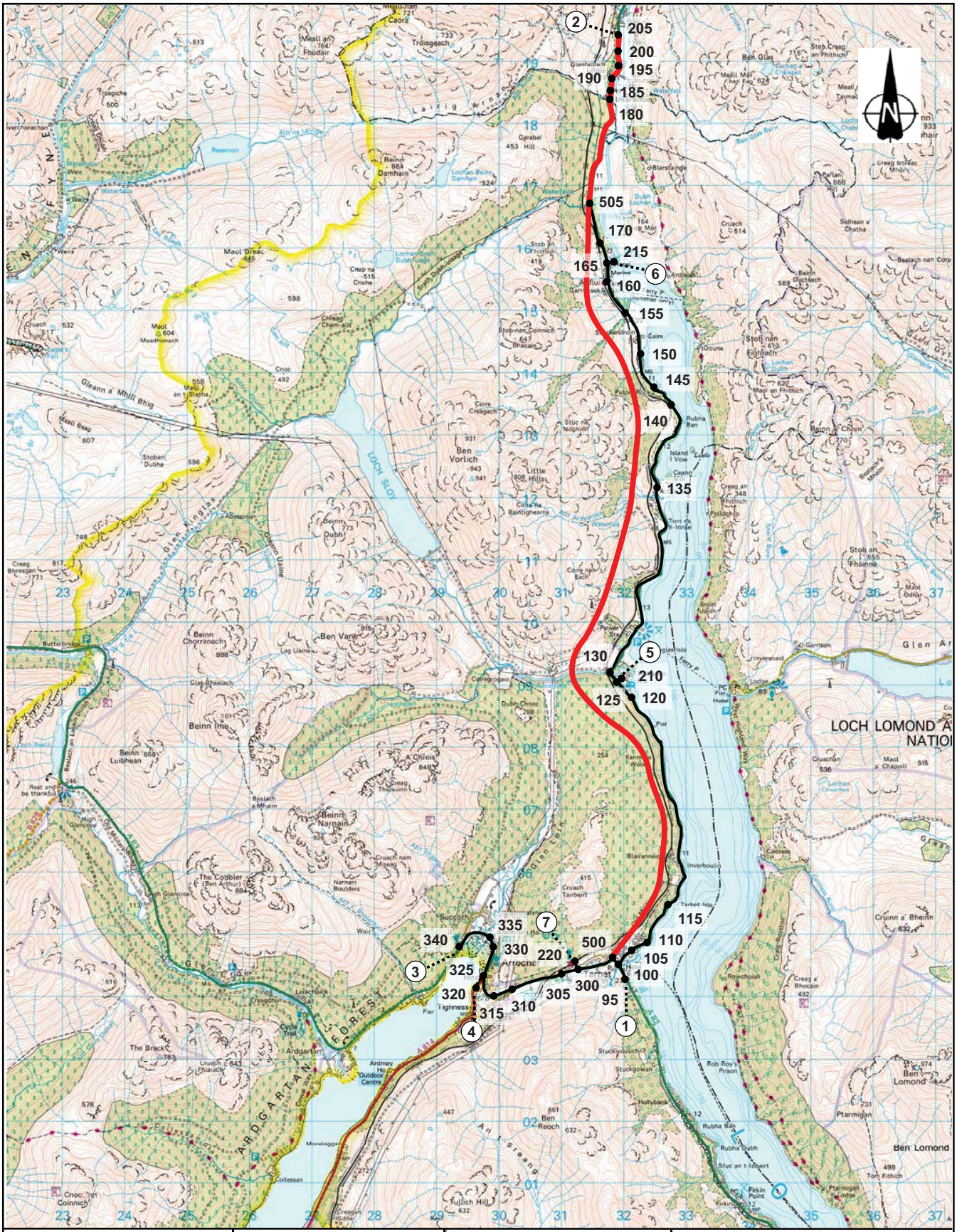
Client: Transport Scotland — The Scottish Government

CH2M HILL FAIRHURST

CH2M Hill Fairhurst JV

A82 Tarbet to Inverarnan Upgrade

NESA Option 2 Corridor
Inveruglas Bypass Option
Node Diagram
Figure 6.2b



Key

● Node

①⋯ Zone

Do-Nothing Link

Do-Something Link

Client

Transport Scotland

The Scottish Government

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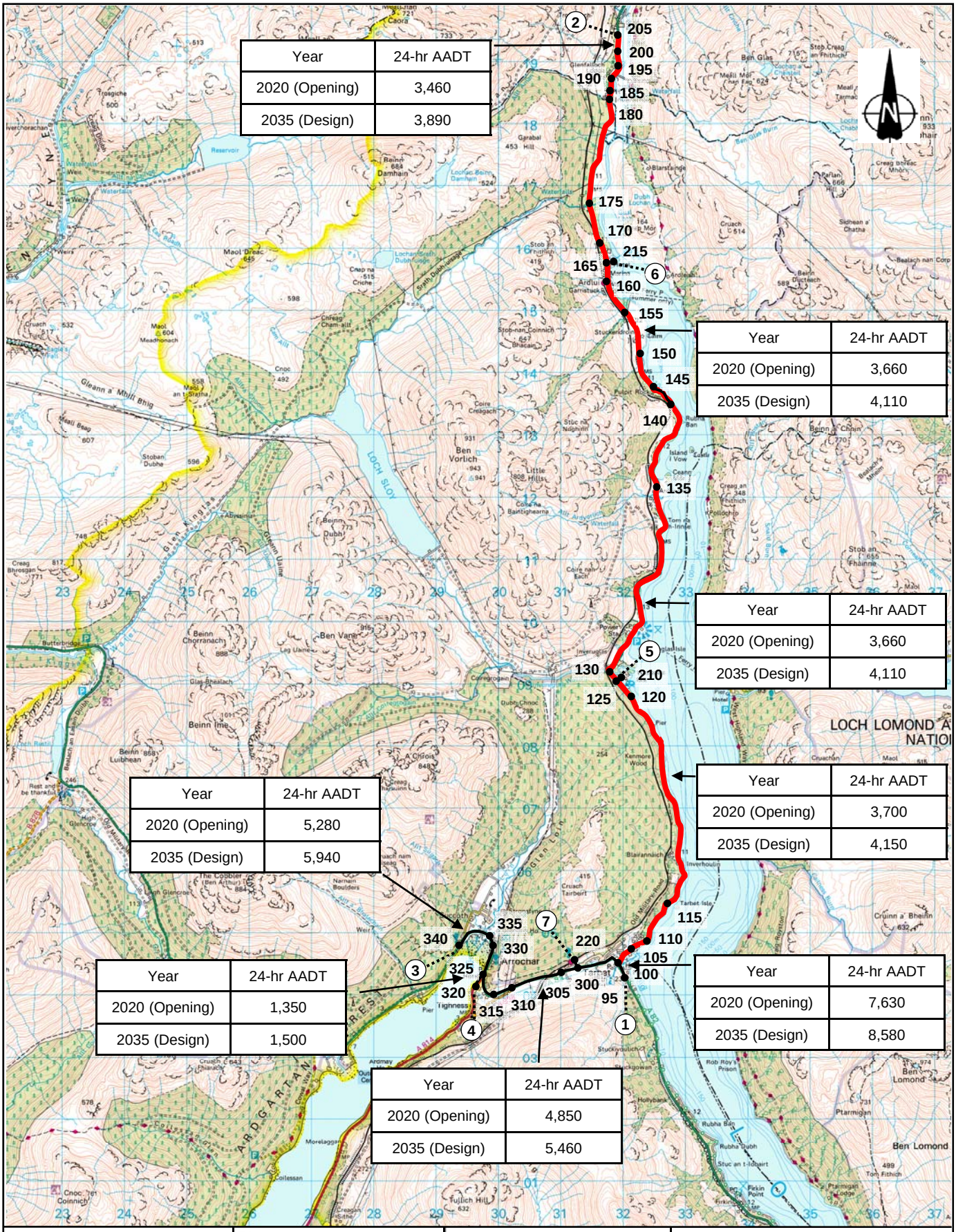
A82 Tarbet to Inverarnan Upgrade

NESA Option 3 Corridor
High Road Option
Node Diagram
Figure 6.2c



Key

- Node
- 1 Zone
- Do-Nothing Link
- Do-Something Link

Client

TRANSPORT SCOTLAND
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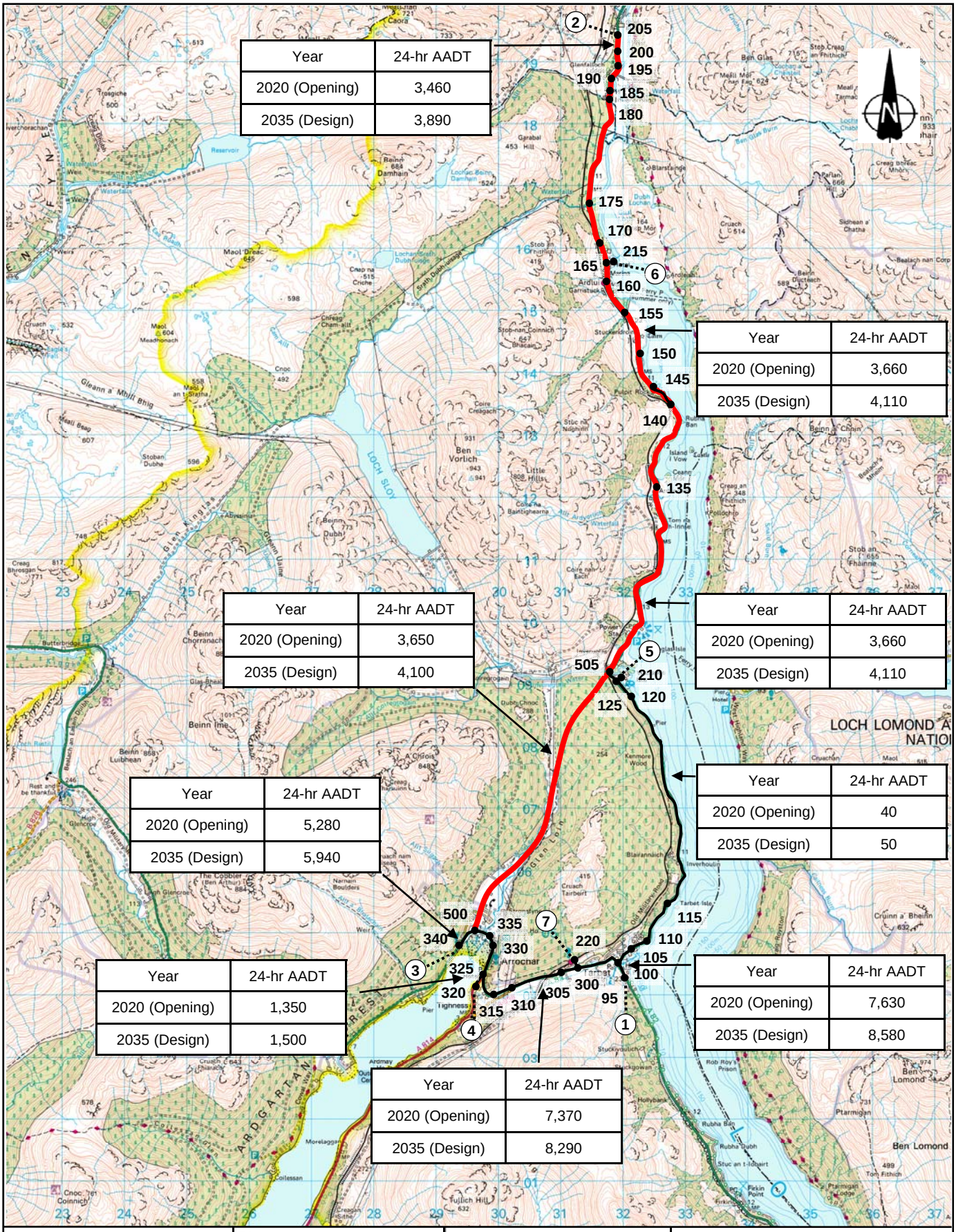
A82 Tarbet to Inverarnan Upgrade

NESA Option 1 Corridor
Online Option
24-hr AADT
Figure 6.3a



Year	24-hr AADT
2020 (Opening)	3,460
2035 (Design)	3,890

Year	24-hr AADT
2020 (Opening)	3,660
2035 (Design)	4,110

Year	24-hr AADT
2020 (Opening)	3,650
2035 (Design)	4,100

Year	24-hr AADT
2020 (Opening)	3,660
2035 (Design)	4,110

Year	24-hr AADT
2020 (Opening)	40
2035 (Design)	50

Year	24-hr AADT
2020 (Opening)	5,280
2035 (Design)	5,940

Year	24-hr AADT
2020 (Opening)	1,350
2035 (Design)	1,500

Year	24-hr AADT
2020 (Opening)	7,630
2035 (Design)	8,580

Year	24-hr AADT
2020 (Opening)	7,370
2035 (Design)	8,290

Key

- Node
- (1) Zone
- Do-Nothing Link
- Do-Something Link

Client: Transport Scotland, The Scottish Government

A82 Tarbet to Inverarnan Upgrade

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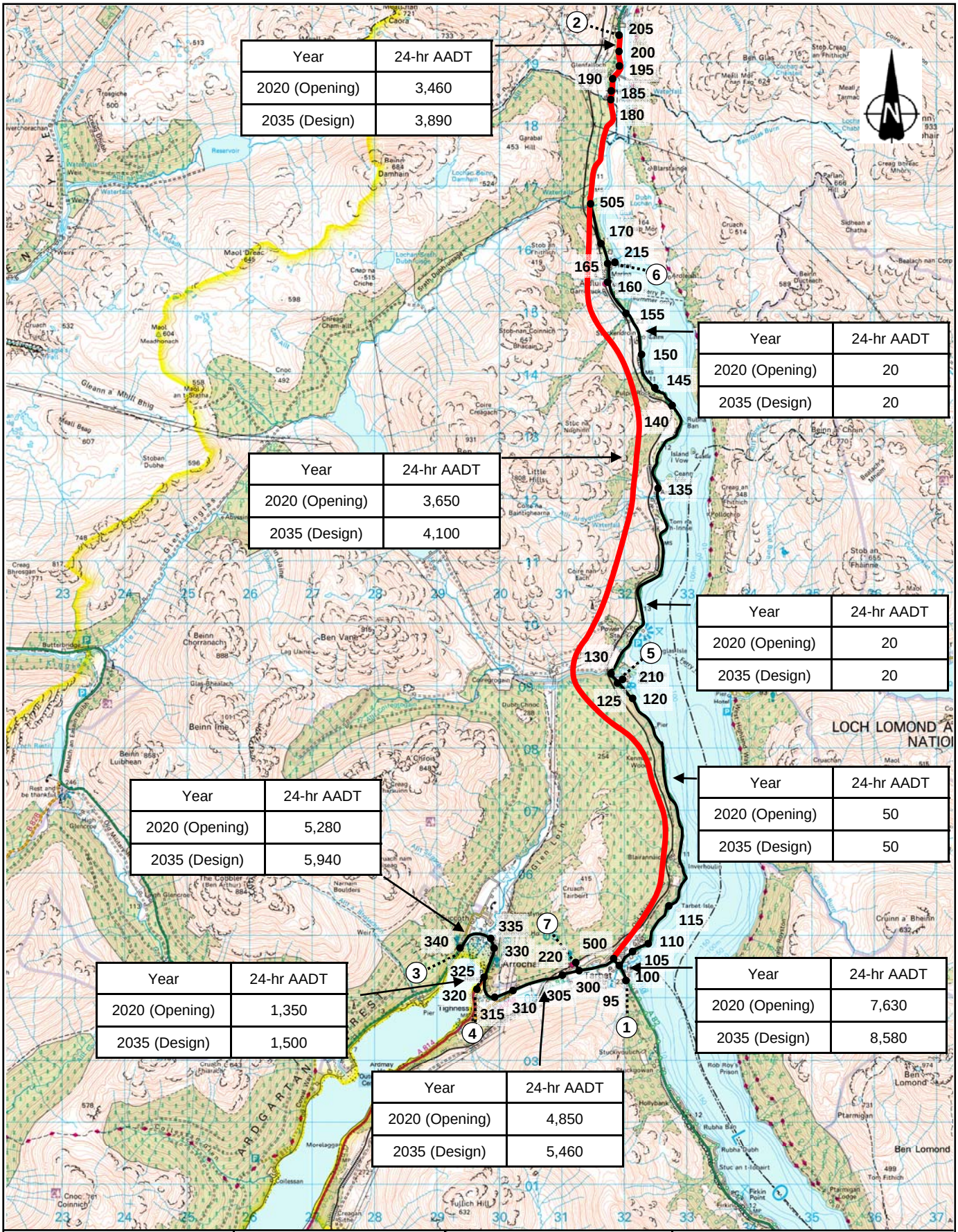
Tel +44 (0)141 552 2000 Fax +44 (0)141 552 2525

NESA Option 2 Corridor
Inveruglass Bypass Option
24-hr AADT
Figure 6.3b


Year | 24-hr AADT
2020 (Opening) | 3,460
2035 (Design) | 3,890
Year | 24-hr AADT
2020 (Opening) | 20
2035 (Design) | 20
Year | 24-hr AADT
2020 (Opening) | 3,650
2035 (Design) | 4,100
Year | 24-hr AADT
2020 (Opening) | 20
2035 (Design) | 20
Year | 24-hr AADT
2020 (Opening) | 5,280
2035 (Design) | 5,940
Year | 24-hr AADT
2020 (Opening) | 50
2035 (Design) | 50
Year | 24-hr AADT
2020 (Opening) | 1,350
2035 (Design) | 1,500
Year | 24-hr AADT
2020 (Opening) | 7,630
2035 (Design) | 8,580
Year | 24-hr AADT
2020 (Opening) | 4,850
2035 (Design) | 5,460
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LOCH LOMOND A
NATIO
Ben Lomond
Key
Node
Zone
Do-Nothing Link
Do-Something Link
Client
TRANSPORT SCOTLAND
The Scottish Government
A82 Tarbet to Inverarnan Upgrade
CH2MHILL. FAIRHURST
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Tel +44 (0)141 552 2000 Fax +44 (0)141 552 2525
NESA Option 3 Corridor
High Road Option
24-hr AADT
Figure 6.3c
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Table 6.4a: Corridor option 1 journey times (light vehicles) – Tarbet to Inverarnan

Node ref.	Journey times (mins:secs)	
	2020 opening year	2035 design year
95 100*	0:30	0:31
100 105*	0:34	0:34
105 110	0:19	0:19
110 115	0:37	0:37
115 120	2:44	2:44
120 125	0:20	0:20
125 130	0:03	0:03
130 135	2:31	2:32
135 140	1:17	1:17
140 145	0:25	0:25
145 150	0:22	0:22
150 155	0:34	0:34
155 160	0:31	0:31
160 165	0:08	0:08
165 170	0:08	0:09
170 175	0:34	0:34
175 180	1:20	1:20
180 185	0:01	0:01
185 190	0:13	0:13
190 195	0:07	0:07
195 200	0:12	0:12
200 205	0:08	0:08
Total	**13:48**	**13:53**

Notes: * includes junction delay

Table 6.4b: Corridor option 1 journey times (light vehicles) – Arrochar to Inverarnan

Node ref.	Journey times (mins:secs)	
	2020 opening year	2035 design year
340 335	0:35	0:36
335 330	0:03	0:03
330 325	0:48	0:48
325 315	0:37	0:37
315 310	0:13	0:13
310 305	0:41	0:41
305 300	0:22	0:22
300 100	1:01	1:02
100 105*	0:36	0:36
105 110	0:19	0:19
110 115	0:37	0:37
115 120	2:44	2:44
120 125	0:20	0:20
125 130	0:03	0:03
130 135	2:31	2:32
135 140	1:17	1:17
140 145	0:25	0:25
145 150	0:22	0:22
150 155	0:34	0:34
155 160	0:31	0:31
160 165	0:08	0:08
165 170	0:08	0:09
170 175	0:34	0:34
175 180	1:20	1:20
180 185	0:01	0:01
185 190	0:13	0:13
190 195	0:07	0:07
195 200	0:12	0:12
200 205	0:08	0:08
Total	**17:43**	**17:49**

*Notes: * includes junction delay*

Examination of Tables 6.4a and 6.4b indicates that:

- trips between Tarbet and Inverarnan via Corridor Option 1 would take just under 14 minutes in 2020, with a slight increase in 2035, providing a journey time saving of approximately 3 minutes when compared to the Reference Case;

- of the 3 minute saving, just under 2.5 minutes is attributable to the upgrade of the A82 between Tarbet and Pulpit, with just over 0.5 minute associated with the upgrade between Pulpit and Inverarnan; and
- trips between Arrochar and Inverarnan would take just under 18 minutes in both 2020 and slightly longer in 2035 via Corridor Option 1, providing a journey time saving of approximately 3 minutes when compared to the Reference Case.

Table 6.5a: Corridor option 2 journey times (light vehicles) – Tarbet to Inverarnan

Node ref.	Journey times (mins:secs)	
	2020 opening year	2035 design year
95 100	0:23	0:24
100 300	1:00	1:01
300 305	0:23	0:23
305 310	0:42	0:42
310 315	0:14	0:14
315 325	0:38	0:38
325 330	0:49	0:50
330 335	0:03	0:03
335 500*	0:37	0:28
500 505	3:26	3:37
505 135	2:31	2:32
135 140	1:17	1:17
140 145	0:25	0:25
145 150	0:22	0:22
150 155	0:34	0:34
155 160	0:31	0:31
160 165	0:08	0:08
165 170	0:08	0:09
170 175	0:34	0:34
175 180	1:20	1:20
180 185	0:01	0:01
185 190	0:13	0:13
190 195	0:07	0:07
195 200	0:12	0:12
200 205	0:08	0:08
Total	**16:57**	**17:05**

*Notes: * includes junction delay*

Table 6.5b: Corridor option 2 journey times (light vehicles) – Arrochar to Inverarnan

Node Ref.	Journey Times (mins:secs)	
	2020 Opening Year	2035 Design Year
340 500	0:21	0:21
500 505*	3:37	3:38
505 135	2:31	2:32
135 140	1:17	1:17
140 145	0:25	0:25
145 150	0:22	0:22
150 155	0:34	0:34
155 160	0:31	0:31
160 165	0:08	0:08
165 170	0:08	0:09
170 175	0:34	0:34
175 180	1:20	1:20
180 185	0:01	0:01
185 190	0:13	0:13
190 195	0:07	0:07
195 200	0:12	0:12
200 205	0:08	0:08
Total	**12:37**	**12:41**

*Notes: * includes junction delay*

Examination of Tables 6.5a and 6.5b indicates that:

- trips between Tarbet and Inverarnan via Corridor Option 2 would take just under 17 minutes in 2020, with a slight increase in 2035, providing little change in journey times when compared to the Reference Case; and
- trips between Arrochar and Inverarnan would take just over 12.5 minutes in 2020 and slightly longer in 2035 via the Corridor Option 2, providing a journey time saving of approximately 8 minutes when compared to the Reference Case.

Table 6.6a: Corridor option 3 journey times (light vehicles) - Tarbet to Inverarnan

Node ref.	Journey times (mins:secs)	
	2020 opening year	2035 design year
95 100	0:23	0:24
100 500*	0:19	0:19
500 505	10:35	10:38
505 180	1:20	1:20
180 185	0:01	0:01
185 190	0:13	0:13
190 195	0:07	0:07
195 200	0:12	0:12
200 205	0:08	0:08
Total	**13:21**	**13:26**

*Notes: * includes junction delay*

Table 6.6b: Corridor option 3 - Arrochar to Inverarnan

Node ref.	Journey times (mins:secs)	
	2020 opening year	2035 design year
340 335	0:35	0:36
335 330	0:03	0:03
330 325	0:48	0:48
325 315	0:37	0:37
315 310	0:13	0:13
310 305	0:41	0:41
305 300	0:22	0:22
300 500	0:52	0:52
500 505*	10:37	10:40
505 180	1:20	1:20
180 185	0:01	0:01
185 190	0:13	0:13
190 195	0:07	0:07
195 200	0:12	0:12
200 205	0:08	0:08
Total	**16:54**	**17:00**

*Notes: * includes junction delay*

Examination of Tables 6.6a and 6.6b indicates that:

- trips between Tarbet and Inverarnan via Corridor Option 3 would take just under 13.5 minutes in 2020 and slightly longer in 2035, providing a journey time saving of approximately 3.5 minutes when compared to the Reference Case; and

- trips between Arrochar and Inverarnan would take around 17 minutes in both 2020 and 2035 via Corridor Option 3, providing a journey time saving of approximately 4 minutes when compared to the Reference Case.

The greatest journey time saving between Tarbet and Inverarnan is provided by Corridor Option 3 (3.5 minutes), closely followed by Corridor Option 1 (3 minutes) as these options provide a fairly direct route for these trips. Corridor Option 2 provides little change in the journey times between Tarbet and Inverarnan as any time savings are offset by the additional time taken to travel through Arrochar in order to access the new route.

Corridor Option 2 provides the greatest journey time saving between Arrochar and Inverarnan (8 minutes) due to the proximity of the corridor to Arrochar. The journey time savings between Arrochar and Inverarnan provided by Corridor Options 1 and 3 are considerably less but similar to one another (3 and 4 minutes respectively).

6.3.3 Network Capacity

As the upgrade will generally improve link capacity and as it has been assumed that the upgrade will not have a significant effect on demand along the A82, none of the modelled links in the do-something are likely to exceed capacity under central traffic growth forecast by 2035.

6.3.4 Road Safety

The change in personal injury accidents based on typical alignments within the corridors are shown in Table 6.7.

Table 6.7: Road safety benefits of corridor options

	No. of personal injury accidents		
	2020	2035	60-year total
Reference Case	14.6	16.1	958.7
Option 1	9.6	10.2	608.7
Savings	5.0	5.9	350.0
Option 2	10.4	11.0	657.5
Savings	4.2	5.1	301.2
Option 3	8.1	8.6	511.8
Savings	6.5	7.5	446.9

The results of the NESA analysis indicate that Corridor Option 3 would provide the greatest level of accident savings, followed by Corridor Option 1 and then Corridor Option 2. Over the 60 year economic life of the upgrade, the projected savings range between 301 and 447 personal injury accidents.

7 Economic Appraisal

The quantitative assessment of the transport economic efficiency and road safety aspects of a proposed road improvement requires the development and application of various computer models. In the case of the DMRB Stage 1 A82 Tarbet to Inverarnan appraisal, this has involved the development of a NESA (Network Evaluation from Surveys and Assignment) model supported by a QUADRO (Queues and Delays at Roadworks) model.

The NESA model was developed to compare the costs and road user benefits of the proposed improvements; and the QUADRO model was developed to examine the delays and costs associated with the construction works and future road maintenance requirements.

7.1 Basis of Economic Appraisal

For the purpose of the comparative assessment, the economic appraisal is based on the following:

- Fixed trip methodologies – whilst it is acknowledged that latent demand may be released by the A82 upgrade, it is not considered to have a significant impact on the comparative assessment of Corridor Options;
- NRTF (1997) central traffic growth projections – a NESA assessment based on the application of traffic growth forecasts under the low growth scenario, to assess the impact of limited growth along the corridor, has been reported as a sensitivity test;
- Local accident rates – a NESA assessment based on default accident rates has been reported as a sensitivity test;
- Optimism bias of 44% for roads and 66% for bridges and tunnels – the preliminary cost estimates for potential Corridor Options have been increased for optimism bias, in accordance with Table 6/8/2 of DMRB 15.1.6.8, to reflect the appraisers' tendency to be overly optimistic;
- Construction works commence in 2017 with a construction period of three years; and
- Typical maintenance profiles and works costs.

7.2 NESA Assessment

The NESA assessment for the A82 Tarbet to Inverarnan upgrade is based on the latest version of the program, version NESA11, which was released on behalf of Transport Scotland in March 2013. This version incorporates current national road traffic forecasts; a mid-2002 price base; and an annual discount rate of 3.5% for the first 30-years, and 3.0% for the remainder of the 60-year appraisal period.

The NESA assessment of the A82 upgrade is based on a comparison of the costs associated with the Reference Case and Design networks, taking account of the estimated scheme cost of the Corridor Options.

7.2.1 Scheme Costs

Preliminary cost estimates, based on typical unit rates per kilometre for constructing trunk road schemes of a similar nature, have been used in the NESA assessment. The Total Scheme Costs include Preparation and Supervision Costs, which are considered to be 12% and 5% respectively of the combined Construction, Land and Property Costs, in accordance with DMRB 15.1.6.8.

The estimated cost of typical alignments for each of the proposed corridors, used in the NESA assessment, is summarised in Table 7.1.

Table 7.1: Preliminary scheme cost estimates (average 2012 prices, excluding VAT)

Cost item	Cost (£m)		
	Option 1	Option 2	Option 3
Construction*	185.00	217.00	364.00
Preparation	22.20	26.04	43.68
Supervision	9.25	10.85	18.20
Total Scheme Cost	**216.45**	**253.89**	**425.88**

*Note: *includes Land & Property Costs.*

The following construction cost profile has been adopted for the purpose of the economic appraisal in line with DMRB 15.1.6.8, Table 6/8/2:

- 2017 - 30% of costs;
- 2018 - 34% of costs;
- 2019 - 33% of costs; and
- 2020 - 3% of costs in the proposed year of opening.

The results of the NESA assessment for the Corridor Options are presented in Table 7.2.

Table 7.2: NESA assessment results

	Corridor options		
	Option 1	Option 2	Option 3
TEE Impact			
Greenhouse Gases (Emissions)	-0.09	-0.68	-0.10
Accident Benefits	10.43	9.51	14.86
Non-Business User Benefits: Commuting	2.04	0.26	2.26
Non-Business User Benefits: Other	6.76	1.18	7.48
Business Users & Provider Benefits	12.35	1.75	13.88
Wider Public Finances (Indirect Tax Revenues)	0.19	1.41	0.20
Present Value of Benefits (PVB)	**31.68**	**13.43**	**38.58**
Government Funding			
Broad Transport Budget	112.76	132.86	223.89
Present Value of Costs (PVC)	**112.76**	**132.86**	**223.89**
Total Impact			
Net Present Value (NPV)	**-81.08**	**-119.43**	**-185.31**
Benefit to Cost Ratio (BCR)	**0.28**	**0.10**	**0.17**

Monetary values are expressed in £m, (2002 prices, discounted to 2002 at 3.5% for the first 30 years and 3.0% for the remainder of the 60-year appraisal period).

The overall results of the NESA assessment indicate that the Corridor Options will deliver economic returns of between -£185.31m and -£81.08m, with BCRs ranging from 0.10 to 0.28. Whilst the Corridor Options are not expected to provide Transport Economic Efficiency Impacts that outweigh Government Funding, the upgrade of the A82 between Tarbet and Inverarnan is predicted to provide benefits to road users, which range from £13.43m to £38.58m. The principal benefits of the upgrade are expected to be as a result of traffic experiencing improved travel times, with total user benefits (i.e. Non-Business User Benefits: Commuting, Non-Business User Benefits: Other, and Business Users & Provider Benefits) ranging from £3.19m to £23.62m.

Corridor Option 3 provides a reasonably direct route between Tarbet and Inverarnan and, of the three Corridor Options, contains the greatest proportion of off-line carriageway (which is constructed to a better standard than can be provided on-line). As such, this corridor is predicted to provide the greatest level of benefits to road users of the three options (£38.58m), including the greatest level of accident benefits (£14.86m). As this option is expected to require the highest level of funding (£223.89m), it is expected to provide the poorest economic return in terms of NPV (-£185.31m).

Corridor Option 2 is likely to provide the least benefits to road users due to the additional travel distance involved in travelling between Tarbet and Inveraran via Arrochar (£13.43m). The funding expected to be required for this option is such that it is expected to provide the poorest BCR (0.10) of the three Corridor Options.

With an NPV of -£81.08m and a BCR of 0.28, Corridor Option 1 is predicted to deliver the best economic return of the three Corridor Options. This can be afforded to the

predicted delivery of significant benefits to road users (£31.68m) for the lowest level of expected funding (£112.76m).

7.3 QUADRO Assessment

To provide a more complete assessment of the economic impact of the Corridor Options over a 60-year period, the following have been assessed using the QUADRO program:

- the road user costs associated with construction of the Corridor Options; and
- the works costs and road user costs associated with undertaking a programme of future maintenance for both the Reference Case and Design scenarios.

The QUADRO assessment for the A82 Tarbet to Inverarnan upgrade is based on Release 9 of the QUADRO4 program. While this is not the latest version of the software, the assessment was carried out using Release 9 due to potential bugs with later versions. The QUADRO4 Release 9 software provides results that are consistent with the NESA assessment.

7.4 Basis of the Assessment

Profiles of future maintenance works for the existing A82 pavement between Tarbet and Inverarnan (excluding the section associated with Pulpit Rock Improvement), the A83 pavement between Tarbet and Arrochar and the provision of new pavement constructed as part of the Corridor Options have been based on the typical maintenance profiles, costs and durations given in DMRB 14.1.4.2, Table 4/1.

The future maintenance profile adopted for the existing A82, existing A83 and new A82 pavement, over the 60-year appraisal period, is presented in Table 7.3.

Table 7.3: Future maintenance profiles

Maintenance activity	Maintenance year	
	Existing A82/A83 pavement	New A82 pavement
Thin Surfacing	2020	-
Overlay	2031	2031
Thin Surfacing	2042	2042
Overlay	2052	2053
Thin Surfacing	2062	2063
Overlay	2072	2073

Whilst it is recognised that there are likely to be differences in the structural integrity of the A82 and A83 pavements, for the purpose of the economic appraisal, it has been assumed that both existing carriageways will require maintenance in 2020.

An allowance has been made for the work costs associated with maintaining those sections of existing A82 carriageway that are lightly trafficked as a result of traffic re-assigning to the new carriageway (such as in Corridor Options 2 and 3), based on the profiles presented in Table 7.3.

Full details of the works considered as part of the QUADRO assessment are provided in the tables presented in Appendix E.

7.4.1 Key Assumptions

For the purpose of the comparative assessment, the following key assumptions have been made:

- future maintenance of the existing A82 in the Reference Case will consist of full closures during the night (19:00 hrs to 07:00 hrs). The A83 will be restricted to shuttle working during the night (19:00 hrs to 07:00 hrs).
- construction works associated with the Corridor Options are carried out throughout the years 2017, 2018 and 2019.
- during the construction of on-line sections, temporary 40 mph speed limits will be in force during the day (07:00 hrs to 19:00 hrs) with the route closed at night (19:00 hrs to 07:00 hrs).
- programmes of future maintenance are restricted to neutral months – March, April, May, October and November.
- future maintenance of the upgraded A82 carriageway and the A83 will be restricted to shuttle working during the night (19:00 hrs to 07:00 hrs); and
- the main diversion route for trips between Tarbet and north of Inverarnan is the A83 to Inveraray followed by the A819 and A85.

7.4.2 QUADRO Assessment Results

The results of the QUADRO assessment for the Reference Case and Corridor Options are presented in Tables 7.4 and 7.5 respectively.

Table 7.4: QUADRO assessment results (£m) – reference case

Future maintenance	
Net Consumer Impact	0.979
Net Business Impact	1.025
Accident Costs	0.345
Fuel Carbon Emission Costs	0.048
Maintenance Works Costs	4.525
Indirect Tax Revenues	-0.093
Total Impact	**6.829**

Monetary values are expressed in £m, (2002 prices, discounted to 2002 at 3.5% for the first 30 years and 3.0% for the remainder of the 60-year appraisal period).

Table 7.5: QUADRO assessment results (£m) – corridor options

	Corridor options		
	Option 1	Option 2	Option 3
During Construction			
Net Consumer Impact	3.949	2.601	0.639
Net Business Impact	3.723	2.465	0.609
Accident Costs	1.773	1.124	0.249
Fuel Carbon Emission Costs	0.140	0.093	0.023
Maintenance Works Costs	0.000	0.000	0.000
Indirect Tax Revenues	-0.467	-0.309	-0.077
Total Impact	**9.117**	**5.973**	**1.444**
Future Maintenance – Existing Routes			
Net Consumer Impact	0.004	0.008	0.004
Net Business Impact	0.005	0.009	0.005
Accident Costs	0.001	0.003	0.002
Fuel Carbon Emission Costs	0.000	0.000	0.000
Maintenance Works Costs	0.806	2.019	3.816
Indirect Tax Revenues	0.000	0.000	0.000
Total Impact	**0.816**	**2.039**	**3.826**
Future Maintenance – New Route			
Net Consumer Impact	0.015	0.014	0.014
Net Business Impact	0.016	0.015	0.014
Accident Costs	0.005	0.004	0.004
Fuel Carbon Emission Costs	0.000	0.000	0.000
Maintenance Works Costs	2.294	2.166	2.329
Indirect Tax Revenues	0.000	0.000	0.000
Total Impact	**2.329**	**2.200**	**2.362**

Monetary values are expressed in £m, (2002 prices, discounted to 2002 at 3.5% for the first 30 years and 3.0% for the remainder of the 60-year appraisal period).

The overall impact of the QUADRO assessment is presented in Tables 7.6.

Table 7.6: QUADRO assessment results – overall impact

	Corridor options		
	Option 1	Option 2	Option 3
Present Value of Benefits (PVB)	-7.23	-3.94	0.83
Present Value of Costs (PVC)	-1.80	-0.56	1.64
Net Present Value (NPV)	-5.44	-3.38	-0.80

Monetary values are expressed in £m, (2002 prices, discounted to 2002 at 3.5% for the first 30 years and 3.0% for the remainder of the 60-year appraisal period).

The results from the QUADRO model indicate that an NPV of between -£5.44m and -£0.80m may be achieved under the modelled construction and future maintenance programme.

To take cognisance of a potential optimism bias towards underestimating the duration of the construction works, the consumer and business impacts; accident costs; fuel carbon emission costs; and indirect tax revenues (ITRs), output by QUADRO, have been increased by 20%, in accordance with Table 6/8/2 of DMRB 15.1.6.8.

Due to changes surrounding the consideration of ITRs within the economic appraisal methodology, the results generated by the QUADRO program have also been adjusted to include the ITRs in the PVB rather than in the PVC.

The overall impact of the QUADRO assessment, including optimism bias and ITR adjustments, is presented in Table 7.7.

Table 7.7: QUADRO assessment results – overall impact (incl. OB and ITR adjustments)

	Corridor options		
	Option 1	Option 2	Option 3
Present Value of Benefits (PVB)	-8.68	-4.92	0.53
Present Value of Costs (PVC)	-1.43	-0.34	1.62
Net Present Value (NPV)	-7.26	-4.58	-1.09

Monetary values are expressed in £m, (2002 prices, discounted to 2002 at 3.5% for the first 30 years and 3.0% for the remainder of the 60-year appraisal period).

The results of the QUADRO assessment, adjusted to include optimism bias and an ITR adjustment, indicates that an NPV of between -£7.26m and -£1.09m may be achieved under the modelled construction and future maintenance programme.

7.4.3 Overall Economic Appraisal Results

The combined results of the NESA and QUADRO assessments are presented in Table 7.8.

Table 7.8: Combined NESA and QUADRO assessment results

	Corridor options		
	Option 1	Option 2	Option 3
Present Value of Benefits (PVB)	23.00	8.51	39.11
Present Value of Costs (PVC)	111.34	132.52	225.51
Net Present Value (NPV)	-88.34	-124.01	-186.40
Benefit to Cost Ratio (BCR)	0.21	0.06	0.17

Monetary values are expressed in £m, (2002 prices, discounted to 2002 at 3.5% for the first 30 years and 3.0% for the remainder of the 60-year appraisal period).

The overall results of the economic appraisal indicate that the Corridor Options will deliver economic returns of between -£186.40m and -£88.34m, with BCRs ranging from 0.06 to 0.21. Whilst the Corridor Options are not expected to provide transport economic efficiency and road safety benefits that outweigh their costs, the upgrade of the A82 between Tarbet and Inverarnan is predicted to provide benefits to road users, which range from £8.51m to £39.11m.

With an NPV of -£88.34m and a BCR of 0.21 Corridor Option 1 is predicted to deliver the best economic return of the three Corridor Options.

7.4.4 Wider Economic Impact

The A82 is a critical link to the north west Highlands from Central Scotland. It is an essential freight route for goods produced or sourced along the West Coast to the main centres of population in Scotland and further afield. While this part of the road is itself in one of Scotland's most scenic and popular areas, the extended A82 is also the main link to the north west Highlands for tourists and for Central Belt residents accessing its attractions for outdoor recreation.

At a local level, the area through which the upgrade passes is sparsely populated, with Tarbet and Ardlui the only settlements of any size. While there are a number of farms on the land adjacent to the road, tourism is the main focus of local business activity within the existing route corridor. Tourism is also a principal source of business activity in settlements such as Inverarnan, Tarbet, Luss, Arrochar and Killin. As a consequence of the area's low population base, local residents have to access education, health, fuel and shopping facilities (for all but everyday groceries) outside the area (the closest petrol station is in Arrochar). For local residents this section of road is essential.

This section of the A82 is affected by low average speeds, variable journey times, and limited formal parking opportunities. For local residents and businesses, a limited improvement in journey times is anticipated from the initial modelling. While the travel time effects are limited, the improvement in accessibility and the construction works themselves may have an effect on broader perceptions of the area's accessibility (to Glasgow, Dumbarton, Helensburgh and other employment focal points). There may therefore be limited housing market impacts in areas within a 30-45 minute drive of main employment centres, although the extent of any benefit to local areas will depend on whether this generates new housing or not.

With the possible exception of the section of A82 north of Ballachulish, this part of the route is arguably the main bottleneck between Glasgow and Fort William. While it passes through one of Scotland's most scenic areas, views from the road of the

surrounding countryside are relatively restricted. Its improvement can therefore be expected to improve perceptions of the accessibility of areas dependent on the A82 generally. Depending on its design, the upgrade may also afford improved views of Ben Lomond and the Loch Lomond and Trossachs National Park (LLTNP) area. Tourism and recreation businesses (and those employed by them) are likely to be the main beneficiaries. While it is likely that related activity across the length of the route may experience some uplift, it is likely to be more pronounced in areas to the north of the upgrade.

A qualitative assessment of the wider economic impacts of the Corridor Options is presented in Table 7.9.

Table 7.9: Qualitative assessment of wider economic impacts

Corridor	Extent of impact	
	Local	Wider
Option 1	Reinforces existing pattern of activity, with potential options to open up views, make the road part of the attraction. Minor economic benefits as visitors are likely to have increased confidence in stopping during longer drives.	As is, plus wider benefits through enhanced perception of accessibility due to more reliable drive times; impacts on visitor markets; potentially on housing markets. Effects on freight movements considered to be slight.
Option 2	Construction impacts may be greater, while minimising disruption on existing routes (during construction of southern element). Increased traffic at Arrochar (at the A83/A82 junction) is likely to generate requirement for improvements to A83 at Arrochar. Arrochar likely to improve service centre function. Area between Tarbet & Inveruglas quietened with removal of HGVs. The original alignment will remain attractive to tourists with improved attraction for local recreation opportunities (increased opportunity to introduce new parking and other facilities).	Effects on non-tourism sectors neutral relative to Corridor Option 1. Relative to Corridor Option 1, tourism impacts are potentially increased. For areas beyond the upgrade area, effects as per Corridor Option 1.

Table 7.9: Qualitative assessment of wider economic impacts (Cont.)

Corridor	Extent of impact	
	Local	Wider
Option 3	Construction impacts may be greater relative to Corridor Option 1. Area between Tarbet & Inveruglas quietened with removal of HGVs. The original alignment will remain attractive to tourists with improved attraction for local recreation opportunities (increased opportunity to introduce new parking and other facilities). Potential for residential development opportunities.	Effects on non-tourism sectors neutral relative to Corridor Option 1. Relative to Corridor Option 1, tourism impacts are potentially increased, with tourists provided the option of the existing low (lochside) road and the new high road (forestry). For areas beyond the upgrade area, effects would be slightly improved relative to Corridor Option 1. The effect of providing visitors with two options potentially increases the numbers attracted to the overall route.

7.5 Conclusion

The upgrade of the A82 between Tarbet and Inverarnan is predicted to provide benefits to road users, which range from £8.51m to £39.11m. Based on the results of the comparative appraisal, Corridor Option 1 is expected to deliver the greatest level of economic return with an NPV of -£88.34m and a BCR of 0.21.

Whilst the Corridor Options are not expected to provide transport economic efficiency and road safety benefits that outweigh their costs, the overall scale of wider economic impacts is anticipated to be moderate, although it should be noted that this will be influenced by the design approach adopted.

In parts of this section of the A82, the road itself could be an attraction to visitors if, for example, 'iconic' features are incorporated. Should this be the case, a greater scale of benefit may be anticipated across the A82 generally, with a heightened focus on the upgraded corridor itself.

8 Sensitivity Tests

A number of assessments have been carried out to test the sensitivity of the NESA assessment results. These are outlined below and are directly comparable with the results presented in Table 7.2.

8.1.1 Low Traffic Growth

As it does not seem unreasonable to assume that there will be little traffic growth between Tarbet and Inverarnan (at least in the short term), the results of a test considering NRTF (1997) low traffic growth projections are presented in Table 8.1.

Table 8.1: NESA assessment results – low traffic growth

	Corridor options		
	Option 1	Option 2	Option 3
TEE Impact			
Greenhouse Gases (Emissions)	-0.09	-0.64	-0.09
Accident Benefits	9.80	8.93	13.96
Non-Business User Benefits: Commuting	1.91	0.25	2.11
Non-Business User Benefits: Other	6.33	1.15	7.01
Business Users & Provider Benefits	11.56	1.72	13.00
Wider Public Finances (Indirect Tax Revenues)	0.18	1.33	0.19
Present Value of Benefits (PVB)	**29.70**	**12.75**	**36.19**
Government Funding			
Broad Transport Budget	112.76	132.86	223.89
Present Value of Costs (PVC)	**112.76**	**132.86**	**223.89**
Total Impact			
Net Present Value (NPV)	**-83.06**	**-120.11**	**-187.70**
Benefit to Cost Ratio (BCR)	**0.26**	**0.10**	**0.16**

Monetary values are expressed in £m, (2002 prices, discounted to 2002 at 3.5% for the first 30 years and 3.0% for the remainder of the 60-year appraisal period).

Based on the application of low traffic growth projections, the PVB for the Corridor Options would reduce by £1.98m (6.3%) for Corridor Option 1, £0.68m (5.1%) for Corridor Option 2 and £2.39m (6.2%) for Corridor Option 3 relative to the results presented in Table 7.2.

With an NPV of -£83.06m and a BCR of 0.26, Corridor Option 1 is predicted to continue delivering the best economic return of the three Corridor Options.

8.1.2 Default Accidents

The results of a test based on the application of default accident rates in the Reference Case are presented in Table 8.2.

Table 8.2: NESA assessment results – default accidents

	Corridor options		
	Option 1	Option 2	Option 3
TEE Impact			
Greenhouse Gases (Emissions)	-0.09	-0.68	-0.10
Accident Benefits	4.88	3.68	8.47
Non-Business User Benefits: Commuting	2.04	0.26	2.26
Non-Business User Benefits: Other	6.76	1.18	7.48
Business Users & Provider Benefits	12.35	1.75	13.88
Wider Public Finances (Indirect Tax Revenues)	0.19	1.41	0.20
Present Value of Benefits (PVB)	**26.12**	**7.59**	**32.19**
Government Funding			
Broad Transport Budget	112.76	132.86	223.89
Present Value of Costs (PVC)	**112.76**	**132.86**	**223.89**
Total Impact			
Net Present Value (NPV)	**-86.63**	**-125.26**	**-191.70**
Benefit to Cost Ratio (BCR)	**0.23**	**0.06**	**0.14**

Monetary values are expressed in £m, (2002 prices, discounted to 2002 at 3.5% for the first 30 years and 3.0% for the remainder of the 60-year appraisal period).

Based on the application of default accident rates in the Reference Case, the PVB would reduce by £5.56m (17.5%) for Corridor Option 1, £5.84m (43.5%) for Corridor Option 2 and £6.39m (16.6%) for Corridor Option 3 relative to the results presented in Table 7.2.

With an NPV of -£86.63m and a BCR of 0.23, Corridor Option 1 is predicted to continue delivering the best economic return of the three Corridor Options.

8.1.3 Summary and Conclusions

Two sensitivity tests have been carried on the results of the NESA assessment – one to assess the impact of limited growth along the corridor and another to confirm the effect of using default accident rates.

Based on the results of the sensitivity tests, adopting low traffic growth scenario or default accidents in the assessment reduces the NPV of the corridor options by up to £4m, with Corridor Option 1 still expected to deliver the greatest level of economic return.

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Appendix A

Automatic Traffic Count Data

For details refer to the following spreadsheets contained on the attached CD:

App A – A82, Tarbet – ATC Data (A814)

App A – ATC08090

App A – ATC08104

App A – ATC08119

App A – ATCCS001

Appendix B

Turning Count Survey Data

For details refer to the following spreadsheets contained on the attached CD:

App B – 47728_JTC08338

App B – A82, Tarbet – Junction Data

Appendix C

Journey Time Survey Data

For details refer to the following spreadsheets contained on the attached CD:

App C – A82 Tarbet – Route 1 - Northbound

App C – A82 Tarbet – Route 1 – Southbound

App C – A82 Tarbet – Route 2 – Section 1

App C – A82 Tarbet – Route 2 – Section 2

App C – A82 Tarbet – Route 2 – Section 3

Appendix D

Automatic Number Plate Recognition (ANPR) Data

For details refer to the following spreadsheets contained on the attached CD:

App D – A82 Northbound 09-08-13 - ANPR

App D – A82 Northbound 10-08-13 – ANPR

App D – A82 Northbound 11-08-13 - ANPR

App D – A82 Southbound 09-08-13 - ANPR

App D – A82 Southbound 10-08-13 - ANPR

App D – A82 Southbound 11-08-13 - ANPR

App D – A82 Tarbet Links

App D – A82 Tarbet O-D results

Appendix E

Construction and Future Maintenance Works Details

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MAINTENANCE DETAILS
DO-MINIMUM PAVEMENT MAINTENANCE PROFILE (QUADRO)

60-Year Maintenance Period

A82 Tarbet to Inveruglas

Job No.	Section		Maintenance Profile			DMRB Costs/Durations		Traffic Management			Activity Details			
	NESA Nodes	Length (km)	Year	Works Period	Activity	Works Cost (£k/km)	Works Duration (7-hr Days/km)	Type	Duration	Works Cost (£k)	Duration of On-site Working (7-hr Day)	(12-hr Day)	(24-hr Day)	Weeks
1	100 - 130	5.551	2020	Neutral	Thin Surfacing	55	4	Full Closure		305		13		2
2	100 - 130	5.551	2031	Neutral	Overlay	200	12	Full Closure		1,110		39		6
3	100 - 130	5.551	2042	Neutral	Thin Surfacing	55	4	Full Closure	12hrs per Day	305		13		2
4	100 - 130	5.551	2052	Neutral	Overlay	210	12	Full Closure	(19:00 - 07:00)	1,166		39		6
5	100 - 130	5.551	2062	Neutral	Thin Surfacing	55	4	Full Closure		305		13		2
6	100 - 130	5.551	2072	Neutral	Overlay	210	12	Full Closure		1,166		39		6

A82 Inveruglas to Pulpit

Job No.	Section		Maintenance Profile			DMRB Costs/Durations		Traffic Management			Activity Details			
	NESA Nodes	Length (km)	Year	Works Period	Activity	Works Cost (£k/km)	Works Duration (7-hr Days/km)	Type	Duration	Works Cost (£k)	Duration of On-site Working (7-hr Day)	(12-hr Day)	(24-hr Day)	Weeks
7	130 - 140	5.021	2020	Neutral	Thin Surfacing	55	4	Full Closure		276		12		2
8	130 - 140	5.021	2031	Neutral	Overlay	200	12	Full Closure		1,004		35		5
9	130 - 140	5.021	2042	Neutral	Thin Surfacing	55	4	Full Closure	12hrs per Day	276		12		2
10	130 - 140	5.021	2052	Neutral	Overlay	210	12	Full Closure	(19:00 - 07:00)	1,054		35		5
11	130 - 140	5.021	2062	Neutral	Thin Surfacing	55	4	Full Closure		276		12		2
12	130 - 140	5.021	2072	Neutral	Overlay	210	12	Full Closure		1,054		35		5

A82 Pulpit to North of Ardlui

Job No.	Section		Maintenance Profile			DMRB Costs/Durations		Traffic Management			Activity Details			
	NESA Nodes	Length (km)	Year	Works Period	Activity	Works Cost (£k/km)	Works Duration (7-hr Days/km)	Type	Duration	Works Cost (£k)	Duration of On-site Working (7-hr Day)	(12-hr Day)	(24-hr Day)	Weeks
13	145 - 175	3.202	2020	Neutral	Thin Surfacing	55	4	Full Closure		176		7		1
14	145 - 175	3.202	2031	Neutral	Overlay	200	12	Full Closure		640		22		3
15	145 - 175	3.202	2042	Neutral	Thin Surfacing	55	4	Full Closure	12hrs per Day	176		7		1
16	145 - 175	3.202	2052	Neutral	Overlay	210	12	Full Closure	(19:00 - 07:00)	672		22		3
17	145 - 175	3.202	2062	Neutral	Thin Surfacing	55	4	Full Closure		176		7		1
18	145 - 175	3.202	2072	Neutral	Overlay	210	12	Full Closure		672		22		3

A82 North of Ardlui to Inveraman

Job No.	Section		Maintenance Profile			DMRB Costs/Durations		Traffic Management			Activity Details			
	NESA Nodes	Length (km)	Year	Works Period	Activity	Works Cost (£k/km)	Works Duration (7-hr Days/km)	Type	Duration	Works Cost (£k)	Duration of On-site Working (7-hr Day)	(12-hr Day)	(24-hr Day)	Weeks
19	175 - 205	2.749	2020	Neutral	Thin Surfacing	55	4	Full Closure		151		6		1
20	175 - 205	2.749	2031	Neutral	Overlay	200	12	Full Closure		550		19		3
21	175 - 205	2.749	2042	Neutral	Thin Surfacing	55	4	Full Closure	12hrs per Day	151		6		1
22	175 - 205	2.749	2052	Neutral	Overlay	210	12	Full Closure	(19:00 - 07:00)	577		19		3
23	175 - 205	2.749	2062	Neutral	Thin Surfacing	55	4	Full Closure		151		6		1
24	175 - 205	2.749	2072	Neutral	Overlay	210	12	Full Closure		577		19		3

A83 Tarbet to 30/60mph Speed Limit

Job No.	Section		Maintenance Profile			DMRB Costs/Durations		Traffic Management			Activity Details			
	NESA Nodes	Length (km)	Year	Works Period	Activity	Works Cost (£k/km)	Works Duration (7-hr Days/km)	Type	Duration	Works Cost (£k)	Duration of On-site Working (7-hr Day)	(12-hr Day)	(24-hr Day)	Weeks
25	100 - 305	1.002	2020	Neutral	Thin Surfacing	55	4	Shuttle working		55		2		0
26	100 - 305	1.002	2031	Neutral	Overlay	200	12	Shuttle working		200		7		1
27	100 - 305	1.002	2042	Neutral	Thin Surfacing	55	4	Shuttle working	12hrs per Day	55		2		0
28	100 - 305	1.002	2052	Neutral	Overlay	210	12	Shuttle working	(19:00 - 07:00)	210		7		1
29	100 - 305	1.002	2062	Neutral	Thin Surfacing	55	4	Shuttle working		55		2		0
30	100 - 305	1.002	2072	Neutral	Overlay	210	12	Shuttle working		210		7		1

A83 60mph section

Job No.	Section		Maintenance Profile			DMRB Costs/Durations		Traffic Management			Activity Details			
	NESA Nodes	Length (km)	Year	Works Period	Activity	Works Cost (£k/km)	Works Duration (7-hr Days/km)	Type	Duration	Works Cost (£k)	Duration of On-site Working (7-hr Day)	(12-hr Day)	(24-hr Day)	Weeks
31	305 - 315	1.147	2020	Neutral	Thin Surfacing	55	4	Shuttle working		63		3		0
32	305 - 315	1.147	2031	Neutral	Overlay	200	12	Shuttle working		229		8		1
33	305 - 315	1.147	2042	Neutral	Thin Surfacing	55	4	Shuttle working	12hrs per Day	63		3		0
34	305 - 315	1.147	2052	Neutral	Overlay	210	12	Shuttle working	(19:00 - 07:00)	241		8		1
35	305 - 315	1.147	2062	Neutral	Thin Surfacing	55	4	Shuttle working		63		3		0
36	305 - 315	1.147	2072	Neutral	Overlay	210	12	Shuttle working		241		8		1

A83 Arrochar

Job No.	Section		Maintenance Profile			DMRB Costs/Durations		Traffic Management			Activity Details			
	NESA Nodes	Length (km)	Year	Works Period	Activity	Works Cost (£k/km)	Works Duration (7-hr Days/km)	Type	Duration	Works Cost (£k)	Duration of On-site Working (7-hr Day)	(12-hr Day)	(24-hr Day)	Weeks
37	315 - 500	1.428	2020	Neutral	Thin Surfacing	55	4	Shuttle working		79		3		0
38	315 - 500	1.428	2031	Neutral	Overlay	200	12	Shuttle working		286		10		1
39	315 - 500	1.428	2042	Neutral	Thin Surfacing	55	4	Shuttle working	12hrs per Day	79		3		0
40	315 - 500	1.428	2052	Neutral	Overlay	210	12	Shuttle working	(19:00 - 07:00)	300		10		1
41	315 - 500	1.428	2062	Neutral	Thin Surfacing	55	4	Shuttle working		79		3		0
42	315 - 500	1.428	2072	Neutral	Overlay	210	12	Shuttle working		300		10		1

NOTES:
All costs are in average 2002 prices as defined by QUADRO.
Maintenance profile, costs and durations derived from DMRB 14.1.2.4 Table 4/1.

MAINTENANCE DETAILS
DO-SOMETHING PAVEMENT MAINTENANCE PROFILE (QUADRO)
RED CORRIDOR

Construction Period

A82 Tarbet to Inveruglas (On-line Upgrade)

Job No.	Section		Maintenance Profile			Local Costs/Durations		Traffic Management		Activity Details				
	NESA Nodes	Length (km)	Year	Works Period	Activity	Works Cost (£k/km)	Works Duration (24-hr Days/km)	Type	Duration	Works Cost (£k)	Duration of On-site Working (7-hr Day)	(12-hr Day)	(24-hr Day)	Weeks
1 (Day)	100 - 130	5.551	2017	Non-Summer	Carriageway Construction	-	66	1x1 Lane Open (40mph)	12hrs per Day (07:00 - 19:00)	-		276		39
1 (Night)	100 - 130	5.551	2017	Non-Summer	Carriageway Construction	-	66	Full Closure	12hrs per Day (19:00 - 07:00)	-		276		39
2 (Day)	100 - 130	5.551	2017	Summer	Carriageway Construction	-	66	1x1 Lane Open (40mph)	12hrs per Day (07:00 - 19:00)	-		92		13
2 (Night)	100 - 130	5.551	2017	Summer	Carriageway Construction	-	66	Full Closure	12hrs per Day (19:00 - 07:00)	-		92		13

A82 Inveruglas to Pulpit (On-line Upgrade)

Job No.	Section		Maintenance Profile			Local Costs/Durations		Traffic Management		Activity Details				
	NESA Nodes	Length (km)	Year	Works Period	Activity	Works Cost (£k/km)	Works Duration (24-hr Days/km)	Type	Duration	Works Cost (£k)	Duration of On-site Working (7-hr Day)	(12-hr Day)	(24-hr Day)	Weeks
3 (Day)	130 - 140	5.021	2018	Non-Summer	Carriageway Construction	-	66	1x1 Lane Open (40mph)	12hrs per Day (07:00 - 19:00)	-		250		36
3 (Night)	130 - 140	5.021	2018	Non-Summer	Carriageway Construction	-	66	Full Closure	12hrs per Day (19:00 - 07:00)	-		250		36
4 (Day)	130 - 140	5.021	2018	Summer	Carriageway Construction	-	66	1x1 Lane Open (40mph)	12hrs per Day (07:00 - 19:00)	-		83		12
4 (Night)	130 - 140	5.021	2018	Summer	Carriageway Construction	-	66	Full Closure	12hrs per Day (19:00 - 07:00)	-		83		12

A82 Pulpit to North of Ardlui (On-line Upgrade)

Job No.	Section		Maintenance Profile			Local Costs/Durations		Traffic Management		Activity Details				
	NESA Nodes	Length (km)	Year	Works Period	Activity	Works Cost (£k/km)	Works Duration (24-hr Days/km)	Type	Duration	Works Cost (£k)	Duration of On-site Working (7-hr Day)	(12-hr Day)	(24-hr Day)	Weeks
5 (Day)	145 - 175	3.202	2018	Non-Summer	Carriageway Construction	-	-	1x1 Lane Open (40mph)	12hrs per Day (07:00 - 19:00)	-		-		4
5 (Night)	145 - 175	3.202	2018	Non-Summer	Carriageway Construction	-	-	Full Closure	12hrs per Day (19:00 - 07:00)	-		-		4
6 (Day)	145 - 175	3.202	2019	Non-Summer	Carriageway Construction	-	66	1x1 Lane Open (40mph)	12hrs per Day (07:00 - 19:00)	-		159		19
6 (Night)	145 - 175	3.202	2019	Non-Summer	Carriageway Construction	-	66	Full Closure	12hrs per Day (19:00 - 07:00)	-		159		19
7 (Day)	145 - 175	3.202	2019	Summer	Carriageway Construction	-	66	1x1 Lane Open (40mph)	12hrs per Day (07:00 - 19:00)	-		53		7
7 (Night)	145 - 175	3.202	2019	Summer	Carriageway Construction	-	66	Full Closure	12hrs per Day (19:00 - 07:00)	-		53		7

A82 North of Ardlui to Inveraman (On-line Upgrade)

Job No.	Section		Maintenance Profile			Local Costs/Durations		Traffic Management		Activity Details				
	NESA Nodes	Length (km)	Year	Works Period	Activity	Works Cost (£k/km)	Works Duration (24-hr Days/km)	Type	Duration	Works Cost (£k)	Duration of On-site Working (7-hr Day)	(12-hr Day)	(24-hr Day)	Weeks
8 (Day)	175 - 205	2.749	2019	Non-Summer	Carriageway Construction	-	66	1x1 Lane Open (40mph)	12hrs per Day (07:00 - 19:00)	-		137		20
8 (Night)	175 - 205	2.749	2019	Non-Summer	Carriageway Construction	-	66	Full Closure	12hrs per Day (19:00 - 07:00)	-		137		20
9 (Day)	175 - 205	2.749	2019	Summer	Carriageway Construction	-	66	1x1 Lane Open (40mph)	12hrs per Day (07:00 - 19:00)	-		46		6
9 (Night)	175 - 205	2.749	2019	Summer	Carriageway Construction	-	66	Full Closure	12hrs per Day (19:00 - 07:00)	-		46		6

MAINTENANCE DETAILS
DO-SOMETHING PAVEMENT MAINTENANCE PROFILE (QUADRO)
RED CORRIDOR

60-Year Maintenance Period

A82 Tarbet to Inveruglas (On-line Upgrade)

Job No.	Section		Maintenance Profile			Local Costs/Durations		Traffic Management			Activity Details			
	NESA Nodes	Length (km)	Year	Works Period	Activity	Works Cost (£k/km)	Works Duration (7-hr Days/km)	Type	Duration	Works Cost (£k)	Duration of On-site Working (7-hr Day)	(12-hr Day)	(24-hr Day)	Weeks
10	100 - 130	5.551	2031	Neutral	Thin Surfacing	55	4	Shuttle working	12hrs per Day (19:00 - 07:00)	305		13		2
11	100 - 130	5.551	2042	Neutral	Overlay	200	12	Shuttle working		1,110		39		6
12	100 - 130	5.551	2053	Neutral	Thin Surfacing	55	4	Shuttle working		305		13		2
13	100 - 130	5.551	2063	Neutral	Overlay	210	12	Shuttle working		1,166		39		6
14	100 - 130	5.551	2073	Neutral	Thin Surfacing	55	4	Shuttle working		305		13		2

A82 Inveruglas to Pulpit (On-line Upgrade)

Job No.	Section		Maintenance Profile			Local Costs/Durations		Traffic Management			Activity Details			
	NESA Nodes	Length (km)	Year	Works Period	Activity	Works Cost (£k/km)	Works Duration (7-hr Days/km)	Type	Duration	Works Cost (£k)	Duration of On-site Working (7-hr Day)	(12-hr Day)	(24-hr Day)	Weeks
15	130 - 140	5.021	2031	Neutral	Thin Surfacing	55	4	Shuttle working	12hrs per Day (19:00 - 07:00)	276		12		2
16	130 - 140	5.021	2042	Neutral	Overlay	200	12	Shuttle working		1,004		35		5
17	130 - 140	5.021	2053	Neutral	Thin Surfacing	55	4	Shuttle working		276		12		2
18	130 - 140	5.021	2063	Neutral	Overlay	210	12	Shuttle working		1,054		35		5
19	130 - 140	5.021	2073	Neutral	Thin Surfacing	55	4	Shuttle working		276		12		2

A82 Pulpit to North of Ardlui (On-line Upgrade)

Job No.	Section		Maintenance Profile			Local Costs/Durations		Traffic Management			Activity Details			
	NESA Nodes	Length (km)	Year	Works Period	Activity	Works Cost (£k/km)	Works Duration (7-hr Days/km)	Type	Duration	Works Cost (£k)	Duration of On-site Working (7-hr Day)	(12-hr Day)	(24-hr Day)	Weeks
20	145 - 505	3.202	2031	Neutral	Thin Surfacing	55	4	Shuttle working	12hrs per Day (19:00 - 07:00)	176		7		1
21	145 - 175	3.202	2042	Neutral	Overlay	200	12	Shuttle working		640		22		3
22	145 - 175	3.202	2053	Neutral	Thin Surfacing	55	4	Shuttle working		176		7		1
23	145 - 175	3.202	2063	Neutral	Overlay	210	12	Shuttle working		672		22		3
24	145 - 175	3.202	2073	Neutral	Thin Surfacing	55	4	Shuttle working		176		7		1

A82 North of Ardlui to Inveraman (On-line Upgrade)

Job No.	Section		Maintenance Profile			Local Costs/Durations		Traffic Management			Activity Details			
	NESA Nodes	Length (km)	Year	Works Period	Activity	Works Cost (£k/km)	Works Duration (7-hr Days/km)	Type	Duration	Works Cost (£k)	Duration of On-site Working (7-hr Day)	(12-hr Day)	(24-hr Day)	Weeks
25	175 - 205	2.749	2031	Neutral	Thin Surfacing	55	4	Shuttle working	12hrs per Day (19:00 - 07:00)	151		6		1
26	175 - 205	2.749	2042	Neutral	Overlay	200	12	Shuttle working		550		19		3
27	175 - 205	2.749	2053	Neutral	Thin Surfacing	55	4	Shuttle working		151		6		1
28	175 - 205	2.749	2063	Neutral	Overlay	210	12	Shuttle working		577		19		3
29	175 - 205	2.749	2073	Neutral	Thin Surfacing	55	4	Shuttle working		151		6		1

A83 Tarbet to 30/60mph Speed Limit

Job No.	Section		Maintenance Profile			DMRB Costs/Durations		Traffic Management			Activity Details			
	NESA Nodes	Length (km)	Year	Works Period	Activity	Works Cost (£k/km)	Works Duration (7-hr Days/km)	Type	Duration	Works Cost (£k)	Duration of On-site Working (7-hr Day)	(12-hr Day)	(24-hr Day)	Weeks
30	100 - 305	1.002	2020	Neutral	Thin Surfacing	55	4	Shuttle working	12hrs per Day (19:00 - 07:00)	55		2		0
31	100 - 305	1.002	2031	Neutral	Overlay	200	12	Shuttle working		200		7		1
32	100 - 305	1.002	2042	Neutral	Thin Surfacing	55	4	Shuttle working		55		2		0
33	100 - 305	1.002	2052	Neutral	Overlay	210	12	Shuttle working		210		7		1
34	100 - 305	1.002	2062	Neutral	Thin Surfacing	55	4	Shuttle working		55		2		0
35	100 - 305	1.002	2072	Neutral	Overlay	210	12	Shuttle working		210		7		1

A83 60mph section

Job No.	Section		Maintenance Profile			DMRB Costs/Durations		Traffic Management			Activity Details			
	NESA Nodes	Length (km)	Year	Works Period	Activity	Works Cost (£k/km)	Works Duration (7-hr Days/km)	Type	Duration	Works Cost (£k)	Duration of On-site Working (7-hr Day)	(12-hr Day)	(24-hr Day)	Weeks
36	305 - 315	1.147	2020	Neutral	Thin Surfacing	55	4	Shuttle working	12hrs per Day (19:00 - 07:00)	63		3		0
37	305 - 315	1.147	2031	Neutral	Overlay	200	12	Shuttle working		229		8		1
38	305 - 315	1.147	2042	Neutral	Thin Surfacing	55	4	Shuttle working		63		3		0
39	305 - 315	1.147	2052	Neutral	Overlay	210	12	Shuttle working		241		8		1
40	305 - 315	1.147	2062	Neutral	Thin Surfacing	55	4	Shuttle working		63		3		0
41	305 - 315	1.147	2072	Neutral	Overlay	210	12	Shuttle working		241		8		1

A83 Arrochar

Job No.	Section		Maintenance Profile			DMRB Costs/Durations		Traffic Management			Activity Details			
	NESA Nodes	Length (km)	Year	Works Period	Activity	Works Cost (£k/km)	Works Duration (7-hr Days/km)	Type	Duration	Works Cost (£k)	Duration of On-site Working (7-hr Day)	(12-hr Day)	(24-hr Day)	Weeks
42	315 - 500	1.428	2020	Neutral	Thin Surfacing	55	4	Shuttle working	12hrs per Day (19:00 - 07:00)	79		3		0
43	315 - 500	1.428	2031	Neutral	Overlay	200	12	Shuttle working		286		10		1
44	315 - 500	1.428	2042	Neutral	Thin Surfacing	55	4	Shuttle working		79		3		0
45	315 - 500	1.428	2052	Neutral	Overlay	210	12	Shuttle working		300		10		1
46	315 - 500	1.428	2062	Neutral	Thin Surfacing	55	4	Shuttle working		79		3		0
47	315 - 500	1.428	2072	Neutral	Overlay	210	12	Shuttle working		300		10		1

NOTES:
All costs are in average 2002 prices as defined by QUADRO.
Assumes construction period of 3 years (2017-2019) and scheme opening year of 2020
40mph speed restriction between 07:00 - 19:00 during construction period.

MAINTENANCE DETAILS
DO-SOMETHING PAVEMENT MAINTENANCE PROFILE (QUADRO)
GREEN CORRIDOR

Construction Period

A82 Inveruglas to Pulpit (On-line Upgrade)

Job No.	Section		Maintenance Profile			Local Costs/Durations		Traffic Management		Works Cost (£k)	Activity Details			
	NESA Nodes	Length (km)	Year	Works Period	Activity	Works Cost (£k/km)	Works Duration (24-hr Days/km)	Type	Duration		Duration of On-site Working (7-hr Day)	(12-hr Day)	(24-hr Day)	Weeks
1 (Day)	505 - 140	5.021	2018	Non-Summer	Carriageway Construction	-	66	1x1 Lane Open (40mph)	12hrs per Day (07:00 - 19:00)	-		250		36
1 (Night)	505 - 140	5.021	2018	Non-Summer	Carriageway Construction	-	66	Full Closure	12hrs per Day (19:00 - 07:00)	-		250		36
2 (Day)	505 - 140	5.021	2018	Summer	Carriageway Construction	-	66	1x1 Lane Open (40mph)	12hrs per Day (07:00 - 19:00)	-		83		12
2 (Night)	505 - 140	5.021	2018	Summer	Carriageway Construction	-	66	Full Closure	12hrs per Day (19:00 - 07:00)	-		83		12

A82 Pulpit to North of Ardlui (On-line Upgrade)

Job No.	Section		Maintenance Profile			Local Costs/Durations		Traffic Management		Works Cost (£k)	Activity Details			
	NESA Nodes	Length (km)	Year	Works Period	Activity	Works Cost (£k/km)	Works Duration (24-hr Days/km)	Type	Duration		Duration of On-site Working (7-hr Day)	(12-hr Day)	(24-hr Day)	Weeks
3 (Day)	145 - 175	3.202	2018	Non-Summer	Carriageway Construction	-	-	1x1 Lane Open (40mph)	12hrs per Day (07:00 - 19:00)	-		-		4
3 (Night)	145 - 175	3.202	2018	Non-Summer	Carriageway Construction	-	-	Full Closure	12hrs per Day (19:00 - 07:00)	-		-		4
4 (Day)	145 - 175	3.202	2019	Non-Summer	Carriageway Construction	-	66	1x1 Lane Open (40mph)	12hrs per Day (07:00 - 19:00)	-		159		19
4 (Night)	145 - 175	3.202	2019	Non-Summer	Carriageway Construction	-	66	Full Closure	12hrs per Day (19:00 - 07:00)	-		159		19
5 (Day)	145 - 175	3.202	2019	Summer	Carriageway Construction	-	66	1x1 Lane Open (40mph)	12hrs per Day (07:00 - 19:00)	-		53		7
5 (Night)	145 - 175	3.202	2019	Summer	Carriageway Construction	-	66	Full Closure	12hrs per Day (19:00 - 07:00)	-		53		7

A82 North of Ardlui to Inveraman (On-line Upgrade)

Job No.	Section		Maintenance Profile			Local Costs/Durations		Traffic Management		Works Cost (£k)	Activity Details			
	NESA Nodes	Length (km)	Year	Works Period	Activity	Works Cost (£k/km)	Works Duration (24-hr Days/km)	Type	Duration		Duration of On-site Working (7-hr Day)	(12-hr Day)	(24-hr Day)	Weeks
6 (Day)	175 - 205	2.749	2019	Non-Summer	Carriageway Construction	-	66	1x1 Lane Open (40mph)	12hrs per Day (07:00 - 19:00)	-		137		20
6 (Night)	175 - 205	2.749	2019	Non-Summer	Carriageway Construction	-	66	Full Closure	12hrs per Day (19:00 - 07:00)	-		137		20
7 (Day)	175 - 205	2.749	2019	Summer	Carriageway Construction	-	66	1x1 Lane Open (40mph)	12hrs per Day (07:00 - 19:00)	-		46		6
7 (Night)	175 - 205	2.749	2019	Summer	Carriageway Construction	-	66	Full Closure	12hrs per Day (19:00 - 07:00)	-		46		6

MAINTENANCE DETAILS
DO-SOMETHING PAVEMENT MAINTENANCE PROFILE (QUADRO)
GREEN CORRIDOR

60-Year Maintenance Period

Arrochar to Inveruglas (Inveruglas Bypass)

Job No.	Section		Maintenance Profile			Local Costs/Durations		Traffic Management		Works Cost (£k)	Activity Details			
	NESA Nodes	Length (km)	Year	Works Period	Activity	Works Cost (£k/km)	Works Duration (7-hr Days/km)	Type	Duration		Duration of On-site Working (7-hr Day)	(12-hr Day)	(24-hr Day)	Weeks
8	500 - 505	4.623	2031	Neutral	Thin Surfacing	55	4	Shuttle working	12hrs per Day (19:00 - 07:00)	254		11		2
9	500 - 505	4.623	2042	Neutral	Overlay	200	12	Shuttle working		925		32		5
10	500 - 505	4.623	2053	Neutral	Thin Surfacing	55	4	Shuttle working		254		11		2
11	500 - 505	4.623	2063	Neutral	Overlay	210	12	Shuttle working		971		32		5
12	500 - 505	4.623	2073	Neutral	Thin Surfacing	55	4	Shuttle working		254		11		2

A82 Inveruglas to Pulpit (On-line Upgrade)

Job No.	Section		Maintenance Profile			Local Costs/Durations		Traffic Management		Works Cost (£k)	Activity Details			
	NESA Nodes	Length (km)	Year	Works Period	Activity	Works Cost (£k/km)	Works Duration (7-hr Days/km)	Type	Duration		Duration of On-site Working (7-hr Day)	(12-hr Day)	(24-hr Day)	Weeks
13	505 - 140	5.021	2031	Neutral	Thin Surfacing	55	4	Shuttle working	12hrs per Day (19:00 - 07:00)	276		12		2
14	505 - 140	5.021	2042	Neutral	Overlay	200	12	Shuttle working		1,004		35		5
15	505 - 140	5.021	2053	Neutral	Thin Surfacing	55	4	Shuttle working		276		12		2
16	505 - 140	5.021	2063	Neutral	Overlay	210	12	Shuttle working		1,054		35		5
17	505 - 140	5.021	2073	Neutral	Thin Surfacing	55	4	Shuttle working		276		12		2

A82 Pulpit to North of Ardlui (On-line Upgrade)

Job No.	Section		Maintenance Profile			Local Costs/Durations		Traffic Management		Works Cost (£k)	Activity Details			
	NESA Nodes	Length (km)	Year	Works Period	Activity	Works Cost (£k/km)	Works Duration (7-hr Days/km)	Type	Duration		Duration of On-site Working (7-hr Day)	(12-hr Day)	(24-hr Day)	Weeks
18	145 - 175	3.202	2031	Neutral	Thin Surfacing	55	4	Shuttle working	12hrs per Day (19:00 - 07:00)	176		7		1
19	145 - 175	3.202	2042	Neutral	Overlay	200	12	Shuttle working		640		22		3
20	145 - 175	3.202	2053	Neutral	Thin Surfacing	55	4	Shuttle working		176		7		1
21	145 - 175	3.202	2063	Neutral	Overlay	210	12	Shuttle working		672		22		3
22	145 - 175	3.202	2073	Neutral	Thin Surfacing	55	4	Shuttle working		176		7		1

A82 North of Ardlui to Inveraman (On-line Upgrade)

Job No.	Section		Maintenance Profile			Local Costs/Durations		Traffic Management		Works Cost (£k)	Activity Details			
	No.	Length (km)	Year	Works Period	Activity	Works Cost (£k/km)	Works Duration (7-hr Days/km)	Type	Duration		Duration of On-site Working (7-hr Day)	(12-hr Day)	(24-hr Day)	Weeks
23	175 - 205	2.749	2031	Neutral	Thin Surfacing	55	4	Shuttle working	12hrs per Day (19:00 - 07:00)	151		6		1
24	175 - 205	2.749	2042	Neutral	Overlay	200	12	Shuttle working		550		19		3
25	175 - 205	2.749	2053	Neutral	Thin Surfacing	55	4	Shuttle working		151		6		1
26	175 - 205	2.749	2063	Neutral	Overlay	210	12	Shuttle working		577		19		3
27	175 - 205	2.749	2073	Neutral	Thin Surfacing	55	4	Shuttle working		151		6		1

A83 Tarbet to 30/60mph Speed Limit

Job No.	Section		Maintenance Profile			DMRB Costs/Durations		Traffic Management		Works Cost (£k)	Activity Details			
	NESA Nodes	Length (km)	Year	Works Period	Activity	Works Cost (£k/km)	Works Duration (7-hr Days/km)	Type	Duration		Duration of On-site Working (7-hr Day)	(12-hr Day)	(24-hr Day)	Weeks
28	100 - 305	1.002	2020	Neutral	Thin Surfacing	55	4	Shuttle working	12hrs per Day (19:00 - 07:00)	55		2		0
29	100 - 305	1.002	2031	Neutral	Overlay	200	12	Shuttle working		200		7		1
30	100 - 305	1.002	2042	Neutral	Thin Surfacing	55	4	Shuttle working		55		2		0
31	100 - 305	1.002	2052	Neutral	Overlay	210	12	Shuttle working		210		7		1
32	100 - 305	1.002	2062	Neutral	Thin Surfacing	55	4	Shuttle working		55		2		0
33	100 - 305	1.002	2072	Neutral	Overlay	210	12	Shuttle working		210		7		1

A83 60mph section

Job No.	Section		Maintenance Profile			DMRB Costs/Durations		Traffic Management		Works Cost (£k)	Activity Details			
	NESA Nodes	Length (km)	Year	Works Period	Activity	Works Cost (£k/km)	Works Duration (7-hr Days/km)	Type	Duration		Duration of On-site Working (7-hr Day)	(12-hr Day)	(24-hr Day)	Weeks
34	305 - 315	1.147	2020	Neutral	Thin Surfacing	55	4	Shuttle working	12hrs per Day (19:00 - 07:00)	63		3		0
35	305 - 315	1.147	2031	Neutral	Overlay	200	12	Shuttle working		229		8		1
36	305 - 315	1.147	2042	Neutral	Thin Surfacing	55	4	Shuttle working		63		3		0
37	305 - 315	1.147	2052	Neutral	Overlay	210	12	Shuttle working		241		8		1
38	305 - 315	1.147	2062	Neutral	Thin Surfacing	55	4	Shuttle working		63		3		0
39	305 - 315	1.147	2072	Neutral	Overlay	210	12	Shuttle working		241		8		1

A83 Arrochar

Job No.	Section		Maintenance Profile			DMRB Costs/Durations		Traffic Management		Works Cost (£k)	Activity Details			
	NESA Nodes	Length (km)	Year	Works Period	Activity	Works Cost (£k/km)	Works Duration (7-hr Days/km)	Type	Duration		Duration of On-site Working (7-hr Day)	(12-hr Day)	(24-hr Day)	Weeks
40	315 - 500	1.428	2020	Neutral	Thin Surfacing	55	4	Shuttle working	12hrs per Day (19:00 - 07:00)	79		3		0
41	315 - 500	1.428	2031	Neutral	Overlay	200	12	Shuttle working		286		10		1
42	315 - 500	1.428	2042	Neutral	Thin Surfacing	55	4	Shuttle working		79		3		0
43	315 - 500	1.428	2052	Neutral	Overlay	210	12	Shuttle working		300		10		1
44	315 - 500	1.428	2062	Neutral	Thin Surfacing	55	4	Shuttle working		79		3		0
45	315 - 500	1.428	2072	Neutral	Overlay	210	12	Shuttle working		300		10		1

NOTES:
All costs are in average 2002 prices as defined by QUADRO.
Assumes construction period of 3 years (2017-2019) and scheme opening year of 2020
40mph speed restriction between 07:00 - 19:00 during construction period.

MAINTENANCE DETAILS
DO-SOMETHING PAVEMENT MAINTENANCE PROFILE (QUADRO)
BLUE CORRIDOR

Construction Period

A82 North of Ardlui to Inverarnan (On-line Upgrade)

Job No.	Section		Maintenance Profile			Local Costs/Durations		Traffic Management		Activity Details			
	NESA Nodes	Length (km)	Year	Works Period	Activity	Works Cost (£k/km)	Works Duration (24-hr Days/km)	Type	Duration	Works Cost (£k)	Duration of On-site Working (7-hr Day)	(12-hr Day)	(24-hr Day)	Weeks
1 (Day)	505 - 205	2.749	2019	Non-Summer	Carriageway Construction	-	66	1x1 Lane Open (40mph)	12hrs per Day (07:00 - 19:00)	-		137		20
1 (Night)	505 - 205	2.749	2019	Non-Summer	Carriageway Construction	-	66	Full Closure	12hrs per Day (19:00 - 07:00)	-		137		20
2 (Day)	505 - 205	2.749	2019	Summer	Carriageway Construction	-	66	1x1 Lane Open (40mph)	12hrs per Day (07:00 - 19:00)	-		46		6
2 (Night)	505 - 205	2.749	2019	Summer	Carriageway Construction	-	66	Full Closure	12hrs per Day (19:00 - 07:00)	-		46		6

60-Year Maintenance Period

A82 Tarbet to North of Ardlui (High Road Option)

Job No.	Section		Maintenance Profile			Local Costs/Durations		Traffic Management		Activity Details			
	NESA Nodes	Length (km)	Year	Works Period	Activity	Works Cost (£k/km)	Works Duration (24-hr Days/km)	Type	Duration	Works Cost (£k)	Duration of On-site Working (7-hr Day)	(12-hr Day)	(24-hr Day)	Weeks
3	500 - 505	14.018	2031	Neutral	Thin Surfacing	55	4	Shuttle working	12hrs per Day (19:00 - 07:00)	771		33		5
4	500 - 505	14.018	2042	Neutral	Overlay	200	12	Shuttle working		2,804		98		14
5	500 - 505	14.018	2053	Neutral	Thin Surfacing	55	4	Shuttle working		771		33		5
6	500 - 505	14.018	2063	Neutral	Overlay	210	12	Shuttle working		2,944		98		14
7	500 - 505	14.018	2073	Neutral	Thin Surfacing	55	4	Shuttle working		771		33		5

A82 North of Ardlui to Inverarnan (On-line Upgrade)

Job No.	Section		Maintenance Profile			Local Costs/Durations		Traffic Management		Activity Details			
	NESA Nodes	Length (km)	Year	Works Period	Activity	Works Cost (£k/km)	Works Duration (24-hr Days/km)	Type	Duration	Works Cost (£k)	Duration of On-site Working (7-hr Day)	(12-hr Day)	(24-hr Day)	Weeks
8	505 - 205	2.749	2031	Neutral	Thin Surfacing	55	4	Shuttle working	12hrs per Day (19:00 - 07:00)	151		6		1
9	505 - 205	2.749	2042	Neutral	Overlay	200	12	Shuttle working		550		19		3
10	505 - 205	2.749	2053	Neutral	Thin Surfacing	55	4	Shuttle working		151		6		1
11	505 - 205	2.749	2063	Neutral	Overlay	210	12	Shuttle working		577		19		3
12	505 - 205	2.749	2073	Neutral	Thin Surfacing	55	4	Shuttle working		151		6		1

A83 Tarbet to 30/60mph Speed Limit

Job No.	Section		Maintenance Profile			DMRB Costs/Durations		Traffic Management		Activity Details			
	NESA Nodes	Length (km)	Year	Works Period	Activity	Works Cost (£k/km)	Works Duration (7-hr Days/km)	Type	Duration	Works Cost (£k)	Duration of On-site Working (7-hr Day)	(12-hr Day)	(24-hr Day)	Weeks
13	100 - 305	1.002	2020	Neutral	Thin Surfacing	55	4	Shuttle working	12hrs per Day (19:00 - 07:00)	55		2		0
14	100 - 305	1.002	2031	Neutral	Overlay	200	12	Shuttle working		200		7		1
15	100 - 305	1.002	2042	Neutral	Thin Surfacing	55	4	Shuttle working		55		2		0
16	100 - 305	1.002	2052	Neutral	Overlay	210	12	Shuttle working		210		7		1
17	100 - 305	1.002	2062	Neutral	Thin Surfacing	55	4	Shuttle working		55		2		0
18	100 - 305	1.002	2072	Neutral	Overlay	210	12	Shuttle working		210		7		1

A83 60mph section

Job No.	Section		Maintenance Profile			DMRB Costs/Durations		Traffic Management		Activity Details			
	NESA Nodes	Length (km)	Year	Works Period	Activity	Works Cost (£k/km)	Works Duration (7-hr Days/km)	Type	Duration	Works Cost (£k)	Duration of On-site Working (7-hr Day)	(12-hr Day)	(24-hr Day)	Weeks
19	305 - 315	1.147	2020	Neutral	Thin Surfacing	55	4	Shuttle working	12hrs per Day (19:00 - 07:00)	63		3		0
20	305 - 315	1.147	2031	Neutral	Overlay	200	12	Shuttle working		229		8		1
21	305 - 315	1.147	2042	Neutral	Thin Surfacing	55	4	Shuttle working		63		3		0
22	305 - 315	1.147	2052	Neutral	Overlay	210	12	Shuttle working		241		8		1
23	305 - 315	1.147	2062	Neutral	Thin Surfacing	55	4	Shuttle working		63		3		0
24	305 - 315	1.147	2072	Neutral	Overlay	210	12	Shuttle working		241		8		1

A83 Arrochar

Job No.	Section		Maintenance Profile			DMRB Costs/Durations		Traffic Management		Activity Details			
	NESA Nodes	Length (km)	Year	Works Period	Activity	Works Cost (£k/km)	Works Duration (7-hr Days/km)	Type	Duration	Works Cost (£k)	Duration of On-site Working (7-hr Day)	(12-hr Day)	(24-hr Day)	Weeks
25	315 - 500	1.428	2020	Neutral	Thin Surfacing	55	4	Shuttle working	12hrs per Day (19:00 - 07:00)	79		3		0
26	315 - 500	1.428	2031	Neutral	Overlay	200	12	Shuttle working		286		10		1
27	315 - 500	1.428	2042	Neutral	Thin Surfacing	55	4	Shuttle working		79		3		0
28	315 - 500	1.428	2052	Neutral	Overlay	210	12	Shuttle working		300		10		1
29	315 - 500	1.428	2062	Neutral	Thin Surfacing	55	4	Shuttle working		79		3		0
30	315 - 500	1.428	2072	Neutral	Overlay	210	12	Shuttle working		300		10		1

NOTES:
All costs are in average 2002 prices as defined by QUADRO.
Assumes construction period of 3 years (2017-2019) and scheme opening year of 2020
40mph speed restriction between 07:00 - 19:00 during construction period.

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