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Stage 1 Report

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REPORT SUMMARY

S1 INTRODUCTION

This is the non-technical executive summary of the report findings outlined in the 'Stromeferry Appraisal, STAG Part 1 / DMRB Stage 1 Report', issue dated May 2013.

The commission to produce this appraisal document was granted by The Highland Council TEC Services to URS in October 2012. The full commission encompasses an appraisal of route options in relation to the Stromeferry Bypass to satisfy the requirements of the Scottish Transport Appraisal Guidance (STAG), including the Pre-Appraisal, Part 1 and 2 of the appraisal process, as well as assessments in accordance with the Design Manual for Roads and Bridges (DMRB) Stage 1 and 2.

The preliminary findings of the Part 1 / Stage 1 report, as summarized in this document, were presented to the Public at a Public Exhibition held at the Lochcarron Village Hall in April 2013. This document as a whole presents the final report issued after the TECS Committee meeting in May 2013, and incorporating comments received during the period April / May 2013.

Following this first report stage, the commission is to further include detailed appraisal work during the period May 2013 to April 2014, which should result in a preferred route option emerging from the assessment work in Autumn 2014.

S1.1 Study Brief

In reaction to a rock fall event in December 2011, which closed the A890 over a period of several months, The Highland Council approved the proposal to carry out a further options appraisal in connection with the Stromeferry Bypass.

The Commission was to re-open the previous discussions and considerations on feasible route corridors and options, applying the processes detailed in current Government Guidelines, with the aim to generate a robust solution.

The appraisal was also to identify a suitable study area, and to describe and assess alternative route corridors and options identified and sifted during the Pre-Appraisal stage against identified transport problems and opportunities, as reflected in the Project Objectives, and also against criteria set out by the Scottish Government. These Government criteria cover aspects of environment, safety, economy, integration, accessibility and social inclusion, as well as the deliverability and affordability of a project and public acceptability.

In addition, the appraisal was to include outline engineering, environmental, traffic and economic assessments, considering the condition of the existing road network and highway structures, the existing topography, geology and geomorphology of the area, as well as looking at drainage issues and utilities. Furthermore, this was to include a brief assessment of the existing environment, and likely environmental effects of any of the proposed route options, and to highlight possible mitigation measures. Initial traffic counts and surveys were to inform the outline economic and traffic appraisal.

The appraisal process involved both a statutory stakeholder group, as well as representatives from the local communities and business interests through an economic stakeholder group. The general public was invited throughout the process to provide comments through a public website, and all findings of this first stage of the assessment were displayed at a Public Exhibition in April 2013. Problems, opportunities and constraints, as well as proposed route

options, were identified, discussed and sifted during various Stakeholder workshops, which took place with both Stakeholder groups between November 2012 and January 2013.

These discussions resulted in a list of key issues, which are fully presented in the report. These related to Health & Safety, Disruption, Landscape & Environment, Socio Economics, Financial and Railway Interface. Existing and future problems and constraints were developed into potential opportunities, with the whole process providing a basis for the later development of the Project (Transport Planning) Objectives.

The main issues identified during this process were highlighting the general feeling that the existing route is perceived to be unreliable, and that a new, reliable road to modern standards, to assure adequate safety and route alignment and gradients, would be required, keeping journey times and local connections to communities in mind.

The potential of economic growth of the area due to development of the Kishorn yard, and therefore the need for adequate routes to take HGV traffic, as well as interest in renewable energy options, were also included.

S1.2 Findings & Conclusions

The appraisal carried out as part of this Stage 1 process, encompassing the Pre-Appraisal and Part1 stage in accordance with STAG, started off by considering 31 No route options located in 6 No route corridors, which were developed and agreed during the early stages of the assessment. Corridors were extending from Dornie in the south, to Kishorn and the Strathcarron Junction in the north. During a sifting procedure, which stakeholder groups had an active involvement in, the number of route options to be considered during the Stage 1 appraisal were reduced to 17 No route options. Reasons for early dismissal of route options were mainly perceived buildability and affordability issues, with retained routes offering the same level of service.

The STAG Part 1 and DMRB Stage 1 assessment of route options that followed the above, resulted in the proposals to consider two northern routes, incorporating either a tunnel or bridge crossing of the Strome Narrows, and five on-line options, involving a viaduct, tunnel, extended avalanche shelter and shared road & rail use, as well as a 'do-minimum' option, where the existing road would remain as is. In addition, one southern route through Glen Udalain, together with associated local link routes, was also to be taken forward to the next stage of the appraisal. The feasibility of incorporating a renewable energy option into one of the northern routes is also to be further investigated.

The above concludes to take eight route proposals (located in three route corridors) and a renewable energy option into the Stage 2 appraisal.

S2 ANALYSIS OF PROBLEMS, OPPORTUNITIES & CONSTRAINTS

S2.1 Introduction

The purpose of this chapter of the report was to outline the adopted process to analyse identified or perceived problems and potential opportunities with the transport system in connection with the Stromeferry Bypass. It presents problems, opportunities and constraints, which were identified during stakeholder discussions held at the Pre-Appraisal stage, and provides information regarding the existing conditions recorded on the road network affected by this appraisal.

Suitable study areas identified and agreed to set the geographical boundaries for this appraisal were identified. The wider area was considered in relation to the economical and strategic transport links to and from the area, including Skye, links to Invergordon in the East, and west to Ullapool. The local area was considered for proposed route options, as well as problems, opportunities and constraints relevant to the Stromeferry Appraisal and covered generally a radius of approximately 10km around Stromeferry.

S2.2 Study Background

The Stromeferry Bypass is an approximately 12km long section of public road alongside the southern shore of Loch Carron, located in Wester Ross, in the western Highlands of Scotland. The road forms part of the A 890, between the Strathcarron Junction and the tie in with the A87, Invergarry to Kyle of Lochalsh Trunk Road, at Auchtertyre. The road also forms part of the wider road network between Dingwall west to the Isle of Skye via Achnasheen, and provides a popular alternative route from Inverness to Kyle of Lochalsh and Skye.

The public road and a single track railway line are sharing a tight corridor along the southern shores of Loch Carron, which is particularly restricted over an approximately 4.5 km long section from Ardnarff to Attadale. The A 890 is mainly a single carriageway but reduces frequently to single track with passing places along this section of road.

Up until 1970, when the bypass was opened to the Public, the transport link from Kyle of Lochalsh north towards Ullapool was provided by a ferry service crossing the Strome Narrows in between South and North Strome, with minor roads linking the crossing to the local road network at either end.

Since the Stromeferry Bypass was opened, the approximately 4.5km long section of mainly single track road from Ardnarff to Cuddies' Point, which is located just west of Attadale, has been subject to landslides and rock fall events, causing The Highland Council to temporarily close the road on several occasions, in order to enable remedial works to the rock slopes to take place.

These events also affected the railway line and forced road and rail users to accept up to 130mile temporary road diversions during these closures. Other contingency measures, including dual running of road and rail and a ferry service from South to North Strome, were put in place by The Highland Council to alleviate some of the traffic problems through periods of road closures following more recent rock fall events.

Due to the ongoing problems with this section of public road, the then Highland Regional Council commissioned several feasibility studies in the 1990s, looking at various possible route options and schemes to bypass the problem areas. However, no final decision was reached on which option to take forward at that stage, and The Highland Council continued to maintain the route and carry out maintenance and emergency works, as and when required.

The issues with regards to ongoing rock fall events affect both the local Loch Carron area from Plockton, Strathcarron and Lochcarron Village up to Applecross, but also significant transport links from East to West, from Skye to Ullapool and Inverness and wider geographical linkages South to North between Fort William and the North West Coast of Scotland.

Transport reliability and dependency is seen as an important business consideration, with businesses vulnerable to delivery delays, uncertainty regarding connectivity and accessibility etc. This affects most local businesses in the retail, tourism, haulage and transportation and other sectors.

S3 TRANSPORT PLANNING OBJECTIVES

S3.1 Introduction

This chapter of the report provides a summary of the process adopted in relation to the Stromeferry Appraisal to establish a set of agreed Project Objectives, together with a list of National and Regional objectives steered by Government policies.

S3.2 Developed Project & Transport Planning Objectives

The Stakeholder workshops held during the Pre-Appraisal stage of the project were conducted in accordance with the requirements of the Scottish Transport Appraisal Guidance (STAG).

A robust Pre-Appraisal is required to provide the foundation to the whole appraisal process, since it promotes the analysis of opportunities in parallel to the identification of transport problems. The aim of the Pre-Appraisal process was to engage stakeholders in the development of the Project Objectives, to capture the essence of the evidence based problems to be addressed and to identify opportunities to be potentially realised.

Project Objectives agreed throughout the Pre-Appraisal stage did not aim to prioritise between route options, but were understood to be an aid to the process of decision making during this appraisal and to allow for informed choices to be made. A set of 'local' Project Objectives, which were proposed to aid the appraisal of route options during the Part 1 assessment, were developed during the Pre-Appraisal stage, as shown in Table S4.1.

'Strategic' Objectives, which consider the Government's Purpose, National Outcomes and Government Agencies' policy statements in relation to this study, were also investigated as part of the appraisal. These are considered to be reflected in the set of agreed Transport Planning (Project) Objectives developed during the process.

The proposed Transport Planning or Project Objectives were not weighted. Relevance in relation to the STAG criteria of environment, safety, economy, integration and accessibility was considered.

S4 OPTION GENERATION AND SIFTING

S4.1 Introduction

The development and sifting of possible route corridors and options formed the central part of the Stage 1 appraisal. The process of considering and, if appropriate, eliminating proposed route options had to be carried out in a logical, transparent, and auditable manner.

During the Pre-Appraisal Stage of this study, both historical and new proposed routes and route corridors were considered. The Stromeferry Bypass project has a long history of feasibility considerations for both on-line and off-line route options, reflecting the ongoing problems associated with the existing route. This historical work was given due consideration, but without prejudice for any particular option, alongside any new route options generated during the Pre-Appraisal stage.

Stakeholder discussions in connection with the development of route options and corridors were focused on the 'local study area', as agreed.

The following table shows the final set of Transport Planning Objectives developed for this project during the Pre-Appraisal process and as agreed with Stakeholders at the joint meeting held on the 31st January 2013.

TRANSPORT PLANNING OBJECTIVES TRANSLATED INTO SMART OBJECTIVES		Table S4.1								
Ref.	Draft SMART Objectives	Appraisal Criteria Objective								
A(1)	Safeguard and, where possible and appropriate, enhance and provide access to the natural and built environment and areas of national, regional and local importance and heritage, during construction, maintenance and operation of the scheme (with reference to environmental appraisal)	Environment	√							
B(2)	Minimise all risk during design, construction, operation and maintenance (with reference to Risk Register)		√	√		√				
C(3)	Ensure deliverability of scheme within programme and to agreed capital cost and maintenance budgets, thus providing 'Value for Money'					√				
D(4)	Deliver a safe and reliable, 2 lane carriageway, by applying appropriate / proportionate design standards			√		√		√		√
E(5)	Solution reduces, or does not increase, the risk to and liability of the railway and maintains suitable access over the life of the scheme			√		√				√
F(6)	Keep the A 890 and peripheral road network open during construction					√		√		√
G(7)	Maintain and improve local social cohesion by improving accessibility for emergency services responding to call-outs, as well as for the local population making use of local and regional leisure, health and educational facilities					√		√		√
H(8)	Maintain and improve choice of transport mode and integration of public transport links over the lifetime of the scheme					√		√		√
I(9)	Scheme to take account of relevant local, regional and national planning policies (during the design stage)		√					√		
J(10)	(Objective removed during Joint Stakeholder Workshop discussions, as included in K(11) below)									
K(11)	Maximise / improve network efficiency, sustainable connectivity and social cohesion in terms of journey times and journey reliability in the Wester Ross area					√		√		√
L(12)	Deliver a scheme that assists both the local businesses to maximise opportunities for sustainable development and economic growth over the life of the scheme					√		√		√

It should be noted, that all developed route options have been given due consideration and been assessed on their own merit, both during the Pre-Appraisal, as well as this Stage 1 assessment.

All route options considered were assessed having both motorized and non-motorised users in mind.

S4.2 Options Generation & Sifting Process

During the Pre-Appraisal stage, 31 route options were identified. These were located in 6 No. route corridors, labeled (north to south) Outer North (ON), North Shore (NS), Mid Loch (M), On-Line (ON), Southern (S) and Outer South (OS). The route options were discussed and agreed in detail during Stakeholder workshops, and some (14 No.) dismissed during a first and second sift.

Reasons for dismissing routes early were mainly similarities with other route options, assumed buildability or deliverability issues due to estimated excessive costs (in particular of the proposed mid-loch crossings), winter maintenance (routes across the Cnoc nam Mult and Logg nam Breac Mora) and routes taking traffic too far off the existing alignment (Outer Southern routes).

This left 17 No. routes to be assessed during the Part 1/ Stage 1 appraisal.

During the Part 1 / Stage 1 assessment of the routes, a further 6 No. route options were dismissed due to their poor scoring against appraisal criteria (including the developed Transport Planning Objectives, and Government criteria), as well as on engineering, environmental and economic grounds.

In addition some of the north shore routes requiring a Strome Narrow crossing were rationalized by presenting the Narrows crossings as a corridor, which could be added to any northern routes. The route with potentially the highest risk during construction and long-term of the on-line route options, namely the proposals for on-line improvements O1, was also dismissed at this stage. Furthermore, southern routes were developed into a principal route with associated local link routes.

Therefore, following the three stages of sifting during Pre-Appraisal and Stage 1, 9 No. route options were presented as the 'emerging route options' at the Public Exhibition on the 27th April 2013.

These included 2 No. northern route options (N6 & N9), plus a renewable energy option (N6b), 5 No. on-line proposals and 1 No. southern route, presented as one principal route (S4) with two local link routes (former S1/3). An illustration and summary of the routes are presented on Figures S4.2.1 and Table S4.2.

S4.3 Engineering Assessment

The engineering assessment conducted in relation to the Stromeferry Bypass has been carried out in accordance with the requirements of the current guidance provided in the DMRB (Design Manual for Roads and Bridges). This included a broad assessment of engineering issues only at this stage, with a more in-depth assessment following at Stage 2.

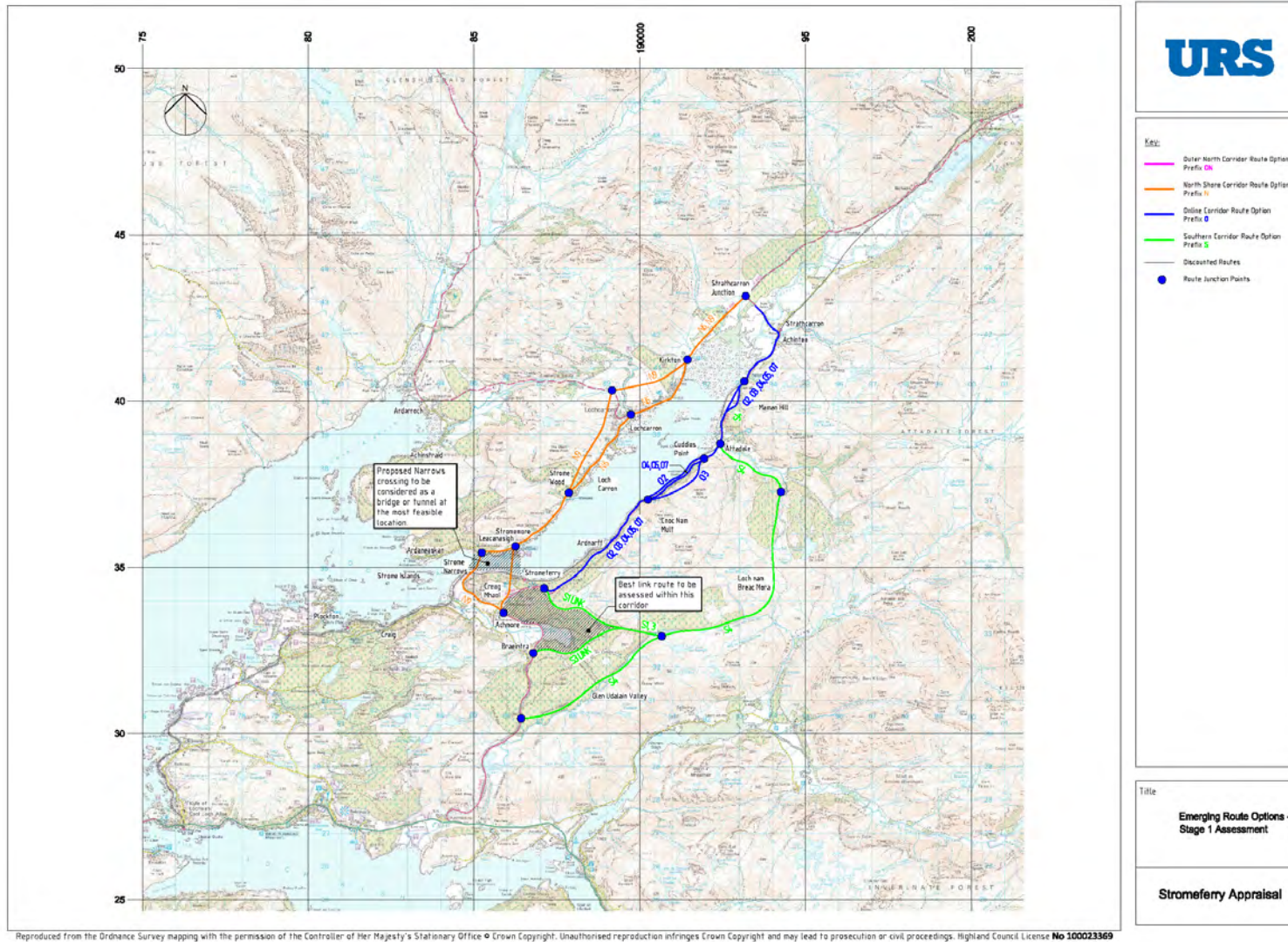


Figure S 4.2.1 – Route Options Emerging after the Stage 1 Appraisal

Table S4.2 – Summary Table of Selected Route Options

CORRIDOR	OPTION	DETAIL	DESCRIPTION
Northern Corridor			
	N6	Route off-line from A890, but on-line through Lochcarron Village	Route North N6 is an off-line route option originating at Achmore, considering (an eastern) Strome Narrows crossing and following the route of the existing minor road along the northern shore of Loch Carron, upgraded to agreed design standards. This route remains on-line through Lochcarron Village
	N6b	Route as above, considering a renewable energy option	This route follows the alignment, in principle, as route N6 (or alternatively N9) . This route considers using the Narrows crossing to incorporate devices to generate renewable energy.
	N9	Route off-line from A890, bypass of Lochcarron Village	Route N9 is an additional route option proposed to provide a full bypass of Lochcarron Village. This route is an off-line route option considering a western bridge crossing of the Strome Narrows, and follows the route of the existing minor road along the northern shore of Loch Carron, upgraded to agreed design standards.
On-line Corridor			
	02	Viaduct	Route On-line O2 considers on-line improvement of the existing carriageway and a local 1.8km bypass of the rock fall area west of Cuddies' Point by means of a cantilevered structure along the shoreline.
	03	Tunnel	Route On-line O3 considers on-line improvement of the existing carriageway and a local 1.6km bypass of the rock fall area west of Cuddies' Point by means of an inland tunnel structure
	04	Do-minimum	Route On-line O4 is the 'Do-Minimum' scenario, with no proposed improvements to the existing route. This option also includes considerations for suitable contingency measures during (future) road closures.
	05	Shared use	Route On-line O5 considers on-line improvement of the existing carriageway and a local 1.8km shared road / rail corridor west of Cuddies' Point
	07	Avalanche Shelter	Route On-line O7 considers on-line improvement of the existing carriageway and a local 2.0km extended rock shelter west of Cuddies' Point.

CORRIDOR	OPTION	DETAIL	DESCRIPTION
Southern Corridor			
	S4	Glen Udalain	Route South S4 considers a principal southern off-line bypass route from the A890 through Glen Udalain and Attadale valley, and on-line improvements of the existing A890 carriageway from Attadale north. In addition, local link routes to the Stromeferry / Achmore area (S1/3) are also to be considered.
Strome Narrow Crossings			
	Any northern route option	Bridge	Considerations for the most suitable location for a bridge crossing of the Strome Narrows.
		Tunnel	Considerations for the most suitable location for a tunnel crossing of the Strome Narrows.

The engineering assessment as outlined in the full Stage 1 report considered the existing condition of the A890 carriageway and structures, as well as topography, hydrology and geology of the area in relation to proposed new route alignments.

Assessment of the existing route highlighted the problems with regards to the restricted corridor alongside Loch Carron, as well as the steep road gradients both on the Maman Hill section, as well as in between Stromeferry and Ardnarff.

All routes considered in the appraisal were assessed from a starting point on the A890 near Stromeferry, to an endpoint at the Strathcarron Junction. The proposed new road alignments are to provide an adequate road width to modern standards, with sufficient width to allow safe use by all traffic, including non-motorised users. The assessment of alignments therefore considered a two lane carriageway, with each lane 3.0m wide, with a 0.65m wide delineated hard strip and 2.5m wide soft verges on either side. This would consider a total corridor width of 12.30m.

Maximum gradients of 10% were set where existing or new road alignments are crossing a steep topography, with the aim to reduce this to 8% maximum at the detailed design stage.

Each of the proposed 17 No. route options were appraised in detail, considering both horizontal (plan) and vertical alignments against the currently accepted road standards. All routes were considered to a design speed of 100 kph (60 mph).

The engineering assessment also covered existing and / or new structures, including bridges, tunnels, culverts and retaining walls, and highlighted issues regarding existing dwellings along proposed routes, where these may restrict potential widening of existing roads. Assessment of the existing A890 between Ardnarff and Cuddies Point included developing a variety of possible local bypass measures, as well as considerations to excavate into existing rock slopes to achieve a widened road corridor.

Considerations for feasible crossings of the Strome Narrows, including bridge structures and tunnels at various locations, were also included.

In addition, information on existing Utilities was gathered and reviewed to establish if these may have an implication on any of the route proposals. Outline proposals in relation to the possibility of a renewable energy option were also investigated as part of the engineering assessment. These covered tidal barrages and tidal stream devices.

Furthermore, Chapter 5 of the report included very outline considerations of scheme costs, which will be further refined during the more detailed Stage 2 works.

S4.4 Environmental Assessment

The environmental appraisal carried out in relation to the Stromeferry Bypass was conducted drawing guidance provided in the Design Manual for Roads and Bridges (DMRB). The key purpose of this stage of the appraisal is to allow a comparison of alternative options, enabling those options which are unsuitable on environmental grounds to be filtered out at an early stage. At this stage the appraisal did not include any detailed on-site survey work, but was conducted using information available for a 'desk based' study. The process also included further consultations with some of the regulatory stakeholders.

The assessment identified environmental advantages, disadvantages and constraints, considering aspects of nature conservation, landscape, road drainage and water environment, noise, air, geology and soils, cultural heritage, effects on travelers and community and private assets. A review of Government policies and plans was also conducted to ensure that none of the route proposals were contradicting these.

The environmental appraisal was conducted using established route corridors (Outer North, North Shore, On-line and Southern), plus an additional corridor covering the Strome Narrows crossings. Nevertheless, where impacts of individual routes within a corridor differed greatly from the assessment of the corridor, this was further assessed and commented on.

The appraisal of all route corridors against the key aspects above was then reported and summarized using a criteria scale from 'major benefit', over 'no benefit or impact' to 'major cost or negative impacts'. Consideration was given to both the magnitude of the effect, and the sensitivity of the receptor.

S4.5 Traffic & Economic Assessment

The Stage 1 assessment in relation to the Stromeferry Bypass also included a high level traffic and economic appraisal of the 17 No. route options emerging after the Pre-Appraisal stage.

Available information on traffic counts were used to establish a traffic pattern on the existing route, confirming the high seasonal dependency with peak flows recorded between May and September, and the busiest month being August. At present, no detailed traffic data regarding user groups, origin and destination information, is available. These will be established during the more detailed Stage 2 works. However, assumptions made regarding the usage of the route, considering this to be a 'rural tourist road', suggest that the route is mainly used by cars (over 80%), and 7.6% of light, with a similar percentage of heavy goods vehicles, and the remainder of 1% of coaches.

The above was important in order to establish the likely economic impact of road closures of the A890 due to rock fall on the various road users. Ten events of rock fall were recorded since March 1990, with the most significant events closing the road for 8 weeks in March 1990, and approximately 4 months during December 2011 and January 2012.

A business survey conducted as part of this appraisal indicated, that the more recent road closure did have a negative impact on local businesses. The survey indicated that road closures lasting longer than 7 days could have a major impact, mainly on businesses serving

the tourism sector, with a substantial proportion of businesses potentially losing more than 30% of their turnover during that period.

The economic survey also included considerations of likely effects that a new route could have on the local economy. Assessment by corridor looked at the distribution and scale of potential impacts, with the main identified sectors covering tourism, retail and wholesale, agriculture, forestry and fish farming and green energy.

S4.6 Other Considerations – Railway Interface

The A890 and the existing Dingwall to Kyle of Lochalsh railway line share a very restricted corridor between Strathcarron and Stromeferry, in particular along the south eastern shore of Lochcarron in between Ardnarff and Attadale. In the past, this increased transport problems and costs during clear-up operations after a rock fall, and this also restricts potential medium to long term measures to modernize road and railway along this section in the future.

However, both road and railway have been recognized as fulfilling an important transport role at present, with no immediate or long-term plans to close either.

Since the road opened in 1970, the liability for inspecting and maintaining the rock face, and therefore safeguarding both the road and railway line, has been the sole responsibility of The Highland Council. It is assumed that this will be the case as long as the public road remains on the existing route alignment. What is however unclear, is whether the liability will remain with The Highland Council, if an off-line route option will emerge as a preferred option after the full appraisal work into finding a solution to the current problems of the Stromeferry Bypass.

Proposals have been considered to develop the existing route corridor into a rock trap arrangement which would protect the railway line from future rock falls, but the long term responsibility to maintain such an arrangement still needs to be confirmed.

Were the road to remain on-line, various protection measures as outlined within the discussed on-line route options have been considered. These include an extended avalanche shelter, a tunnel or elevated road structure bypassing the worst of the rock fall area, or a combined road rail solution, where the railway line is developed into a second lane to be used by both the road and railway traffic.

The above will be considered in further detail during the next stage of this appraisal.

S5 SUMMARY, CONCLUSIONS & RECOMMENDATIONS

S5.1 Summary

The Part 1 / Stage 1 assessment of route options in relation to the A890 Stromeferry Bypass was conducted in keeping with the requirements as outlined in the Scottish Transport Appraisal (STAG) guidance and the Design Manual for Roads and Bridges (DMRB).

The assessment as detailed in the report encompassed a Pre-Appraisal stage, which involved two stakeholder groups and identified 31 No. potential route options located in 6 No. route corridors within the agreed study area.

During the workshop discussions held at the Pre-Appraisal stage, Transport Planning Objectives were developed, reflecting both locally recognized problems and opportunities in relation to the existing A890 between the Strathcarron Junction and Stromeferry, as well as national and regional objectives derived from government policies and directives.

During workshop discussions 14 No. route options were dismissed on grounds of perceived buildability and affordability issues, leaving 17 No. route options to be assessed during the Part 1 / Stage 1 appraisal.

These emerging options were appraised against STAG criteria, including the developed Transport Planning Objectives, as well as aspects of environment, safety, economy, integration, accessibility, social inclusion, deliverability, public acceptability and affordability. Feeding into this appraisal were separate assessments carried out in accordance with the requirements of the DMRB, considering engineering and environmental issues, as well as an assessment of traffic and economic issues, including outline costs.

Findings of the assessments and appraisals conducted were presented in various summary tables, using a recognized standard seven point scale, ranging from major benefit to major negative impact identified for a particular route option against the criteria outlined above.

S5.2 Conclusions

A review of the summary tables established during the appraisal indicated, that all new (greenfield) routes score poorly on environmental grounds, with less impact anticipated for the on-line route proposals. In economic and affordability terms, routes that do not require any major structures are more attractive, and therefore all northern routes, which require a crossing of the Strome Narrows, result in a poorer score than southern routes. All on-line proposals have higher risks associated with them, based on assumptions made regarding buildability, likely disruptions to both road and rail users, and estimated cost of construction.

Considering overall scores against the criteria, southern routes score highest, followed by the least expensive north shore route. All on-line proposals resulted in a negative to neutral score, mainly due to potential disruptions during construction and associated perceived low public acceptability. The tunnel option appeared to be the most favorable on-line proposal. Proposed on-line improvements resulted in the poorest overall score, mostly due to associated risks and disruptions.

In order to overcome affordability issues, as well as some of the buildability and disruption issues, phased construction was considered for all route proposals, but particularly the on-line options.

S5.3 Recommendations

Recommendations outlined in the report make suggestions regarding whether a route option considered at Stage 1 should be progressed to the Stage 2 work, or rejected at this point in the assessment process.

Recommendations are made for route proposals ON3, N2 & N2b, O1, O6 and S5b to be rejected, and southern route proposals to be rationalized, leaving 9 No. proposals to be considered at Stage 2, as shown on figure S4.2.1. Route proposals are rejected based on poorest scores within the respective corridors, as well as eliminating options with the highest associated potential risks or buildability and acceptability issues. In addition, where a route along existing route corridors can potentially deliver a similar solution as a considered new route option (for example comparing N9 to ON3), the option following established routes (in this case N9) would be preferred at this stage.

North Shore options to remain at this stage are N6 (from Strome More through Lochcarron Village to the Strathcarron Junction) and N9, with a similar alignment from Strome More to Strome Wood, but including a full bypass of the village of Lochcarron. Stage 2 works would determine the most feasible alignment for this corridor, as well as consider a renewable energy solution currently presented as N6b.

Strome Narrows crossings are to be considered in general, including both tunnel and bridge options, to determine the most advantageous solution during the Stage 2 appraisal work. These considerations are also to include further detailed investigations of a renewable energy solution.

Although all on-line proposals do not score as well, 5 No. options are to be further investigated during the more detailed appraisal stage. These include a 'do-minimum' option, where the existing route corridor will remain as is, as well as various considerations for a local bypass of the section worst affected by rock fall in the past. These include a viaduct, tunnel, extended avalanche shelter and a combined road-rail solution.

For the southern corridor considered, it is recommended that a principal route along S4 is adopted at this stage, with considerations for a local link route to the Stromeferry / Achmore area, represented by the shaded area between former link routes S1 and S3 on figure S4.2.1.

The report also recommends, that further consultation discussions with Network Rail should be sought to clarify the situation regarding long-term liability concerning inspection and maintenance of rock slopes along the existing road corridor and other issues.

In addition, detailed survey work to supplement the current findings of the engineering, environmental, economic and traffic assessments will also be required.

Recognising the fact that potential costs, complexity and buildability of some of the (on-line) route proposals may become critical in the decision process, it is further recommended to involve established civil engineering contractors to inform the conclusions to the Stage 2 works.

Table S4.2 summarises the route options proposed to be taken forward into the Stage 2 appraisal work.

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1 INTRODUCTION

1.1 Study Background

1.1.1 *General*

The Stromeferry Bypass is an approximately 12km long section of public road alongside the southern shore of Loch Carron, located in Wester Ross, in the western Highlands of Scotland. The road forms part of the A 890, between the Strathcarron Junction and the tie in with the A87, Invergarry to Kyle of Lochalsh Trunk Road, at Auchtertyre. The road also forms part of the wider road network between Dingwall west to the Isle of Skye via Achnasheen, and provides a popular alternative route from Inverness to Kyle of Lochalsh and Skye.

The public road and a single track railway line are sharing a tight corridor along the southern shores of Loch Carron, which is particularly restricted over an approximately 4.5 km long section from Ardnarff to Attadale. The A 890 is mainly a single carriageway but reduces frequently to single track with passing places along this section of road.



Figure 1.1 – Southern Shore of Loch Carron from Attadale in the east (top) towards South Strome in the west (bottom)

Up until 1970, when the bypass was opened to the Public, the transport link from Kyle of Lochalsh north towards Ullapool was provided by a ferry service crossing the Strome Narrows in between South and North Strome, with minor roads linking the crossing to the local road network at either end.

Since the Stromeferry Bypass was opened, the approximately 4.5km long section of mainly single track road from Ardnarff to Cuddies' Point, which is located just west of Attadale, has been subject to landslides and rock fall events, causing the Local Authority to temporarily close the road at several occasions, in order to enable remedial works to the rock slopes to take place.

These events also affected the railway line and forced road and rail users to accept up to 130mile temporary road diversions during these closures. Other contingency measures, including dual running of road and rail and a ferry service from South to North Strome, were put in place by The Highland Council to alleviate some of the traffic problems through periods of road closures following more recent rock fall events.

Due to the ongoing problems with this section of public road, the Local Authority commissioned several feasibility studies in the 1990s, looking at various possible route options and schemes to bypass the problem areas. However, no final decision was reached on which option to take forward at that stage, and The Highland Council continued to maintain the route and carry out emergency works, as and when required.



Figure 1.2 – Area Plan

1.1.2 *Geographical & Economical Context*

The issues with regards to ongoing rock fall events on the A 890 between Ardnarff and Cuddies' Point affect both the local Loch Carron area from Plockton, Starthcarron and Lochcarron Village up to Applecross, but also significant transport links from East to West, from Skye to Ullapool and Inverness and wider geographical linkages South to North between Fort William and the North West Coast of Scotland.

The Local Transport Strategy plan identifies the A890 as a 'H2a Regional' road in the context of the Highland roads hierarchy. The route does not feature in the Strategic Transport Projects Review, as it is not a Trunk Road. Although nationally not recognized as a 'strategic' route, locally it provides vital links to health, educational and leisure facilities, as well as places of work, and is a popular tourist route. The West Coast of Scotland is also home to a variety of businesses from renewable energy developments and fish farming, to forestry enterprises, and more local shops and tourism related businesses, all of which rely on the availability of the (local) road network.

Transport reliability and dependency is seen as an important business consideration, with businesses vulnerable to delivery delays, uncertainty regarding connectivity and accessibility etc. This effects most local businesses in the retail, tourism, haulage and transportation and other sectors.

Closure of the A890 alongside Loch Carron results in diversions via the wider public road network of 130 miles length, through Achnasheen, Muir of Ord , Loch Ness side and Kintail as shown below.



Figure 1.3 – Diversion Route



Figure 1.4 – Northern Shore of Loch Carron, looking west towards Lochcarron Village

1.1.3 *Social Context*

The Highland Council Local Transport Strategy outlines the ‘uniqueness’ of the Highland area, suggesting ‘*the Highlands are distinctive within the UK with their unique culture, extreme weather patterns and rugged topography..*’ as well as highlighting that ‘*outwith the Moray Firth area there are many scattered rural communities with low population densities and a high car dependency. Many of these communities, including Wester Ross and Lochaber, are economically fragile and geographically remote*’.

The study area is covered under the context of the ‘Single-Outcome-Agreement’ between the Scottish Government and the Highland Community Planning Partnership as part of the Highland area. This agreement document identifies the area under consideration as a 2 to 3 on a scale of 7 indicators for fragile areas, 7 being most fragile. On the Scottish index of Multiple Deprivation, the Loch Carron area is shown as 40 to 60% for level of deprivation in the Highlands, with 0% being most deprived and 100% least deprived.

The area under consideration forms part of Highland Ward 06. Current Ward statistics for Ward 06, Wester Ross, Strathpeffer and Lochalsh show that this Ward is the largest in Highland, with the second lowest population density. The overall age profile is older than the

Highland average with a below average proportion in the under 45 age group. It also states that *‘the rural nature of the Ward is reflected in highest proportion of self-employed workers in Highland /.. It has a large number of jobs in the health, retail and education sectors /.., with the highest percentage of people employed of 24.3% in ‘accommodation and food services’.*

Further detailed information considering the social context in connection with this project, is provided in chapter 6 of this report.



Figure 1.5 – South west end of Loch Carron, looking west towards the Narrows

1.2 Study Brief

1.2.1 *The Project Brief*

Following a rock fall event in December 2011, when the A890, Stromeferry Bypass, had to be closed over a period of several months, The Highland Council Committee for Transport, Environmental and Community Services, approved the proposal for a further options appraisal in connection with the Stromeferry Bypass to be carried out in August 2012.

URS Infrastructure and Environment UK Ltd were appointed by The Highland Council in October 2012.

The Client's brief included the following stipulations.

1. The study is to review and consider relevant historical information from The Highland Council archives;
2. The study is also to carry out proportionate appraisal work following current Scottish Government Appraisal Guidelines and the DMRB;
3. In accordance with STAG, during the Pre-Appraisal process the Consultant is to establish Stakeholder Groups, to carry out Stakeholder workshops and to develop the defined objectives for the scheme in consultation with the Stakeholders and the Client, considering identified problems and opportunities;
4. The commission is also to undertake a Stage 1, Option Generation, Sifting and Development process in accordance with the Scottish Transport Appraisal Guidelines (STAG) and the Design Manual for Roads and Bridges (DMRB) and to prepare material to allow presentations of the findings of the first appraisal stage to the public in March 2013;
5. In addition, the brief also includes the second stage appraisal in accordance with STAG Part 2 and DMRB Stage 2. A report to complete the appraisal process is to be issued to summarize the findings of both Part 1 and Part 2 assessments of the options in Spring 2014.

The outline design of a 'preferred route option', which should emerge after Stage 2 of this appraisal, is to consider aspects of highway, structures and geotechnical design issues, as well as economic impact and cost benefit analysis, in addition to suitable mitigation measures, including landscaping, to reduce the environmental impact and damage during construction and operation of the preferred route alignment.

This Commission is to re-open the previous discussions and considerations on feasible route corridors and options in relation to the 'Stromeferry Bypass', applying the processes of current Government Guidelines, with the aim to generate a robust solution. The report and presentation material is to detail the outcome and findings of the whole appraisal process, and should allow consideration by The Highland Council Full Committee in their determination of the preferred (route) option.

It is understood, that The Highland Council is proposing to take the preferred option into their list of proposed projects to be considered in the next 10 year Capital programme, which will run between 2013 and 2023, but would seek Central Government funding to realize the project.

1.2.2 *Appraisal*

This Options Appraisal is to be carried out in accordance with current Scottish Government guidelines and Design Standards, as outlined in the Client's brief above. A combined STAG Part 1 and DMRB Stage 1 appraisal requires the Consultant to:

- Identify a suitable study area;
- Obtain and review existing information available for the study area;
- Describe and appraise alternative route corridors and options identified and sifted during the STAG Pre-Appraisal stage,
 - a. against identified or perceived transport problems and potential opportunities;
 - b. for consistency with established policy directives;
 - c. against Transport Planning Objectives developed and sifted through the STAG Pre-Appraisal process;
 - d. for likely impact against the STAG Criteria;
 - e. against public acceptability, affordability and feasibility regarding construction and operation;
 - f. for a clear rationale to reject option up to completion of the Part 1 Appraisal;
- Carry out a brief engineering assessment, considering:
 - g. Condition of existing road networks and highway structures;
 - h. Topography and Land Use;
 - i. Geology and Geomorphology;
 - j. Hydrology Drainage;
 - k. Public Utilities;
- Carry out a baseline Environmental Assessment, considering:
 - l. Baseline Conditions;
 - m. Environmental Constraints;
 - n. Environmental Effects;
 - o. Mitigation;
 - p. Consultations;
- Carry out and outline Traffic and Economic Assessment, including:
 - q. Existing and Future Conditions;
 - r. Effect of Options;
 - s. Economics.

The combined processes of STAG Part 1 and DMRB Stage 1 aim to provide an initial but robust appraisal of the options generated during Pre-Appraisal and involve a qualitative assessment of the likelihood of the options being able to meet the set Transport Planning Objectives, as well as the feasibility and affordability of these options in engineering, environmental and economical terms.

It is likely, that no single route corridor or option will emerge from this part of the appraisal process and as such, the STAG Part 2 / DMRB Stage 2 appraisal would be used to appraise alternative options in further detail with the aim to present a 'preferred option' at completion of the appraisal process.

1.3 Report Structure

This report outlines the appraisal process covering STAG Part 1 and DMRB Stage 1, with reference to the outcome from the STAG Pre-Appraisal stage. A detailed, separate document has been prepared to report on the Pre-Appraisal process and its findings, under reference 47065084 / Pre-Appraisal Rev 0.

This STAG Part 1 / DMRB Stage 1 report provides a brief introduction to the project and Client's requirements, and focuses on describing the analysis of problems, opportunities and objectives identified and discussed during the Stakeholder workshops at pre-appraisal stage, in chapters 2 and 3 of this document.

Chapter 4 provides information on the process concerning the generating of proposals for route corridors and options, and explains the first steps taken during the pre-appraisal workshop stage to discuss and sift identified options in order to present a firm list of route options to be taken into this stage of the appraisal process.

The 'Engineering Assessment' as required in accordance with DMRB Volume 5, Section 1, Part 2, TD 37/93, including a brief description of the existing road, preliminary considerations regarding topography, land use, geology, geomorphology, hydrology, drainage and existing public utilities, an outline of applied design standards, as well as a preliminary engineering assessment of route options, is included in chapter 5 of this document.

An outline environmental assessment is included in chapter 6 of this report. This addresses general considerations of nature conservation, cultural heritage, landscape and drainage, with emphasis on water and environment. A brief assessment of the affect of considered options on the foregoing factors, with added considerations concerning noise and air quality, are also included. The DMRB also requires the description of baseline conditions, environmental constraints and mitigation. In addition, information on current policies and Government directives influencing the proposals, as well as details of statutory consultations conducted as part of this appraisal, is included.

This appraisal also considers issues in relation to traffic and economics. Chapter 7 looks at current and future traffic flows through the local and wider road network as well as the effect of proposed options on journey times and connectivity, safety, integration, accessibility and social inclusion. A detailed summary of past rock fall events and their local impact has also been included in chapter 7.

Chapter 8 provides a summary of the Part 1 / Stage 1 appraisal process, outlining considered options, highlighting reasons for rejecting options or proposals to take these into the Part 2 / Stage 2 process. This chapter includes detailed appraisal summary tables and also touches on risks and uncertainties in connection with particular route choices, identified during this stage of the appraisal process.

Chapter 9 provides a summary to the report, and draws this stage of the appraisal process to a conclusion, recommending further appraisal work required, leading to the development and publication of the STAG Part2 / DMRB Stage 2 report in spring 2014.

Appendices included in this document contain drawings referred to in the body of the report. Appendix A is a separate portfolio of drawings and figures to support the report text.

Some of the historical technical documents derived from The Highland Council archives to inform this Part 1 / Stage 1 assessment process are listed below:

Table 1.1 – Historical Documents used to inform Process

DOCUMENT REGISTER		
Title	Author	Date
Strome Ferry By-Pass, Scheme 'E' Utilising Estate Roads At South Strome Forest and Attadale	Babtie, Shaw and Morton	July 1965
Letter, A896 Stromefery Bypass Progress Report	Highland Council Principal Engineer (Structures)	July 1988
A890 Stromeferry Bypass, Alternative Routes, Inception Report	Mott MacDonald	June 1991
A890 Stromeferry Bypass, New Route Studies, Attadale Section, Assessment of Rock Cuttings	Mott MacDonald	August 1992
A890 Stromeferry Bypass, New Route Studies, Seangan Section – Geomorphological Assessment	Mott MacDonald	December 1992
A890 Stromeferry Bypass, Feasibility Study, Tunnel Options	Mott MacDonald	November 1992
A890 Stromeferry Bypass, Feasibility Study, Alternative Route Assessment	Mott MacDonald	January 1993
A890 Stromeferry Bypass, New Route Studies, Tunnel Route 2 Preliminary Assessments	Mott MacDonald	August 1993
A890 Stromeferry Bypass, Road Improvement, Feasibility of Widening the Existing Road Alignment	TRL Scotland	1993
A890 Stromeferry Bypass, Feasibility Study, Executive Summary	Highland Regional Council	May 1994
A890 Stromeferry Bypass, Feasibility Study of Rockfill Embankment Alternative	Thorburn Colquhoun	February 1995

In addition, the following stand-alone documents were prepared during this stage of the appraisal process, and are referred to within the report text:

Table 1.2 – URS Documents referred to in this Report

DOCUMENT REGISTER		
Title	Author	Date
Stromeferry Options Appraisal, STAG Pre-Appraisal Report 47065084 / Pre-Appraisal Rev 0	URS	March 2013
Stromeferry Options Appraisal, Geotechnical Desk Study Report 47065084 / GLRP 0001	URS	March 2013
Stromeferry Options Appraisal, 47066120 - Contingency Ferry Operations	URS	April 2013
Stromeferry Options Appraisal, Business Survey Results	URS	March 2013
Stromeferry Options Appraisal, Traffic Survey and Data Report (Draft)	URS	May 2013

2 ANALYSIS OF PROBLEMS, OPPORTUNITIES & CONSTRAINTS

2.1 Introduction

The purpose of this chapter of the document is to outline the adopted process to analyse identified or perceived problems and potential opportunities with the transport system in connection with the Stromeferry Bypass. It presents problems, opportunities and constraints, which were identified during the Pre-Appraisal stage, and provides information regarding the existing conditions recorded on the road network affected by this appraisal.

STAG stipulates that ‘the identification of problems should be accompanied by a full analysis of the opportunities available and supported by an understanding of the issues and constraints which are likely to affect the chances of any transport option meeting the Transport Planning Objectives and alleviating identified transport problems’. Therefore an in-depth assessment of identified problems, opportunities and constraints was established in collaboration with the Stakeholders during the Pre-Appraisal stage. These developed into Project Objectives to ensure that the appraisal was consistent throughout and the identified problems, opportunities and constraints were reflected in the assessment of route options during the Part 1 appraisal stage.

Suitable study areas have been agreed in order to set the geographical boundaries for this appraisal. Figure 2.1 below shows a wider area considered in relation to economical and strategic transport links to and from the area. Figure 2.2 shows the boundaries of the local area considered in relation to existing road network and infrastructure, and proposed route options, problems, opportunities and constraints relevant to the Stromeferry Options Appraisal.



Figure 2.1 – Wider Study Area



Figure 2.2 – Local Study Area

The above figure also includes further areas shown hatched, which were highlighted during Stakeholder workshop discussions as part of the local road network in need of upgrade, and therefore directly affecting or affected by the proposed works in relation to the Stromeferry bypass.

The western area is the local public and access road leading to the Kishorn yard, branching off from the A896 towards Ullapool and including a section of the minor public road to Applecross.

The eastern area is an 9.5km stretch along the A890 from the Strathcarron junction to the Lair bridge. This section of the public road is a recognized 'bottleneck', highlighted in The Highland Council's Local Strategy Plan as part of the Highland Council's strategic road network, where *'the road is of single track with passing place standard or structures on the route may be subject to height or weight restrictions'*, and therefore potentially benefiting from improvements. The Highland Council's Local Transport Strategy confirms that this project will be considered as a project in the future, subject to available funding, but is not yet included in the Council's Capital Programme.

The hatched area shown to the south west of Stromeferry indicates an extension to one of the route corridors considered and described in chapter 4. This 'outer north' corridor included considerations for a western bridge crossing originating at Craig, east of Plockton. It was recognized that the existing single track road in between Craig and Achmore, where it joins the A890, would not be suitable for the expected traffic volumes long term, and that an upgraded, more direct link to the A87 Trunk Road, Kyle of Lochalsh and Skye would be required at some point in the future, if this western route was to be considered further.

Neither of the areas shown hatched in Figure 2.2 above will however be included in this appraisal and may be subject to separate scheme considerations by The Highland Council in the future.

2.2 Methodology

The methodology agreed with the Client in relation to this study overall is as outlined in the Client's brief and appraisal process included in section 1.2 of this report. The methodology combines the processes of the Scottish Transport Appraisal Guidance (STAG) and Design Manual for Roads and Bridges (DMRB). This methodology adopts a phased approach to scheme delivery as follows:

1. Pre-Appraisal stage; active involvement of local 'economic' and 'regulatory' stakeholders through workshop sessions to develop project (Transport Planning) Objectives, considering identified problems, constraints and opportunities, as well as develop route options and a first step sifting;
2. STAG Part 1 / DMRB Stage 1; high level appraisal of route options and corridors to fulfill the requirements for the preparation of a Stage 1 Scheme Assessment report in accordance with the DMRB, in combination with an assessment of the route options and corridors against Transport Planning Objectives, STAG Criteria, established policy directives and public acceptability. This is to provide a rationale for the selection or rejection of a route or corridor option.
3. STAG Part 2 / DMRB Stage 2; further in-depth appraisal of emerging route options and corridors in accordance with the requirements of the DMRB Stage 2 Scheme Assessment process, in combination with an appraisal of options against the Transport Planning Objectives and other STAG criteria.

This report focuses on the STAG Part 1 / DMRB Stage 1 assessment and follows the methodology as outlined under (2) above. This appraisal stage is to include outline engineering, economic and environmental considerations, which will be further refined in Stage 2.

2.3 Stakeholder Consultation

2.3.1 Consultation Process

The Stakeholder consultation process in relation to the Stromeferry Options Appraisal to-date took place during the Pre-Appraisal Stage, which was carried out to satisfy the requirements of STAG. This involved consultations with various Stakeholder groups from an early stage, aiming to be an informed process from the onset of the project.

The Highland Council had proposed two Stakeholder groups prior to commencement of this appraisal. Details of these groups are shown in 2.3.2 below. Stakeholders were divided into 'Regulatory Stakeholders' and 'Economic Stakeholders' for the initial workshops, due to their differing requirements and in order to keep the numbers manageable.

The Pre-Appraisal process involved the following workshops during the period November 2012 to January 2013:

Table 2.1 – Stakeholder Workshops

NO	DATE	STAKEHOLDER GROUP	VENUE	ATTENDANCE
1	21 st November 2012	1 st Regulatory	Columba Hotel, Inverness	13
2	4 th December 2012	1 st Economic	Strathcarron Hotel, Strathcarron	15
3	12 th December 2012	2 nd Regulatory	Columba Hotel, Inverness	10
4	10 th January 2013	2 nd Economic	Strathcarron Hotel, Strathcarron	17
5	31 st January 2013	3 rd Joint Regulatory & Economic	Strathcarron Hotel, Strathcarron	24

The agenda for the workshops, which were part of a continuous and informed process, were set in two main workshop discussions as follows:

- Engage Stakeholders, in order to discuss their key issues relating to the study area in general, and any route corridors or locations in particular;
- Highlight any *Problems* anticipated with a particular route corridor or location;
- Highlight any *Opportunities* or *Ambitions* that Stakeholder may like to realise through this appraisal process;
- Highlight any *Constraints* within the study area;
- Stakeholder engagement to highlight any *Key Issues*, considering aspects under:
 - ❖ Environment
 - ❖ Safety
 - ❖ Economy
 - ❖ Integration
 - ❖ Accessibility and Social Inclusion

Following the identification of Transport Problems, Opportunities and Constraints, the key aim of the workshops was to develop these into Project Objectives, which were later to be developed further into Transport Planning Objectives. These would then be used to inform the next stage of the appraisal / assessment process in Part 1.

The second important aim of the Pre-Appraisal Stakeholder workshops discussions was to:

- Develop possible route options;
- Sift developed route options;
- Propose (final) set of route options to be considered in Stage 1 assessment.

The STAG process promotes an objective rather than solution led approach to avoid pre-conceived solutions being brought forward without considering all other possible options. Therefore, workshop presentations aimed to start with a 'clean sheet' approach when considering possible route options and corridors, nevertheless acknowledging the fact of historically considered options.

The full options development and first sifting process is further described in chapter 4 of this report.

2.3.2 *Stakeholders*

The following Stakeholders were invited and represented during the various Stakeholder Workshops held during the Pre-Appraisal stage:

Regulatory Stakeholders:

- The Highland Council, Chief Executive's Service, Ward Manager (Wester Ross, Strathpeffer & Lochalsh);
- The Highland Council, Planning, Environment & Development Service;
- Transport Scotland;
- Highlands & Islands Enterprise;
- Network Rail;
- First Scotrail;
- Scottish Natural Heritage (SNH);
- Scottish Environment Protection Agency (SEPA);
- Historic Scotland;
- Marine Scotland;
- Highlands & Islands Enterprise.

Economic Stakeholders:

- Highlands & Islands Enterprise;
- The Highland Council, Chief Executive's Service, Ward Manager (Wester Ross, Strathpeffer & Lochalsh);
- Kirkton Woodland & Heritage Group;
- Lochcarron Community Council;
- Stromeferry & Achmore Community Council;
- Plockton Community Council;
- Applecross Community Council;
- Lochcarron and District Business Association;
- Area Highland Councillors;
- Forestry Commission.

Also present during the workshop were:

- Representatives of The Highland Council (THC) TEC Services, Project Design Unit (PDU) Golspie, the Client, and

- Representatives of URS Infrastructure & Environment UK Ltd, STAG Appraisal team.

2.4 Analysis of Problems, Opportunities & Constraints

The analysis of problems, opportunities and constraints in relation to the Stromeferry Bypass was undertaken during the detailed Stakeholder discussions held during the STAG Pre-Appraisal workshops as outlined below.

Prior to the first workshops being held, Stakeholder information was issued to all attendees with the aim to start an informed discussion. This included a Stakeholder questionnaire, which all attending Stakeholders were asked to consider in preparation for the first workshop.

A Pre-Appraisal Summary report has been prepared, with reference 'Stromeferry Options Appraisal, STAG Pre-Appraisal Report, 47065084 / Pre-Appraisal Rev0 March 2013, summarizing the whole process prior to the Part 1 / Stage 1 assessment work.

2.4.1 *Workshop Discussions*

Workshop discussions held as part of the Stromeferry Options Appraisal recognised that the identification of existing and potential problems, opportunities and constraints within the transport and land-use system ('study area') forms the starting point for the development of any transport proposal.

It was also suggested that a key element in the STAG process is to be able to understand the root causes of any identified problems within the study area and to develop transport improvement options that address the underlying issues. Identified problems should be supported by an analysis of available opportunities and an understanding of the constraints and uncertainties that may impact on the success of a proposed transport improvement option. Wherever reasonably practical, problems should be quantified in order to gauge the scale of the problem and to assist in defining appropriate targets as part of the established transport planning objectives.

Identified Problems & Constraints

The identification of existing and future problems and constraints within the current transport corridor and wider study area was considered an important process in the development of appropriate transport proposals in the future. Key issues as shown in table 2.2 below were noted during the discussions in relation to the ongoing rock fall problems along the A890, as well as issues identified considering the study area as a whole.

Opportunities

Considering changes to an existing transport system provides opportunities for improvements, both on-line as well as in the wider, affected area of the system. It was recognised that some of the problems identified could be developed into potential opportunities. Tables to record and present this process were developed during the Pre-Appraisal stage, to ensure that none of the key issue identified at the early stage was lost in the process. These have been re-produced in Table 2.2 shown on the following pages.

During the Stakeholder workshop discussions it became clear that there is a strong feeling of opportunity amongst local communities with regards to the potential of development at Kishorn Port, as well as the wish to explore renewable energy development opportunities in the area. In conjunction with discussions regarding potential for forestry developments it was recognised, that suitable and reliable transport routes and journey times can be the deciding

factor when it comes to the feasibility and financial viability of developments, particularly if these are considered to be marginal operations.

Table 2.2 – Identified Problems & Opportunities

Identified Problems & Opportunities				Table 2.2
Group	Item No	Key Issue of identified 'Existing Problems' & 'Constraints'	Action	Opportunity
Health & Safety	H1	Safety Concerns (risk of personal injury and damage to property from rock fall) & reliability of existing route (lack of local confidence in stability of rock face and high risk of future rock fall)	Will become Objective, to be addressed in study and solution made reliable. Condition of existing route (for any solution) will have to be addressed. Use to create opportunity	Provide a safe and reliable road to adequate / proportionate standards and lesser gradients, applying 'Best Practice' during the design stage, considering the value of the natural environment, and thus establishing the A890 as a recognized through route from Inverness to Skye with long term impact on local economic development. Improve whole section between Strathcarron Jct and Stromeferry.
	H2	Poor Standard of existing road & alignment	Use to create opportunity	As above
	H3	Crucial life line route from Applecross / Lochcarron area for (emergency vehicle) access to Broadford hospital on Skye potentially disrupted	Will be addressed by new route, including considerations during construction. Contingency plan currently in place.	Create a reliable access route between Wester Ross and Skye, with improved access to Broadford hospital and airport.
	H4	Risk of rock fall onto railway line	Contingency plan currently in place. Refer to R1	Consider long term solution to make whole corridor safe; use existing road corridor for separation / rock ditch
Group	Item No	Key Issue of identified 'Future Problems' & 'Constraints'	Action	Opportunity
Health & Safety	H5	Future weathering of rock face	Inter relationship with road and rail will become part of appraisal for on-line or off line route. Close working relationship to be built with railway colleagues to identify 'best' mutual solutions	Consider long term solution to make whole corridor safe; use existing road corridor for separation / rock ditch
	H6	Potential of heavy transport movements through Lochcarron Village	Consider any on-line proposals through Lochcarron village carefully, to ensure safety and acceptability	Improve road corridor through and connectivity to Lochcarron
	H7	H&S issues due to unstable rock faces, during maintenance & construction works	CDM considerations during Options appraisal	Provide safe, (off-line) route

Identified Problems & Opportunities (continued)				Table 2.2
Group	Item No	Key Issue of identified 'Existing Problems' & 'Constraints'	Action	Opportunity
Disruption	D1	Effectiveness of existing rock netting / protection	-	Long term solution not to depend on effective netting
	D2	Journey times during diversion, which are potentially 130 miles long, and associated cost to local businesses, tourists etc.	Journey times will become objective. Use to create opportunity	Reduce journey times (with particular consideration for school transport and business access)
	D3	Potential disruption of public transport links, school bus services, postal and other services in the area	Will be addressed by new route, including considerations during construction. Contingency plan currently in place.	Provide a safe and reliable road to adequate / proportionate standards and lesser gradients, applying 'Best Practice' during the design stage, considering the value of the natural environment, with and aspiration to provide a single carriageway width throughout.
	D4	Mitigation measures during disruptions limited; ferry availability very limited (daytime hours only)	Contingency plan currently in place Use to create opportunity	Opportunity to re-instate the ferry service on a reliable basis
	D5	No guaranteed resilience of existing route / constant risk of road closure	See H1 Use to create opportunity	Identify best option and create route to modern, appropriate standard
	D6	Perceived lengthy journey time due to congestion during summer months	Journey times will become objective. Use to create opportunity	Reduce journey times by provision of improved road corridor width and gradient
	D7	Transport link for livestock movements between Kyle and Dingwall. Prolonged journey times cause added stress to livestock	As above	As above
Group	Item No	Key Issue of identified 'Future Problems' & 'Constraints'	Action	Opportunity
Disruption	D8	Potential disruptions and road closures during on-line construction works	Economic Stakeholder emphasis on 'no disruption' during construction. Consider this is assessment of options, but keep open mind to not be exclusive of on-line options	Consider minimal disruptions as strong objective throughout appraisal process. Retain adequate accessibility to local areas. Find solution that will provide improved reliability and minimize disruption both short and long term

Identified Problems & Opportunities (continued)					Table 2.2
Group	Item No	Key Issue of identified 'Existing Problems' & 'Constraints'	Action	Opportunity	
Landscape & Environmental	L&E1	Existing rock netting conceals SSSI area of rock cut (site of geological importance)	Recognised but will need to link to R1	Enhance access to the SSSI if feasible	
	L&E2	Problems with current route prohibit enjoyment of natural heritage and area	Benefit to Natural Heritage taken to Objective Create opportunity	Enhance driver / tourist experience on route Consider road cantilevered over lochside (Pulpit rock design) Potential for new loch side access	
	L&E3	Steep topography of area	Consider area topography during Options appraisal and outline design of route options	Consider routing alleviating problems with steep gradients	
Group	Item No	Key Issue of identified 'Future Problems' & 'Constraints'	Action	Opportunity	
Landscape & Environmental	L&E4	Unscheduled archaeology uncovered during excavations	Investigations will be undertaken. Specification and Programme will address this during construction	-	
	L&E5	Strome Narrows bridge crossing would greatly impact on high quality landscape and site of national importance and site of a scheduled monument (Strome Castle)	Apply best practice principles and consider above and below water implications (marine consultation area)	Consider the value of the natural environment and enhance driver experience	
	L&E6	Areas of ecological value potentially effected by all routes	Apply best practice principles; consider impact on peat and wetland etc	Road design to an appropriate standard considering the value of the natural environment	
	L&E7	Likelihood of future rock fall from cut faces along existing route due to geological nature of rock	Consider both on and off line solutions, not forgetting the longterm obligations to protect from rock fall along the existing route	Enhance cut slopes, applying sound engineering principles	
	L&E8	Potential for higher altitude road levels for off-line routes with impact on winter maintenance	Consider during route appraisal	Preferred route to result in reduced maintenance costs	
	L&E9	Potential impact on water environment and flood risk	Consider during route appraisal	Use opportunity to enhance the water and wider environment as part of the design considerations	

Identified Problems & Opportunities (continued)				Table 2.2
Group	Item No	Key Issue of identified 'Future Problems' & 'Constraints' (continued)	Action	Opportunity
Landscape & Environmental	L&E 10	Available corridor for land purchase not adequate to achieve full habitat / environmental mitigation	Consider under SMART objectives	Ensure best practice principles are applied and appropriate design standards applied
	L&E 11	Existing deer and livestock management, as well as fish farming etc restricting development areas	Consider during route assessments	Ensure preferred routes have minimum impact on existing land-use
	L&E 12	Restricted clearance for ship movements underneath new bridge structure	Ensure adequate consultations conducted during appraisal process	Ensure all interested stakeholders adequately consulted. Potential for renewables incorporated into crossing
	L&E 13	Impact on scheduled monument of Strome Castle and it's surroundings	Apply best practice principles	Enhanced access to the area; Reference to H1.
	L&E 14	Unknown stability of future rock cuts	Apply best practice principles	Enhanced cut slopes, applying sound engineering principles to any new or improved areas of rock cut

Identified Problems & Opportunities (continued)				Table 2.2
Group	Item No	Key Issue of identified 'Existing Problems' & 'Constraints'	Action	Opportunity
Socio – Economics	S1	Southern routes would bypass village of Lochcarron, which is already isolated due to existing road network at present	Will be considered during study when considering options.	Enhance linkage to and integration of Lochcarron Village
	S2	In the event of a rock fall and road closure, 130 mile detour required	Consider source and target of traffic	Preferred solution does reduce risks of regular road closures and provides reliable route
	S3	Existing road is unreliable and alignment does not comply with modern standards and may therefore prevent development of existing and future businesses	Carried to Objectives, will be addressed. Create opportunity	Refer to H1. Enhance driver / tourist experience on route, and consider NMU, in particularly cyclists. Support the creation of new business & employment opportunities in the area by providing adequate and reliable access (along the West Coast)
	S4	Poor existing Community Transport (all transport links to and from the communities)	Create Objective. Traffic & Economic assessment to address this.	Enhanced community transport links through more reliable road & rail network
	S5	Poor / restricted access to Community Services & Leisure Facilities	Consider good networking and linkages during route assessment	Improved access and integration of / from local areas to vital leisure/ educational and health facilities, with particular focus on young people
	S6	Poor vehicular access to and from South Strome ferry slipway	Consider all alternative route options, including adequate access to ferry slip ways	Improved ferry facilities and access to and from the slipways
	S7	Forestry – unreliable road link with no feasible alternative routes adding to high transport costs	Consider adequate linkage to areas of potential forest harvesting	Open new areas for forest harvesting, providing reliable route to adequate standards
	S8	Forestry – areas for potential timber extraction restricted due to lack of suitable road access	As above	As above

Identified Problems & Opportunities (continued)				Table 2.2
Group	Item No	Key Issue of identified 'Future Problems' & 'Constraints'	Action	Opportunity
Socio – Economics	S9	Existing road structure of poor standard and alignment, which makes it unsuitable to cope with traffic growth on road and rail (heavy traffic associated with future local developments at Kishorn etc) and unattractive for developers (Reference Carron & Lair Bridges, Maman Hill etc)	Make Objective. Traffic & Economic assessment will address this. Create opportunity	Design to consider future expectations as far as possible Enhanced Kishorn port access (local access as well as south towards Ft William) Potential for renewables schemes (tidal, wind etc) could open up further funding Opening new areas for forest harvesting, fish farming, walkers etc
	S10	Community linkage during construction	Works Specification and Programme to address this during construction	Consider alternatives & contingency measures, including improved ferry links, during construction
	S11	Accessibility and social inclusion within the wider area of Scotland	Create Objective. Traffic & Economic assessment will address this. Consider as opportunity	Improved access to Broadford Airport, considering links between Skye and Wester Ross
	S12	Confidence in team to deliver project and potential difficulty identifying preferred solution	Create Objective	Active Stakeholder involvement and regular reporting to Client to ensure delivery of project
	S13	Suitable access for Utility Companies	Consider all road users during appraisal and ensure emphasis on vital linkages / life line routes in existing road network	Enhance reliability, accessibility and journey times long term
	S14	Potential for extended journey times on new routes (inland route)	See also D6. This will be assessed as part of the traffic & economic exercise	Enhance reliability of route and consider (shorter) journey times

Identified Problems & Opportunities (continued)					Table 2.2
Group	Item No	Key Issue of identified 'Existing Problems' & 'Constraints'	Action	Opportunity	
	F1	Cost and maintenance of existing route	Will become assessment factor during route selection	Produce solution that is 'value for money' and reduce maintenance costs in relation to existing corridor to a minimum, considering THC long term liabilities	
Financial	F2	Transport costs increased due to unreliable route / length of route / potential for disruptions & diversions	Consider economic impact of road closures; assess cost of delays, disruptions, journey length etc	Improved transport links along west coast, east and south from the area	
		Cost of road closures to local businesses	Consider in Socio – economic study	'Preferred solution' to minimize financial risks to local businesses due to road closures or unreliable route	
Group	Item No	Key Issue of identified 'Future Problems' & 'Constraints'	Action	Opportunity	
Financial	F3	Securing funding for scheme	Important point, which is to be consolidated later on in the appraisal process	<p>Explore funding opportunities through renewable developments.</p> <p>Opportunity to open new areas for forestry harvesting, fish farming and renewables.</p> <p>Consider value of opening new areas for walking and cycling etc.</p>	

Identified Problems & Opportunities (continued)				Table 2.2
Group	Item No	Key Issue of identified 'Existing Problems' & 'Constraints'	Action	Opportunity
Railway Interface	R1	Existing road provides some protection to railway line. If road removed, residual risks for railway to be considered	Inter relationship with road and rail will become part of appraisal for on-line or off line route. Close working relationship to be built with railway colleagues to identify 'best' mutual solutions. Use to create opportunity	Provide a wider / standard cross section with adequate separation of road and rail by improving existing transport corridor
	R2	Close proximity of road to railway and vulnerability of both to rock fall	As above	As above
	R3	Railway line currently categorised as 'high risk' with the result of speed restrictions on this route to 30mph	As above	As above
	R4	Railway line currently not used to full potential (transport of heavy goods, poor timetable etc)	Explore possibilities of future expansion / modernisation of route through discussions with NR	Opportunity to enhance rail to sea transport links and public transport routes
	R5	Existing railway line not suitable for heavy transport or higher speed?	As above	Opportunity to improve railway line and services
	R6	Existing level crossing at Strathcarron	Consider in route assessments	Remove need for level crossing
Group	Item No	Key Issue of identified 'Future Problems' & 'Constraints'	Action	Opportunity
Railway Interface	R7	Separation road / rail	Inter relationship with road and rail will become part of appraisal for on-line or off line route. Close working relationship to be built with railway colleagues to identify 'best' mutual solutions Consider as opportunity	Consider a level, shared road / rail solution long term. Consider long term solution acceptable to all Stakeholders, taking current THC liability with regards to maintenance of route corridor into account
	R8	If new route established, what happens to existing road corridor & railway line	Problem acknowledged and will be addressed at the route selection stage.	Create engineered separation between railway and rock face using road corridor for rock ditches

3 TRANSPORT PLANNING OBJECTIVES

3.1 Introduction

This chapter provides a summary of the process adopted in relation to the Stromeferry Options Appraisal to establish a set of agreed Project Objectives, together with a list of National and Regional objectives steered by Government policies.

Both groups of objectives will be equally considered during the appraisal of proposed route options and corridors. STAG outlines the necessity of developed objectives as follows: *'Establishing objectives is essential to the overall quality of the appraisal of transport options and their ultimate results. The relative performance of options against objectives plays a key role in a STAG study'*.

The following objectives led by policy directives are considered relevant in the context of this options appraisal. The information has been provided by the relevant Stakeholder following workshop discussions, or has been abstracted from source data.

3.2 National and Regional Objectives

3.2.1 *Strategic Transport Projects Review (STPR)*

Although the A890 is not explicitly mentioned in the STPR or subject to an intervention, the priorities of the STPR, which are based on the outcomes of the National Transport Strategy as stated below, are valid in the context of this project and appraisal and should be considered in terms of policy directives.

3.2.2 *National Transport Strategy*

The Scottish Government's Purpose, as stated in their Policy Statements, is to focus government and public services on creating a more successful country, with opportunities for all of Scotland to flourish, through increasing sustainable economic growth. This is translated into five strategic objectives to underpin its core purpose for a wealthier & fairer, healthier, safer & stronger, smarter and greener Scotland.

The National Transport Strategy vision is of *"an accessible Scotland with safe, integrated and reliable transport that supports economic growth, provides opportunities for all and is easy to use; a transport system that meets everyone's needs, respects our environment and contributes to health; services recognised internationally for quality, technology and innovation, and for effective and well-maintained networks; a culture where fewer short journeys are made by car, where we favour public transport, walking and cycling because they are safe and sustainable, where transport providers and planners respond to the changing needs of businesses, communities and users, and where one ticket will get you anywhere"*. (Scotland's Transport Future 2004)

The NTS sets 5 high level objectives in *Scotland's Transport Future*. These are to:

- Promote economic growth by building, enhancing managing and maintaining transport services, infrastructure and networks to maximise their efficiency;
- Promote social inclusion by connecting remote and disadvantaged communities and increasing the accessibility of the transport network;
- Protect our environment and improve health by building and investing in public transport and other types of efficient and sustainable transport which minimise emissions and consumption of resources and energy;

- Improve safety of journeys by reducing accidents and enhancing the personal safety of pedestrians, drivers, passengers and staff; and
- Improve integration by making journey planning and ticketing easier and working to ensure smooth connection between different forms of transport.

Scotland's National Transport Strategy also uses Key Strategic Outcomes (KSO) as the basis for delivering improvement to transport in Scotland in line with the Government's Purpose and Strategic Objectives:

- Improving journey times and connections – to tackle congestion and the lack of integration and connections in transport which impact on (Scottish Government) high level objectives for economic growth, social inclusion, integration and safety;
- Reducing emissions – to tackle the issue of climate change, air quality and health improvement which impact on our high level objective for protecting the environment and improving health, and
- Improving quality, accessibility and affordability – to give people a choice of public transport, where availability means better quality transport services and value for money or an alternative to the car.

Progress of the above and Government outcomes will be measured against a series of national indicators. In terms of transport, these include the following:

- Improved journey times and connections;
- Reduced emissions;
- Average distance walked and cycled per person per year;
- Improved quality, accessibility and affordability;
- Satisfaction of bus and rail passengers;
- Access to key services.

3.2.3 *The Scottish Government – National Performance Framework 2007*

To focus Government and public services on creating a more successful country, with opportunities for all of Scotland to flourish and through increasing sustainable economic growth, economic performance will be tracked by means of purpose targets set by the Scottish Government:

- Economic growth (GDP)
- Productivity;
- Participation;
- Population;
- Solidarity;
- Cohesion and Sustainability

3.2.4 *The Highland Council – Local Transport Strategy 2010/11 to 2013/14*

The Highland Council's Local Transport Strategy, issued by the Transport, Environmental and Community Services in December 2010, sets the direction for transport in the Highlands at a local level for the financial years 2011/12 to 2013/14. The strategy aims to guide policy and investment on transport within Highland Council and also within partner bodies involved in the delivery of transport infrastructure and transport services in the Highland area.

The document highlights the uniqueness of the Highland area, which are distinctive within the UK with their unique culture, extreme weather patterns and rugged topography and with a long exposed coastline. In consequence, the Highlands contain a unique transport network which requires its own individual solutions.

At the heart of the strategy are the principal themes of:

- Safety;
- Sustainability;
- Economic development, and
- Integration.

These are themes recognized also in national and regional transport strategies.

The Highland Council Local Transport Strategy also highlights the importance of maintaining the existing transport network both in terms of quality of infrastructure and also in terms of the network of services which utilize the infrastructure. Also the strategic importance of North to South and East to West linkages, in particular for the Western Highlands and Islands is mentioned.

Chapter 3 of the LTS outlines The Highland Council's vision, 'through its Local Transport Strategy, THC seeks to enable and facilitate sustainable development and economic growth; support, include and empower communities through transparent decision making, and establish an integrated transport network which supports safe and sustainable environments in which people can live, work and travel.

The above is expressed in the Local Transport Strategy Objectives:

- Economy: provide a transport network to enable sustainable economic growth, noting the very different conditions between urban and rural locations and addressing the remoteness factor facing Highland trips to the rest of the UK;
- Social Inclusion: Facilitate travel to enable economic/social involvement and improve access/travel choices to essential services for those without access to a private car;
- Environment: manage/reduce the impacts of transport on the natural and built environment;
- Health: Increase levels of cycling and walking to promote health improvement and modal shift;
- Road Safety: Continue to improve road safety, addressing locations where road accidents are above average levels;
- Personal Safety: Address issues of perceived safety and personal security particularly where they are a barrier to walking, cycling and public transport;
- Policy Integration: Identify policy overlap across Council services, and with other public bodies (e.g.NHS), maximise benefits and minimise contradiction;

- Investment Integration: Identify benefits and opportunities of combined transport procurement for all Council services;
- Traffic Reduction: Where appropriate, consider targets for reducing traffic, although noting the variation in conditions and requirements between rural and urban areas.

3.2.5 *The Highland Council – ‘Working Together for the Highlands, A Programme for The Highland Council, 2012 – 2017*

This document, issued by The Highland Council as an information booklet to the general public, outlining the Council’s ‘bold and ambitious’ programme of priorities for delivery during the period 2012 to 2017, states that The Highland Council ‘will deliver a transport and infrastructure programme fit for the 21st century. THC will work with all governments and agencies to deliver infrastructure projects to support employment and connect their communities’.

Paragraph 5 relates to the Stromeferry Bypass, stating that ‘*The Council will develop options for a long-term solution which provides a secure and effective transport link between Lochcarron and the Lochalsh area in consultation with partners and the local community, and pursue the options for securing external funding*’.

3.2.6 *HITRANS - Regional Transport Strategy*

The Highlands and Islands Transport Partnership’s Regional Transport Strategy was approved by Scottish Ministers in 2008. HITRANS’s vision is ‘*enhancing the area’s viability – enhancing its place competitiveness and thereby attracting and retaining people in the area and making it a more attractive place in which to live, to work, to conduct business and to visit.*’

This vision will be achieved through improving the interconnectivity of the whole area to strategic services and destinations. This will require development of a fit for purpose, multi-modal transport system.

The strategy’s principal benefit to the communities and businesses of the HITRANS area will be to increase sustainable economic growth in line with Scottish Governments Economic Strategy, by enabling the area to compete and support growth. Other benefits will be to:

- Enable people to participate in everyday life;
- Improve the safety and security of travel;
- Manage the impacts of travel on the area’s environmental assets;
- Improve people’s health.

Actions and investments to deliver the Strategy will be focused on 10 themes, of which the following apply to the A890 route:

- Active travel – promoting the long term development of walking and cycling across the region to reduce the use of cars for short journeys and to contribute towards health;
- Freight transport – assisting freight transport to shift mode from road to less environmentally damaging sea and rail transport;
- Locally significant network and maintenance of the area’s roads – developing a programme of investment to improve and maintain the locally significant rural road network which has suffered from under-investment in the past;

- Mainstream passenger transport – preparing a strategy for investment in regional bus services;
- Ports, ferries and waterway transport – preparing a strategy for investment in ports and ferries;
- Cost of transport and travel – developing initiatives for reducing the cost of transport and travel;
- Environmental impacts – develop ways to reduce and mitigate the climate change impact of travelling in, to and from the region.

In addition, the promotion and development of cycling and active travel forms a core element of the HITRANS Regional Transport Strategy in which the following themes are identified as key objectives:

- Promote the long-term development of active travel across the region;
- Enable progress in active travel to be monitored;
- Promote partnership working in promotion of active travel;
- Achieve consistency of standards in infrastructure to support active travel.

The Scottish Government target is set at 10% of all journeys in Scotland to be made by bike.

The principle objective of HITRANS is to generate sustainable economic growth across the region by improving the interconnectivity across the area to destinations and strategic services. This is undertaken through the support of Local Authorities, Scottish Government and other important private and public sector partners to create an enhanced transport network across the Highlands and Islands of Scotland.

HITRANS aim to ‘improve journey reliability, recognizing the need for continuing investment to provide roads of a modern standard that offer safe, reliable travel with suitable overtaking opportunities; ensuring that the road network is as safe as possible’.

They also aim to improve and create more integrated transport services to increase the tourist and business usage of public transport. Subsequently they aim to provide a high quality public and freight service and be considered as one of the leading regions in terms of intelligent transport systems.

3.2.7 *National Planning Policy*

The National Planning Framework 2 was published in 2009 by the Scottish Government and outlines the key principles which are to guide the wider planning system in Scotland until 2030. NPF2 guides Scotland’s spatial development to 2030, setting out strategic development priorities to support the Scottish Governments central purpose of promoting sustainable economic growth.

NPF2 states:

‘Scotland needs an effective national transport infrastructure which will facilitate sustainable economic growth’ (paragraph 106).

‘We need to reduce journey times and make them more reliable; make connections which build and sustain economic growth; and improve links between cities, towns and rural communities throughout the country’ (paragraph 107).

'Many of the roads in the Highlands and Islands and the South of Scotland are lifeline routes for rural communities and of critical importance to the local economy. Their continued maintenance and improvement is essential to ensure the safety of the network and to support long term development' (paragraph 133).

NPF2 makes no specific reference to the need for improvements to the A890 at Stromeferry but clear reference is made to the need for reliable connections in rural areas to support sustainable economic growth.

3.2.8 *Scottish Planning Policy*

The Scottish Planning Policy (SPP) document is a statement of the Scottish Governments policy on nationally important land use matters.

The planning system guides and facilitates development while at the same time "*protecting and enhancing the natural and built environment*", and is considered to be central to the Scottish Government's central purpose of achieving sustainable economic growth (paragraph 4).

Transport is addressed as a subject policy within SPP and it is recognised that the relationship between transport and land use has a strong influence on sustainable economic growth. The strategic transport network, which includes trunk roads, is identified as being critical in support a level of national connectivity that facilitates sustainable economic growth.

SPP states:

'The primary purpose of the strategic transport network is to provide for the safe and efficient movement of strategic long distance traffic between major centres, although in rural areas it also performs important local functions' (paragraph 174).

Rural Development is also addressed as a subject policy within SPP and there is recognition that the planning system has a significant role in supporting economic growth in rural area. The policy aim is stated as being *'to enable development in all rural areas which supports prosperous and sustainable communities whilst protecting and enhancing environmental quality'* (paragraph 92).

3.2.9 *Regional and Local Policies*

Highland-wide Local Development (2012)

The Highland Council published the Highland-wide Local Development Plan (LDP) in 2012. The plan sets out the overarching vision statement, spatial strategy and general planning policies for the whole of the Highland Council area. It supersedes most of the policy statements previously contained in the "Wester Ross Local Plan (2006)" and the "West Highland and Islands Local Plan (2010)".

The overall vision in the Highland-wide LDP has an overall vision which is as follows:

'By 2030, Highland will be one of Europe's leading regions. We will have created sustainable communities, balancing population growth, economic development and the safeguarding of the environment across the area, and have built a fairer and healthier Highlands' (Chapter 5, paragraph 5.1)

In the accompanying proposals map Lochcarron is identified within the hierarchy of settlements as a 'Local Centre'. The majority of the wider area around Loch Carron and

Stromeferry is identified as being of Local/Regional Importance as defined by Policy 57 where developments will be allowed if it can be satisfactorily demonstrated that they will not have an unacceptable impact on the natural environment, amenity and heritage resource.

When addressing the West Highlands and Islands the LDP acknowledges the west coast's particular, peripheral and fragile nature and in setting a tailored and positive vision for the area one of the objectives is to 'be better connected' and to 'be a place of outstanding natural and cultural heritage' (Chapter 7). In the Vision and Spatial Strategy for the West Highland and Islands (Figure 2) Lochcarron is identified as a 'Larger life line village', improved rail connections are proposed along Loch Carron and the area around Kishorn is identified as a 'Renewable Resource'.

Highland and Islands Local Plan

The study area falls within the Skye and Lochalsh section of the Local Plan for which a strategy and vision is still retained. The Strategy states that 'safeguarding and improving the physical identity of places' is a key theme of good planning practice and that 'improving accessibility and connectivity' is an essential aim and theme for the Highlands, and Skye and Lochalsh in particular.

Further details of National and Regional (Planning) Policies and an assessment of compliance is provided in chapter 6 of this report.

3.2.10

Highlands and Islands Enterprise – Government Economic Strategy

The primary aim of the Highlands and Islands Enterprise is to focus all of its activities on achieving the Government's purpose which is to create opportunities for all in Scotland to flourish through increasing sustainable economic growth. Ministers will expect Highlands and Islands Enterprise to do this by pursuing the Government's Economic Strategy;

Transport related Policy Statement (section C):

- Focus investment on making connections across, within and to/from Scotland better, improving reliability and journey times, seeking to maximise the opportunities for employment, business, leisure and tourism;
- Invest in maintaining our existing infrastructure to ensure it remains safe and reliable, so safeguarding current connectivity;
- Facilitate the transition to a low carbon economy by providing integrated and cost-effective public transport and better connecting people, places and work;
- Safeguard transport links to remote and rural communities and support economic growth in remote communities /.. / through encouraging tourism / ..

HIE were represented during the Stakeholder workshop discussions. Their policy statement recorded as part of the feedback collected proposed:

- Providing a better quality, reliable / resilient road links to the Lochcarron / Kishorn area has the potential to reduce community fragility and encourage new economic activity, (and could have significant role in encouraging development of Kishorn port for offshore renewables activity).

3.2.11 *Historic Scotland – Corporate Plan 2012 to 2015*

Historic Scotland's 'Scotland's Past, Scotland's Future, Corporate Plan 2012-15', outlines their vision for the agency's business in the coming years and their commitment in carrying out that business. The vision and commitments are arranged under 5 strategic priorities:

- Championing Scotland's historic environment;
- Contributing to sustainable economic growth;
- Managing Scotland's historic environment creatively;
- Supporting the transition to a low-carbon economy;
- Delivering their business.

The first two strategic priorities are the most relevant in relation to this project. These are to be delivered, amongst others, by:

- enhancing the local and national sense of place through building the quality of our/.../rural areas/...;
- growing understanding and appreciation of the value of the historic environment through optimising access to the most significant buildings and sites;
- enhancing pride in our national identity through working creatively to showcase Scotland;
- increasing Scotland's attractiveness as a place for doing business through effective and sustainable management of the historic environment, thus helping Scotland realize its full economic potential;
- increasing Scotland's economic potential by, growing Scotland's tourist industry, growing Scotland's construction industry and stimulating capital growth.

3.2.12 *The Marine (Scotland) Act 2010*

The marine (Scotland) Act 2010 introduces a new system of marine planning. This seeks to manage competition for marine space creating 'win win' scenarios which deal with conflicts in future development of Scottish marine space.

Highlighted 'duties' and 'aims' include:

- Increase the achievement of sustainable development – including protecting, and where appropriate enhancing, the health status of the Scottish Marine Area;
- Champion Scotland's interests to ensure a sustainable future for those who make a living from the sea;
- Engage with all who have an interest in the future of Scotland's seas; Protect Scotland's marine environment;
- Research and Monitor Scotland's seas to provide evidence to support sound decision making;
- Advocate using Scotland's marine environment sustainably.

3.2.13 *Scottish Natural Heritage*

SNH publish a series of policy notes, outlining their aims and duties. Under their policy statement of 'Caring better for wildness and wild land', highlighted 'duties' include safeguarding wildness and wild land, enhancing nature, responsible recreational use, recovery of past damage and promoting awareness.

These are reflected in a statement of SNH policy regarding 'strategic objectives' received from one of the SNH representatives during the Pre-Appraisal stage:

- safeguard and enhance those aspects of the natural heritage which are of national importance;
- follow best practise in design, maximising positive opportunities for nature and local landscapes, also considering recovery of past damage;
- raise awareness, understanding and enjoyment of the natural heritage and promote responsible recreational use;
- support measures that enhance the socio-economic benefits provided by natural heritage.

3.2.14 *Scottish Environment Protection Agency*

SEPA's mission statement, as found in their publications is 'to be an excellent environmental regulator and an effective and influential authority on the environment'. Their corporate values are stated in the three E's, Environment, Excellence and Engagement.

Environment includes the understanding, protecting and improving the environment.

SEPA's enforcement Policy, Policy No5; is one part of SEPA's overall approach to protecting and improving the environment. The policy is amongst others to ensure that the environment is protected and improved and harm to human health prevented.

SEPA's aim is the protection of the water environment and groundwater dependant terrestrial ecosystems and the avoidance of flood risk, waste, disturbance of peatlands. References are made to the Scottish Government's Zero Waste plans and supports the Scottish Government's purpose by protecting and improving the environment to help ensure that Scotland flourishes. By ensuring the high quality environment which is vital for industries such as fishing, farming, forestry, whisky, renewable energy, mineral extraction, tourism, shellfish and fish-farming, they make an important contribution to sustainable economic growth.

The above is reflected in some of the 'opportunities' highlighted in table 2.1 of this report; 'use opportunity to enhance the water and wider environment as part of the design considerations, applying best practice principles'.

3.3 Developed Project & Transport Planning Objectives

The Stakeholder workshops held during the Pre-Appraisal stage of the project were conducted in accordance with the requirements of STAG, and as part of the whole appraisal process, incorporating Pre-Appraisal, Part1 Appraisal, Part 2 Appraisal and Post Appraisal work.

A robust Pre-Appraisal provides the foundation to the whole process, since it promotes the analysis of opportunities in parallel to the identification of transport problems. The aim of the Pre-Appraisal process, which is now complete, was to engage Stakeholders in the development of the Project Objectives, to capture the essence of the evidence based problems to be addressed and to identify opportunities to be potentially realised.

Project Objectives agreed throughout the Pre-Appraisal stage of the process do not aim to prioritise between options, but rather be understood to be an aid to the process of decision making during this appraisal and to allow for informed choices to be made.

The Pre-Appraisal process carried out in relation to the Stromeferry Bypass successfully resulted in delivering a set of 'local' Project Objectives, which were proposed to be taken forward as 'Transport Planning Objectives' to aid the appraisal of route options during this Part 1 appraisal. Developed Transport Planning Objectives in relation to this project are outlined in table 3.1 below.

These objectives were also expressed with SMART principles in mind. A SMART objective is to be **S**pecific, **M**easurable, **A**ttainable, **R**elevant and **T**imed. Some of the Transport Planning Objectives as shown may at this stage not be entirely 'SMART', but collective the Objectives provide a 'SMART' basis for the assessment of developed route options, with 'time' being one of the primary considerations.

The 'strategic' Objectives, which consider the Government's Purpose, National Outcomes and Government Agencies' policy statements in relation to this study, as outlined in section 3.2 of this report, and as further summarized below, are considered to be well reflected in the set of agreed Transport Planning Objectives shown in table 3.1.

The proposed Transport Planning Objectives are not weighted. Relevance in relation to the STAG criteria of environment, safety, economy, integration and accessibility has been considered and is shown in the table below.

In addition, relationship to the identified 'problems, constraints and opportunities' identified in chapter 2 is also indicated, to ensure full continuity of the appraisal process.

3.3.1 Summary of 'Developed Transport Planning Objectives'

The following table shows the final set of Transport Planning Objectives developed for this project during the Pre-Appraisal process and as agreed with Stakeholders at the joint meeting held on the 31st January 2013.

TRANSPORT PLANNING OBJECTIVES TRANSLATED INTO SMART OBJECTIVES							Table 3.1						
Ref.	Draft SMART Objectives	Ref table 2.2	Appraisal Criteria Objective										
A(1)	Safeguard and, where possible and appropriate, enhance and provide access to the natural and built environment and areas of national, regional and local importance and heritage, during construction, maintenance and operation of the scheme (with reference to environmental appraisal)	L&E1, L&E2, L&E4, L&5 L&E6, L&E9, L&E10, L&E11, L&E13	Environment	Safety	Economy	Integration	Accessibility	√					
B(2)	Minimise all risk during design, construction, operation and maintenance (with reference to Risk Register)	H4, H6, H7, D1, L&E7, L&E8						√	√	√			
C(3)	Ensure deliverability of scheme within programme and to agreed capital cost and maintenance budgets, thus providing 'Value for Money'	L&E8, S12, F1, F3, R7, R8								√			
D(4)	Deliver a safe and reliable, 2 lane carriageway, by applying appropriate / proportionate design standards	H1, H2, H4, H5, H6, H7, D1, D2, D5, L&E3, L&E6 L&E7, L&E8, L&E9, L&E10, L&E14, S3, S6, S7, S9, S13, F2, R2, R6, R7, R8						√	√	√	√	√	
E(5)	Solution reduces, or does not increase, the risk to and liability of the railway and maintains suitable access over the life of the scheme	H5, L&E7, F2, R1, R2, R3, R6, R7, R8						√	√	√	√	√	
F(6)	Keep the A 890 and peripheral road network open during construction	D2, D8, S2, S10, S13, F2								√	√	√	
G(7)	Maintain and improve local social cohesion by improving accessibility for emergency services responding to call-outs, as well as for the local population making use of local and regional leisure, health and educational facilities	H3, D3, L&E12, S1, S4, S5, S10, S11, S13								√	√	√	
H(8)	Maintain and improve choice of transport mode and integration of public transport links over the lifetime of the scheme	D3, D4, S1, S2, S4, S5, S6, S11, F2, R4, R5								√	√	√	
I(9)	Scheme to take account of relevant local, regional and national planning policies (during the design stage)	H6, L&E12, S11						√			√		
J(10)	(Objective removed during Joint Stakeholder Workshop discussions, as included in K(11) below)												
K(11)	Maximise / improve network efficiency, sustainable connectivity and social cohesion in terms of journey times and journey reliability in the Wester Ross area	D2, D3, D6, D7, S1, S2, S3, S4, S5, S6, S9, S11, S13, S14, F2, R4, R5								√	√	√	
L(12)	Deliver a scheme that assists both the local businesses to maximise opportunities for sustainable development and economic growth over the life of the scheme	D2, L&E12, S3, S7, S8, S9, S10, S11, S13, F2, F3								√	√	√	

3.3.2 *Summary of 'Strategic' National and Regional Objectives*

- Improved safety of journeys by reducing accidents and enhancing personal safety;
- Improved journey times and reliability of connections;
- Promote social inclusion and accessibility by connecting and safeguarding transport links to remote and disadvantaged communities;
- Protect the environment and improve health by promoting multi modal transport;
- Support sustainable economic growth;
- Protect and enhance Scotland's natural and historical heritage and environment;
- Promote sustainable use of the natural environment (through tourism);
- Provide a better quality and more reliable transport link to Lochcarron and Kishorn with the potential to reduce community fragility and encourage new economic activity;

The above strategic National and Regional objectives are reflected in the Transport Planning Objectives developed for this project, as shown in table 3.1.

4 OPTION GENERATION AND SIFTING

4.1 Introduction

The development and sifting of possible route corridors and options forms the central part of this appraisal. The process of considering and, if appropriate, eliminating proposed route options has to be carried out in a logical, transparent and auditable manner.

During the Pre-Appraisal Stage of this study, both historical and new proposed routes and route corridors were considered. The Stromeferry Bypass project has a long history of feasibility considerations for both on-line and off-line route options, reflecting the ongoing problems associated with the existing route. This historical work was given due consideration, but without prejudice for any particular option, alongside any new route options generated during the Pre-Appraisal stage.

Stakeholder discussions in connection with the development of route options and corridors were focused on the 'local study area', as shown on figure 2.2 in chapter 2.

It should be noted, that all developed route options have been given due consideration and been assessed on their own merit, both during the Pre-Appraisal, as well as this Stage 1 assessment.

However, it is important to highlight the fact, that long-term, The Highland Council may be tied into a maintenance obligation in connection with the existing route corridor in between Ardnarff and Cuddie's Point. Although this route may not be required to be retained as a public road, an obligation to maintain the rock slopes in order to safeguard railway operations along this section may remain with the Council, and cost associated with this will be required to be assessed and added to the cost of all off-line proposals.

All route options considered were assessed having both motorized and non-motorised users in mind.

4.2 Pre-Appraisal Stakeholder Consultations – Options Generating & First Sift

A major part of the five Stakeholder workshops held as part of the Pre-Appraisal process in connection with this Stromeferry Bypass Options Appraisal, was the generation of possible route options and corridors.

Although promoting a 'clean sheet' open minded approach, without any preconceived solutions, the starting point of the discussions was the recognition of previous feasibility work and therefore the presentation and consideration of historically developed routes and corridors, as shown in figures 4.1 and 4.2 below.

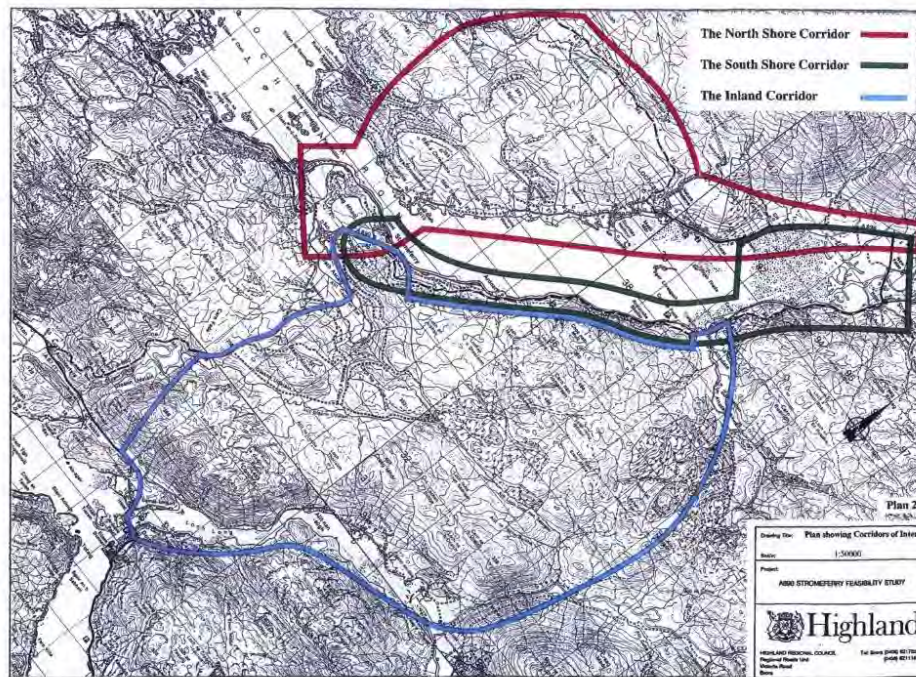


Figure 4.1 – Historical Route Corridors

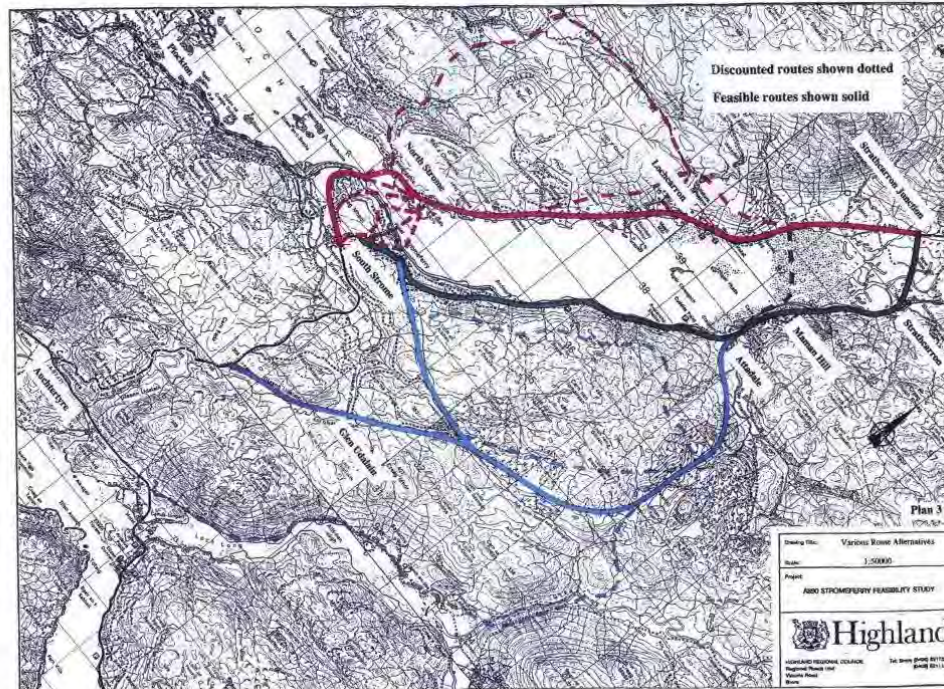


Figure 4.2 – Historical Route Options

These historical routes and corridors were carefully considered within the context of the current discussions in relation to the Stromeferry Bypass, and in addition to these, new route options identified.

The following route and corridor options were generated during the Stakeholder workshop discussions, as well during the assessment process by the appraisal team, and are further illustrated on drawing numbers 47065084 / in Appendix A of this report:

- **ONC**, Outer North, 'purple' corridor, containing 3 No route options and including two possible western Strome Narrows crossings;
- **NC**, North Shore, 'orange' corridor, containing 8 No route options, and including a variety of possible Strome Narrows crossings;
- **MC**, Mid-loch, 'yellow' corridor, containing 3 No loch crossings;
- **OC**, On-line, 'Blue' corridor, containing 7 No on-line route options, including a 'do-minimum' scenario;
- **SC**, South, 'green' corridor, containing a total of 8 No route options, and
- **OSC**, Outer South, 'red' corridor, containing 2 No route options.

Route descriptions adopted throughout this report outline the routes from south to north in general. All routes originated from a point on the A890 near to or south of Stromeferry, and extend up to the Strathcarron junction, in order to provide adequate comparability between routes regarding length, journey times etc. Some routes could be considered as link routes in conjunction with 'principal' routes, which is further explained in the detailed route descriptions.

Further details in respect of each of the above corridor and route options are provided below. Full engineering, environmental and economic assessments of all emerging routes after the Pre-Appraisal process, including detailed cost estimates, are included in the following chapters of this report.

Some of the route options generated were discarded during the Pre-Appraisal Stakeholder discussions in a first 'sifting' of route options. Details of the discarded routes and reasons for rejecting a particular option are given in section 4.6.

4.3 Part 1 / Stage 1 Appraisal – Assessment of Options & Second Sift

During the Part 1 / Stage 1 assessment of route options, a further sifting process of route options was undertaken by the appraisal team. Routes dismissed at this stage were rejected mainly on grounds of vertical alignment problems, cost implications or buildability issues. In addition, route options including Strome Narrows crossings were rationalized to aid the assessment process, by means of adopting a general 'western', 'central' or 'eastern' crossing location, which could represent various structures types (bridges, tunnels and/or integrated renewable solutions), and could be added to all northern routes.

The following sections describe the route options included in this Part 1 / Stage 1 assessment of identified route options. Any potential route options discarded during the sifting process as outlined above, are further described in section 4.6, including reasoning for dismissing the respective route or corridor. In addition, all discarded routes were assessed against STAG criteria, which is included in the summary tables provided in chapter 8 of this report.

4.4 'Do Minimum' Scenario, On-line O4 – Baseline Case

A 'do-minimum' scenario has been considered in relation to this options appraisal in order to produce a baseline option for reasons of comparison.

This scenario would be the 'status quo', i.e. use of the A890 on the existing alignment between Stromeferry and the Strathcarron Junction. This includes steep road sections with gradients in excess of 10% at The Maman Hill and in the approach to Stromeferry from the east. It also includes the section of mostly single track carriageway in between Cuddies' Point and Ardnarff, which is subject to rock fall events. In the event of a road closure due to rock fall, The Highland Council contingency measures, including road diversions and temporary ferry services between Stromeferry and North Strome, would be put in place.

Considerations regarding the ferry services, using the existing slipways at Stromeferry and Stromemore, are outlined in a separate report with reference 'URS, 47066120 - Contingency Ferry Operations, April 2013'.

The 'do-minimum' scenario is the least popular with all Stakeholders, as no improvements to the current situation would be realised, and the route would remain as unreliable as it has been.

However, this option is the least expensive route options, albeit unpredictable in required annual spend, as annual maintenance of an estimated £0.25M is increased by 'reactive' spending to deal with rock fall events (recent event in December 2011 resulted in a spend of £2.4M overall). This scenario is further considered in chapter 7, Traffic & Economic Assessment.

4.5 Routes considered during Part 1 / Stage 1 Assessments

4.5.1 *Outer North Corridor (ONC), including Western Strome Narrows Crossing*

The ONC is an off-line corridor, generally leaving the existing A890 route alignment near Achmore, south-west of Stromeferry. This corridor encompasses three considered route options, varying in the location of the (western) Strome Narrows crossings, and location of the tie-in with the existing road network near Lochcarron Village.

This route corridor was developed to reflect a direct south-north link along the west coast, and would utilize parts of the existing A896 between Ardarroch and Lochcarron. The routes within this corridor would also offer easier access to Kishorn yard. ONC would by-pass Stromeferry, the section of the A890 in between Ardnarff and Cuddies' Point subject to rock fall events, and all dwellings along the southern shores of Loch Carron, from Stromeferry east to the Strathcarron Junction.

Two out of the three developed outer north route options were discarded during the 1st sift carried out during the joint Stakeholder workshop discussions on the 31st January 2013. The discarded options are further described in 4.11

4.5.1.1 Outer North ON3

This route has a total length of 19.8km from leaving the A890 at Achmore, to the tie-in at the Strathcarron Junction. (In comparison, the existing route is 13.1km long from Stromeferry to the Strathcarron Junction). The proposed route would lead west from Achmore, rounding Creag Mhaol to cross the Strome Narrows via a multi span bridge structure towards Leaconasigh. It then heads north to meet the A896 east of Ardarroch. The route would follow the existing public road east for approximately 4km. Rather than following the existing road

into Lochcarron Village, it is proposed to by-pass the village over a length of approximately 2km, with tie-in to the A 896 near Kirkton, following the A896 up to the Strathcarron Junction, where it would terminate.

The SSSI Allt nan Carnan is likely to be affected by the proposed eastern Lochcarron village bypass.

4.5.2 *North Shore Corridor (NSC), including Western Strome Narrows Crossings*

The North Shore corridor is an off-line corridor, generally leaving the existing A890 route alignment near Achmore, south-west of Stromeferry. This corridor encompasses the whole width of considered options for Strome Narrows crossings. The proposed routes then follow the corridor along the northern shore of Loch Carron, including both on-line routes through the village of Lochcarron, as well as considerations for a partial or complete by-pass.

This route corridor was developed to satisfy the wish for better connectivity of Lochcarron Village, and replicates the original route from Kyle to Lochcarron, before the ferry at Stromeferry was abandoned and the Stromeferry Bypass constructed. It would by-pass the section of the A890 in between Ardnarff and Cuddies' Point subject to rock fall events, and but also all dwellings along the southern shores of Loch Carron, from Stromeferry east to the Strathcarron Junction.

Eight route options were originally developed within this corridor. These mainly varied with regards to the considered location and means of crossing the Strome Narrows, including bridge, tunnel and ferry options. Four out of the eight developed north shore route options remained after the 1st sift carried out during the joint Stakeholder workshop discussions on the 31st January 2013. A further route was discarded after assessment of vertical alignments in the approach to the Narrows during the Stage 1 assessment work. Remaining options are detailed below. The discarded options are further described in 4.11.

4.5.2.1 North Shore N2

Route option N2 includes two considered western Strome Narrows crossings, a tunnel and a multi span bridge. Due to the proposed location of the crossings, this route avoids major gradients on the southern shore. Nevertheless, the tunnel option would require substantial excavations to achieve adequate road levels in the approaches at either end of the tunnel.

On-line improvements to achieve the adopted design standards and carriageway width would be required along the existing minor road from Leacanasigh through Stromemore to Strome Wood along the northern shore of Loch Carron. This would include replacement of structures such as retaining walls, bridges and culverts. This route is also proposed to provide a partial, approximately 3km long western by-pass of Lochcarron Village, leaving the existing road alignment at Strome Wood, heading towards the A 896 north west of Lochcarron. This section may involve gradients of up to 8%. The route would then continue along the existing A896 through Lochcarron Village, and east through Kirkton to the Strathcarron Junction.

Stakeholder workshop discussions highlighted the wish to improve connectivity of Lochcarron village, but with a preference to locally bypass the centre of town. A variant of N2 will therefore be considered, with an additional eastern bypass to follow the eastern end of route ON3. This additional route was added during the Stage 1 route assessment and will be labeled N9.

4.5.2.2 North Shore N6, including Tidal Barrage

During the detailed Stakeholder discussions, it was agreed that Route proposal N6 was to represent all fixed link Strome Narrows crossings considered at the eastern end of the Narrows, from near Stromeferry in the south to North Strome. The route alignments for represented options N6 (bridge), N7 (bridge) and N8 (tidal barrage) all follow a similar alignment of a steep approach from the A890 to a crossing of the Strome Narrows near Stromeferry towards Stromemore on the north shore. The route follows the existing local road alignment from Stromemore, through Strome Wood, on-line through Lochcarron Village and Kirkton to the Strathcarron Junction. On-line improvements to achieve the adopted design standards and carriageway width would be required along the existing minor road between Stromemore and Lochcarron. The cost of retaining walls has been considered in the assessment, in order to reduce encroachment beyond the width of the required road corridor. In addition, off-road parking would have to be considered to allow free flow during peak times. If this route is shown to be viable, the foregoing aspects will be considered in further detail during the Stage 2 work. In addition, restricted availability of a suitable road corridor in the western end of Lochcarron may also be a problem and will be considered in further detail at Stage 2 appraisal.

Detailed considerations in connection with potential renewable energy solutions integrated in Strome Narrows crossings are provided in chapter 5 of this study.

All route options including a crossing of the Strome Narrows will need to consider the visual impact on a landscape of particular natural beauty, and the close vicinity to Strome Castle. In addition, environmental impact on marine life within the Narrows will be given due consideration in the appraisal of these route options.

4.5.3 *Mid Loch Corridor (MLC)*

The 'mid loch' route corridor is an off-line corridor, solely considering two Loch Carron crossings as an alternative to the more western crossings at the Strome Narrows and on-shore road options. Both routes would have considered elevated bridge structures of a considerable length. Both routes were discarded during the first sifting process conducted during the joint Stakeholder workshop in January 2013.

Further details are provided under the 'discarded route options', section 4.11.

4.5.4 *A890 On-line Corridor (OC)*

The on-line corridor (OC) is representing all route options considered for on-line route proposals, from the 'do-minimum' baseline proposal to considerations for a widened on-line carriageway or shared road/rail, build-out viaduct and tunnel solutions.

The primary consideration for all on-line proposals is the improvement of the approximately 4.5km long road section in between Ardnarff and Cuddie's Point, which has been subject to ongoing rock fall events. In addition, all on-line route options consider, where possible, general improvements to the existing alignments and steep gradients of the route sections from Stromeferry to Ardnarff, , and the southern section from Attadale to Strathcarron. More detailed considerations regarding improvements of alignment and gradients will be included in the Stage 2 assessments of routes.

An improvement to the level crossing at Strathcarron by means of an overbridge has been considered for all on-line routes, and outline costs to consider replacement of the River Carron bridge have also been included at this stage.

It was recognized during the Stakeholder workshops, that all on-line solutions would potentially result in unacceptable disruption to existing traffic flows on the A890 during construction. This problem, identified during the Stakeholder discussions, will be considered in detail during the Stage 2 assessment. Contract documents would be developed to address this issue. In addition, early engagement with potential Contractors could aim at minimizing this disruption to an acceptable level, considering traffic control measures, convoy systems, night time working and other contingency measures such as ferry services.

4.5.4.1 On-line O1 – On-line Improvements

On-line route proposal O1 considers the 13.2km section of the A890 from Stromeferry to the Strathcarron Junction. This option is for the on-line improvement of the existing carriageway to a two-lane carriageway throughout. Some improvements of existing alignment and steep gradients are proposed between Stromeferry and Ardnarff and along the Maman Hill section of the public road.

In order to achieve a two lane carriageway throughout, large amount of rock excavations along the 4.5km section of road from Ardnarff to Cuddies' Point would be required, as a widening of the carriageway towards the shore will not be possible due to the existing railway line. This option will require considerations for safe rock excavations and the impact on railway services during the works.

Disposal of the excavated material quarried during these works as well as the environmental impact of the works will also need detailed consideration.

4.5.4.2 On-line O2 – Embankment / Viaduct

O2 focuses on the 4.5km section between Ardnarff and Cuddies' Point. The remainder of the route is proposed to be subject to on-line improvements as described in 4.5.4.1 for on-line route option O1 above.

This option considers the construction of a widened corridor into the loch beyond the railway line, and will therefore require two crossings of the railway line, and either embankment or a cantilevered elevated road / viaduct construction beyond the current shore line. Vertical alignment of this proposal is difficult to achieve as sufficient clearance for the two railway crossings will be required. Steep sided shorelines and unknown quality of foundation strata below water makes this proposal a challenging solution.

4.5.4.3 On-line O3 - Tunnel

On-line route option O3 also focuses on the 4.5km section between Ardnarff and Cuddies' Point, which presents the section of existing route corridor with ongoing rock fall issues. The remainder of the route between Stromeferry and Ardnarff, and from Cuddies' Point east to Strathcarron is proposed to be subject to on-line improvements as described in 4.8.1 for on-line route option O1.

In addition, an approximately 1.6km length of the existing road corridor east of Ardnarff would also be subject to on-line improvements without tunneling. This section of the existing corridor is considered suitable for widening without the requirement of excessive rock excavations due to the existing topography and considering the geotechnical aspects of the existing rock faces.

The proposed tunnel solution would comprise the construction of a 2.3km long lined tunnel, providing sufficient space for a two lane carriage way over the remainder of the route up to Cuddies' Point. Further engineering details of this option are provided in chapter 5 of this report.

4.5.4.4 On-line O4 – ‘Do Minimum’

On-line route O4 is described as the ‘Do-Minimum’ scenario under section 4.4 above.

4.5.4.5 On-line O5 – Joint Road Rail Solution

On-line route option O5 again focuses on the 4.5km section between Ardnarff and Cuddies’ Point. The remainder of the route between Stromeferry and Ardnarff, and from Cudies’ Point east to Strathcarron is proposed to be subject to on-line improvements as described in 4.8.1 for on-line route option O1 above.

This option proposal considers a joint road rail solution within a shared corridor, with road traffic running on the same line as the (single track) railway line. In effect, this option is an extension of the temporary solution implemented during the remedial works in relation to the rock fall event of December 2011.



Figure 4.3 Temporay Road Diversion April 2012

On-line O5 provides an ‘out-of-the-box’ proposal, and would require detailed discussions with Network Rail and First Group, operators of the Dingwall to Kyle railway line and the Regulator. Health and Safety as well as maintenance and liability issues would need careful assessment, with road traffic proposed to be running along the same route as the railway, similar to an inner city shared road and tram corridor. Careful signage and traffic control measures would also need to be put in place.

This is a solution that does work abroad and at this stage of the appraisal has not been discounted.

Below are some examples of existing shared road / rail systems currently in use in New Zealand, Alaska and Sweden.

This solution would enable a widening of the existing road corridor without further excessive rock excavations. However, this would only be considered a feasible solution for a railway line of low frequency of traffic, as every train movement would result in disruptions to the road traffic.

This option could be considered as a medium term solution, depending on both road and rail traffic growth. It would allow an on-line upgrade to be delivered using a phased approach.

This option could also consider an improved separation of road and railway from the unstable rock face, depending on the alignment adopted for the shared road/rail track.



Figure 4.4 – Shared Road and Railway Bridge, New Zealand



Figure 4.5 – Shared Road and Railway Bridge, New Zealand



Figure 4.6 Armtrak Train, Orlando, Florida

4.5.4.6 On-line O6 – Alternative Eastern Link Route

On-line route O6 represents an approximately 3km long alternative north eastern link route from Attadale east up to Kirkton. This link route does not necessarily represent a full alternative on-line option from Stromeferry to Strathcarron in itself, but can be combined with all other considered on-line improvement options O1 to O5 and O7, and indeed with considered southern route S4, as an alternative link route to bypass the Maman Hill section of road.

This proposal comprises an elevated road construction, starting at Attadale just beyond the River Attadale bridge crossing, and requires a skewed bridge crossing over the railway before continuing across the flood plains at the north eastern end of Loch Carron towards at tie-in with the A896 at Kirkton. Routes would then follow the existing A896 from Kirkton to Strathcarron Junction.

Construction of the elevated road across the flood plains will require careful consideration regarding natural water flows from the River Carron and its contributors, as well as impact on the natural habitats of this area.

Construction of this road link would greatly improve the current road gradients at the Maman Hill section and also omit the difficult alignment of road and railway at the level crossing at Strathcarron. In addition, it would provide a River carron crossing of adequate width and omit the requirement for a future bridge replacement of the existing River carron bridge on the existing road alignment.

This route however would bypass the communities of Strathcarron and Achintee, although the existing A890 would be retained as a local minor road to service these communities and safeguard an adequate road link.

4.5.4.7 On-line O7 – Extended Avalanche Shelter

Proposed on-line route option O7 focuses again mainly on the 4.5km section between Ardnarff and Cuddies' Point, as this represents the section of existing route corridor subject to ongoing rock fall events. The remainder of the route in between Stromeferry and Ardnarff, and from Cuddies' Point east to Strathcarron is proposed to be subject to on-line improvements as described in 4.5.4.1 for on-line route option O1.

This route improvement proposal comprises considerations for an extension of the existing avalanche shelter west of Cuddies' Point by approximately 2km. The existing shelter was built during the construction of the existing road in 1969, in reaction to a major landslide as a result of the extensive rock blasting works undertaken to establish the current road corridor. The existing shelter is approximately 200m long and covers both road and railway line at this location. The road is single track through the shelter, with passing places provided at either end.

Details of the proposed shelter extension are described in chapter 5 of this report.

In addition, an approximately 2km length of the existing road corridor east of Ardnarff would also be subject to on-line improvements without construction of protective structures such as shelters. This section of the existing corridor is considered suitable for widening without the requirement of excessive rock excavations due to the existing topography and considering the geotechnical aspects of the existing rock faces.

4.5.5 *Southern Corridor (SC)*

The southern corridor considered as part of this options appraisal is an off-line corridor, considering alternative bypass routes to the south of the existing A890 road corridor. The principal route in this corridor follows a forest track through Glen Udalain, leaving the A890 approximately 5 km north of Auchtertyre in a north easterly direction towards Glen Attadale, extending as far north as Strathcarron.

This route corridor was adopted to follow a previously considered route corridor through Glen Udalain, providing a completely off-line new routing between the A890 south of Stromeferry to Strathcarron. It would by-pass the section of the A890 in between Ardnarff and Cuddies' Point subject to rock fall events, but also potentially all communities along the southern shores of Loch Carron, as far west as Plockton.

Eight route options were originally developed within this corridor. These comprise two principal routes with six considered link routes providing alternative tie-in at the western and eastern ends. Five out of the eight developed south route options remained after the 1st sift carried out during the joint Stakeholder workshop discussions on the 31st January 2013. A further route was discarded after assessment of vertical alignments and altitudes near Loch nan Nreac Mora during the Stage 1 assessment work. Remaining options are detailed below. The discarded options are further described in 4.11.

4.5.5.1 South S1

This off-line southern route option was considered as a link route to the principal south route S4, as described in 4.5.5.3 below. S1 would leave the A890 just beyond the viewpoint south east of Stromeferry and climb through forestry areas over a length of approximately 4km to meet the main route S4 at Glen Udalain. The remainder of this approximately 18.9km long proposed route would follow S4 up to the Strathcarron Junction.

S1 was considered in conjunction with principal route S4 to retain a vital direct link towards Stromeferry, Achmore and the south shore of Loch Carron. Route S1 would require a new road construction through virgin land, currently used for forestry and livestock. The existing topography may result in steep road gradients near Stromeferry and the route would also cross various steep sided gorges.

Detailed engineering, environmental and economic considerations of this link route are included in the following chapters in this report.

4.5.5.2 South S3

This off-line southern route option was also considered as a link route to the principal south route S4, similar to S1 above. S3 would leave the A890 corridor near Braeintra and climb steeply through forestry areas over a length of approximately 4km to meet the main route S4 at Glen Udalain. The remainder of this approximately 18.5km long proposed route would follow S4 up to the Strathcarron Junction.

S3 was considered in conjunction with principal route S4 to retain a more direct link west towards the Plockton area. The route would require a new road construction through virgin land, currently used for forestry and livestock. The existing topography may result in steep road gradients beyond the tie-in with the A890 at Braeintra and the route would also cross various steep sided gorges.

Detailed engineering, environmental and economic considerations of this link route are included in the following chapters in this report.

4.5.5.3 South S4 – ‘Glen Udalain’

Route South S4 was developed from historical route proposals as the principal southern route within the SC corridor, providing a low altitude link from the A890 north of Auchtertyre, with gentle gradients along Glen Udalain towards Glen Ling and Glen Attadale, and along the southern side of Glen Attadale to a tie-in with the existing A890 west of the Attadale River bridge. This route continues similar to the on-line options considered along an improved road corridor from Attadale north east up to the Strathcarron Junction. As an alternative, link route O6 could also provide a feasible connection towards the tie-in at Strathcarron Junction.

The route as indicated on drawing 47065084 / 1004 in Appendix A of this report, would measure approximately 19km in length in between the western and eastern tie-ins with the A890. This would result in a slight increased route length of approximately 1km from the existing road alignment past Stromeferry, Ardnarff and Attadale to the Strathcarron junction, coming from the A87 Trunk Road in the south.

However, traveling north from Stromeferry, option S4 would add another 5km to the journey. For this reason, link routes S1 and S3 as described above have been adopted from historical considerations, to provide a similar connectivity through the proposed new road network to the existing conditions.

Southern route S4 is proposed to utilize the alignment of an existing forest track through Glen Udalain, which would require replacement if this route was constructed.

Although this route option was recognized as having the potential to open up new areas for tourism and forestry, and to provide an alignment easy to construct due to gentle gradients and few constraints, it would also be a route to mainly virgin ground and require careful assessment of the environmental impact it may cause.

A detailed engineering, environmental and economic assessment of this route is provided in chapters 5, 6 and 7 of this report.

4.5.5.4 South S5

This southern route was added to the list of proposed route options after detailed Stakeholder discussions suggested a southern route to be considered that would omit the requirement of a new route constructed through Glen Attadale, and at the same time bypass the steep gradients on the existing A890 road alignment at the Maman Hill.

Therefore the original route proposed for S5 connected onto route proposal S4 south east of Glen Attadale, crossing the River Attadale at the eastern end of the Glen, heading due north towards Cairn Ruairidh and Lochan Dubha, before dropping down the steep hillside of Creag Dhubh Bheag to Achintee and Strathcarron, where it would tie into the existing A890 road corridor towards the Strathcarron Junction.

Outline assessments of the proposed route with regards to vertical alignments indicated that the route was leading over ground of high altitude of 340m AOD near Cairn Ruairidh, and road gradients towards the tie-in at Achintee would have been excessive. Therefore an amended road alignment was considered as route S5b, along the northern side of Glen Attadale and bypassing the existing road alignment at the Maman Hill.

This route option will be further considered as described in chapter 5 of this report.

4.5.6 *Outer Southern Corridor (OSC)*

The outer southern route corridor considered as part of this options appraisal is an off-line route corridor of approximately 20km length, extending from the A87 at Dornie in the south, along Loch Long, north through Glen Ling towards Attadale and Strathcarron.

The outer south red route corridor was developed to provide a complete south – north link from the A87 Trunk Road to the A890 at Strathcarron. It would by-pass the section of the A890 in between Ardnarff and Cuddies' Point subject to rock fall events, but also all communities west of the corridor, including Attadale, Stromeferry and the Plockton area.

Two route options were originally developed within this corridor, but discarded during workshop discussions during the first sift. The options are further described in 4.6 below.

4.6 Discarded Route Options

As described in the foregoing sections 4.2 and 4.3, a total of 32 route options within 6 route corridors were developed during the Pre-Appraisal process. All suggested options were subject to two stages of a sifting process. The first sift was undertaken during the joint Stakeholder discussions during the final Pre-Appraisal workshop, and a second sift undertaken by the appraisal team during the early stages of the Stage 1 assessment.

Route options discarded during this sifting process, and reasons for dismissing an option, are outlined below. All route options are illustrated on drawing no. 47065084-1003 in Appendix A of this report.

4.6.1 *Route Outer North ON1*

Route corridor ONC is an off-line corridor supporting a direct south to north route, as described in section 4.5. It includes western Strome Narrows crossings and continues north towards a tie-in with the A896 near Ardarroch and east from there towards the Strathcarron Junction.

Two out of the three developed outer north route options were discarded during the 1st sift carried out during the joint Stakeholder workshop discussions on the 31st January 2013. The discarded options are further described below.

Outer North ON1 has a proposed total length of 15.7km from leaving the A890 at Achmore to the tie-in at the Strathcarron Junction. (In comparison, the existing route is 13.1km long from Stromeferry to the Strathcarron Junction). The proposed route would lead west from Achmore along the existing, very restricted single track road to Craig (upgrade of this section should also be considered but is not included in this option proposal), to cross the Strome Narrows via a major, multi span bridge structure of approximately 3.1km length over the Strome islands towards Leaconasigh. The route would then follow the corridor north through virgin ground to meet the A896 east of Ardarroch. ON1 would follow the existing public road east for approximately 4km. Rather than following the existing road into Lochcarron Village, it is proposed to by-pass the village over a length of approximately 2km, with tie-in to the A 896 near Kirkton.

This route option, would utilize the small islands of Eilean na Creige Duibh, Ulluva, Eilean an-t Stratha and Strome Islands, located at the western end of the Narrows, was dismissed during the first sift in discussions with the Stakeholder groups.

Main reasons for discarding this option, having carried out limited cost, environmental or engineering assessments of the proposal at this stage, were noted as:

- Perceived excessive cost of structure due to the required length of the crossing;
- Route proposal would not provide any benefits over more eastern route proposals with shorter Narrows crossings;
- Environmental issues in relation to the construction of such a long crossing, utilizing islands known for their wildlife;
- Unnecessary de-tour west from Achmore, adding to length of route and journey times;
- Difficult access to southern end of crossing, with major road upgrade required between Achmore and Craig.

4.6.2 *Route Outer North ON2*

Proposed route Outer North ON2 is identical with chosen route ON3, as described in section 4.5.1.1, up until the point where ON3 would continued along a new eastern bypass of Lochcarron Village. Route ON2 is proposed to continue along the A896 into Lochcarron and through Kirkton and along the existing road network to the Strathcarron Junction.

This route was dismissed during the first sift of route options, recognizing the similarity with route ON3, and with a general preference of the local Stakeholder group to bypass Lochcarron long term.

4.6.3 *Route North Shore N1*

Proposed corridor NC is an off-line corridor, promoting south to north linkage, generally leaving the existing A890 route alignment near Achmore, south-west of Stromeferry. This corridor also encompasses the considered options for Strome Narrows crossings. The proposed corridor then continues along the northern shore of Loch Carron, including both on-line routes through the village of Lochcarron, as well as considerations for a partial or complete by-pass of the village.

North Shore route N1 is one of the 'historical' route options considered in previous feasibility studies, re-instating the original route from Stromeferry northwards. North Shore route N1 was proposed to follow the route corridor along an improved existing road network from Stromemore through Lochcarron Village to the Strathcarron Junction along the northern shores of Loch Carron. This option included a non-fixed (ferry) crossing of the Strome Narrows from Stromeferry to Stromemore, utilizing upgraded existing slipways, but with improved access to and from Stromeferry.

This route option was dismissed during the first sift in discussions with the Stakeholder groups. Main reasons for discarding this option, having undertaken limited cost, environmental or engineering assessments of the proposal at this stage, were noted as:

- Primary aim and Stakeholder objective is to create a safe and *reliable* (fixed link) connection, with ferries considered unreliable due to weather dependency, breakdowns, limited timetables etc.;
- All non-fixed links would mean disruptions to traffic flows and added journey time and transport costs;
- Difficulties in creating adequate road access to Stromeferry due to the steep topography;
- Limited space for modern ferry facilities on either side of the Narrows at the proposed locations.

The above arguments are further strengthened when consideration is given to potential future development at Kishorn and the long term aspiration of a north south strategic link through Sutherland, Wester Ross and Skye.

As well as the comments set out above, the existing ferry slipways are inadequate for current needs. Whilst in a reasonable condition they are not satisfactory with regard to width and approach gradient. In addition both approaches are inadequate for the volumes and traffic mix and there is insufficient space for marshalling and stacking vehicles, mooring facilities would also need to be upgraded. Whilst it accepted the option of a ferry may have a lesser capital cost, ongoing maintenance and liabilities would have to be considered. It also has to be accepted re- installation of the ferry is weather dependant and no guarantees can be given to continuous running and therefore a key project Objective can not be met.

This aspect is discussed in more detail in URS report 'Stromeferry Options Appraisal, 47066120 – Contingency Measures for Ferry Operations, April 2013', where the ferry forms part of The Highland Councils mitigation strategy.

4.6.4 *Non-Fixed Strome Narrows Crossings - Air Travel*

Other options for non-fixed crossings were also considered, in particular the option of air travel. It was recognised that air travel could not provide the necessary linkage across the Strome Narrows to satisfy many of the Objectives and therefore air travel as an alternative to road travel has been rejected.

There is no accepted facility for landing aircraft in the study area. It is recognised however that air travel as an option within or adjacent to the study area would be a benefit. The study team are aware of a recent feasibility study investigating the potential of re-introducing scheduled air services from the Isle of Skye. The commission undertook a review of the potential for re-establishing scheduled air services to and from the Ashaig airstrip in Broadford on the Isle of Skye, which is owned by The Highland Council. The area has been without a scheduled air service since 1988 when a Logan Air service to Glasgow ended. The study looked at the demand for air services, including what people would be prepared to pay; potential airport and aircraft options and the capital and operating cost of these; and the overall business case. The Ashaig Airstrip is currently used by light aircraft but at 771m long and 23m wide, the report concludes it would need substantial upgrading to handle scheduled flights. The final report is awaited.

4.6.5 *Route North Shore N3*

Discarded north shore route N3 is a route proposal within north shore corridor NC, with the route leaving the A890 at Achmore in a westerly direction, rounding Creag Mhaol to lead towards a central Strome Narrows crossing towards Leacanasigh on the northern shore of the Narrows. The route would then continue, following the corridor along an improved existing road network from Stromemore through Lochcarron Village to the Strathcarron Junction along the northern shores of Loch Carron.

The Strome Narrows crossing included in this proposal was an approximately 2.5km long tunnel below the Narrows, from the southern shore west of Stromeferry across to Leacanasigh.

This proposed route option was dismissed, with focus on the proposed Narrows crossing, during the first sift in discussions with the Stakeholder groups. Main reasons for discarding this option, having carried out limited cost, environmental or engineering assessments of the proposal at this stage, were noted as:

- Topography on the southern shore would make an approach to a tunnel very difficult to impossible to achieve, with excessive excavation required to create approach roads to adequate gradients;
- Difficult crossing of the railway line on the southern shore; approach may require tunnel through Creag Mhaol to achieve suitable road levels and clearance to railway line.

It was concluded to dismiss N3 as a Strome Narrows tunnel crossing at this location, but to consider the Narrows for feasible fixed link crossings in general, as reflected in chosen route options N2 / N2b and N6, with N2b a western Strome Narrows tunnel crossing.

4.6.6 *Route North Shore N4*

Route proposal North Shore N4 follows the same route alignment as described for route N3 above, from the A890 at Achmore, across the Strome Narrows at a central location west of Stromeferry, to continue along the northern shore of Loch Carron along an improved existing road network from Stromemore through Lochcarron Village to the Strathcarron Junction.

This route proposal differs from N3 only by the proposed means of a Strome Narrows crossing. Route proposals for N4 considered a bridge crossing from west of Stromeferry to Leacanasigh on the northern shore of the Narrows. Similar to the considerations described above, the southern approaches to a bridge structure at this location would be very difficult to achieve due to the existing topography. Construction of this route would encompass substantial excavations to achieve approach roads to the adopted design standards and gradients.

This route proposal was retained after the first step of the route sifting process during Stakeholder workshop discussions as an alternative Strome Narrows crossing, but dismissed during the second step of sifting during the early stages of the Stage 1 engineering assessment.

Highlighted reasoning for discarding this route proposal are as mentioned above:

- Topography on the southern shore would make an approach to a bridge structure very difficult to with extensive excavation required to create approach roads to the adopted design standards and gradients.

4.6.7 *Routes North Shore N5 & N5b*

The proposed route options North Shore N5 and N5b were included to replicate routes considered in previous feasibility studies, and present very similar routes as described in section 4.6.1 for route option North Shore N2. Road alignments of the proposed routes are identical, leaving the A890 at Achmore to follow a route west of Creag Mhaol, with a western Strome Narrows crossing towards Leacanasigh on the north shore of the Narrows.

On-line improvements to achieve the adopted design standards and carriageway width would be required along the existing minor road from Leacanasigh through Stromemore to Strome Wood along the northern shore of Loch Carron. This would include replacement of structures such as retaining walls, bridges and culverts. This route was also proposed to provide a partial, approximately 3km long western by-pass of Lochcarron Village, leaving the existing road alignment at Strome Wood, heading towards the A 896 north west of Lochcarron. This bypass section may involve gradients of up to 8%. The route would then continue along the existing A896 through Lochcarron Village, and east through Kirkton to the Strathcarron Junction.

Proposed route options N5 and 5b differ from N2 only by the adopted alignment of these routes across the Strome Narrows (crossings shown for route options N5 and N5b are proposed to originate at the same point as N2, but take a more easterly direction towards the north shore, making the crossings slightly longer than N2) and the proposed means of crossing, with route proposal N5 being a tunnel and N5b a ferry crossing.

Route proposal N5 was discarded to favour a wider assessment corridor for a western tunnel crossing at the most feasible location (covered by N2 – tunnel) and N5b discarded for being a non fixed link proposal. Both options were dismissed during the first sift in discussions with the Stakeholder groups. Main reasons for discarding the option proposals, having carried out

limited cost, environmental or engineering assessments of the proposal at this stage, were noted as:

- Primary aim and Stakeholder objective is to create a safe and *reliable* (fixed link) connection, with ferries considered unreliable due to weather dependency, breakdowns, limited timetables etc.;
- All non-fixed links would mean disruptions to traffic flows and added journey time and transport costs;
- Potential to restrict new developments in the area considering Kishorn yard.

4.6.8 *Routes North Shore N7&8*

The proposed route options North Shore N7 and N8 follow the same road alignment as proposed route North Shore N6 (refer to 4.6.2), with all three route proposals including a fixed link Strome Narrows crossing at the eastern end of the Narrows near Stromeferry.

Route N7 was to include a bridge crossing from South Strome to Stromemore and N8 considerations for an integrated renewable energy solution (tidal barrage or similar) near Stromeferry.

In order to rationalize the assessment process, it was agreed during the joint Stakeholder group discussions in January 2013, that route proposal N6 would be considered as a principal route from Stromeferry to Stromemore, continuing on line through Lochcarron Village and the Strathcarron Junction, as described in 4.6.2, thus representing all fixed link eastern Strome Narrows crossings, including a bridge at the most favourable location and the possibility of an integrated renewable energy solution.

Route options North Shore N7 and N8 were therefore not carried over into the Stage 1 assessment work as stand-alone route options.

4.6.9 *Route Mid Loch M1*

The 'mid loch' route corridor MC is an off-line corridor, solely considering two Loch Carron crossings as an alternative to the more westerly crossings at the Strome Narrows and on-shore road options. Both routes would consider elevated bridge structures of a considerable length.

Route option Mid Loch M1 considered an elevated bridge structure in between the Rubha an Loingeis, west of Ardnarff and the north shore of Loch Carron near Strome Wood, thus providing an alternative direct link between the south shore of Loch Carron towards Lochcarron Village, shortening existing journey times considerably, and bypassing the problem area of the A890 in between Ardnarff and Cuddies' Point.

The road network at either end of the crossing would comprise of upgraded existing road alignments, with tie-ins difficult due to the 'square' alignment of the crossing as shown. However, this would provide the shortest crossing length of 1.7km at this location; with a skewed structure requiring additional length.

This route option was discarded during the first sift of route options during the Stakeholder discussions for the following reasons:

- Excessive length of structure of 1.7km resulting in potentially excessive construction costs (outline estimate of £295m);

- Complexity of construction due to the depth of the loch (in excess of 100m deep);
- Impact on Loch Carron, considering visual impact on natural landscape, potential restrictions to shipping and fish farming, potential environmental impact;
- Alternative bridge crossing to considered Strome Narrows crossings, with no benefit over the more westerly crossings, but at a higher cost.

4.6.10 *Route Mid Loch M2*

Mid Loch route option M2 was suggested during Stakeholder discussions in order to provide a route with the most direct link in between Stromeferry and Strathcarron. This would be achieved through the construction of an elevated iconic bridge structure of 7.7km length from the viewpoint on the A890 above Stromeferry, across Loch Carron, to the outcrops of Sgeir Chreagach and Sgeir Fhada and to a tie-in with the existing A896 at Kirkton.

This route was also proposed to recognize that a short link would reduce journey times, and a bridge structure of such magnitude could provide an attraction to tourism, similar to the Milau bridge in Northern France.

However, workshop discussions also concluded that a structure of such excessive length would potentially come at an excessive cost, and this option was therefore dismissed, noting the following points:

- Excessive length of 7.7km of this structure resulting in potentially excessive construction costs, making this an undeliverable proposal (comparison with Milau, a 2.5km long cable stay bridge structure, constructed in between 2001 and 2004 at a cost of £442m, would result in estimated cost of M2 of 1,360m);
- Complexity of construction due to the depth of the loch (up to 100m deep);
- Impact on Loch Carron, considering visual impact on natural landscape, potential restrictions to shipping and fish farming, potential environmental impact;
- Alternative bridge crossing to considered Strome Narrows crossings, with no benefit over the more westerly crossings, but at a higher cost.

4.6.11 *Route South S2*

The southern corridor SC considered as part of this options appraisal is an off-line corridor, considering alternative bypass routes to the south of the existing A890 road corridor. The principal route in this corridor follows a forest track through Glen Udalain, leaving the A890 approximately 5 km north of Auchtertyre in a north easterly direction towards Glen Attadale, extending as far north as Strathcarron.

This route corridor was adopted to follow a previously considered route corridor through Glen Udalain, providing a completely off-line new routing between the A890 south of Stromeferry to Strathcarron. It would by-pass the section of the A890 in between Ardnarff and Cuddies' Point subject to rock fall events, but also potentially all communities along the southern shores of Loch Carron, as far west as Plockton.

Green Route South S2 is one of 8 route options originally developed within this corridor. This route was considered at the early stages of the Pre-Appraisal process as a complete alternative southern route option, leaving the A890 at Glen Udalain, following a forestry track north east for approximately 5km, from where it would leave the forest track and continue in a

north easterly direction towards Loch nam Breac Mora. Beyond the loch this route would descent in a north easterly direction into Glen Attadale and re-join the existing A890 road alignment just west of the River Attadale bridge. The route would then follow the A890 corridor, including improvements to the alignment and gradients at Maman Hill, onwards to the Strathcarron Junction.

This route is identical to route option S4, apart from the approximately 4km long section from the forest track at Glen Udalain to just east of Loch nam Braec Mora. This 4km long section climbs up to an altitude of approximately 330mAOD, which would be higher than guidance given to stay below altitudes of 300m AOD, in order to ease winter maintenance burdens.

The route was retained during the first sifting process carried out at the joint Stakeholder group workshop in January 2013 as a possible option, but later discarded in the second sift during the early stages of the Stage 1 engineering assessment. The assessment concluded to favour route S4, which is of similar alignments and length to S2, but retains lower altitudes of 260mAOD and below throughout, missing the section of higher finished road levels near Loch nam Breac Mora. In order to retain lower altitude along S2, extensive excavations would be required through virgin ground, which could not be justified due to the potential environmental and economic impact of the required works.

Considerations regarding remoteness and winter maintenance issues of a higher altitude road also added to the arguments to dismiss this route proposal.

4.6.12 *Routes South S6, S7 & S8*

The developed route corridor SC originally held eight route option proposals, three of which were shown to follow a line parallel to the south shore of Loch Carron in principal, but at a high level across the top of the steep sided hillside of Cnoc nam Mult, climbing to heights of 360m AOD above Loch Carron.

These three routes, labeled S6, S7 and S8, originate on the A890 east of Stromeferry and would leave the existing road corridor just to the east of the viewpoint. All three routes would climb steeply approximately 120m over a 1.5km long section from the A890 to near Allt an Donn, using various alignments. From there one principal route continues across deep and steep sided burn gorges before rounding Aonach Baile na Creige above the avalanche shelter at an altitude of 310m AOD. The remainder of the route options is an approximately 1km link onto southern route S4 above Glen Attadale.

All three of these route options would provide an alternative link in between southern routes S1 in the west and S4 in the east, which would be shorter by about 4km than the more southerly combined route of S1/S3/S4, but at a much higher altitude, and with the requirement of various bridge structures to cross the steep sided gorges.

The southern route options S6, S7 and S8 were presented in detail during the joint Stakeholder workshop on the 31st January 2013, and discarded during the first step of the sifting process with the following arguments noted:

- Challenging topography at the western and eastern tie-in with the A890 and/or southern routes S1 and S4, resulting in steep road gradients;
- Challenging topography across the hillside of Cnoc Nam Mult and Aonach baile na Creige would result in large rock excavations of unknown nature and stability, to achieve a road alignment in keeping with the adopted design standards;
- Various major bridge structures required to bridge across steep sided burn gorges;

- Road construction on very exposed, high ground resulting in difficult conditions during construction and maintenance of this route.

The presented route options S6, S7 and S8 do not provide sufficient benefit over other considered route options further south (Glen Udalain) and therefore do not justify the potential difficult construction and maintenance, and cost involved in realizing this option, which was thus discarded.

4.6.13 *Routes Outer South OS1 & OS2*

The outer south route corridor OSC considered as part of this options appraisal is an off-line route corridor of approximately 20km length, extending from the A87 at Dornie in the south, along Loch Long, north through Glen Ling towards Attadale and Strathcarron.

The outer south red route corridor was developed to provide a complete south – north link from the A87 Trunk Road to the A890 at Strathcarron. It would by-pass the section of the A890 in between Ardnarff and Cuddies' Point subject to rock fall events, but also all communities west of the corridor, including Attadale, Stromeferry and the Plockton area.

Two route options were originally developed within this corridor, one leaving the A87 Trunk Road north of Dornie, continuing along the northern side of Loch Long through Conchra and Sallachy, and a southern route exiting the A87 at Dornie, following the route of the minor road through Carndu and Bundalloch to continue in a north easterly direction to Glen Elchaig. Both routes would meet at the southern end of Glen Ling and follow the OSC (and SC) north through Glen Attadale to Strathcarron and Strathcarron Junction.

This route corridor was added to provide a direct link into the Trunk road network. However, at a site visit conducted with Stakeholders to view the area along Loch long, it was considered to be a route too far removed from existing road links and travel habits.

The outer south route proposals were further discussed during the 1st sift process at the joint Stakeholder workshop on the 31st January 2013. Both routes, and therefore the entire red Outer South corridor, were discarded as a result of these discussions.

Main reasons for discarding the option proposals, having carried out limited cost, environmental or engineering assessments of the proposals at this stage, were noted as:

- Although the route would use existing topography well, avoiding areas of high ground, the new route would be too far removed from existing lines of travel and have potential to disconnect communities west of the corridor;
- Detrimental economic effect on communities like Achmore, Strome ferry and Plockton;
- Increased journey time from the Isle of Skye to Lochcarron and Applecross;
- Existing route of the A890 from Auchtertyre to Stromeferry would become minor route and waste previously spent capital to improve this section of road;

It was concluded that the outer south routes OS1 and OS2 would not provide any further benefit over the southern route corridor, and as the green corridor would provide routes closer to existing lines of traffic flows, this would be favoured over the red routes.

4.7 Summary – Route Options taken to Appraisal

The route option descriptions as shown below consider the agreed corridors as illustrated on the drawings contained in Appendix A of this report. Descriptions such as ‘on-line’ or ‘off-line’ relate to the existing A890 corridor. All routes will be considered from a point of origin on the existing A890 corridor between Auchtertyre and Stromeferry, and the Strathcarron Junction.

Table 4.1 –Summary of Route Options taken to Part 1 / Stage 1 Appraisal

CORRIDOR	ROUTE	OPTION DESCRIPTION
ONC	ON3	Route Outer North 3 is an off-line route option, which provides a direct south to north link from Achmore as far north as Ardarroch, including a Strome Narrows western bridge crossing, and a full bypass of Lochcarron Village
NC	N2 (bridge)	Route North N2 is an off-line route option considering a western bridge crossing of the Strome Narrows, and follows the route of the existing minor road along the northern shore of Loch Carron, upgraded to agreed design standards, including a partial, western bypass of Lochcarron Village
NC	N2b (tunnel)	Route North N2b is an off-line route option considering a western tunnel crossing of the Strome Narrows, and follows the route of the existing minor road along the northern shore of Loch Carron, upgraded to agreed design standards, including a partial, western bypass of Lochcarron Village
NC	N6	Route North N6 is an off-line route option originating at Achmore, considering an eastern Strome Narrows crossing and following the route of the existing minor road along the northern shore of Loch Carron, upgraded to agreed design standards. This route remains on-line through Lochcarron Village.
NC	N6b	Route N6b takes the same alignment as described for N6 above. N6b considers an integrated renewable energy solution for the Narrows crossing.
NC	N9	Route N9 is an additional route option proposed to provide a full bypass of Lochcarron Village. This route is an off-line route option considering a western bridge crossing of the Strome Narrows, and follows the route of the existing minor road along the northern shore of Loch Carron,, upgraded to agreed design standards.
OC	O1	Route On-line O1 considers the on-line improvement of the existing A890 to a two-lane carriageway throughout, including minor improvements to alignments and gradients
OC	O2	Route On-line O2 considers on-line improvement of the existing carriageway and a local 1.8km bypass of the rock fall area west of Cuddies' Point by means of a cantilevered structure along the shoreline.
OC	O3	Route On-line O3 considers on-line improvement of the existing carriageway and a local 1.6km bypass of the rock fall area west of Cuddies' Point by means of an inland tunnel structure

CORRIDOR	ROUTE	OPTION DESCRIPTION
OC	O4	Route On-line O4 is the 'Do-Minimum' scenario, with no proposed improvements to the existing route
OC	O5	Route On-line O5 considers on-line improvement of the existing carriageway and a local 1.8km shared road / rail corridor west of Cuddies' Point
OC	O6	Route On-line O6 provides a northern upper loch crossing as an alternative link from Attadale to the A896 at Kirkton, and considers on-line improvements of the existing carriageway as per O1. This route can be considered as an alternative link to all southern on- and off-line route options.
OC	O7	Route On-line O7 considers on-line improvement of the existing carriageway and a local 2.0km extended rock shelter west of Cuddies' Point.
SC	S1	Route South S1 considers a southern off-line bypass (link) route from Stromeferry through parts of Glen Udalain and Attadale valley, and on-line improvements of the existing A890 carriageway from Attadale north
SC	S3	Route South S3 considers a southern off-line bypass (link) route from Braeintra through parts of Glen Udalain and Attadale valley, and on-line improvements of the existing A890 carriageway from Attadale north
SC	S4	Route South S4 considers a principal southern off-line bypass route from the A890 through Glen Udalain and Attadale valley, and on-line improvements of the existing A890 carriageway from Attadale north
SC	S5b	Route South S5b considers the southern off-line bypass route S4 from the A890 through Glen Udalain to Attadale Valley, with a northern route through Attadale and a bypass of the Maman Hill, and on-line improvements of the existing A890 carriageway north from the tie-in

4.8 Railway Interface, Ardnarff to Achintee

4.8.1 Introduction

The road and railway share the same corridor from Ardnarff to Achintee for some 8.5 km of the existing route, both are constrained by the loch and the rock cuttings over this length with the narrowest point being west of Cuddies Point at the avalanche shelter where the combined width for both road and track is only 15m or thereby.

The close proximity of the road to the railway and to the unstable rock slopes has caused problems to both asset owners since the road was opened in 1970. Significant correspondence is available to demonstrate these problems and the frustrations caused to the travelling public.

During the various consultations that have taken place to inform the DMRB Stage1 process, discussions have taken place in particular with Network Rail, but also the operator First Scot Rail.

4.8.2 *Need for the Railway*

The question has been asked as to the future need for the railway. There are obvious benefits in such a tight corridor for one of the assets to be removed. In asking this question it was known that the services offered by the railway and the condition of the railway are limited. Looking at these in detail:

A) Frequency of Service

The railway provides a linkage for local people as well as business and tourism. Even though there are only four trains per day (Monday to Saturday, two on Sunday), the route is seen as necessary. This aspect is addressed further in chapter 7 of this report. In addition there is a limited use of the line by freight operators. From discussion with Network Rail these services will continue and will be expanded as required to suit demand.

B) Condition of the Railway

The condition of the railway is assessed regularly by Network Rail and currently has a reduced category in addition to a 30mph speed limit. We understand Network Rail have an annual maintenance budget and a limited capital budget to ensure the line is kept operational. We are not aware of any planned capital expenditure on the line within the study area over the coming years.

C) Requirement for the Future

Network Rail and First ScotRail have no plans to restrict the use or close the railway line. In addition, workshop discussions held with the Stakeholders highlighted reluctance to consider any form of re-alignment of the route. This would include any future joint road / rail corridor across the Strome Narrows along the north shore of Loch Carron. Major re-alignment was dismissed mainly due to the assumed high capital cost associated with such an undertaking, and the fact that the existing railway line is considered to fulfill its purpose at the current location. For the purpose of this study therefore it is assumed the railway will continue to operate as existing, through the study area and terminating at Kyle. An agreed Objective has been set for the project to ensure the *Solution reduces, or does not increase, the risk to and liability of the railway and maintains suitable access over the life of the scheme.*

4.8.3 *Current Liabilities*

The Highland Council

Since the new road was opened the liability for inspecting and maintaining the rock face has been the sole responsibility of The Highland Council.

This has resulted in a maintenance spend of £250,000 per year with £2.5M having to be spent on reactive maintenance following a major slip. To put this in perspective, if these costs are averaged over a 20 year period, assuming two significant falls, a £10M burden to the Council can easily be generated.

It should be recognised however that Treasury guidance gives 60 years as the period for appraisal with costs discounted over that period from the year of opening. Economic modelling of this scenario is undertaken in chapter 7 of this report but in undiscounted terms, this amounts to a cost of £30M over the 60 year period.

Future Arrangements

An understanding between The Highland Council and Network Rail is in place for managing the existing slope to allow safe passage along the road and railway. It can be assumed this covers any development of new routes within the existing corridor. What is unclear is the responsibility/liability if a recommendation resulting from the DMRB Stage 2 Feasibility Study suggests a route away from the existing corridor is preferred i.e. Glen Udalain or a crossing of the Strome Narrows. It is understood The Highland Council and Network Rail are discussing the detail of their arrangement and it is likely that an element of liability will remain with The Highland Council.

This requires to be fully investigated and costed as the outcome could influence route selection, leading to a preference for on-line options.

Currently a capital cost figure of has been added to off-line routes to compensate for this possibility as developed in section 4.8.5 below.

4.8.4 *Short Term Mitigation*

1. As well as the liability outlined above, there is in place a contingency arrangement covered by the Basic Asset Protection Agreement to allow; access, emergency repair, maintenance and cost recovery should rock falls occur.
2. Following the rockfall in December 2011 The Highland Council have been working closely with Network Rail on the planning and implementation of mitigation measures. Should there be another significant fall, facilities are in place for dual running as was implemented successfully during the Spring of 2012.
3. In addition to this, The Highland Council are encouraging Network Rail to upgrade the Radio Electronic Token Block (RETB) such that a transfer station could be introduced at Stromeferry Station. This would benefit the area by reducing traffic delays and extending the working hours when slope works or inspections are required.

4.8.5 *Engineering Solution*

Dialogue has commenced with Network Rail and will continue as the feasibility study works progress. Several options are being developed that will have direct impact on the railway. These are described in chapter 5 of this report, On-line options 01 to 07.

- Closing, restricting or terminating the railway at Strathcarron has been investigated and rejected for the reasons set out above;
- Complete re-alignment of the railway line in conjunction with a new road alignment has also been considered and ruled out due to the assumed high capital cost of such an undertaking;
- Moving the railway locally in conjunction with developing a revised road alignment as per Option O2 has been considered. The potential cost implications, buildability issues (bearing in mind loch depths and restricted width corridors), and satisfying the above Objective must be recognised. However it should also be recognised that lengths of the railway are built on reclaimed land at present, and this option in general was considered worth more detailed consideration during the Stage 2 work;
- Providing a protected asset by means of a combined road/rail avalanche shelter (Option O7) as described and illustrated in chapter 5 of this report is a realistic option;

- Removing the risk of rockfall onto the railway by re-engineering the rock slopes has been considered (Option O1). Enhancing the separation of the railway and the road from the rock face offers distinct benefits. Confirmation of land ownership boundaries is required. This linked with the options work and an agreed minimum distance between the road and railway will establish if there is any additional space available for the road corridor. In addition this would highlight areas of land within Network Rail's ownership that may be available for transfer to enhance scheme development. Achieving this option whilst keeping the road/railway open will be very difficult;
- Due to the low frequency of trains, consideration has been given to running the road and railway on the same 'bed' (Option O5). In effect this is an extension of the temporary solution implemented during the rock fall of December 2012 but over some 2km. The introduction of a Radio Electronic Token Block (RETB) and transfer station at Stromeferry Station would benefit this option. There are obvious issues here with dual running and discussion with Network Rail and the Regulator must take place. However it is a solution operated abroad and at this time has not been discounted. This option could be considered a medium term option depending on both road and rail traffic growth but what it would do would be to allow an on-line upgrade to be delivered using a phased approach;
- Should an off-line solution emerge as a preference, there will still be a maintenance liability attached to the existing road corridor. This cost and associated risk could be significantly reduced by closing the existing road through the worst rockfall area. Turning areas and limited parking would be provided with through access only provided for Network Rail and The Highland Council for maintenance. Some 4km of the existing road between Ardnarff and Cuddies Point would be narrowed, rock treatment would be undertaken as necessary and a rock trap ditch/fence would be incorporated (Drg no. 47065084-5200 refers). An initial cost of £9.5M has been assumed for this over a 60 year period with capital costs of £1.5m for roadworks and £3.5M for rock treatment with an additional allowance for three rockfall events at £1.5m. It is envisaged annual maintenance in the order of £25,000/year should also be considered along the full length of the existing road.



Figure 4.7 Temporary Rock Protection April 2012

4.8.6 *Future Work*

In order to advise the Stage 2 work the following work requires to be undertaken:

- Confirmation of landownership between The Highland Council and Network Rail (and Attadale Estates) should be confirmed to allow options to be fully developed.
- Confirmation of any formal agreements between The Highland Council and Network Rail with regard to liability of inspection and maintenance of rock slopes, considering situation of off line solution being selected.
- Confirm if dual running is a practical option.
- Confirm if Network Rail would agree to local re-alignment of the line to consider combined road and rail solutions as per proposed options O2 and O7.
- Confirm cost of reconfiguring and maintaining existing road corridor should off-line option emerge as preferred solution.
- Confirm Network Rail historical spend and expected future capital and maintenance spend.

5 ENGINEERING ASSESSEMENT

5.1 Introduction

The engineering assessment conducted in relation to the Stromeferry Bypass as outlined in this chapter has been carried out in accordance with the requirements of TD 37/93, Preparation of the Stage 1 Report.

Only a broad assessment of engineering issues can be made at this stage. The general condition of the existing A890 carriageway and structures, as well as topography, hydrology, geology and geomorphology have all been considered. In addition, problems arising from the existing conditions have been identified and are further outlined below.

Preliminary assessments regarding alignments include considerations for both motorized and non-motorised users.

5.2 Existing Road

The existing public road under consideration in this appraisal is part of the A890 from Auchtertyre on the West Coast of Scotland to Achnasheen, and in particular the section between Stromeferry and the Strathcarron Junction.

5.2.1 *Existing Conditions*

The Stromeferry Bypass is an approximately 12km long section of the A890 alongside the southern shore of Loch Carron. The road forms part of the local road network between the Lochcarron area and Skye, as well as the wider road network from the Isle of Skye east towards Dingwall, and north along the west coast. It also provides a popular alternative tourist and route from Kyle of Lochalsh and Skye to Inverness.

The public road and a single track railway line are sharing a tight corridor along the southern shores of Loch Carron, which is particularly restricted over an approximately 4.5 km long section from Ardnarff to Attadale. The A 890 is mainly a single carriageway but reduces frequently to single track with passing places along the section between Ardnarff and Cuddies' Point.

Currently national speed limits would apply on the existing route between Auchtertyre and the Strathcarron Junction. However, steep sections of the A890 with gradients of up to 12% between Stromeferry and Ardnarff, and up to 14% between Attadale and Strathcarron, as well as sections of single track road reduce the average speed of traveling considerably.

5.2.2 *Rock Fall Issues*

Since the Stromeferry Bypass was opened, the approximately 4.5km long section of mainly single track road from Ardnarff to Cuddies' Point, which is located just west of Attadale, has been subject to landslides and rock fall events, causing the Local Authority to temporarily close the road at several occasions, in order to enable remedial works to the rock slopes to take place.

The last major event, which caused closure of the road to through traffic over several months occurred in December 2011.

Detailed considerations regarding geotechnical issues in relation to the site are given in a separate report by URS with title 'Stromeferry Options Appraisal, Geotechnical Desk Study Report, February 2013'.

5.3 Engineering Design Standards

Roads in Scotland are designed to the requirements set out in the Design Manual for Roads and Bridges (DMRB). These requirements include desirable minimum requirements and absolute requirements. Designs can be below the desirable minimum requirements at the discretion of the Designer, this is known as a Relaxation. If a design does not meet the absolute requirements, a Departure from Standard is required and this must be approved by the Overseeing Organisation, in this case, The Highland Council.

Road geometry is designed in accordance with DMRB Volume 6, Section 1, Part 1, TD 9/93 'Highway Link Design', which details the standards for horizontal and vertical geometry dependant on the design speed of a road. The existing design speed for Stromeferry Bypass was calculated to be 100 B kph for the section of road between Ardnarff and Cuddie's Point. The national speed limit of 60mph is equivalent to a design speed of 100kph. Therefore, the preliminary route options aim to have geometry appropriate for a design speed of 100kph. However due to the constrained nature of the study area and the local topography, relaxations in both the horizontal and vertical geometry are included to minimise the impact on the local environment. At this preliminary stage, transitions and superelevation have not been included for the route option alignments.

DMRB TD 9/93 Highway Link Design states that the desirable maximum gradient for a single carriageway road is 6%, and that gradients steeper than 8% shall be considered a Departure from Standard. TD 9/93 recognises that in hilly terrain steeper gradients will frequently be required, particularly where traffic volumes are low, which is the case for Stromeferry. Therefore, for offline options steep gradients have been fixed at maximum of 10% (which would be a Departure from Standard), in an effort to minimise the height of cutting and embankment slopes, and thus reduce the scheme footprint and minimise the impact on the local environment. For on-line options, the existing steep gradients have largely been adopted. A further consideration when developing alignments has been the altitude of route options with regards to weather and especially snow, ice and ongoing winter maintenance. The level of route options has been kept below the level of 300m.

During Stage 2 the Preferred Route Corridor options will be developed and assessed in more detail towards recommending a Preferred Route Option. At Stage 3 the Preferred Route Option will undergo detailed design, and applications for any Departures from Standard will be sought from the Overseeing Organisation.

5.3.1 Road Cross Section

DMRB Volume 6, Section 1, Part 2 TD 27/05 Cross Sections and Headrooms states that the cross section for an all purpose single carriageway is a 7.3m wide carriageway (2 x 3.65m lanes) with 1.0m hard strips and 2.5m verges. A 6.0m carriageway is permitted in Scotland where the design year flow is 5,000 AADT or less, which is the case for the A890 at Stromeferry. In comparison Highland Council has adopted a cross section consisting of 5.5m carriageway with 0.65m hardstrips for a similar lightly trafficked road in Sutherland. Therefore, the proposed road cross section for Stromeferry Options Appraisal is a single carriageway consisting of two 3.0m lanes, two 0.65m hard strips and 2.5m verges. The typical cross section is detailed on drawing 47065084 – 5203 in Appendix A.

It should be noted that design standards were considered in detail during the STAG Pre-Appraisal stage where an Objective was set to 'Deliver a safe and reliable, 2 lane carriageway, by applying appropriate / proportionate design standards'. Considerations also included adequate corridors to accommodate non-motorised users.

5.3.2 *Road Alignment*

DMRB requires the Stage 1 Assessment of road improvements to identify and consider broadly defined improvement strategies. These strategies should be described in general terms, highlighting major features as appropriate. Due to the historical nature of the project and the detail of previous work done, a modified approach has been adopted for this project involving the development and consideration of a number of distinct route options rather than broad improvement strategies.

Individual route options were developed in five corridors after consideration of information from a variety of sources. As outlined in chapter 4 several route options were presented to the Stakeholder groups as part of the STAG Pre-appraisal and some options were discarded through the sifting process at this stage. The remaining 17 options were then refined and have undergone formal Stage 1 Scheme Assessment.

All the route options are encompassed within the following broad corridors:

- Outer North Corridor: offline from Achmore, west of Creag Mhaol, crossing Strome Narrows, heading north passing east of Achintraid and Ardarroch, on-line on the existing A896 until north of Lochcarron, offline until Kirkton, then returning back on-line until Strathcarron Junction.
- North Shore Corridor: crossing of the Strome Narrows, then continue north eastwards, either on-line along the existing road through Lochcarron, or offline just north of Lochcarron, returning on-line at Kirkton until Strathcarron Junction
- On-line Corridor: on-line along the existing A890 corridor from Stromeferry to Strathcarron Junction.
- South Corridor: offline south of the existing A890, coming offline from between Glen Udalain and Stromeferry, heading north eastwards passing east of Loch Nam Breac Mora, then passing through the River Attadale valley and returning on-line along the existing A890 to Strathcarron Junction.

For clarity all northern corridor routes start at Achmore and finish at Strathcarron Junction. On-line routes start at Stromeferry and finish at the Strathcarron Junction. South corridor routes start at Stromeferry, Braeintra and Glen Udalain and finish at Strathcarron Junction.

Three dimensional outline designs have been developed for the options undergoing Stage 1 Assessment using computer software called MX. The options are described briefly below and drawings showing plan and profiles of each option are contained in the drawing folio Appendix A.

It should be noted that the alignments as described below are appropriate to the level of design development that has been undertaken at this stage. The alignments and standard of geometry will be re-assessed and refined during Stage 2 Assessment.

5.3.3 *Junctions and Side Roads*

Junction locations and sideroads will be considered in more detail at Stage 2, but it is envisaged that at-grade priority junctions would be provided at interfaces with existing roads. Impacts would be low and no engineering difficulties are envisaged.

5.4 Engineering Assessment of Options

5.4.1 *Outer North Corridor (ONC)*

5.4.1.1 Option ON3 (refer to drawing nos. 47065084 – 5111 to 5113)

Option ON3 leaves the existing A890 at Achmore, heading offline northwards, passing west of Creag Mhaol, crossing the Strome Narrows. A bridge crossing of the Strome Narrows would have a total span of approximately 800m, spanning both the Strome Narrows and the Dingwall to the Kyle of Lochalsh railway line. ON3 would then continue north passing east of Achintraid and Ardarroch, then continue on-line on the existing A896 until north of Lochcarron, where it continues offline until Kirkton, returning on-line along the existing A896 until Strathcarron Junction. Option ON3 has a total length of 19.8km.

On the southern approach to the Strome Narrows crossing, Option ON3 adopts geometry such that it skirts round the foot of Creag Mhaol. The horizontal geometry has a minimum radius of 255mR which is equivalent to the desirable minimum for a design speed of 60kph. The vertical geometry south of the Strome Narrows is generally equivalent to a design speed of 100kph, with maximum gradients of 2%. As shown, there may be large cuttings and embankments just north of Achmore, though it should be noted that these slopes would be considered in more detail during Stage 2 and their impact could be reduced. Similarly the impact of slopes could be reduced by the construction of retaining walls, the cost of which has been included in the cost estimates.

From the Strome Narrows to Ardarroch, ON3 has horizontal geometry equivalent to a design speed of 85kph. However, due to more challenging topography, ON3 would have steep gradients with several grades being 8% or greater, up to a maximum gradient of 10% which would be a Departure from Standard. However, these steeper grades would reduce the height of cuttings and embankments and would therefore minimise the route footprint.

From Ardarroch to north of Lochcarron, ON3 would follow the alignment of the existing A896 road, with on-line widening and some earthworks required. ON3 would have horizontal geometry equivalent to a design speed of 60kph. The vertical geometry through this section is mostly to standard, with gradients within the desirable standards. However, a 460m length of 10% gradient would be required on the offline section between Allt Nan Carnan and Kirkton.

From Kirkton to the Strathcarron junction, ON3 would follow the alignment of the existing A896, with on-line widening which would incur minimal earthworks. The vertical geometry is largely to desirable standards with no steep gradients required.

Option ON3 has several structures, the most notable being the bridge crossing of the Strome Narrows, which would also span the Dingwall to Kyle of Lochalsh railway line. This structure is discussed in more detail section 5.9.

Junction locations and side roads will be considered in more detail at Stage 2, but it is envisaged that at-grade priority junctions would be provided at interfaces with existing roads.

5.4.2 *North Shore Corridor (NC)*

5.4.2.1 Option N2 (refer to drawing nos. 47065084 – 5001 to 5003)

Option N2 follows the same alignment as option ON3 from Achmore and across the Strome Narrows, therefore it comes offline from the existing A890 from Achmore, continues northwards west of Creag Mhaol and crossing the Strome Narrows. N2 would then continue on-line following the existing road through Leaconasigh, Stromemore and Strome Wood. From Strome Wood, N2 would continue offline passing north of Lochcarron until reaching the existing A896. It would then return on-line along the existing A896 through the eastern end of Lochcarron, and remain on-line through Kirkton until Strathcarron Junction. Option N2 has a total length of 16.0km.

On the southern approach to the Strome Narrows crossing, Option N2 adopts geometry such that it skirts round the foot of Creag Mhaol. The horizontal geometry has a minimum radius of 255mR which is equivalent to the desirable minimum for a design speed of 60kph. The vertical geometry south of the Strome Narrows is generally equivalent to a design speed of 100kph, with maximum gradients of 2%. As shown, there may be large cuttings and embankments just north of Achmore, though it should be noted that these slopes would be considered in more detail during Stage 2 and their impact could be reduced. Similarly the impact of slopes could be reduced by the construction of retaining walls.

From Stromemore, N2 would continue north-eastwards on-line along the existing road until Strome Wood. This on-line section would have horizontal geometry equivalent to a design speed of 70kph, with a 255mR curve provided on the northern approach to the Strome Narrows crossing which is equivalent to a design speed of 60kph. The vertical geometry through this section comprises of relatively shallow gradients. Properties fronting on to this section of existing road are a constraint and may be impacted due to the widened road, however this would be considered in more detail at Stage 2. The impact of slopes could be reduced by the construction of retaining walls, the cost of which has been included in the cost estimates.

From Strome Wood through to the A896, N2 would have large horizontal curves, and good vertical geometry with maximum gradients of 4%, therefore the geometry would be equivalent to a design speed of 100kph. This section would have some earthwork slopes, with cutting slopes being no greater than a maximum height of approximately 15m.

N2 would then follow the existing A896 through the eastern end of Lochcarron, including the horizontal curve of 155m R which is equivalent to a design speed less than 50kph. The gradient through this curve is 8% which is the maximum desirable for a single carriageway. Crossing Allt Nan Carnan and through Lochcarron, N2 would aim to adopt the existing A896 geometry.

From Kirkton to the Strathcarron junction, N2 would follow the alignment of the existing A896, with on-line widening which would incur minimal earthworks. The vertical geometry is largely to desirable standards with no steep gradients required.

Option N2 has several structures, the most notable being the bridge crossing of the Strome Narrows, which would also span the Dingwall to Kyle of Lochalsh railway line. This structure is discussed in more detail section 5.9.

Junction locations and sideroads will be considered in more detail at Stage 2, but it is envisaged that at grade priority junctions would be provided at interfaces with existing roads.

5.4.2.2 Option N2b (refer to drawing nos. 47065084 – 5011 to 5013)

Option N2b has the same alignment as Option N2, but instead has a tunnel crossing of the Strome Narrows. The total length of N2b is approximately 16.0km.

Therefore the geometry for N2b is as that described for N2, but varies from ch.1000 to ch.4000 approximately, due to the vertical geometry of the tunnel approaches. N2b as shown has approach gradients of 10% on both the north and south tunnel approaches, both approximately 500m in length. The tunnel is discussed in more detail in section 5.10.

As with N2, junction locations and sideroads will be considered in more detail at Stage 2, but it is envisaged that at grade priority junctions would be provided at interfaces with existing roads.

5.4.2.3 Option N6 (refer to drawing nos. 47065084 – 5021 to 5023)

Option N6 leaves the existing A890 south of Stromeferry, passing to the east of Creag Mhaol, and to the west of Stromeferry. It then crosses the Strome Narrows, via a bridge crossing with a total span length of approximately 800m. The bridge crossing would span both Loch Carron and the Dingwall to Kyle of Lochalsh railway line. From North Strome, N6 would then remain on-line along the existing road through Stromemore, Strome Wood, Lochcarron and Kirkton until Strathcarron Junction. Option N6 has a total length of approximately 12.3km.

The southern approach to the bridge crossing has horizontal geometry equivalent to a design speed of 85kph. The vertical geometry required on the southern approach to the bridge crossing would incur major earthworks cuttings, and as shown would have slopes up to a maximum height of approximately 50m. The vertical geometry has been reduced in standard providing 10% gradients in an effort to minimise these earthworks.

A horizontal curve of radius 127m is provided on the northern approach to tie back into the existing road, this is equivalent to a design speed of less than 50kph. The vertical geometry on the northern approach has shallow gradients and therefore N6 earthworks have less impact on the local environment than the southern approach. From Stromemore, N6 would continue north-eastwards, remaining on-line following the existing road. Properties fronting on to this section of existing road are a constraint and may be impacted due to the widened road, however this would be considered in more detail at Stage 2. The impact of slopes could be reduced by the construction of retaining walls, the cost of which has been included in the cost estimates.

From Stromemore through to the A896, the horizontal geometry provided is largely equivalent to a design speed of 70kph, with some short curves equivalent to a design speed of 50kph. The vertical geometry would aim to follow the existing road, with mostly minimal earthworks incurred, and some cutting slopes up to 10m in height at minor realignments. Properties which front on to the existing road are a constraint and may be impacted due to the road being widened or minor realignments of the road. This would be considered in more detail at Stage 2. The impact of slopes could be reduced by the construction of retaining walls, the cost of which has been included in the cost estimates.

As discussed for N2, from the A896 through to Kirkton, N6 would aim to follow the existing road geometry, which has horizontal geometry largely equivalent to 70kph, with some short curves equivalent to 50kph. N6 would aim to adopt the existing vertical geometry, which is relatively flat and would incur mostly minimal earthworks.

From Kirkton to the Strathcarron junction, N6 would follow the alignment of the existing A896, with on-line widening which would incur minimal earthworks. The vertical geometry is largely to desirable standards with no steep gradients required.

Option N6 has several structures, the most notable being the bridge crossing of the Strome Narrows which is describe in more detail in section 5.9.

Junction locations and sideroads for N6 will be considered in more detail at Stage 2, but it is envisaged that at grade priority junctions would be provided at interfaces with existing roads.

5.4.2.4 Option N6b (refer to drawing nos. 47065084 – 5031 to 5033)

Option N6b has the same alignment as Option N6, but instead has a tidal barrage crossing of the Strome Narrows. Option N6b has a total length of approximately 12.3km.

Therefore the geometry for N6b is as that described for N6, but varies from approximately ch.100 to ch.2000, due to the vertical geometry of the tidal barrage approaches. N6b as shown has an approach gradient of 10% on southern approach which is approximately 420m in length. This approach would incur earthwork cutting slopes up to a maximum of approximately 70m in height. The northern approach vertical geometry would have a short length of 8% gradient, with cutting slopes of approximately 20m in height.

Option N6b has several structures, the most notable being the tidal barrage crossing of the Strome Narrows which is describe in more detail in section 5.11.

As for Option N6, junction locations and sideroads for N6b will be considered in more detail at Stage 2, but it is envisaged that at grade priority junctions would be provided at interfaces with existing roads.

5.4.2.5 Option N9 (refer to drawing nos. 47065084 – 5035 to 5037)

Option N9 is a new option developed following the STAG Pre-Appraisal process, introduced to ensure a fully offline Lochcarron bypass option was included in the range of North Corridor options undergoing Stage 1 assessment.

Option N9 follows the same alignment as option N2 from Achmore and across the Strome Narrows, therefore it comes offline from the existing A890 from Achmore, continues northwards west of Creag Mhoar and crossing the Strome Narrows. N9 would then continue on-line following the existing road through Leaconasigh, Stromemore and Strome Wood. From Strome Wood N9 would continue offline passing north of Lochcarron, crossing both the existing A896 and Alt Nan Carnan, then follow Option ON3 alignment, returning on-line along the existing A896 from Kirkton to Strathcarron Junction.

On the southern approach to the Strome Narrows crossing, Option N9 adopts geometry such that it skirts round the foot of Creag Mhaol. The horizontal geometry has a minimum radius of 255mR which is equivalent to the desirable minimum for a design speed of 60kph. The vertical geometry south of the Strome Narrows is generally equivalent to a design speed of 100kph, with maximum gradients of 2%. As shown, there may be large cuttings and embankments just north of Achmore, though it should be noted that these slopes could be reduced in later more detailed design stages, or the impact of slopes reduced by the construction of retaining walls, the cost of which has been included in the cost estimates.

From Stromemore, N9 would continue north-eastwards on-line along the existing road until Strome Wood. This on-line section would have horizontal geometry equivalent to a design speed of 70kph, with a 255mR curve provided on the northern approach to the Strome

Narrows crossing which is equivalent to a design speed of 60kph. The vertical geometry through this section comprises of relatively shallow gradients. Properties fronting on to this section of existing road are a constraint and may be impacted due to the widened road, however this would be considered in more detail at Stage 2. The impact of slopes could be reduced by the construction of retaining walls, the cost of which have been included in the cost estimates.

From Strome Wood through to the A896, N9 would have large horizontal curves, and good vertical geometry with maximum gradients of 4%, therefore the geometry would be equivalent to a design speed of 100kph. This section would have some earthwork slopes, with cutting slopes being no greater than a maximum height of approximately 15m.

N9 crosses the A986 and Allt Nan Carnan north of Lochcarron, and as shown has a horizontal curve of radius 1440m, which is equivalent to a design speed of 100kph, and has a maximum gradient of 4% though this section, with earthwork slopes of heights no greater than approximately 10m. However, a 460m length of 10% gradient would be required on the approach to returning on-line at Kirkton.

From Kirkton to the Strathcarron junction, N9 would follow the alignment of the existing A896, with on-line widening which would incur minimal earthworks. The vertical geometry is largely to desirable standards with no steep gradients required.

Option N9 has several structures, the most notable being the bridge crossing of the Strome Narrows which is described in more detail in section 5.9.

Junction locations and sideroads for N9 will be considered in more detail at Stage 2, but it is envisaged that at grade priority junctions would be provided at interfaces with existing roads.

5.4.3 *On-Line Corridor (OC)*

5.4.3.1 Option O1 (refer to drawing nos. 47065084 – 5041 to 5043)

Option O1 is on-line widening along the existing A890 from Stromeferry to the Strathcarron junction, which largely follows the south shore line of Loch Carron. The total length of O1 is approximately 13.2km. As the existing A890 through this section is largely single track with passing places, providing a two lane road with standard verges will incur earthworks due to the wider road cross section.

The On-line corridor is especially constrained on the section between Ardnarff and Cuddies Point, as the existing A890 is bounded the steep existing rock face to the south, and the Dingwall to Kyle of Lochalsh railway line and Loch Carron to the north.

O1 remains on-line and parallel to the railway and has widening to the south side only, such that the railway would not need to be realigned. Refer to drawing no. 5202 in Appendix A for a typical cross section for O1.

The geometry as shown for O1 aims to follow the existing alignment with small improvements made to the horizontal and vertical geometry. As with all options, the geometry would be developed in more detail during Stage 2 Assessment.

Between Stromeferry and Ardnarff, the horizontal geometry for O1 as shown would have minimum curves of radius 255mR which is the equivalent to the desirable minimum for a 60kph design speed. The vertical geometry aims to follow the existing road profile, with some steep gradients including a 10% grade approximately 350m in length approaching Ardnarff. There are some earthworks cutting slopes due to the wider cross section cutting into the rock

face, with some slopes being approximately 55m in height. The geometry would be considered in more detail and refined in Stage 2 to try to minimise the impact on adjacent land. The earthworks slopes could also be steepened should local ground conditions allow, this would also be considered in more detail during Stage 2.

From Ardnarff to Cuddies Point, the existing road corridor is narrow. Option O1 as shown aims to follow the existing road with no resulting impact on the railway line, with road widening to the south side only. Therefore, the geometry through this section has smaller horizontal curves, with the minimum curve radii equivalent to a design speed of 50kph. The vertical geometry is relatively flat with shallow gradients. The wider road cross section would cut into the existing rock face, with slope heights of around 60 – 70m high. However, the rock face would be remodelled to give a steep rock face cut slope, at an angle of 70 degree, with a 4m berm every 15m rise in height, as shown on drawing 47065084 – 5202. Therefore, the rock cuts through this section would typically have three to five 'bermed' rises, with a height of the cut rock face of approximately 40m.

From Cuddies Point through to Maman Hill, the geometry aims to follow the existing road alignment but with minor improvements, therefore horizontal curves are equivalent to a design speed of 60kph. The vertical alignment is mostly to standard, with a 6% gradient approaching the River Attadale valley. O1 would adopt the existing steep gradients through Maman Hill, which is 14% on both approaches, a short 120m length of 14% gradient on the southern approach, and a longer 260m length of 14% gradient on the northern approach. The route alignment and steepness of earthworks slopes would be developed in more detail during stage 2, to try and minimise the earthworks through Maman Hill.

From Maman Hill through to Strathcarron Junction, O1 aims to adopt the existing road alignment, with horizontal curves largely equivalent to a 70kph design speed, with the exception of the tight left hand curve at railway crossing at Strathcarron train station, which is equivalent to a design speed less than 50kph. O1 could either cross the railway by a level crossing, or as shown O1 would be carried over the railway by a new underbridge, and this has been allowed for in the cost estimates. From the Strathcarron train station to Strathcarron Junction, O1 would have shallow gradients.

Option O1 has several structures, mostly river crossing and culverts.

Junctions and sideroads for O1 will be considered in more detail at Stage 2, but it is envisaged that the existing at grade priority junctions would be retained and realigned as necessary to tie into the new route.

5.4.3.2 Option O2 (refer to drawing no. 47065084 – 5051)

Option O2 follows the same alignment as O1, except for the section from Croc Nam Mult to Cuddies Point. O2 would realign the road out on to a sidelong viaduct structure built out into the Loch. The viaduct structure would be approximately 1800m in length. The realignment sub-options for O2 would be considered and developed in more detail during Stage 2, but as shown, the road would be bridged over the railway at each approach to the viaduct, so that the railway alignment would remain unchanged. The total length of Option O2 would be approximately 13.2km.

In addition to the sidelong viaduct structure discussed in section 5.905, structures for Option O2 are as described for O1.

Junctions and side roads for O2 will be considered in more detail at Stage 2, but it is envisaged that the existing at grade priority junctions would be retained and realigned as necessary to tie into the new route.

5.4.3.3 Option O3 (refer to drawing no. 47065084 – 5061)

Option O3 follows the same alignment as O1, except for the section from Croc Nam Mult to Cuddies Point. O3 would move offline to the south of the existing route, passing through an inland tunnel. The tunnel would be approximately 1.6km in length. The total length of Option O3 would be approximately 13.0km.

In addition to the inland tunnel discussed further in section 5.10, all other structures required for Option O3 are as described for Option O1.

Junctions and side roads for O3 will be considered in more detail at Stage 2, but it is envisaged that the existing at grade priority junctions would be retained and realigned as necessary to tie into the new route.

5.4.3.4 Option O4 (refer to drawing nos. 47065084 – 5071 to 5073)

Option O4 is described as the 'do-minimum' scenario, with no improvements made to the existing road other than ongoing maintenance. The road would remain as per existing, therefore retaining sections of single track with passing places.

5.4.3.5 Option O5 (refer to drawing nos. 47065084 – 5081 to 5083)

Option O5 follows the same alignment as O1, except for the section from Croc Nam Mult to Cuddies Point. O5 would have a section of shared railway/roadway, with road traffic running on the same corridor as the (single track) railway line. The road would share the railway line for a length of approximately 1800m. The total length of Option O5 from Stromeferry up to the Strathcarron Junction would be approximately 13.2km.

In addition to the shared road/rail section outlined in section 4.5.4.5, all other structures required for Option O5 are as described for Option O1.

Junctions and sideroads for O5 will be considered in more detail at Stage 2, but it is envisaged that the existing at grade priority junctions would be retained and realigned as necessary to tie into the new route.

5.4.3.6 Option O6 (refer to drawing nos. 47065084 – 5091 to 5093)

On-line Option O6 from Mamam Hill to Strathcarron Junction can be considered as a link which can be used as a northern alternative to any of the on-line options, and also S1, S3 and S4, instead of remaining on-line through Strathcarron level crossing to Strathcarron Junction. However, for the purposes of the costing exercise detailed in section 5.13, Option 6 has been joined with option O1, and it is this route which is described below.

Option O6 follows the same alignment as O1, except for the section from Maman Hill to Strathcarron Junction, O6 would instead provide an upper loch crossing. The total length of Option O6 from Stromeferry to the Strathcarron Junction would be approximately 13.5km.

O6 would stay on-line along the existing A890 from Stromeferry through across the River Attadale as described for O1. O6 would come offline south of Maman Hill, crossing the Dingwall to Kyle of Lochalsh railway line by a skew underbridge. O6 would then also bridge across the downstream River Carron, then turn left and head toward Kirkton across an upper loch viaduct structure. It would then return on-line following the existing A986 until Strathcarron Junction, as described for option ON3.

The geometry as shown for the alignment through the railway crossing is equivalent to a design speed of 60kph. The alignment across the upper loch is relatively straight and level, with no geometry issues.

In addition to the upper loch crossing discussed in section 5.9.6, structures required for Option O6 are depending on the chosen route alignment up to the Attadale River bridge. Costs outlined in section 5.12 in connection with O6 were based on the assumption of the upper loch crossing combined with on-line route option O1.

Junctions and side roads for O6 will be considered in more detail at Stage 2, but it is envisaged that the existing at grade priority junctions would be retained and realigned as necessary to tie into the new route.

5.4.3.7 Option O7 (refer to drawing nos. 47065084 – 5101 to 5103)

Option O7 follows the same on-line alignment as O1, except for the section west of Cuddies Point. O7 would include an extension or alteration to the existing avalanche shelter structure, which would consider the carriageway as well as the railway. The avalanche shelter would be approximately 2000m in length. The total length of Option O2 from Stromeferry to the Strathcarron Junction would be approximately 13.2km.

In addition to the avalanche shelter discussed in section 5.9.7, structures required for route Option O7 are as described for Option O1.

Junctions and side roads for O7 will be considered in more detail at Stage 2, but it is envisaged that the existing at grade priority junctions would be retained and realigned as necessary to tie into the new route.

5.4.4 *South Corridor (SC)*

5.4.4.1 Option S1 (refer to drawing nos. 47065084 – 5121 to 5123)

Option S1 would leave the existing A890 at Stromeferry, heading westwards passing east of Loch Nam Breac Mora, it would then continue northwards toward the River Attadale valley, remaining on the south west side of the River Attadale valley, continuing in a north westerly direction before returning on-line to the existing A890 at the River Attadale bridge. S1 would then remain on-line through Maman Hill until Strathcarron Junction. The total length of S1 is approximately 18.9km.

The horizontal geometry provided from Stromeferry to River Attadale crossing is equivalent to a design speed of 100kph, with the exception of the geometry at Stromeferry which is equivalent to a design speed of 70kph. Similarly, a 450mR horizontal curve is provided approaching the River Attadale valley which is equivalent to a design speed of 70kph. Due to the steep topography, option S1 as shown has some steep gradients, with several lengths of 10% gradients, including a 500m length of 10% grade to climb out of Stromeferry, and a 1300m length of 10% gradient on approach to the River Attadale valley. The earthwork cuttings associated with S1 have heights up to approximately 30-35m leaving Stromeferry and on approach to the River Attadale valley. Similarly, S1 as shown has cutting slopes of heights up to approximately 30-35m adjacent to some watercourses. The route alignment and earthworks slopes would be developed in more detail during Stage 2, to try and minimise the earthworks.

S1 would adopt the existing steep gradients through Maman Hill, which are 14% on both approaches, a short 120m length of 14% gradient on the southern approach, and a longer 260m length of 14% gradient on the northern approach. The route alignment and steepness

of earthworks slopes would be developed in more detail during stage 2, to try and minimise the impact of earthworks through Maman Hill.

From Maman Hill through to Strathcarron Junction, S1 aims to adopt the existing road alignment, with horizontal curves largely equivalent to a 70kph design speed, with the exception of the tight left hand curve at railway crossing at Strathcarron train station, which is equivalent to a design speed less than 50kph. S1 could either cross the railway by a level crossing, or as shown S1 would be carried over the railway by a new underbridge, and this bridge has been allowed for in the cost estimates. From the Strathcarron train station to Strathcarron Junction, S1 would have shallow gradients.

Option S1 has several structures, mostly river crossings and culverts.

Junction locations and side roads for S1 will be considered in more detail at Stage 2, but it is envisaged that at grade priority junctions would be provided at interfaces with existing roads.

5.4.4.2 Option S3 (refer to drawing nos. 47065084 – 5131 to 5133)

Option S3 follows the same alignment as S1, but differs only in its southern link to the existing A890. S3 would leave the existing A896 at Braeintra, currently shown as a priority junction with the A896. S3 would head eastwards, and then follow the same alignment as S1.

From Braeintra, S3 has horizontal geometry equivalent to a design speed of 100kph. S3 has several lengths of steep gradients towards Braeintra, with two sections of 10% gradient, 300m and 380m in length, and also a 540m length of 8% (which is the desirable maximum grade for a single carriageway). The earthworks slopes from Braeintra have a height up to maximum of approximately 15m.

The horizontal geometry is generally of a high standard, equivalent to a design speed of 100kph, with the exception of a 450mR horizontal curve which is provided on entering the River Attadale valley which is equivalent to a design speed of 70kph. Due to the steep topography, option S3 as shown has some steep gradients, with several lengths of 10% gradients, including a 1300m length of 10% gradient on approach to the River Attadale valley. The earthwork cuttings associated with S3 have heights up to approximately 30-35m on the approach to the River Attadale valley. Similarly, S3 as shown has cutting slopes of heights up to approximately 30-35m adjacent to some watercourses. The route alignment and earthworks slopes would be developed in more detail during Stage 2, to try and minimise the impact of earthworks.

S3 would adopt the existing steep gradients through Maman Hill, which are 14% on both approaches, a short 120m length of 14% gradient on the southern approach, and a longer 260m length of 14% gradient on the northern approach. The route alignment and steepness of earthworks slopes would be developed in more detail during stage 2, to try and minimise the impact through Maman Hill.

From Maman Hill through to the Strathcarron junction, S3 aims to adopt the existing road alignment, with horizontal curves largely equivalent to a 70kph design speed, with the exception of the tight left hand curve at railway crossing at Strathcarron train station, which is equivalent to a design speed less than 50kph. S3 could either cross the railway by a level crossing, or as shown S3 would be carried over the railway by a new underbridge, and this has been allowed for in the cost estimates. From the Strathcarron train station to Strathcarron Junction, S3 would have shallow gradients.

S3 would have several structures, mostly river crossings and culverts.

Junction locations and side roads will be considered in more detail at Stage 2, but it is envisaged that at-grade priority junctions would be provided at interfaces with the existing roads. Furthermore, although an at-grade priority junction connection with the A890 at Braeintra is proposed for S3, Stage 2 could consider changing the priority such that the link into Stromeferry would become the main road alignment.

5.4.4.3 Option S4 (refer to drawing nos. 47065084 – 5141 to 5143)

Option S4 has been developed from the historical 'Glen Udalain' route. S4 would leave the existing A890 south of Braeintra, and follow the existing forest track through the Glen Udalain valley, remaining largely to the north of Allt Gleann Udalain. S4 would then cross the Allt Gleann Udalain, heading towards the Allt Loch Innis Nan Seangan valley. From here, S4 would follow the same alignment as S1, that is heading north east passing east of Loch Nam Breac Mora, it would then continue northwards toward the River Attadale valley, remaining on the south west side of the River Attadale valley, continuing in a north westerly direction before returning on-line to the existing A890 at the River Attadale bridge. S4 would then remain on-line through Maman Hill until Strathcarron Junction. The total length of S4 is approximately 19.5km.

Through the Glen Udalain valley, S4 would have a horizontal geometry equivalent to a design speed of 120kph. The vertical geometry through Glen Udalain is mostly shallow gradients, except for a 200m length of 10% gradient towards the Allt Loch Nan Seangan valley. The earthworks slopes through Glen Udalain have heights up to maximum of approximately 15m.

Towards the River Attadale valley, the horizontal geometry is generally equivalent to a design speed of 100kph, with the exception of a 450mR horizontal curve which is provided on entering the River Attadale valley which is equivalent to a design speed of 70kph. Due to the steep topography, option S4 as shown has some steep gradients, with several lengths of 10% gradients, including a 1300m length of 10% gradient on approach to the River Attadale valley. The earthwork cuttings associated with S4 have heights up to approximately 30-35m on the approach to the River Attadale valley. Similarly, S4 as shown has cutting slopes of heights up to approximately 30-35m adjacent to some watercourses. The route alignment and earthworks slopes would be developed in more detail during Stage 2, to try and minimise the impact of earthworks.

S4 would adopt the existing steep gradients through Maman Hill, which are 14% on both approaches, a short 120m length of 14% gradient on the southern approach, and a longer 260m length of 14% gradient on the northern approach. The route alignment and earthworks slopes would be developed in more detail during stage 2, to try and minimise the impact through Maman Hill.

From Maman Hill through to Strathcarron Junction, S4 aims to adopt the existing road alignment, with horizontal curves largely equivalent to a 70kph design speed, with the exception of the tight left hand curve at railway crossing at Strathcarron train station, which is equivalent to a design speed less than 50kph. S4 could either cross the railway by a level crossing, or as shown S4 would be carried over the railway by a new underbridge, and this bridge has been allowed for in the cost estimates. From the Strathcarron train station to Strathcarron Junction, S4 would have shallow gradients.

S4 would have several structures, mostly river crossings and culverts. These would be assessed in further detail during the Stage 2 appraisal.

Junction locations and side roads will be considered in more detail at Stage 2, but it is envisaged that at-grade priority junctions would be provided at interfaces with the existing roads. As per option S3, although an at-grade priority junction connection with the A890 is

proposed for S4, Stage 2 could consider changing the priority such that the link into Stromeferry would become the minor road.

5.4.4.4 Option S5b (refer to drawing nos. 47065084 – 5151 to 5153)

Option S5b follows the same alignment as S4, but remains offline until after Maman Hill, therefore avoiding the steep Maman Hill gradients. S5b follows the Glen Udalain valley as per S4, continuing towards the River Attadale valley, but then crosses the river at the southern end of the valley. S5b would continue north westwards, skirting round the foot of the hills to the north of Attadale. S5b would then turn eastwards, running parallel to the existing A890, before returning on-line north of Maman Hill. The total length of S5b is approximately 19.3km.

The horizontal geometry of S5b as shown is equivalent to a design speed of 60kph at the River Attadale crossing at the southern end of Glen Attadale. The vertical geometry as shown includes a 1000m length of 10% gradient on approach to the River Attadale valley, and a 250m length of 10% gradient at the Maman Hill, which although is greater than the desirable maximum of 8%, is less than the 14% gradients on the existing A890 road through Maman Hill. The earthwork slopes for S5b are however quite substantial, having maximum heights of approximately 70m along the north side of Glen Attadale. The route alignment and steepness of earthworks slopes would be developed in more detail during stage 2, to try and minimise the impact of earthworks.

S5b would have several structures, mostly river crossings and culverts. A substantial underbridge may be required for the River Attadale crossing.

Junction locations and side roads will be considered in more detail at Stage 2, but it is envisaged that at-grade priority junctions would be provided at interfaces with the existing roads. As per option S3, although an at-grade priority junction connection with the A890 is proposed for S5b, Stage 2 could consider changing the priority such that the link into Stromeferry would become the minor road.

5.5 **Climate, Topography and Land Use**

The effect of the climate on the engineering design will be addressed in detail during Stage 3 work (which does not form part of this commission). At this stage allowance has been made to set options below the 300m AOD contour and an assessment of drainage outflows to accommodate increased flows due to climate change issues is discussed in chapter 6.

Considerations regarding the existing topography and land-use within the study area are included in chapter 6, environmental assessment, of this report.

5.6 **Geology, Geomorphology and Ground Conditions**

A detailed geotechnical desk study has been undertaken to advise this Stage 1 appraisal. This has been issued as a separate document with reference 'URS, Stromeferry Options Appraisal, Geotechnical Desk Study Report 47065084 GLRP0001, March 2013'. This desk study includes assessments of geology, geomorphology and ground conditions, with recommendations for further detailed investigation work required prior to the design of respective options and mitigation measures.

At this preliminary stage, design earthworks slopes of 1 in 2 have been provided for both cut and fill slopes for the preliminary route options. The incline of the slopes can be steepened or slackened as required during Stage 2 should more details be determined for the ground conditions.

5.7 Hydrology, Hydrogeology and Drainage

The main waterbodies in the study area are Loch Carron, Abhainn Cumhang a Ghlinne, River Carron, River Attadale, Allt Cadh an Eas, Allt Gleann Udalain, and Allt Loch Innis nan Seangan. These waterbodies are discussed in more detailed in chapter 6. All of the above identified watercourses are potential outfalls for the road drainage system. Proposals for road drainage will be considered in more detail in Stages 2 and 3.

Groundwater flow within the bedrock recorded to underlie the site is classified as through fractures (bedding planes, joints and faults.) These rocks are classified as aquifers with a low to very low productivity.

As discussed in section 6.5, the groundwater for the study area has been given a vulnerability classification of 4. A vulnerability classification of 4 indicates that groundwater within bedrock beneath the site will be vulnerable to those pollutants not readily absorbed or transformed. Where bedrock is exposed, or only a thin layer of topsoil is present, a vulnerability classification of 5 would be more appropriate. A vulnerability classification of 5 indicates that groundwater within the bedrock will be vulnerable to most water pollutants with rapid impact in many scenarios. The groundwater quality beneath the study area has been classified as “good” by SEPA.

5.8 Public Utilities

Preliminary inquiries were made, in accordance with Appendix C2 of the Code of Practice to the New Roads and Streetworks Act 1991, to the undernoted major utility operators to establish the presence of their apparatus and assess the impact on each of the route option corridors:

- Openreach ducting for local telecommunication services present
- National Grid no electricity or gas transmission apparatus present
- Scotland Gas Networks no gas apparatus affected
- Scottish and Southern Energy low and high voltage electricity apparatus present
- Scottish Water water and sewerage apparatus present
- Virgin Media no Virgin Media or Viatel apparatus affected

Details of the utilities information received are reproduced in drawing nos. 47065084 – 5301 to 5306, and can be found in Appendix A of this report.

5.8.1 *Openreach*

The response received from Openreach indicates the presence of telecommunications apparatus, mainly in the form of general ducting for local services and joint boxes, along the main road network within the study areas, as indicated on drawings 47065084 – 5301 to 5306 included in Appendix A of this report.

A preliminary review of the information received would suggest that BT Openreach apparatus will be encountered on various sections along proposed route options, but that none of the proposals are considered to require major re-locatiion of existing services. This would require confirmation from the Utility company once a detailed options design stage is reached.

5.8.2 *Scottish and Southern Energy*

Electricity apparatus is present throughout the study area in the form of medium-voltage 11kV and 33kV overhead distribution lines, generally in the vicinity of existing roads: A890 south from Achmore and Stromeferry, A890 from Attadale and Achintee to Strathcarron Junction, A896 through Lochcarron and towards Kishorn and the C1096 from Lochcarron to North Strome. There are sub-stations between the two different voltage networks at Kishornhill, adjacent to the A896, and Achintee adjacent to the A890.

Diversion of distribution lines should not add significantly to the cost of schemes.

The locations of conflicts between the 33kV medium voltage lines and the route option corridors are noted in Table 5.1. There are crossings of existing roads which could affect on-line sections of several options on the A890 at Achintee and on the A896 between Kirkton and Strathcarron junction, as well as conflicts affecting Option S5b in the River Attadale valley.

An 11kV route runs parallel and crosses routes within the north of the study area and would particularly affect route ON3, N2 and the landing point of for any Strome Narrows bridge.

Table 5.1 – SSE apparatus within study area

OPTION	CROSSING	APPROXIMATE LOCATION
Outer North		
ON3	33kV	A896 Lochcarron Industrial Estate
	33kV	A896 Ribhuachan
North Shore		
N2, N2b, N6, N6b, N9	33kV	A896 Lochcarron Industrial Estate
	33kV	A896 Ribhuachan
On-line		
O1, O2, O3, O4, O5, O7	33kV	A890 Achintee
O6	33kV	A896 Lochcarron Industrial Estate
	33kV	A896 Ribhuachan
South		
S1, S3, S4	33kV	A890 Achintee
S5b	33kV	Attadale
	33kV	Attadale House
	33kV	A890 Achintee

5.8.3 *Scottish Water*

There are localised water main networks ranging from 3” to 150mm diameter at the following settlements:

- Achmore and Stromeferry, affecting options ON3, N2, N6
- Achintraid, affecting option ON3
- Slumbay, Lochcarron and Kirkton, affecting options ON3, N2, N6, O6
- Achintee and Strathcarron, affecting On-line and South options

The Lochcarron water treatment works is located above the village adjacent the A896 towards

Table 5.2 – Scottish Water apparatus within study area

OPTION	CROSSING	APPROXIMATE LOCATION
Outer North		
ON3	3”	Achmore
	125mm	Achintraid
	125mm	Achintraid
	90mm	A896 Kirkton to Strathcarron jn

OPTION	CROSSING	APPROXIMATE LOCATION
North Shore		
N2, N2b, N6, N6b, N9	3"	Achmore, Stromeferry
	90mm	C1096 Slumbay, A896 Lochcarron
	150mm	A896 Lochcarron
	90mm	A896 Kirkton to Strathcarron Jn
On-line		
O1, O2, O3, O4, O5, O7	90mm	A890 Achintee to Strathcarron Jn
O6	90mm	A896 Kirkton to Strathcarron Jn
South		
S1, S3, S4, S5b	90mm	A890 Achintee to Strathcarron Jn

Sewer networks are present at Achmore, Achintraid, Slumbay and Lochcarron, however the first two will not affect the route options. Options N2 and N6 involving widening of the existing carriageway could however be affected by the sewer network at Slumbay and Lochcarron which is adjacent the road and the foreshore.

5.9 Structures

Given the traffic volumes in the study area, it is expected that new junctions and private accesses will be at-grade and there will not be grade-separated crossings of other roads and therefore the majority of structures will involve the crossing of watercourses and water bodies - streams, rivers, Loch Carron and the Strome Narrows. The options being considered also include bridge crossings of the railway and special structures on the On-line corridor comprising a sidelong viaduct and an avalanche shelter.

Several of the options include on-line sections of the existing A896, C1096 and A890 roads where existing structures could be upgraded or replaced. There could also be a need for retaining structures where improvement of on-line sections is constrained by existing development or topography.

Generally, the types of structure comprise:

- Culverts for small streams and large drains
- Bridges for large streams and rivers, railways
- Major bridges for water crossings - options ON2, N2, N6 - Strome Narrows
- Multi-span viaduct - option O2 - Frenchman’s Burn to Cuddies Point
- Multi-span viaduct - option O6 - Upper Loch Crossing
- Avalanche shelter - option O7 - Frenchman’s Burn to Cuddies Point
- Retaining structures on on-line improvement of existing roads.

Significant structures are summarised in Table 5.3. Where bridges cross watercourses and rivers, only those named on Ordnance Survey 1:50,000 mapping have been noted.

Table 5.3 – Structures

OPTION	CROSSING	LOCATION
Outer North Corridor		
ON3	800m major bridge watercourse watercourse existing structures watercourse existing structures	Portchullin - Leacanasigh Reraig Burn Abhainn Cumhang a Ghlinne A896 Sannachan to Lochcarron Allt nan Carnan A896 Kirkton to Strathcarron Jn
North Shore Corridor		
N2, N2b	800m major bridge existing structures existing structures	Portchullin - Leacanasigh C1096 Leacanasigh to Strome Wood A896 Lochcarron to Strathcarron Jn

OPTION	CROSSING	LOCATION
N6, N6b	900m major bridge existing structures existing structures	Stromeferry - Stromemore C1096 Stromemore to Lochcarron A896 Lochcarron to Strathcarron Jn
N9	800m major bridge existing structures watercourse existing structures	Portchullin - Leacanasigh C1096 Leacanasigh to Strome Wood Allt nan Carnan A896 Kirkton to Strathcarron Jn
On-line Corridor		
O2	railway water body railway	sidelong viaduct
O7	railway	avalanche shelter (viaduct)
O1, O2, O3, O4, O5, O7	river watercourse river railway river	River Attadale (existing bridge) Carron Pottery (existing bridge) River Taodail (existing bridge) Strathcarron level crossing River Carron (existing bridge)
O6	river railway overbridge water body existing structures	River Attadale (existing bridge) Maman Hill Loch Carron A896 Kirkton to Strathcarron Jn
South Corridor		
S1, S3	watercourse watercourse river watercourse river river	Allt Cadh an Eas Allt Gleann Udalain River Attadale (existing bridge) Carron Pottery (existing bridge) River Taodail (existing bridge) River Carron (existing bridge)
S4	watercourse river watercourse river railway river	Allt Gleann Udalain River Attadale (existing bridge) Carron Pottery (existing bridge) River Taodail (existing bridge) Strathcarron level crossing River Carron (existing bridge)

OPTION	CROSSING	LOCATION
S5b	watercourse	Allt Gleann Udalain
	river	River Attadale
	watercourse	Carron Pottery (existing bridge)
	river	River Taodail (existing bridge)
	river	River Carron (existing bridge)

5.9.1 *Culverts*

Culverts for field drains and small streams would mostly be constructed using precast concrete pipes which are typically available up to 2.4m diameter. Rectangular precast concrete culverts require less depth of excavation to achieve the same discharge rate as circular culverts and can offer cost savings from reduced time and labour on site but are generally more expensive than pipes. At this stage, it is assumed that 1.2m to 1.5m diameter precast concrete pipes would be sufficient to carry the flow from the small streams that cross the routes. Although it may become apparent that other construction types would be more applicable at some specific sites, this type of construction is fast and economic and is therefore deemed the preferred method.

Large streams could be accommodated with corrugated steel culverts, arches or pipe-arches which are plate structures consisting of various width, curved steel sheets of varying profiles, lengths and thicknesses that are bolted together to form durable structures. These are typically used for diameters of over 3.6m and are available in spans/diameters up to 12m. Bolted plate structures have a high loadbearing capacity and offer some advantages over concrete structures including strength to weight ratio, ease of installation and adaptability to changing conditions.

5.9.2 *Bridges*

Simple short span bridge crossings would be constructed with decks of in-situ reinforced concrete slab or precast prestressed concrete beams on reinforced concrete abutments with appropriate footings. In-situ concrete box structures could be used as underpasses to carry minor access roads or accommodation tracks under the new routes where necessary.

Longer span bridge crossings may be necessary in places to cross a river with a wide floodplain or to allow structures with an open aspect for aesthetic reasons. This type of crossing could be a three-span structure consisting of composite prestressed precast concrete or structural steel beams and in-situ reinforced concrete slab deck. The potential main span range is quite large and could be increased up to around 40m if required.

The existing bridges on the A896, C1096 and A890 are of a variety of types, including prestressed precast concrete beam, reinforced concrete slab and reinforced concrete beam and slab bridges, as well as masonry structures. It is likely to be necessary to refurbish, upgrade or replace some of these structures within the on-line sections of the route improvement options, depending on their condition, load capacity and available road cross section.

Major bridge structures associated with the route options are discussed separately in following subsections of this chapter.

5.9.3 *Retaining Structures*

It is likely that retaining structures will be required within sections of the route options with existing development constraints or difficult topography such as options N2 and N6 through Slumbay and Lochcarron and option ON3 along the A896 adjacent to the Abhainn Cumhang a Ghlinne watercourse. Retaining walls can be formed in reinforced concrete and special geotechnical measures such as reinforced soil treatments or soil nails can be used to enable steepened cutting and embankment slopes where there are space constraints.

5.9.4 *Options ON3, N2, N6 - Strome Narrows Bridge*

The Outer North and North Shore corridor options incorporate a major bridge crossing of the Strome Narrows which would allow future traffic to be re-routed to avoid the problem area on the south side of Loch Carron. Furthermore these options can be constructed without being affected by the constraints of the problem area and without affecting the existing A890 road traffic and rail traffic.

Two locations have been considered to cross the Strome Narrows, the choices being determined by the need for southern approaches to a bridge to traverse around the steep sided Creag Mhaol hill. Options ON3 (Western crossing) and N2 (Eastern crossing) are to the west of Creag Mhaol and cross from near Portchullin on the south shore to Leacansigh on the north of the Narrows. Option N6 to the east of Creag Mhaol crosses from near Stromeferry over to Strome Castle.

Structural form

Examples of potential bridge solutions for these crossing locations in the form of a concrete box girder bridge and a cable-stayed bridge are illustrated in outline in Drawing Nos. 5204 and 5205.

It is understood from previous studies that navigation clearance of the order of 20m was required by the Royal Navy and therefore a high level crossing is necessary. Contact has been made as part of this study with several consultee bodies to confirm clearance requirements however this has not proved conclusive but initial feedback would suggest 20m is adequate. There may however be scope for a lower level structure with shorter spans and this can be investigated further at Stage 2 should this option be progressed.

The nautical chart shows the sea bed at the Portchullin - Leacansigh location gradually deepening in the southern half to around 10m then markedly steepening to over 20m closer to the north shore. This would lead towards a large main span in the northern half with shorter approach spans in the southern half. At the Stromeferry - Strome Castle location, the sea bed is generally over 10m deep across the full width of the crossing which would make a large span solution more appropriate with scope for shorter approach spans from the north side to around the small island adjacent to Strome Castle.

The overall length of a high level structure should be a maximum of 800m at Portchullin - Leacansigh and 900m at Stromeferry - Strome Castle. High level bridges at both crossing locations would clear the railway on the south side of the loch.

Buildability

Given the nature of the glacially formed loch, it is expected that suitable foundation conditions for a bridge are available at relatively shallow depth however geotechnical investigations are required to confirm this. It is to be expected that bridge foundations and supports will require to be constructed within the loch. Depending on the structural form selected, the

superstructure could be erected from the floating working platforms or incrementally from the superstructure itself.

The nearby former fabrication yard at Kishorn would be a suitable holding place for the delivery and assembly of components combined with local landfall areas created on both shores.

Aesthetics

The bridge crossing main structures and associated approach spans would have a major visual impact in the landscape and the seascape and require significant architectural input to ensure an elegant design that is fitting for this area.

Any bridge solution for option N6 would require to be sensitive to the historic setting of Strome Castle.

Operation/Maintenance/Inspection

The operation, maintenance and inspection requirements of this major bridge structures are not considered to be any different to any other structure over water of these sizes and types. It would be important in the design phase to incorporate as many durable features as possible. Routine maintenance and inspection could be carried out from the carriageway above and using underbridge units and roped access inspection, however given the large scale of these bridges, access for inspection and maintenance should be incorporated into the structure.

Risks

There are risks to the construction relating to operations in tidal flow and working from water which would have to be addressed to satisfy the Construction Design and Management (CDM) Regulations' 2007.

There is a residual risk that a high level bridge could be subject to traffic restrictions or closure in high winds which might be expected to occur at the Narrows.

Impact during Construction

The nearby settlements of Achmore and Slumbay would experience disruption from construction traffic accessing the site, though bringing materials and components in by sea would help to reduce this as well as ease the impact on the regional road network. There would be more significant disruption to the property holding immediately adjacent to the crossing locations.

The duration of the bridge works is likely to be over two years.

5.9.5

Option O2 - Viaduct

Relocating the road onto a viaduct along the loch side of the railway serves to remove traffic from the hazard area immediately below the hillside and allows construction to take place offline with less disruption to existing road traffic and rail services. The corridor of the existing road would then provide a safety margin for future rockfalls impinging on the railway.

The 2km viaduct would be founded on the sidelong bed of Loch Carron. Some examples of sidelong viaduct construction are the A84 Cruachan viaduct at Loch Awe and the A82 Pulpit Rock viaduct at Loch Lomond, which is to be built in 2013, as well as the A9 Killiecrankie viaduct which is on hillside.

Structural form

A rock causeway is an alternative option to providing a viaduct. The nautical chart for Loch Carron indicates that the loch is 80m - 100m deep which has been confirmed by The Highland Council by sonar and depth survey. The detail indicates a 1 in 1.5 to 1 in 1.8 scree slope to a depth of 30m - 40m, then a shallower slope out towards the middle of the loch. Widening the shoreline by placing a 2km rock causeway at a 1 in 1.5 slope would take of the order of 2M m³ of material plus an additional 0.8M m³ as the toe would ravel down the slope. There would be an attendant risk of slip failure of this material and/or the underlying slope which would have to be considered.

A multi-span viaduct structure would take the form a composite steel beam and concrete slab deck continuously supported on rock socket piled columns. The realigned road would cross the railway at each end either by a level crossing or a railway overbridge, with the topography at Cuddies Point lending itself to the latter method. This structure is illustrated in Drawing No. 5206.

Buildability

It is envisaged that a viaduct would be constructed from the floating working platforms with barge-mounted piling rigs and cranes and that materials and components would be brought in by sea. The nearby former fabrication yard at Kishorn would be a suitable holding place for the delivery and assembly of components. A local landfall area could be created at Cuddies Point and a temporary bridge constructed over the railway for early access during the construction period until a permanent structure is built.

Deep piled concrete foundations would be required, constructed through the superficial deposits on the sloping loch bed and socketed into the underlying bedrock. Concrete piers would then be constructed from the piles by either precast segmental construction or in-situ construction with a climbing formwork system. Depending on the superstructure adopted and whether the piers require to be raking, the piers could take the form of individual columns only or columns combined with crossheads.

The superstructure could be formed from a number of material options (reinforced concrete, prestressed concrete or structural steel) however it is envisaged that steel beams would be used rather than concrete for ease of placement by barge-mounted cranes. Deck slab could either be in-situ reinforced concrete on permanent formwork or could make use of a precast deck slab system. As the deck construction progresses, access would also be made along the superstructure for the delivery and placement of materials.

Aesthetics

A viaduct would be a visible feature from across the loch however it should be relatively discreet against the shoreline and the scale of the hillside above. The tidal range would expose varying appearances of the viaduct and care would be required to ensure an elegant structure particularly at low tide with appropriate attention to structure proportions, materials and finishes.

Driver views of the scenic loch setting would arguably be enhanced from the viaduct while rail passenger views should not be adversely affected.

Operation/Maintenance/Inspection

The operation, maintenance and inspection requirements of the viaduct are not considered to be any different to any other structure over water of this size and type. It would be important

in the design phase to incorporate as many durable features as possible e.g. minimising the number of expansion joints and making provision for bearing replacement. Routine maintenance and inspection could be carried out from the carriageway above and using underbridge units and roped access inspection. Choosing suitable steel specifications and treatments could help to limit future maintenance requirements.

Risks

The main risk associated with the viaduct option is the need for geophysical survey information on the underlying rockhead profile and the definition of the internal structure of the rock to determine the presence any fault zones which would affect the design.

Construction risks such as working from water would be addressed to satisfy the Construction Design and Management (CDM) Regulations' 2007. The residual risk of further rockfalls affecting the railway would remain and is allowed for elsewhere in this report.

Impacts during Construction

Given that the viaduct is offline from the existing A890 and the railway and can be constructed by taking access from the loch and bringing materials by sea, disruption to road and rail traffic should be limited. Railway services would likely be affected by piling operations depending on the method of working. Although the viaduct works would be undertaken from working platforms in the loch there will still be times when short term closures are required, particularly when plant or equipment is being repositioned.

The construction of the railway crossings at each end, whether overbridge or level crossing, in proximity to the existing road would require a certain amount of one-way traffic management. Some full-road closures would have to be considered for short durations and these would be limited to night-time closures where possible.

Bringing materials and components in by sea has the benefit of reducing delivery by road transport and associated impact on the regional road network.

The duration of the viaduct works is likely to be over two years.

5.9.6 *Option O6 - Upper Loch Crossing*

The provision of a multi-span viaduct across the head of Loch Carron would enable road traffic to avoid the long steep gradients and constricted horizontal geometry of Maman Hill on the south shore. The viaduct would be positioned to cross Loch Carron from near the base of the hill to Kirkton on the north shore, crossing above the low tide level over shingle beds and the outflow from several watercourses, namely River Taodail, River Carron, Balnaglash Burn and Abhainn Bhuachaig. The structure would cross over the railway at Maman Hill to connect to the A890 near Attadale and tie into embankment to connect to the A896 at Kirkton on the north shore.

Structural form

The relatively shallow depths of the crossing location would lend themselves to a causeway solution with bridge openings to allow for the river outflows however there would be issues in respect of flooding and environmental habitat impacts. A causeway design option can be investigated further if this corridor is progressed to the Stage 2 assessment, however a viaduct arrangement will be considered for assessment purposes at this stage.

A multi-span viaduct structure would be expected to be supported on reinforced concrete piers with either piled or spread footing foundations depending on the ground conditions. The superstructure could be formed from a number of material options whether reinforced concrete, prestressed concrete, post-tensioned concrete or structural steel, and span lengths will be partly dependent upon the material chosen. A structure outline is detailed in Drawing No. 5207.

Buildability

Access will be required into the tidal area of Loch Carron between the high and low tide levels for the construction of pier foundations and supports. Depending on the tidal range there may not be sufficient depth to take access from floating working platforms and a temporary causeway or pontoon system may be appropriate, subject to suitable flooding and environmental impact mitigation measures.

If spread footing foundations are suitable, cofferdams would be used to excavate and construct these, or piles would be driven and pilecaps formed. Reinforced concrete piers would then be constructed, either of precast segmental construction or in-situ construction with a climbing formwork.

Access for the superstructure construction could either be by the same method as for the pier supports or along the superstructure if span-by-span techniques are adopted. Alternatively, a post-tensioned concrete box girder could be launched incrementally from an onshore casting yard as achieved at the A876 Clackmannanshire Bridge and A9 Dornoch Firth Bridge.

Aesthetics

A multi-span viaduct at the head of the loch would be a visible from all around, from both the north and south shores and from Strathcarron. The tidal range would expose varying appearances of the viaduct and care would be required to ensure an attractive structure with appropriate attention to structure proportions, materials and finishes. It is possible that the viaduct would look somewhat incongruous when the tide is out and the structure appears only to be crossing low lying water and shingle beds.

Careful consideration of the combined horizontal and vertical alignment of the viaduct will be necessary to avoid an unattractive foreshortened perspective where it curves and rises to clear the railway on the approach to the south shore.

Operation/Maintenance/Inspection

The operation, maintenance and inspection requirements of the viaduct are not considered to be any different to any other structure over water of this size and type. It would be important to incorporate durability features in the design such as minimising the number of expansion joints and making provision for bearing replacement. Routine maintenance and inspection could be carried out from the carriageway above and using underbridge units and roped access inspection. If a steel superstructure is adopted, weathering steel beams would help to limit future maintenance requirements.

Risks

A significant risk during construction would be environmental impact on the tidal and estuarial habitats between the low and high tide levels and it could prove appropriate to locate the crossing further downstream to mitigate this impact.

Impacts during Construction

As the viaduct is offline from the existing roads and the railway except to tie-in at its north and south ends, disruption to road and rail traffic should be limited and mostly related to local access arrangements for construction.

The construction of the railway crossing at the south end of the viaduct in proximity to the existing A890 would likely require a certain amount of one-way traffic management. Some full-road closures could be expected for short durations however these should be limited to night-time closures where possible.

Bringing in materials and components for the viaduct by sea has the benefit of reducing delivery by road transport and associated impact on the regional road network.

The duration of the viaduct works is likely to be of the order of two years.

5.9.7

Option O7 - Avalanche Shelter

Debris flow shelters, stone shelters or 'avalanche' shelters are engineered structures that form canopies over a section of road prone to rock fall or debris flows. These structures are usually formed from reinforced concrete and energy is dissipated by placing a depth of granular material on the roof on which the debris flow lands. Where the energy is anticipated to be very high, modifications can be made by shaping the roof so that the material passes over the structure without dissipating much energy.

The existing shelter built at time of the original road construction covers both the road and the railway for approximately 60m and is formed in reinforced concrete with 'window' openings in the wall between the road and railway and in the external lochside wall. The road is single track with hard strips.

Structural form

The general form of an extended shelter to provide protection for road users would be a reinforced concrete box over the full length of the area of concern (approximately 2.0km). It may be possible to provide less coverage by only locating shelters at the high risk locations subject to appropriate slope treatment measures at the intervening sections and this could be considered at the detailed assessment stage of the study.

The shelter would be an 'open' structure towards the railway and lochside to provide light and ventilation, thus avoiding the requirements that apply to a tunnel and reducing the impact on the views experienced by road users.

Several configurations of shelter have been considered:

- Single track carriageway
- Two-way carriageway
- Single width covering road only
- Double width covering road and railway
- Road above road
- Road above railway.

A single-width structure covering only the road will be considered for this stage of the study, entailing the need to incorporate a rock catch wall on the roof to prevent debris falling on the railway. The roof slab itself would need to be designed for rockfall loads depending on level of treatment to the existing rock slopes.

Taking guidance from DMRB, the minimum advisable carriageway width through an extended shelter would be 6.0m to allow traffic to pass broken down or stopped vehicles. DMRB Standard TD 42/95 for 'Design of Major/Minor Priority Junctions' requires minimum 6.0m wide carriageway at single lane sections greater than 50m. In comparison, Standard TD 27/05 'Cross Sections and Headrooms' requires at least 7.0m on all-purpose slip roads. This therefore rules out a minimal lane width single track option unless passing places can be accommodated. It would also rule against a road-over-road solution.

A carriageway width of 6.0m is however sufficient for two-way single carriageway operation. A footway would be necessary for pedestrian passage, particularly to enable safe egress from broken down vehicles. A suitable overall cross section would comprise a 6.0m wide carriageway with kerbed 2.0m wide footway on one side and a 0.6m raised verge on the other, as shown in Drawing No. 5208. Assuming a wall section of 0.8m and a 3.0m clearance to the railway, this would require a construction width at least 13m from the nearside rail which in turn would necessitate excavation in the rock face and associated slope stabilisation measures albeit that the excavation width would be less than that required to accommodate an open carriageway and adjacent rock catch ditch. If this option is to be taken forward, further work will be undertaken during the Stage 2 assessment to appraise the rock/structure interface issues.

An alternative arrangement to avoid excavation of the rock face would be to locate the road on a viaduct above the railway leaving sufficient width for a rock catch ditch on the line of the existing road. The benefits of this type of solution over an avalanche shelter are:

- less encroachment into the rockface
- less remediation measures essential to stabilise rockface
- open aspect
- less disruption during construction.

An outline of a viaduct-over-rail structure is shown in Drawing No. 5209.

Buildability

Construction activities for either structure arrangement would be extremely constrained in the available working area between the rock face, the existing road and the railway. Construction would be carried out in a number of short sections to reduce the length of single lane traffic management where possible however it is inevitable that prolonged full closures will be necessary. The viaduct option should require less traffic closures than the shelter option which will require rockface excavations and construction on the line of the existing A890. The viaduct option would still need to use the A890 carriageway for construction access. It may be possible to divert light vehicle traffic onto the railway using specialist 'Holdfast' units as was used during the emergency works. The use of precast components such as columns and deck slabs would allow some activities to take place offsite and help reduce work activity durations in the constrained site.

The construction of both structure arrangements would be affected by the close proximity of the railway. All work activities would require to be fail-safe to prevent plant and materials falling on the railway. It is envisaged that both structure arrangements can be founded to on

spread footings however it is likely excavation in rock will be necessary. Foundation excavations for the viaduct option in particular would impinge on the railway track support zone.

The viaduct superstructure could be formed from a number of material options (reinforced concrete, prestressed concrete or structural steel) however it is envisaged that steel beams would be used rather than concrete for ease of placement cranes. Deck slab could either be in-situ reinforced concrete on permanent formwork or could make use of a precast deck slab system. As the deck construction progresses, access would also be made along the superstructure for the delivery and placement of materials.

Aesthetics

An avalanche shelter and associated rock cuttings or a viaduct above the railway would be visually intrusive within the setting of Loch Carron, although views from the opposite side of the loch would be distant and the structures themselves would be relatively insignificant against the scale of the hillside above.

Driver experience within an extended avalanche shelter would be impacted by a reduction in the open and picturesque panoramic views currently enjoyed by travellers along this section of the A890. Railway passenger views would also be affected. Conversely, driver experience from a viaduct option could actually be enhanced.

Operation/Maintenance/Inspection

There are no specific operational requirements for the shelter structure or viaduct. Routine maintenance and inspection would be required as for any structure, with specific requirements relating to drainage, lighting and road surface issues. Maintenance would be required to remove any debris from the roof of the shelter requiring a means of access for small plant which could be facilitated by incorporating ramps at each end. A means for maintenance vehicles to access the railway would also be need to be incorporated. The viaduct option would need a safe method of access to maintain bridge bearings in proximity to the railway.

Risks

Significant risks include the risk to construction personnel from falling debris throughout a lengthy construction period, the stability of the slopes being affected by the shelter works and the risk of both options working in close proximity to railway operations.

Impact during Construction

Given the constraints of the narrow corridor it is inevitable that full road closures would be necessary for significant durations to allow rockface excavation and construction of a reinforced concrete box structure. Even when construction activities allow traffic to be diverted onto the railway under one-way working or through the box structure there would be long term traffic management delay and disruption. There would also be disruption and closure of rail services. Although it has its own disruption difficulties, the viaduct option should cause less impact overall.

The duration of the works is likely to be over three years.

5.10 Tunnel Options

5.10.1 *Introduction*

This section outlines the main considerations for selection and further development of the two options (N2 & 03) which include new road tunnels as part of the proposed routes. It is recognised preliminary assessment work was undertaken by Mott MacDonald in 1994 and their report (Mott MacDonald Scotland, A890 Stromeferry Bypass New Route Studies: Tunnel Route Preliminary Assessment, August 1993) refers. The following paragraphs review that work and consider changes to standards, design guidance and costings, bringing the work up to date. Particular geotechnical and construction considerations apply to the tunnelled elements of these routes as discussed below.

5.10.2 *Design Codes and Regulations*

Design Standards:

The tunnel will be required to comply with the road authority (The Highland Council) and or Transport Scotland design standards. The relevant standard is BD 78/99 'Design of Road Tunnels'.

This is the main document for controlling safety systems, carriageway width and therefore tunnel cross-section. Strictly speaking this standard only applies to Trunk Roads and therefore the relevant road authority may vary the requirements. It is assumed however, that the road authority would generally seek to follow the requirements of BD 78/99 in the absence of any other standard. It is also recognised that there may be no other road tunnels in the UK that have a similar combination of length and light traffic flows on which to base a comparison.

Design Manual For Roads and Bridges, BD 78/99 – Design of Road Tunnels

Other Design References:

Road tunnels which form part of the Trans-European road network and exceed 500m in length must be designed in accordance with the Road Tunnel Safety Regulations (2007) which transpose into UK law Directive 2004/54/EC of the European Parliament.

It is recognised that the A890 does not form part of the Trans-European road network and therefore is not subject to the entirety of these regulations. The regulations do however exist as an example of best practice and provide relevant guidance intended to minimise risk in road tunnels. It is therefore considered that the design of a new tunnel as part of the A890 should be in accordance with relevant requirements of the regulations as referenced below;

Directive 2004/54/EC of the European parliament and of the council of 29 April 2004 on minimum safety requirements for tunnels in the trans-European road network

Statutory Instruments, 2007 No. 1520, Highways, Tunnels, The Road Tunnel Safety Regulations 2007

Risk Management:

The British Tunnelling Society publishes a code of practice aimed at minimising exposure to risks resulting from tunnelling works. This document is relevant to the design and construction process for any tunnel options.

The British Tunnelling Society, The Association of British Insurers, The Joint Code of Practice for Risk Management of Tunnel Works in the UK.

5.10.3 *Interpreted Design Requirements and Guidance*

The references cited above provide important requirements and guidance for the design of new road tunnels and these should be considered at the option evaluation and design stages. Relevant requirements and guidance is summarised below;

- The Road Tunnel Safety Regulations provide requirements for those tunnels within its scope and guidance for all tunnels regarding the management of road tunnels in the UK. This guidance should be considered with regard to long term management of the tunnel by the relevant administrative authority. In particular, the regulations would suggest the following be considered for any tunnel forming part of this scheme;
 - Duties of the Tunnel Manager
 - Appointment of a Safety Officer
 - Appointment of an Inspection Entity
 - Appointment of a Technical Approval Authority
 - Use of Risk Analysis to assess operating risks prior to design
- Suitable signage should be provided as indicated within the 2007 Regulations Annex I.
- Emergency equipment and exits and the provision of information to tunnel users in an emergency should be in accordance with the 2007 Regulations Annex I.
- Planning and design of the tunnel and ground investigation for tunnelling should be in accordance with the BTS/ABI Code of Practice referenced above.
- Pedestrians and Animals are generally not permitted to use road tunnels under the requirements of BD 78/99. Therefore specific design requirements must be considered if pedestrians and animals (NMU,s) are to be permitted to use the tunnel. This may require the use of a dividing wall within the tunnel to provide a separate structural cell for the use of pedestrians and animals.
- BD 78/99 requires classification of the tunnel by length (O3,1.6km & N2,1.2km) and traffic volume to determine safety measures and requirements. Based on an annual average traffic flow (AADT) of 1164 vehicles / day, both tunnel options would be classified as Tunnel Category B. The classification would only be reduced if tunnel lengths were below 1km. The B classification leads to the following principal safety and fire protection requirements;
 - Emergency Telephones
 - Fire Extinguishers
 - Pressurised Fire Hydrants
 - Emergency Exit Signs
 - Lane Control and Tunnel Closure Signs . Signals
 - Emergency Stopping Lane
 - Emergency Walkway
 - Ventilation for Smoke Control

In addition, the following equipment or measures may be required depending on Tunnel Design and Safety Consultation Group (TDSCG)

- Radio rebroadcasting system
- Traffic Loops

- CCTV
- Fire Hose Reels
- Escape Doors

Based on the safety requirements outlined above and the need to provide pedestrian access through the tunnels, it is likely that the pedestrian route through the tunnels would need to be separated from the carriageway. This would potentially enable the pedestrian route to be used as an emergency escape in the event of a fire or other emergency within the vehicle tunnel. It is envisaged that this separation would be provided by a concrete floor to ceiling concrete wall with emergency doors at intervals giving access from the carriageway.

5.10.4 *On-line Route O3 – Tunnel*

Alignment

A route option has been developed with a new tunnel providing a means of bypassing the most problematic areas of the current road alignment between Cuddies Point and Ardnaff. This option requires approximately 1.6km of tunnel. The proposed alignment would run from the current alignment at each end, arcing away from the shoreline to maintain rock cover to the tunnel.

The proposed alignment includes cover to the tunnel up to approximately 150m in depth. The road level varies from approximately 8.0m AOD at the western portal to 24m AOD at the eastern portal. This change in level should facilitate gravity drainage, however specific drainage measures or a short uphill section into the tunnel at the eastern portal should be provided to prevent rainwater or spilled liquids running into the tunnelled section. It is desirable to minimise gradients as much as possible in order to avoid slowing large vehicles and increasing emissions and ventilation requirements. The indicated gradient of less than 1% is comparatively light and could be varied at later design stages if required. European regulations suggest that gradients above 3% should attract further consideration due to increased risks associated with the passage of heavy vehicles.

The proposed horizontal alignment provides a curve at each end to allow the tunnel to be orientated away from the face of the rock slope. This provides adequate rock cover to the tunnel and also provides clearance from potentially fragmented or damaged rock masses adjacent to the existing road alignment. The curves at the portals are also beneficial in that they limit the daylight entry into the tunnel and therefore allow the transition from tunnel to daylight to be better controlled by suitable lighting and portal arrangements. It is desirable to maximise curve radius within the tunnel in order to preserve sightlines and therefore a single large radius has been indicated over the remainder of the tunnel. BD 78/99 gives 470m radius as a desirable minimum for a design speed of 70 km/h in tunnels against 360m radius for an open road, this has been provided.

Geotechnical Conditions

Based on the Mott MacDonald assessment carried out previously, the ground conditions at the tunnel location are anticipated to primarily consist of gneiss and schist. The assessment anticipates that, although the majority of the alignment will be constructed in competent rock there will be significant areas of faulting and fractured rock mass.

The Motts report assumes that all faulting is vertical. This is unlikely to be the case and as a result the volumes of different rock types will probably change.

Borehole positions should be selected based on the available GI information along with ensuring that a representative spread of holes are available during the detailed design works. It is advised that a minimum spacing of 150m is adopted with additional holes as required.

Cross Section

It is envisaged that the tunnel cross-section would be of a conventional 'horseshoe' profile conventionally used in rock tunnelling accommodating two lanes of traffic and a pedestrian / escape path.

It is likely that a structural invert would not be required unless the rock mass was heavily weathered or fragmented and therefore it is anticipated that the arch will be founded on the rock without a structural invert. There is potential for a structural invert being required at portals where the rock mass quality is likely to be lower.

In the event that investigations show high quality rock mass, the curved sides of the tunnel profile could potentially be replaced with vertical walls to reduce excavation volume.

The following indicative cross section has been developed on the basis outlined above. This profile is based on the following criteria;

- 3.0m lane width (2 lanes)
- 0.65m hard strips both sides
- Single 1.0m wide footway within vehicle compartment for emergency use
- 5.4m total headroom, TD27/05

The cross-section has been developed assuming normal trunk road headroom requirements. It is recognised there are higher loads associated with forestry operations or renewable energy components in/out Kishorn but due to existing restrictions at the avalanche shelter and an alternative route (albeit long) the tunnel at this time has not been design as a high load route.

- Lateral kinematic clearance 0.6m
- 3.0m wide pedestrian / escape passage.

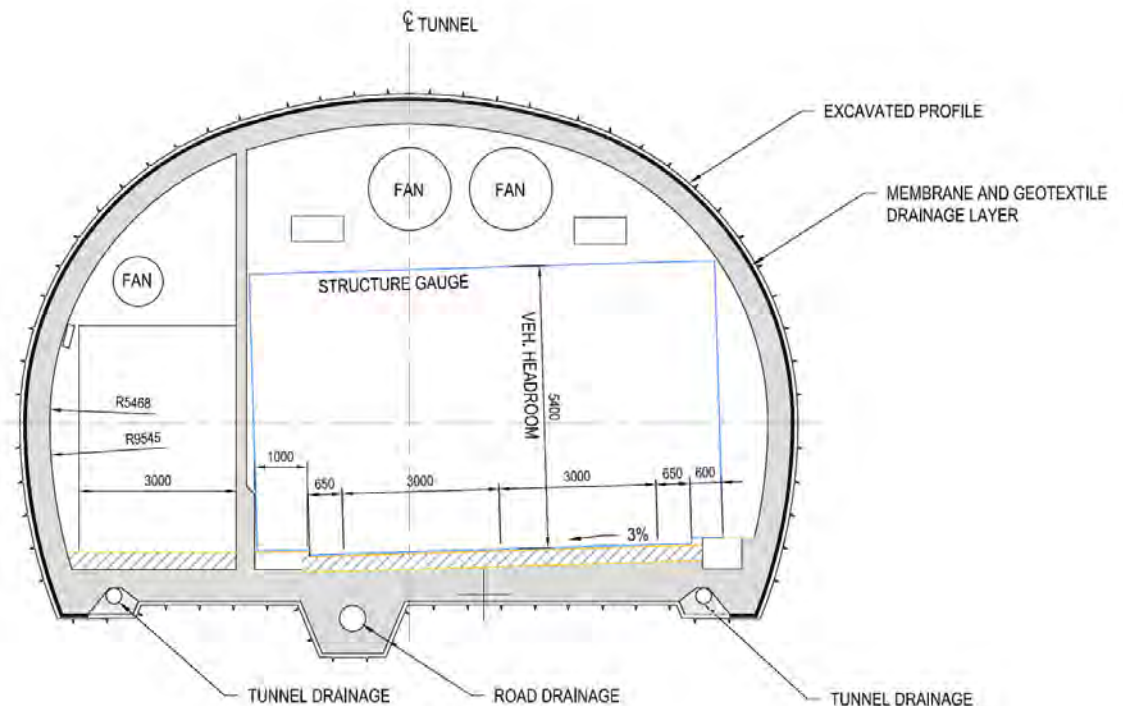


Figure 5.1 - URS Indicative Tunnel Profile (drained lining)

A requirement for emergency stopping lanes is given within BD 78/99 however this document also notes that continuous emergency stopping lanes are generally not provided due to the high costs associated and that suitable additional lane width and verges are a suitable alternative. Given the relatively low anticipated vehicle flow, it is anticipated that the 0.65m hard strips and 1.0m verges provided in the indicative cross-section are sufficient to temporarily allow traffic to pass a stranded vehicle. Further consideration should be given at a later design stage to the widths provided and the potential for enlarged sections of tunnel to provide lay-bys as an alternative to providing additional width in the whole tunnel length.

In order to accommodate access for pedestrians and provide an escape route separated from the main tunnel, the cross-section incorporates a full height concrete wall separating the pedestrian passage from the carriageway. To comply with regulations, this wall should incorporate fire doors for access at 100m spacing. The separate pedestrian access / escape route would require independent ventilation, including the ability to provide a higher air pressure within the escape route, to prevent smoke from a fire in the main tunnel from entering the escape route.

A gradient across the carriageway should be provided depending on road speed and curve radius and for drainage.

Drainage

It is assumed that the tunnel will be designed as a drained tunnel, as is typical for such tunnels in rock. The lining will therefore incorporate a drainage layer behind the internal lining to take seepage water from the rock mass to drains at the base of each tunnel wall. Given the

gradient of the tunnel, it is likely that seepage water can be gravity fed to a suitable outlet at the lower portal.

A separate highway drainage system will be required for water from the carriageway. This system should also allow gravity drainage, though consideration should be given to dealing with potential fuel spills or other liquid spills from vehicles using the tunnel.

Portals

Additional rock cuttings will be required at both tunnel portals in order to access a section of rock face with sufficient cover of competent rock to allow tunnelling to commence. In the permanent condition, it is likely that a permanent portal structure incorporating some form of canopy would be necessary in order to protect the roadway from potential rock falls from the slope above the portal. Minimum length of protective canopy depends on rock slope above the crown of the tunnel and mountainside/cutting immediately adjacent. It is possible that an 'avalanche' canopy is required to both portal approaches. Particular difficulties are envisaged at the western portal for a 1.6km tunnel and stabilisation works including protection to the railway has been included in the costings.

Construction Methodology

It is likely that excavation by drill and blast tunnelling methods will be the most economic in the anticipated ground conditions in which excavation advances in a series of steps with the rock mass drilled and explosives installed to break the rock at each advance. Use of TBM excavation (closed face or road header type) would also be technically possible, but is unlikely to be economic given the comparatively short length of tunnel and the high set-up costs associated with TBM excavation.

Based on a drill and blast methodology, rock support would be installed as required as the tunnel advances, including rock bolts, sprayed concrete and steel mesh or fibre reinforcement depending on rock mass quality. Installation of a permanent structural lining would follow, including the installation of a suitable drainage layer behind the permanent lining. Permanent lining could take the form of either in-situ cast or sprayed concrete.

It is envisaged that tunnelling would be carried out from both portals concurrently, without intermediate construction shafts given the high rock cover.

Construction Rates/Programme

An excavation advance rate of 2m per day or some 14m per week (7 day working) could be anticipated. Assuming that tunnelling will commence from both portals, excavation could take a minimum of 60 weeks & perhaps longer if significant areas of poor/faulted ground was encountered. The installation of the concrete lining could follow on behind, as drill & blast operations continue, with completion of the lining estimated at some 3 to 4 months post drill & blast operations. Additional fit out works for installation of E&M plant is anticipated to take a further 3 to 4 months - staggered with the civils works. Completion of the tunnel therefore is likely to take in excess of 18 months.

Working areas around the tunnel portals will have to be developed for temporary lay-down/compound/messing/working area/plant/crusher etc. This should be able to be achieved with minimal disturbance to the existing road. At this time, it is estimated that circa 400 cum. of bulked storage of blasted rock per day will require to be stored. Tunneling is likely to produce in excess of 200,000m³ of rock spoil. Subject to the results of materials suitability testing, a proportion of the Lewisian Gneiss could be used crushed as a construction aggregate on the

tunnel scheme itself, leaving a substantial quantity for disposal or use elsewhere. Accordingly, it may be beneficial to consider implementing this scheme 'back-to-back' with another scheme which requires rockfill. Temporary areas for stockpiling of materials will be required to be identified.

Ground Investigation

It is recommended that a number of inclined cored rotary boreholes be undertaken to intercept the faults and attempt to establish fault widths and orientation. These boreholes could be drilled using a combination of rotary open hole and rotary core drilling to allow 'spot coring' at targeted areas to reduce drilling costs.

It is anticipated that additional GI could be undertaken from the existing highway and possibly from the rock face (roped access) depending on confirmed tunnel alignments. Roped access work will be more expensive but may provide more useful information depending on the geological feature being targeted and it's orientation within the large rock mass (particularly related to faults).

Cost

Original Mott McDonald (MM) Profile – update based on inflation:

Generic costs of construction for a 100m² tunnel, similar in profile to the original MM proposal (shown in Fig 5.2 below) are assumed to amount to approximately £33,000 per linear meter, including contingencies.

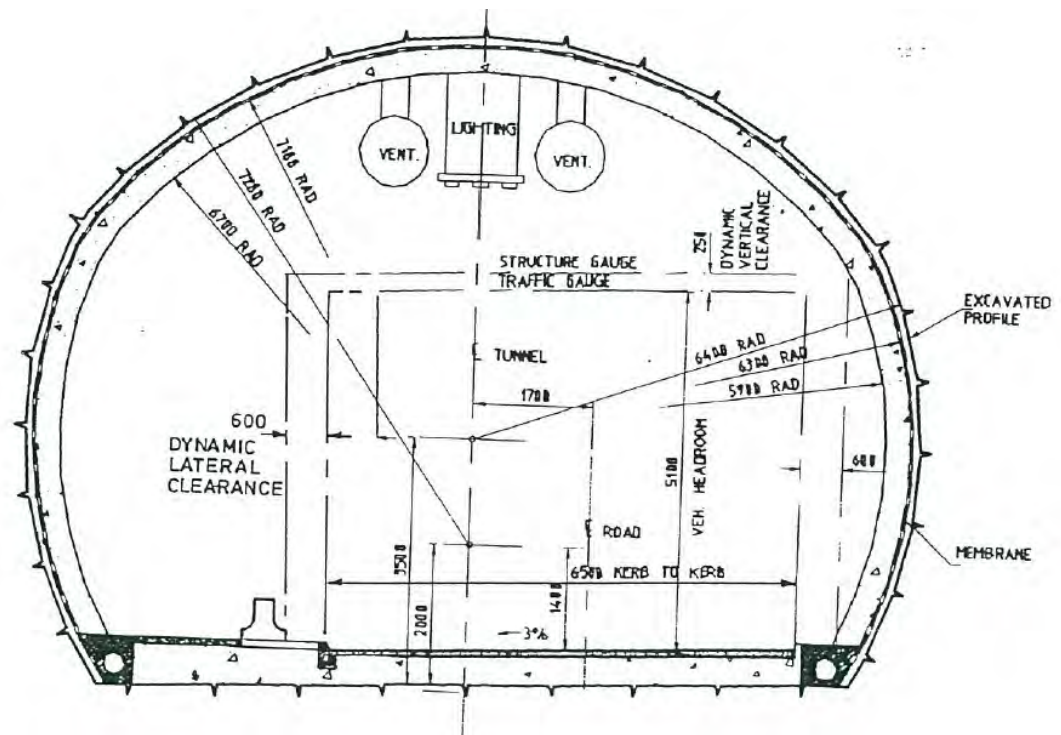


Figure 5.2 - Mott MacDonald Tunnel Profile August 1993

Increased URS Profile in line with current highway standards:

Generic costs for a **130m2** modern tunnel section as shown in Fig 5.1, are assumed to amount to approximately £46,000 per linear meter, including contingencies.

5.10.5 *North Shore Route N2b – Western Tunnel*Alignment

Constraints imposed by the topography and approach roads lead to an indicative alignment requiring relaxations from standard in horizontal alignment but still with comparatively sharp bends in the tunnel and approaches. Further development may therefore consider lengthening the tunnel as a means of providing a straighter, if longer, passage beneath the narrows. The additional cost of lengthening the tunnel should be considered alongside the minimum permitted curve radii, potential limitations to traffic speed and increased operational risks associated with tighter curves. As an alternative a tunnel crossing could be considered at the eastern crossing point (N6). It is unlikely alignments will be considerably better. At this stage it is assumed geotechnical conditions will be similar.

Geotechnical Conditions

The northern route is predominantly likely to be a combination of schist, gneiss and amphibolites. The area is covered by glacial material and at the current time differentiation of underlying rock types and lateral extents and limits is not possible.

Cross Section

The internal cross section of the Route N2b tunnel is subject to the same criteria as the Route O3 tunnel option discussed above.

Given that the tunnel is constructed at lower level and beneath the loch, there is potential for greater groundwater inflow. Experience in similar Norwegian tunnels suggests that this may be outweighed by improved rock mass quality and the presence of overlying impermeable strata, however the potential for water inflow remains. Given the geometry of the tunnel, infiltration water will need to be pumped out of the tunnel from the lowest point and therefore represents a potentially significant ongoing operational cost.

It is therefore likely that the tunnel would be constructed with a structural invert and an un-drained lining in order to avoid significant inflow into the completed tunnel. The tunnel lining would therefore incorporate a complete ring of waterproof barrier and the concrete lining designed to resist full water pressures anticipated, therefore requiring a thicker lining and greater excavation area than the tunnel required for Route O3.

An indicative tunnel cross-section is provided below.

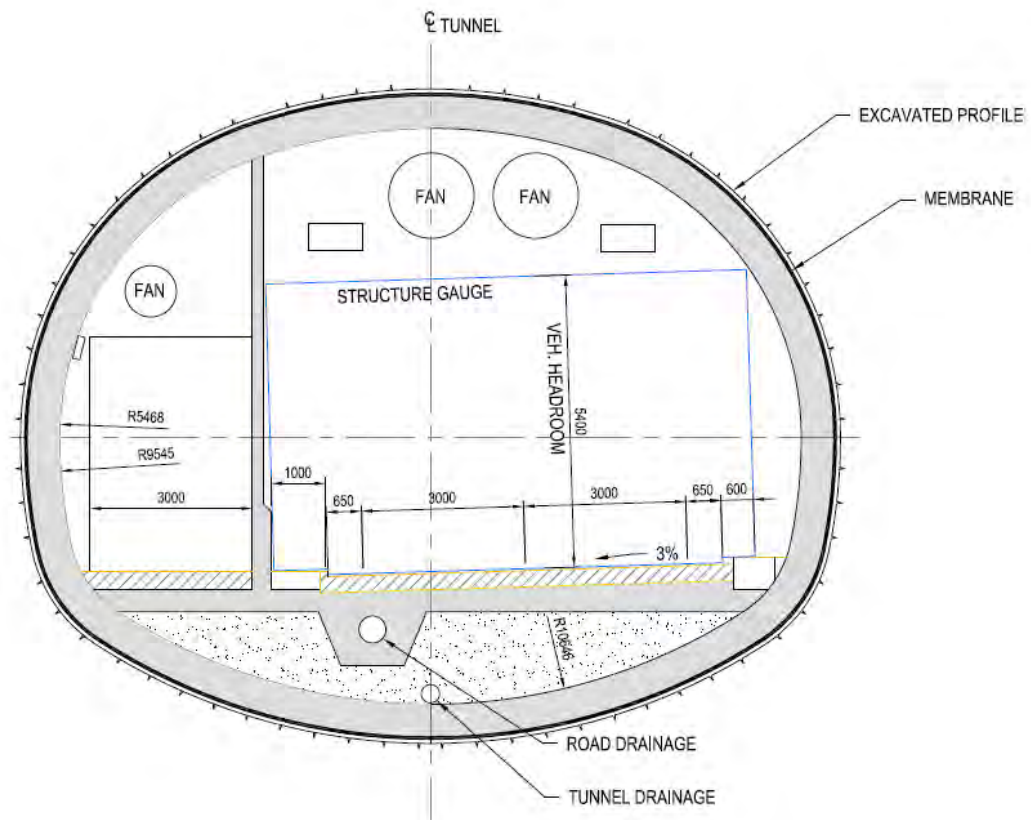


Figure 5.3 - URS Indicative Tunnel Profile (un-drained lining)

Drainage

A pumped highway drainage system will be required in order to carry any water inflow from the surface or carried in by vehicles from sumps within the tunnel to suitable drainage outlets at the surface.

Whilst the tunnel is likely to be designed as a water-tight structure, some seepage is inevitable and this inflow will also need to be pumped out of the tunnel from a suitable sump.

Portals

Portals will be subject to similar considerations to those discussed above for the Route O3 tunnel. In addition, suitable measures will have to be taken to ensure that the portal structures are not subject to flooding that may flood the entire tunnel. Portal structures may therefore need to incorporate flood walls that line the approach cuttings until the road level exceeds design flood/tidal surge levels.

Approach structures may include a combination of cutting and cut and cover tunnel with tunnelling commencing when suitable strata and depth of cover is reached.

Construction Methodology

As for the Route 3 tunnel discussed above, it is likely that drill and blast tunnelling will offer the most efficient construction methodology in the anticipated ground conditions. Given the greater potential for groundwater inflow, consideration must be given at the investigation and design stages to ensuring that groundwater inflow is limited sufficiently to avoid delaying construction progress. Site investigation will need to identify areas where faulting or fragmentation of the rock mass make inflow more likely and where mitigation measures such as grouting are required. Probing will be necessary during construction to identify area of high potential inflow ahead of the face to allow grouting to be carried out as the tunnel progresses.

Construction Rates/Programme

An excavation advance rate of 2m per day or some 14m per week (7 day working) could be anticipated. Assuming that tunnelling will commence from both portals, excavation could take a minimum of 40 weeks & perhaps longer if significant areas of poor/faulted ground was encountered. The installation of the concrete lining could follow on behind, as drill & blast operations continue, with completion of the lining estimated at some 2 to 3 months post drill & blast operations. Additional fit out works for installation of E&M plant is anticipated to take a further 2 to 3 months - staggered with the civils works. Completion of the tunnel therefore is likely to take around 18 months.

Working areas around the tunnel portals will have to be developed for temporary lay-down/compound/messing/working area/plant/crusher etc. This should be able to be achieved with minimal disturbance to the existing road. At this time, it is estimated that circa 400 cum. of bulked storage of blasted rock per day will require to be stored. Tunneling is likely to produce in excess of 180,000m³ of rock spoil. Subject to the results of materials suitability testing, a proportion of the Lewisian Gneiss could be used crushed as a construction aggregate on the tunnel scheme itself, leaving a substantial quantity for disposal or use elsewhere. Accordingly, it may be beneficial to consider implementing this scheme 'back-to-back' with another scheme which requires rockfill. Temporary areas for stockpiling of materials will be required to be identified.

Ground Investigation

We would recommend that a number of inclined cored rotary boreholes be undertaken to intercept the faults and attempt to establish fault widths and orientation. These boreholes could be drilled using a combination of rotary open hole and rotary core drilling to allow 'spot coring' at targeted areas to reduce drilling costs.

Shallow intrusive holes will also be required to establish the thickness and lateral extent of the glacial materials. It is anticipated that these holes would be undertaken using a combination of cable percussive, window sampling and machine excavated trial pits.

It is anticipated that additional GI could be undertaken from the existing highway and possibly from the rock face (roped access) depending on confirmed tunnel alignments. Roped access work will be more expensive but may provide more useful information depending on the geological feature being targeted and it's orientation within the large rock mass (particularly related to faults).

It is recommended that inclined boreholes be undertaken at the crossing location to confirm the loch bed geology. Overwater drilling may also be a suitable option dependent on cost and programme (and prevalent weather conditions at the time of any proposed GI).

Cost

URS Profile in line with current highway standards:

Generic costs for a **150m²** tunnel with undrained lining suitable for below water construction, as shown in Fig 5.3 above, are estimated to amount to approximately £56,000 per linear meter, including contingencies.

This excludes the portals and costs associated with road realignment. It also excludes client & design costs. Portal costs of £1.5Million have been included in road alignment costs.

Lower cost/ Lower standard Tunnels

A review of similar remote tunnels with low traffic volumes in Iceland and Norway with reduced cross-section (3m lane widths and 0.8m verges either side without a dedicated escape route) has been undertaken and was also commented on by Mott McDonald. It is noted however that some of the Norwegian tunnels are receiving criticism because of non-compliance with EU regulations.

At this time it is thought prudent to assume the conservative design and enter detailed dialogue with the Road Authority (The Highland Council), Transport Scotland, the Regulator and Inspector during the Stage 2 assessment work.

5.11 Renewable Energy Considerations, Option N6b - Tidal Power Barrage Crossing

5.11.1 *Introduction*

The topography of Strome Narrows/Loch Carron basin may provide an opportunity to develop a tidal power generation scheme. The Stromeferry bypass scheme may provide an opportunity to incorporate tidal power generation.

The predictability of tidal movements means tidal energy production has a distinct advantage over other forms of renewable energy production;

- Tides flow in and out of estuaries and rivers on a regular cycle (approximately 12 hours 25 minutes, 2 tides every 24 hours and 50 minutes).
- Spring tide every 2 weeks – new moon and full moon (earth, moon and sun in line with each other).
- Neap tide every other 2 weeks – moon at quarter phase
- Tides are 100% predictable.

Several tidal power generation technologies have been considered as part of this Stage 1 assessment considering using two basic criteria to assess their suitability;

1. **Water depth & width:** Can the technology be implemented given the width of the likely crossing locations and the water depth?

2. **Water velocity:** Are the tidal current velocities capable of generating a commercial quantity of energy from the natural tidal movements?

The review concluded that the following options are worthy of consideration for the site between Strome Islands and Strome Ferry.

Principle of Operation	Option	Concept	Description
Impounding reservoir to develop maximum available head difference for power generation	Tidal barrage – Road crossing incorporated into energy scheme (Option N6b)	Reservoir created by barrage across the estuary	To obtain energy from a head difference.
Tidal fence to command increased velocity resulting from constraining the tidal flow	Tidal fence – Energy scheme incorporated into bridge at eastern crossing point (Option N6)	Line of tidal stream devices housed in a structure that extends across the estuary	Continuous barrier across the estuary constraining the tidal flow and increasing the velocity locally to drive stream flow generating plant.
Tidal stream device operating in natural flow velocity conditions without impacting the tidal range	Horizontal axis turbine – No bridge crossing, national or community power generation project	Array of turbines placed where natural velocity is sufficient	Line of tidal stream devices housed in a structure that extends across the estuary

Table 5.4 – Tidal Energy Production Options

5.11.2 *Tidal Energy Production*

5.11.2.1 Tidal Barrage

Description

The barrage method is very similar to the hydro dam system that uses a static head to drive turbines. A dam or barrage is constructed across an estuary or bay that experiences an adequate tidal range (normally in excess of 5m). Low head turbines with small diameter heads can be used in shallow water applications. Turbines installed on the barrage wall generate power as the water flows in and out of the estuary.

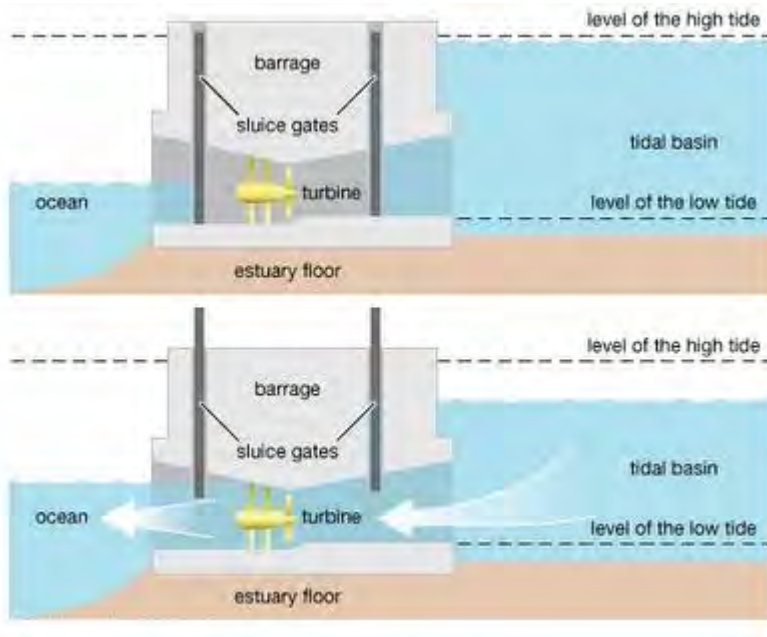


Figure 5.4 - Illustration of a tidal barrage

The two methods of power generation are;

Ebb Generation:

Sluices are placed along the barrage and allow water to enter the basin or estuary. The sluices are closed at full tide. Turbines or pumps can be used to further raise the water level in the estuary increase the pressure head.

The water is held for a period of time until the sea level drops. Gates in the turbine caissons are opened allowing the water to flow through the turbines producing power. The energy used for supplementary pumping over a small head is more than returned as a greater head is achieved on release.

Two Way Generation or Flood Generation:

The turbines are used to generate power at both flood and ebb tide. Sluices are not used and the water is not held back.

Two way generation is less efficient than ebb but produces power over a longer period.

Tidal Barrage Examples

Table 5.8 below provides details of tidal barrage schemes currently in operation and includes estimated figures for a scheme at Strome Narrows.

Scheme	Sihwa, South Korea	La Rance, France	Annapolis River, Canada	Potential scheme at Strome Narrows, Scotland	Jiangxia Tidal Power Station, China	Kislaya Guba, Russia
No. Turbine Units	10	24	1	5	5	2
Turbine Capacity	26MW / bulb turbine	10MW / bulb turbine	20MW	4.8MW	(1 × 0.5MW) (1 × 0.6MW) (3 × 0.7MW) 3.2MW	(1 × 0.2MW) (1 × 1.5MW) bulb turbines 1.7MW
Annual Energy Production	550GWh	540GWh	50GWh	35.4GWh (24MW)	6.5GWh	N/A
Turbine Diameter	7.8m	5.35m	7.8m	TBC	N/A	N/A
Tidal Range	average 5.6m, maximum 7.8m	average 8.2, maximum 13.5m	average 7m	TBC		
Energy Production Method	Ebb generation (single direction)	Ebb and flood generation (two way)	Ebb generation (single direction)	Ebb generation (single direction)	Ebb and flood generation (two way)	N/A
Date of Construction	2008 -2011	1961 - 1966	1980 -1984	TBC	1980	1968 – 2004
Other		Min head: (ebb generation) 1.2m, increased to +1.75m by pumping Min head: (flood generation) 1.7m				

Table 5.5 – Tidal Barrage Examples

Tidal Barrage - Loch Carron

From inspection of the Admiralty Chart the depth of water at Strome Narrows is relatively shallow measuring somewhere between 15-20 metres with a tidal velocity of 3 knots or 1.5m/s. In 1978 the National Engineering Laboratory produced a paper "Tidal Power in Scottish Lochs", locations for a barrage were investigated at Loch Carron and the location considered offering the lowest cost of energy production was at Strome Narrows. Admiralty tide tables and charts were used to calculate an annual energy production of 35.4 GWh (approximate power output 24MW) with an assumption that the turbines would not operate until there was 1m head across the turbine and considered ebb generation only. A shipping lock would also be required to allow shipping to access into the Loch.

It was concluded that due to the high capital cost of constructing a barrage and resultant high unit cost of electricity a tidal barrage was not competitive, (Loch Carron was three times as expensive compared to other means of energy production at that time). The 1994 work undertaken by Mott Macdonald (Report No. 4453/10606/001) again reported the project as not economical. At that time the capital cost was £65 million with a 60 year pay back for generating 35.4Wh. It is assumed these figures does not include for the cost of upgrading the grid infrastructure.

However, in defence of tidal barrage schemes, the river Severn tidal scheme argued that a barrage will generate much cheaper electricity than all other generating sources when cost is considered over the full lifetime of the generating assets e.g. if coal and gas plants and offshore wind farms operate for a maximum of about 30 years and a barrage has a lifespan of 120-years, these other types of generating assets would need to be built or substantially replaced four times. Similarly, nuclear plants, with a lifespan of about 60 years, would need to be built twice. To make a fair cost comparison with the barrage, therefore, the levelised costs of offshore wind, nuclear, coal and gas must be averaged over several cycles over its 120-year life.

Tidal devices have a significant impact on sea bed characteristics particularly ecology. It is recognised this will be an issue at Strome where Flame Shells and other valued species have been identified within the Loch Carron Marine Consultation Area. Although energy yield would be reduced, the adoption of an ebb and flow generation system, due to its lower turbine efficiency in both directions, is likely to have ecological, sediment management and value of energy benefits over an ebb only system.

Assessment of the bathymetry and tidal range is required to conduct further assessment of likely energy production utilising a tidal barrage at across the Strome Narrows.

5.11.2.2 Tidal Stream Devices

Description

A tidal stream device (TSD) uses the kinetic energy of moving water to power a turbine, very similar to the way wind turbines use the wind. Due to the higher density of sea water in comparison to air (over 800 times) power can be produced at relatively low tidal flow velocities. Tidal stream devices extract energy from the natural velocity of the tidal flow and do not need to impose a water level difference.

Tidal Stream Device (TSD) Examples

There are currently a number of different types of TSDs being field tested (vertical, horizontal and shroud or open centre) and are connected to the national grid.

To develop marine energy at a commercial scale wave and tidal leasing marine energy parks have been established in Scotland at Pentland Firth and Orkney Waters and in south west England stretching from Bristol to Cornwall, several devices have been tested and trialed.

Several full scale trial TSD sites have been in operation around the UK;

1. Marine Current Turbines: Seagen - Strangford Lough, Northern Island
Type: seabed mounted tidal stream generator using axial flow rotors
Commissioned: April 2008, connected to grid July 2008
50% funded by DTI
2. Open Hydro Group: Open-centre turbine – Orkney
Type: sea bed mounted open centre tidal stream generator
Commissioned: 2006, connected to grid May 2008
3. Pulse Tidal: Pulse Stream 100 – River Humber, Hull
Type: seabed mounted tidal stream generator using oscillating hydrofoils
Commissioned: 2009, exporting the power to Millennium Chemicals (plant on the South bank of the estuary)

Tidal stream technology has not yet been constructed on a commercial scale. However, there are currently plans to construct tidal arrays at the following sites;

1. Scottish Power Renewables plan to install 10no. 1MW [Andritz Hydron Hammerfest HS1000 Tidal Turbines](#) which will be fully submerged on the seabed just south of Port Askaig, Islay (Sound of Jura).
2. Kylesha, Skye: Pulse Tidal plan to install 8no. turbines and Marine Current Turbines intend to install 4no. SeaGen turbines.

Tidal Stream Generation – Loch Carron

An inspection of the Admiralty Chart indicates the water depth at the Strome Narrows to be approximately 15m (lowest astronomical tide) and the tidal velocity 3 knots or 1.5m/s. The shallow water depth at the narrows restricts TSD selection and the relatively slow tidal velocity may not be sufficient to make the deployment of TSDs financially viable. Industry advice suggests tidal energy devices do not begin operating until around 1.0 m/s, and at this operating point the device will be operating in its most inefficient condition.

As an example the Marine Current Turbine SeaGen device requires 25-35 metres water depth to safely accommodate the turbine design and peak spring tidal current velocities of the order 3.0 m/s.

To accommodate shallower water depths the horizontal axis design layout of the Pulse Tidal device can be deployed. The Pulse Stream 100 device was installed in only 9m water depth at the river Humber (refer to figure 2 below).

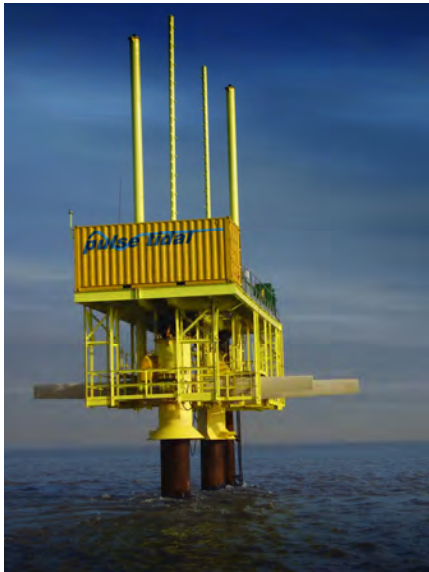


Fig 5.5 - Pulse Stream 100 (0.1MW) TSD



Fig. 5.6 - Pulse Tidal 1.2MW Horizontal Axis TSD

Pulse Tidal are currently in the advanced stages of designing the next generation of their pulse stream unit (refer to artists impression figure 3 above). A sizeable device measuring 50m long (i.e. transverse to the flow) by 13m wide. It is reported that the device could generate 1.2MW in 15m of water (if no restriction on overhead clearance is required). In order to be economically viable the device requires a tidal flow rate in the region of 3 - 3.5m/s at peak spring tide.

Although tidal velocities at Strome Narrows may be less than that required for the efficient deployment of TSDs a study of site conditions (hydrographic survey, geotechnical survey, bathymetry analysis, etc) is required to accurately assess the site for consideration of TSD deployment and assist with energy production yield calculations. It is suggested this should be undertaken during the Stage 2 assessment.

5.11.2.3 Tidal Fence (Bridge)

Description

A tidal fence/bridge comprises a line of underwater tidal current turbines. The tidal flow is normally constricted (by means such as a causeway) to a reduced cross-sectional to induce higher flow velocities to drive the devices. Some devices can be built into the structures of bridges. "Tidal fencing" is a relatively new technology and is still in development and it is understood no schemes are currently in operation. A tidal fence/bridge would have significantly less impact on wildlife and the environment than a tidal barrage. Two companies have assisted in the assessment undertaken to date; Pulse Tidal and Blue Energy.

Tidal Fence/Bridge – Loch Carron

The following tidal bridge solutions combine tidal stream devices with a bridge structure and causeway to restrict flow and increase flow through the devices.

Due to the shallow water design Pulse Tidal devices could be incorporated into a bridge structure across the Strome Narrows. The Pulse Stream 100 (PS-100) device is ‘of the shelf technology’ available at a cost of £1 million per unit and is rated at 0.1MW output. The advantage of this unit is that it can be deployed in 5m of water and is rated for 2m/s current speed. Even considering the shallow depths at Strome Narrows it may still be possible to deploy multiple PS-100 devices. If a higher current velocity was achieved then this would greatly increase the power output (power output is proportional to the cube of the velocity).

The Pulse Tidal next generation device is in the advanced stages of design but is approximately 3-4 years from going to market. Each device will cost in the region of £5 million or £4.5 million if it was mounted in a bridge or similar and is rated at 1.2MW at 3 to 3.5 m/s peak spring tide current velocity.

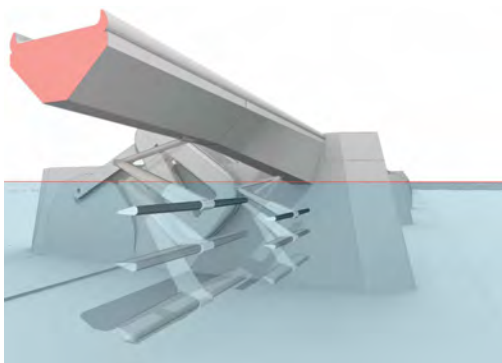


Figure 5.7 - Artists Impression Pulse Tidal Bridge Thames Estuary

Blue Energy Inc. is currently developing a tidal bridge using vertical-axis turbines with four fixed hydrofoil blades and an integrated gearbox and electrical generator assembly. The rotation of the turbine is unidirectional on both the ebb and the flow of the tide.



Figure 5.8 - Artists Impression Blue Energy Inc. Tidal Fence (Bridge)

As part of the Stage 1 study, Blue Energy completed a preliminary assessment of different crossings at Strome Narrows and provided estimated power generation figures and turbine costs based on a range of current velocities. The table below provides the results of this assessment based on a crossing point similar to route N6b;

Loch Carron Tidal Fence (Bridge)				Water Velocity (m/s)						Cost Estimate (£M)		
Channel Area (m ²)	Channel Length (m)	Causeway Length (m)	No. of Turbines	1.5	2.5	3	3.5	4	5	Turbines		
				Power Output MW /MVA						5m/s	4m/s	3m/s
1950	140	322	14	1.51	7.02	11.00	19.28	28.78	50.75	65.64	51.66	35.00

Table 5.6 – Possible Costs and Estimated Power Output Blue Energy Inc Tidal Fence

Blue Energy Inc. is currently in discussions with Orkney Islands Council regarding a trial site to construct a tidal bridge using this technology.

The Shetland Isles Council is currently working on a tidal fence project which is currently at the feasibility stage.

The information provided by Blue Energy is preliminary. A hydrographic survey is required to provide data to examine the existing channel depths and current velocities at Loch Carron/Strome Narrows.

5.11.3 *Grid Connection*

Generating power at source is only one aspect. The opportunity for export to the grid to realise the financial benefits must be considered i.e. giving due consideration to the transmission network. A high level assessment was completed taking account of location and generation capacity only. From the initial investigations conducted at this time it is likely that the tidal barrage (grid connection up to 110MVA) and tidal bridge (grid connection 17 – 50 MVA) would require new overhead lines and sub-station infrastructure as there is no reinforcement planning in the area. It is likely that a tidal stream device (grid connection 1.2MVA) would be a distribution connection (less than 33kV – no new network infrastructure required) and should be acceptable provided there is capacity on the distribution network.

A full assessment of the network infrastructure and connection of tidal power generation devices is required by Scottish & Southern Energy Power distribution. Initial approaches have been made but this will developed further during the Stage 2 assessment. However, an initial assessment of cost for connecting is provided in table 5.10

Scheme	Connection Requirement	Power Infrastructure	Estimated cost
Tidal Barrage	24 – 110MVA	New infrastructure	Unknown at this time
Tidal Bridge	17 – 50 MVA	New infrastructure	Unknown at this time
Tidal Stream Device (Pulse Tidal 1.2MW)	1.2 MVA	Existing infrastructure	£5 million (fully installed)

Table 5.7 – Grid Connections

5.11.4 *Cost Estimates / Payback Period*

To gain a broad understanding of the validity of this technology a high level cost estimate has been completed using figures extracted from the Mersey (2011) and Severn feasibility studies. The estimate is preliminary based on the limited information available at this time and all costs are undiscounted.

Mersey Tidal Stage 3 Feasibility Study financial modelling assumptions made;

- Climate change levy exemption (£4.5 MWh)
- Feed in tariff assumed to run for 50 years at a rate of £160/MWh
- Energy sale price £45/MWh, uplifted by 25% (£56.25 MWh) from 2075

5.11.4.1 Tidal Barrage

Capital Expenditure

To establish an estimated capital cost for constructing a tidal barrage at Strome Narrows the estimated costs for schemes on the river Mersey and Severn were considered.

An indicative capital cost of Loch Carron tidal barrage = £103.5million (figure includes a 20% contingency, allowance for a navigation loch and road crossing but excludes grid connection/infrastructure costs)

Operating Costs

Operating costs have been estimated using figures from the Mersey Tidal Power feasibility study and reduced by a factor of annual output capacities (35.4GWh/1050GWh).

Estimated annual operating cost = £1.3 million

Revenue

A further exercise has been undertaken to ascertain what revenues may be generated after the pay back period and within the design life of the structure estimated at 120 years. This work requires more detailed analysis to take account of operating, maintenance, and replacement etc over the life time of the project.

Annual revenue has been estimated using figures extracted from the Mersey Tidal Power feasibility study and reduced by a factor of annual output capacities (35.4GWh/1050GWh).

Commissioning period (12 months)	£2.90million/year
2020 – 2070	£5.82million/year
2070 – 2140	£2.15million/year

Breakeven

A broad based assessment estimates that the tidal barrage is likely to financially breakeven around year 24. It is noted there is no allowance for national grid infrastructure capital expenditure which is unknown at this time but could easily double the pay back period.

5.11.4.2 Tidal Stream Device – Pulse Tidal 1.2MW Horizontal Axis Turbine

Due to the lack of tidal data available it is difficult to assess the power generation capacity of a tidal stream device. Any increase or decrease in current speed will have a dramatic effect on power generation as power output is proportional to the cube of the tidal velocity.

Taking a mid-range value, that a flow velocity of 3m/s can be achieved through Strome Narrows the estimated annual power production would be 3.1GWh. The cost estimate for Pulse Tidal 1.2MW horizontal turbine stream device is as follows;

Capital Expenditure

Assuming a single next generation 1.2MW Pulse Tidal device is deployed in the Strome Narrows. The unit cost is approximately £5m and installation/grid connection is estimated to be around £5m. It should be noted due to the size of the unit only one device could fit the crossing width.

Estimated capital cost of 1no. 1.2MW Pulse Tidal Device = £10million

Operating Costs

Estimated operating cost of Pulse Tidal 1.2MW device = £150,000

Revenue

Annual revenue has been estimated using figures extracted from the Mersey Tidal Power feasibility study and reduced by a factor of annual output capacities (3.1GWh/1050GWh).

Annual average revenue = £510,000/year

Breakeven

A broad based assessment, assuming a flow velocity of 3/ms is achieved, it is estimated that a single Pulse Tidal 1.2 MW horizontal axis tidal stream device is likely to financially breakeven around year 28.

If 5no. Pulse Tidal 1.2MW devices were deployed it is estimated that the scheme is likely to financially breakeven around year 15. However, the national grid infrastructure would require upgrading and this is not included in this financial assessment estimate.

5.11.4.3 Tidal Fence (Bridge)

There are currently no tidal fences in operation, very limited financial data available it is difficult to assess the capital cost of a prospective scheme.

When considering the cost of a tidal fence (bridge) Blue Energy Inc. has provided a cost estimate of between £35m - £65m for 12no. vertical turbines and Pulse Tidal estimate the cost of 1no. next generation Pulse Stream horizontal unit to be £4.5m (the cost of constructing the causeway, bridge and roadway is excluded from these costs),

Due to the lack of tidal data available it is difficult to assess the power generation capacity of a tidal fence. Any increase or decrease in current speed will have a dramatic effect on power generation (power is a function of flow velocity cubed). For example Blue Energy Inc estimates power generation using 12no. vertical turbines across Strome Narrows to be;

Flow Velocity (m/s)	Power Output (MW)
1.5	1.51
2.5	7.02
3.0	11.00
3.5	19.28
4.0	28.78
5.0	50.75

Table 5.8 – Estimated Power Output Blue Energy Inc. Tidal Fence

Blue Energy Inc – Tidal Bridge

On the basis that a flow velocity of 3m/s can be achieved by restricting flow through Strome Narrows, assuming a 30% efficiency factor and an annual power production of 28.9GWh the cost estimate for a Blue Energy vertical turbine tidal bridge is as follows;

Capital Expenditure

Blue Energy Inc has provided an estimated cost of £35million for 12no. horizontal turbines (figure includes a 20% contingency, excludes grid connection/infrastructure costs, road, bridge and causeway construction costs).

Operating Costs

Estimated operating cost of tidal bridge turbines;
 Operation and maintenance of turbines = 3% annual revenue
 Rent = 5% annual revenue
 Maintenance variable = £1.8/MWh
 Depreciation (20 year straight line) = £1.75million

Total estimated annual operating cost = £2.2million

Revenue

Annual revenue has been estimated using figures extracted from the Mersey Tidal Power feasibility study and reduced by a factor of annual output capacities (28.9GWh/1050GWh).

Annual average revenue = £4.8million/year

Breakeven

A broad based assessment, assuming a flow velocity of 3/ms is achieved, it is estimated that the Blue Energy vertical axis tidal bridge is likely to financially breakeven around year 14. It should be noted this includes turbines only, there is no inclusion for causeway/bridge/roadway and national grid infrastructure capital expenditure.

A broad based assessment of a single Pulse Tidal 1.2MW horizontal axis tidal stream device incorporated into a bridge structure as illustrated in figure 4 has been undertaken and assuming a flow velocity of 3/ms is achieved, it is estimated that it would financially breakeven around year 27. It should be noted this includes turbine and grid connection only.

5.11.5 *Summary*

Scheme	No. Turbines	Estimated Annual Power production	Cost estimate	Grid Connection Requirements	Estimated Payback Period
Tidal Barrage	5	35.4 GWh	£103.5 million*	New infrastructure	24 years
Tidal Stream Device (Pulse Tidal 1.2MW)	5	15.5 GWh	£30million	New infrastructure	15 years
Tidal Fence (Bridge) – Blue Energy	12	28.9GWh	£35million**	New infrastructure	14 years
Tidal Fence (Bridge) – Pulse Tidal 1.2MW	1	3.1GWh	£9.5million**	Existing Infrastructure	27 years

Table 5.9 – Summary of Cost Estimates

*Includes road crossing on barrage

** Bridge costs to be added

- 1) Tidal barrage schemes have a major impact on the environment.
- 2) A tidal barrage requires significant capital expenditure (Both the Mersey and Severn tidal barrage schemes were shelved as they were deemed not profitable enough in the medium term).
- 3) When considering the lifetime cost, tidal barrage electricity production costs may be less than other forms of production e.g. La Rance - The development costs were high but these have now been recovered and electricity production costs are lower than that of nuclear power generation (1.8c per kWh, versus 2.5c per kWh for nuclear).
- 4) Using factored Mersey Tidal feasibility figures it is estimated that a 24MW tidal barrage at Loch Carron would cost £103.5m and would take 24 years to break even, excluding grid connection/infrastructure costs these will have significant impact on break even period.
- 5) Tidal barrage is a proven technology with several schemes operating around the world.
- 6) The energy available from a tidal barrage is dependent on the vertical tidal range and the volume of water. Power generation outputs are approximate and have been calculated using Admiralty Charts and Tide Tables only.
- 7) The energy available from a tidal stream device/tidal fence is dependent on the volume of water and the tidal velocity (power output is proportional to the cube of the tidal velocity).

- 8) Assuming a flow velocity of 3m/s, annual power production of 28.9GWh, estimated cost of turbines £35million and using factored Mersey Tidal feasibility figures it is estimated that a Blue Energy Inc. tidal bridge at Strome Narrows would take around 14 years to break even (excluding cost of grid connection/infrastructure, causeway, bridge and roadway).
- 9) The Blue Energy Inc. vertical axis turbine technology is currently in development.
- 10) Tidal fence technology is an emerging technology and is unproven in the field.
- 11) To date tidal stream devices have only been deployed as full scale trials.
- 12) The Pulse Stream 'next generation' device is several years away from market.
- 13) Assuming a flow velocity of 3m/s, the deployment of 5no. Pulse Tidal 1.2MW tidal stream devices, estimated installation cost of £30million and using factored Mersey Tidal feasibility figures it is estimated that an of tidal stream devices at Strome Narrows would take around 15 years to break even (excluding cost of grid connection/infrastructure).
- 14) In order to develop details of the tidal barrage/tidal fence/tidal stream options further studies are required to determine more accurate predictions of power production, scheme layouts, plant details and operating strategies. At the next stage of the feasibility study for renewable energy production scheme at Strome Narrows, the following should be considered;
 - Tidal current velocity and range
 - Water depth and bathymetry
 - Wave, turbulence and flow information
 - River traffic
 - Environmental Impact Assessment
 - System Design (Civil works, grid connection, generating equipment)
 - Detailed system costing;
 - Civil construction costs
 - The cost of grid-connection/grid infrastructure improvements
 - The cost of electro-mechanical equipment
 - Engineering and project management fees
 - Estimate of energy output and annual revenue (using river flows, hydraulic losses, operating head, turbine efficiencies and methods of calculation) and calculation of the output of the scheme in terms of the maximum potential output power (in kW) and the average annual energy yield (kWh/year) converted into annual revenue (£/year).
- 15) The benefits/ viability at this stage of the assessment are questioned. In addition to the financial balance, there would be issues with regard to technologies moving on over the long pay back period and the remaining design life after pay back and maintenance liabilities of the barrage and lock system.

Further work will be undertaken at Stage 2 to primarily ascertain if a tidal energy project at a national or community level is viable. It should be noted however that if a scheme is viable, options are available that could be developed within the Narrows that do not require a barrage

N6b type solution and therefore any financial gains from the tidal barrage/renewable energy option should offer a discount to any of the options being progressed.

In summary N6b should be rejected as a stand alone option but renewable energy within the Narrows should be progressed and if viable, the benefit applied to all options being considered at Stage 2. This philosophy may re-introduce Option N6b.

References:

1. National Engineering Laboratory – Paper C2 Tidal Power in Scottish Lochs
2. Mersey Tidal Power, Feasibility Study
3. Department of Energy and Climate Change - Severn Tidal Power Feasibility Conclusions and Summary Report

5.12 Route Option Cost Considerations

5.12.1 *Introduction*

In order to satisfy the requirements of STAG Part 1 and DMRB Stage 1, cost estimates for considered route options located in elected corridors should be prepared. However, it must be recognized that due to the preliminary nature of the Part 1 / Stage 1 proposals considered at this stage, only broad-based estimates of cost can be made to allow economic modeling to be undertaken.

With regard to preparing these cost estimates for the Stromeferry Bypass at Stage 1 several factors have to be recognized:

- Information available is limited with desk-top assessments being undertaken, and no physical on-site survey works have been carried out;
- Significant costs will be expended and will be attributable to the road/rail /loch interface. At this time these costs are unknown;
- Maintenance liabilities for the existing rock face currently lie with THC. The effect that a potential off-line route option selection will have on this liability is unknown at this time;
- Significant costs will be expended and will be attributable to the construction of any on-line option, particularly in view to temporary arrangements to maintain road and rail traffic during construction. The scale of these costs is currently unknown.

The main point to be recognised however is that of broad based rational decision making in line with the ethos of Stage1/Part1 assessment. From the work undertaken it is known that southern routes are the least expensive proposals, considering total project costs. However, it is a requirement for STAG practitioners to consider the full range of selection criteria i.e. Objectives, Environment, Safety, Economy, Integration, Accessibility & Social Inclusion, Deliverability- Public Acceptance & Affordability. Focusing on cost alone at this stage could over influence the selection process moving onto the Stage 2 work. It is therefore essential, that the selection of routes going forward is based on the full range of criteria, without cost influencing decision making too early in the process.

Assumptions for alignments include a start point for northern routes at Achmore, on-line routes at Stromeferry with southern routes starting at Stromeferry, Braeintra and Glen Udalain. All routes terminate at Strathcarron Junction. The exception is the do-minimum option O4 which has no allowance for improvements to the existing road other than ongoing maintenance. The road would remain as per existing, therefore retaining sections of single track with passing places.

5.12.2 *Preliminary Cost Estimates*

The preliminary cost estimates have been developed giving due consideration to the variables outlined above, and in particular that of affordability of a scheme. A range of costs as shown in table 5.11 below has been considered to cover both the complex, as well as the more straight forward elements of the project, and where possible, phasing of the delivery of a scheme has been considered to assist with deliverability.

The lower end of the cost range reflects early phasing of high priority work, with the higher end of the range covering complete network costs.

All costs stated are construction costs, including allowances for preliminaries and contingencies.

Table 5.10 indicates the cost range covered by the resource band included in table 5.11 below.

Table 5.10 – Resource Bands

RESOURCE BAND	COST RANGE (£M)
A	< 20 to 70
B	71 to 120
C	121 to 170
D	> 170

Table 5.11 – Option Cost Range

ROUTE	OPTION DESCRIPTION	COST RANGE		RESOURCE BAND	ROUTE
		Lower	Upper		
ON3	Route Outer North 3 is an off-line route option, which provides a direct south to north link from Achmore as far north as Ardarroch, including a Strome Narrows western bridge crossing, and a full bypass of Lochcarron Village	£ 90M	to £ 155M	B/C	ON3
N2 (bridge)	Route North N2 is an off-line route option considering a western bridge crossing of the Strome Narrows, and follows the route of the existing minor road along the northern shore of Loch Carron, upgraded to agreed design standards, including a partial, western bypass of Lochcarron Village	£ 60M	to £ 135M	A/B/C	N2 (bridge)
N2b (tunnel)	Route North N2b is an off-line route option considering a western tunnel crossing of the Strome Narrows, and follows the route of the existing minor road along the northern shore of Loch Carron, upgraded to agreed design standards, including a partial, western bypass of Lochcarron Village	£ 80M	to £ 155M	B/C	N2b (tunnel)
N6	Route North N6 is an off-line route option originating at Achmore, considering an eastern Strome Narrows crossing and following the route of the existing minor road along the northern shore of Loch Carron, upgraded to agreed design standards. This route remains on-line through Lochcarron Village.	£ 60M	to £ 135M	A/B/C	N6
N6b	Route N6b takes the same alignment as described for N6 above. N6b considers an integrated renewable energy solution for the Narrows crossing.	£ 120M	to £ 205M	C/D	N6b
N9	Route N9 is an additional route option proposed to provide a full bypass of Lochcarron Village. This route is an off-line route option considering a western bridge crossing of the Strome Narrows, and follows the route of the existing minor road along the northern shore of Loch Carron,, upgraded to agreed design standards.	£ 60M	to £ 125M	A/B	N9
O1	Route On-line O1 considers the on-line improvement of the existing A890 to a two-lane carriageway throughout, including minor improvements to alignments and gradients	£ 30M	to £ 90M	A/B	O1
O2	Route On-line O2 considers on-line improvement of the existing carriageway and a local 1.8km bypass of the rock fall area west of Cuddies' Point by means of a cantilevered structure along the shoreline.	£ 80M	to £ 145M	B/C	O2
O3	Route On-line O3 considers on-line improvement of the existing carriageway and a local 1.6km bypass of the rock fall area west of Cuddies' Point by means of an inland tunnel structure	£ 70M	to £ 130M	B/C	O3

ROUTE	OPTION DESCRIPTION	COST RANGE		RESOURCE BAND	ROUTE
		Lower	Upper		
O4	Route On-line O4 is the 'Do-Minimum' scenario, with no proposed improvements to the existing route	£ 20M	to £ 30M	A	O4
O5	Route On-line O5 considers on-line improvement of the existing carriageway and a local 1.8km shared road / rail corridor west of Cuddies' Point	£ 10M	to £ 60M	A	O5
O6	Route On-line O6 provides a northern upper loch crossing as an alternative link from Attadale to the A896 at Kirkton, and considers on-line improvements of the existing carriageway as per O1. This route can be considered as an alternative link to all southern on- and off-line route options.	£ 30M	to £ 150M	A/B/C	O6
O7	Route On-line O7 considers on-line improvement of the existing carriageway and a local 2.0km extended rock shelter west of Cuddies' Point.	£ 70M	to £ 130M	B/C	O7
S1	Route South S1 considers a southern off-line bypass (link) route from Stromeferry through parts of Glen Udalain and Attadale valley, and on-line improvements of the existing A890 carriageway from Attadale north	£ 35M	to £ 60M	A	S1
S3	Route South S3 considers a southern off-line bypass (link) route from Braeintra through parts of Glen Udalain and Attadale valley, and on-line improvements of the existing A890 carriageway from Attadale north	£ 35M	to £ 60M	A	S3
S4	Route South S4 considers a principal southern off-line bypass route from the A890 through Glen Udalain and Attadale valley, and on-line improvements of the existing A890 carriageway from Attadale north	£ 25M	to £ 50M	A	S4
S5b	Route South S5b considers the southern off-line bypass route S4 from the A890 through Glen Udalain to Attadale Valley, with a northern route through Attadale and a bypass of the Maman Hill, and on-line improvements of the existing A890 carriageway north from the tie-in	£ 50M	to £ 70M	A	S5b

6 ENVIRONMENTAL ASSESSEMENT

6.1 Introduction and Context

This section of the report presents the findings of the Scottish Transport Appraisal Guidance (STAG) Part 1 Environmental Appraisal which draws on guidance provided in the Design Manual for Roads and Bridges (DMRB).

The key purpose of the STAG Part 1 Appraisal is to allow a comparison of alternative options, enabling those options which are unsuitable on environmental grounds to be filtered out at an early stage. It will also help to scope required appraisals at Part 2.

DMRB requires that a Stage 1 assessment should identify the environmental advantages, disadvantages and constraints associated with broadly defined strategies.

Five route corridors and the Strome Narrows Crossings for the A890 Stromeferry Bypass have been assessed and presented in this report. As individual route options were also available where the impacts of these differ greatly from the corridor assessment reference has been made to this. Table 6.1.1 shows the route corridors and corresponding route options, these are also shown on Drawing no 47065084 – 1004, Preliminary Route Options Plan.

These options have been sifted down in number from the original options through consultation with key stakeholders, details of this process and the original options can be found in chapters 2 and 4 of this report. Full descriptions of the route options can be found in sections 4.5 and 5.4.

Table 6.1.1 – Route Corridors and Individual Route Options

ROUTE CORRIDOR	INDIVIDUAL ROUTE OPTIONS
Outer North Corridor (ON)	
North Shore Corridor (NS)	
	N2
	N6
	N9
On-line Corridor (O)	
	O2
	O3
	O4
	O5
	O6

ROUTE CORRIDOR	INDIVIDUAL ROUTE OPTIONS
	O7
Southern Corridor (S)	
	S3
	S4
	S5 (b)
Strome Narrows Crossings	
	Western Crossing – Bridge
	Western Crossing – Tunnel
	Eastern Crossing – Bridge
	Eastern Crossing – Tidal Barrage

6.1.1 *The Study Area*

This section of the report describes the existing conditions of the A890 Strome Ferry Bypass study area. The scheme is located on the A890 between Achmore and the A890/A896 Strathcarron Junction. There are some general existing constraints with regards to the environmental assessment of the scheme which are taken into account within each section and are cross-cutting themes.

These are shown in the general constraints map in Drawing 6.1 – General Environmental Constraints and are listed below:

- The Kyle of Lochalsh to Inverness railway line runs beside the current A890 from Strome Ferry to Strathcarron. Stations along the existing route are present at Strome Ferry, Attadale and Strathcarron
- There are seven Sites of Special Scientific Interest (SSSI) found within the study area. One is located along the existing route adjacent to the avalanche shelter.
- One national nature reserve, north of Ardarroch
- Several scheduled monuments
- Numerous listed buildings
- Scattered area of woodland found on the Ancient Woodland Inventory (AWI)
- Four areas designated as Special Areas for Conservation (SAC)
- The main routes within the area are the A890 and A896.

6.1.2 *Methodology*

The methodology detailed in the STAG technical guidance for environmental assessment requires the Part 1 Appraisal to cover the following:

- Confirm the nature of the option including the alternatives under consideration;
- Identify if an Environmental Impact Assessment, or Strategic Environmental Assessment is required;
- Identify the range of likely impacts on the environment;
- Identify the extent to which these impacts need to be investigated;
- Identify methodologies to be employed;
- Define data availability and further data gathering requirements;
- Set the indicative thresholds and significance criteria to be used in the Evaluation of impacts;
- Identify broad mitigation measures; and
- Agree the above with statutory bodies.

At the Part 1 Appraisal stage, a qualitative assessment should be completed using the STAG criteria seven point scale assessment (see Table 6.1.2), considering the relative size and scale of its impacts (magnitude of impact).

Table 6.1.2 – STAG Criteria assessment scale

STAG CRITERIA
Major benefit - these are benefits or positive impacts which, depending on the scale of benefit or severity of impact, the practitioner feels should be a principal consideration when assessing a option's eligibility for funding;
Moderate benefit - the option is anticipated to have only a moderate benefit or positive impact. Moderate benefits and impacts are those which taken in isolation may not determine an option's eligibility for funding, but taken together do so;
Minor benefit - the option is anticipated to have only a small benefit or positive impact. Small benefits or impacts are those which are worth noting, but the practitioner believes are not likely to contribute materially to determining whether an option is funded or otherwise.
No benefit or impact - the option is anticipated to have no or negligible benefit or negative impact.
Small minor cost or negative impact - the option is anticipated to have only a moderate cost or negative impact. Moderate costs/negative impacts are those which taken in isolation may not determine an option's eligibility for funding, but taken together could do so.
Moderate cost or negative impact - the option is anticipated to have only a moderate cost or negative impact. Moderate costs/negative impacts are those which taken in isolation may not determine an option's eligibility for funding, but taken together could do so;
Major cost or negative impacts - these are costs or negative impacts which, depending on the scale of cost or severity of impact, the practitioner should take into consideration when assessing an option's eligibility for funding.

In order to determine the ‘significance of environment effect’, consideration has been given to both the magnitude of effect and the sensitivity of the receptor. DMRB, Volume 11, Section 2, Part 5 (HA 205/08) provides guidance on determining significance of environmental effects. Table 6.1.3 below provides typical descriptions for assigning environmental value (or sensitivity).

Table 6.1.3 – Environmental Value (or Sensitivity) and Typical Descriptors

Value (sensitivity)	Typical descriptors
Very High	Very high importance and rarity, international scale and very limited potential for substitution.
High	High importance and rarity, national scale, and limited potential for substitution.
Medium	High or medium importance and rarity, regional scale, limited potential for substitution
Low (or Lower)	Low or medium importance and rarity, local scale
Negligible	Very low importance and rarity, local scale.

Table 6.1.4 combines the STAG criteria with the sensitivity of receptors to provide significance categories to determine the significance of the effect. This matrix has been used throughout the assessment and areas shaded in dark blue are considered to be significant effects.

Table 6.1.4- Significance of Environmental Effect Matrix (areas in dark blue are considered significant effects)

MAGNITUDE OF IMPACT	SENSITIVITY OF RECEPTOR				
	Very High	High	Medium	Low	Negligible
MAJOR	Major	Major	Moderate	Minor	Negligible
MODERATE	Moderate	Moderate	Minor	Minor	Negligible
MINOR	Moderate	Minor	Minor	Negligible	Negligible
No benefit or impact (negligible)	Negligible	Negligible	Negligible	Negligible	Negligible

It should be noted that at this stage of the assessment involves the comparison of route corridors as no preferred scheme has of yet been identified. The extent to which individual environmental effects are capable of being mitigated has therefore not yet been established. The impacts identified in this report are therefore **prior** to mitigation and it may be that the impacts of specific options are minimized as mitigation measures are devised at the next stage of assessment. Further consideration of mitigation proposals will form part of the DMRB Stage 2 assessment process should this be taken forward following this Study.

Further details of topic specific methodology is provided within each topic assessment.

6.1.3 *Scope of Assessment*

DMRB provides guidance in Volume 11 (Environmental Assessment) for individual environmental topics to assess the impacts of road schemes.

The Highways Agency (HA) is currently modernizing DMRB Volume 11. The Aims and Objectives of Environmental Assessment (DMRB, Vol.11, Part1: HA 200/08) identifies in Table 1.1 the Environmental Impact Assessment Topics. At present only some of the topics have published updated guidance and some topics rely on previous historic guidance. For the purposes of this report the new DMRB topic structure shall be used with old guidance being used where no new guidance is available. Table 6.1.5 shows the relationship between the old DMRB topics and the new topic structure.

Table 6.1.5 – DMRB new topic structure

Old DMRB Topics	New DMRB Topics (followed for this report)
Air Quality	Air Quality
Cultural Heritage	Cultural Heritage
Landscape Effects	Landscape
Ecology and Nature Conservation	Nature Conservation
Geology and Soils	Geology and Soils
Traffic Noise and Vibration	Noise and Vibration
Vehicle Travellers	Effects on all travellers
Pedestrians Equestrians	
& Community Effects	Community and Private Assets
Land Use	
Road Drainage and Water Environment	Road Drainage and Water Environment
	Materials Assessment
Impact of Road Schemes on Policies and Plans	Now absorbed into each new topic chapter *
Disruption due to Construction	Now absorbed into each new topic chapter**

*A standalone Policies and Plans section has been provided in this assessment for ease of reading

** Disruption due to Construction is not considered fully at this stage given as there is not enough detailed information to allow an assessment to be made. Where possible topic sections discuss construction disruption in a general sense.

Materials Assessment

As noted in table 6.1.5 above Materials Assessment is a new DMRB topic, however no specific guidance is available as yet. An Interim Advice Note (IAN) 'Guidance on Environmental Impact Assessment of Materials' was published in October 2011. The IAN provides the latest and most up to date guidance available and notes that this is a developing area and that this guidance will be developed in time to cover the full scope of assessment methodologies expected in DMRB Volume 11.

At this stage, detailed information regarding materials and waste is not available as route alignments have not been developed. The IAN provides an assessment levels which should be followed, these include scoping, simple assessment and detailed assessment. At the scoping stage for those projects which have an estimated cost of greater than £300,000 it is assumed that the potential exists for impacts and effects to take place. Therefore, an assessment of materials should be undertaken to at least the simple level of assessment.

As all of the route corridors considered are likely to have project costs of greater than £300,000, it is proposed that at least a 'simple' level of assessment should be undertaken at the next stage of the project (DMRB Stage 2) when options are more refined. Materials Assessment is not considered any further within this report.

6.1.4 *Structure of the Environmental Assessment*

The following environmental drawings have been produced to support the assessment and are referred to in the topic assessments where relevant. Table 6.1.6 shows the list of drawings with their reference numbers.

Table 6.1.6 – Structure of Report and Supporting Drawing References

Topic Assessment sections	Report Drawing Reference	Full Drawing Reference
6.1 - Introduction	Drawing 6.1 - General environmental Constraints	46065084.6001
6.2 - Policies and Plans	N/A	
6.3 - Nature Conservation	Drawing 6.2 -Nature Conservation Designations	46065084.6002
6.4 - Landscape	Drawing 6.3 - Landscape Designations Drawing 6.4 - Landscape Character Assessment	46065084.6003 46065084.6004
6.5 - Road drainage and water environment	Drawing 6.5 - Watercourses and Water bodies	46065084.6005
6.6 - Noise	N/A	
6.7 - Air	Drawing 6.6 -Stage 1 Air Quality Assessment Outer North Corridor Route Option Drawing 6.7 - Stage 1 Air Quality Assessment North Shore Corridor Route Option Drawing 6.8 - Stage 1 Air Quality Assessment On Line Corridor Route Option Drawing 6.9 - Stage 1 Air Quality Assessment Southern Corridor Route Option	46065084.6006 46065084.6007 46065084.6008 46065084.6009

Topic Assessment sections	Report Drawing Reference	Full Drawing Reference
6.8 - Geology and soils	Drawing 6.10 - Soil Classification	46065084.6010
6.9 - Cultural heritage	Drawing 6.11 - Cultural Heritage Designations	46065084.6011
	Drawing 6.12 - Historic Land Use Assessment	46065084.6012
	Drawing 6.13 - Undesignated Cultural Assets	46065084.6013
6.10 - Effects on all travellers	Drawing 6.14 - Core paths and Rights Of Way	46065084.6014
6.11 - Communities and private assets	Drawing 6.15 - Residential, Community Assets and Woodland	46065084.6015
	Drawing 6.16 - Agricultural Land Classification	46065084.6016

6.1.5 *Environmental Consultations*

A number of statutory bodies were consulted as part of the Stage 1 assessment and Table 6.1.7 provides details of the consultations undertaken.

In addition to the consultation with the statutory bodies, a range of stakeholder workshops were held in December 2012 and January 2013, see section 2 for more details.

Table 6.1.7 - Consultation Responses

Consultee	Response
The Highland Council	<p>Email correspondence was also received from the Highland Council on 14th December 2012, which stated that 'given the sensitivities around the potential routes that affect the [Attadale] estate, you should make contact with Ewen Macpherson and explain the need for all options to be properly considered'.</p> <p>In addition email correspondence was received from the The Highland Councils Access and GIS Officers which provided information on the Rights of Way (RoW) and the core paths located in the area.</p>
Historic Scotland	<p>Responded via Email on 29 November 2012 by outlining their statutory remit at the national level for scheduled monuments and their setting, category A listed buildings and their setting and gardens and designed landscapes appearing in the Inventory.</p> <p>Their key issues were, of the potential impact upon Strome Castile (Index No. 8481). In addition, their response stated their concern regarding any bridge options and that there are numerous heritage assets within the corridors.</p> <p>Recommended that Highland Council's conservation and archaeological services will also be able to advise on any likely impacts from the development on the historic environment, and particularly in this case for information and advice about the treatment of unscheduled and</p>

Consultee	Response
	unrecorded/unknown archaeology along the route of the road.
Scottish Natural Heritage (SNH)	<p>SNH Responded on 8 July 2011 and provided information on high level objectives which they believed should be included in the STAG process. These included:</p> <ul style="list-style-type: none"> • Safeguard those aspects of the natural heritage which are of national importance; • Follow best practice in design, maximising positive opportunities for nature and local landscapes; • Raise awareness, understanding and enjoyment of the natural heritage, and; • Raise support measures that enhance the socio-economic benefits provided by the natural heritage. <p>In addition a response on 29th January 2013 provided baseline information regarding the Allt nan Carnan, Slumbay Island and Attadale Sites of Special Scientific Interest within the Lochcarron area.</p>
Forestry Commission Scotland	<p>Response received on 4 December 2012.</p> <p>Expressed that FCS interest in the area they maintain in the study area relates to supervision of forest operations in South Strome, Achnashellach and Slattadale Forests, and the potential economic impact of road closures upon timber transport.</p> <p>FCS noted that they would not be keen on tunnel or bridge routes for HGV's (Heavy Goods Vehicles) and machinery movements through Lochcarron and due to Health and Safety concerns. However, they also noted opportunities including improved access and increased simplicity of future timber harvesting operations.</p> <p>FSC highlights that their objectives relating to this appraisal are to improve and not to diminish transport links to forests.</p>
SEPA	<p>Response received on 3 December 2012.</p> <p>SEPA consider that certain issues, listed below, are key issues that should be addressed in the project planning process.</p> <p><u>Carbon balance</u></p> <p>SEPA state that in line with SPP and government guidance the carbon balance needs to be systematically assessed which should include all elements of the proposal. A web link is provided to a revised guidance methodology for estimating impacts upon carbon dynamics of peat lands.</p> <p>SEPA state that they will validate carbon balance assessment and</p>

Consultee	Response
	<p>provide comment on draining and waste management aspects of the peat management scheme to ensure that carbon balance benefits are maximised.</p> <p>SEPA state that the assessment of the likely effect on carbon rich soils should be undertaken in line with SPP and should include mitigation measures through a detailed peat management scheme to ensure that the carbon balance benefits of the scheme are maximised.</p> <p>SEPA stat that their advice on peat management options may need to be taken into consideration when you consider the assessments.</p> <p>Web links are provided to further guidance and information regarding best practice.</p> <p><u>Disruption to wetlands including peatlands</u></p> <p>SEPA state that if wetlands or peatland systems are present then a phase 1 habitat survey should be undertaken, and demonstration impact areas and mitigation measures is required.</p> <p>SEPA state that the National Classification survey and Appendix 2 of SEPA's Planning guidance on windfarm developments should be used to identify if wetlands are groundwater dependent terrestrial ecosystems, which are protected un the Water Framework Directive.</p> <p>SEPA state that infrastructure within 100m (roads, tracks, trenches) or 250m (borrow pits or foundations) of groundwater dependant ecosystems should be reconsidered and if not possible to relocate then the likely impact requires further assessment with the results and any necessary mitigation measures detailed.</p> <p>SEPA state the impacts relating to groundwater dependant ecosystems to be considered and include mitigation measure examples which need to be presented in the Construction Environmental Management Document as detailed below. They also state that detailed information on waste management is required as detailed below.</p> <p><u>Disturbance and re-use of excavated peat</u></p> <p>SEPA state that, prior to the application gaining consent, where the proposed infrastructure will impact upon peatlands, it is now best practice for developers to produce a Peat Management Plan within the Environmental Statement which sets out the principles as to how any surplus peat will be managed within the site.</p> <p>SEPA state that the Peat Management Plan, SEPA then detail the outputs of the peat management plan and assessments. This information is often already required as part of any peat slide risk assessment. They provide links to guidance and further information.</p> <p>SEPA then provide advice on a number of common issues queried within</p>

Consultee	Response
	<p>Peat Management Plans, including best practice guidance on road shoulders, alternate construction techniques and their detailing within the Peat Management Plan, and information regarding peat re-use.</p> <p>SEPA state that the generation of surplus peat is a difficult area which needs to be addressed from the outset given the limited scope for re-use.</p> <p>SEPA state that there are important waste management implications of measures to deal with surplus peat as set out within SEPA's Regulatory Position Statement - Developments on Peat.</p> <p>It is therefore essential that the scope for minimising the extraction of peat is explored and alternative options identified that minimise risk in terms of carbon release, human health and environmental impact. Early discussion of proposals with us is essential, and an overall approach of minimisation of peatland disruption should be adopted. If it is proposed to use some excavated peat within borrow pits or bunding then details of the proposals, including depth of peat and how the hydrology of the peat will be maintained, should be outlined in the ES or planning submission.</p> <p>A weblink to further information current best practice guidance on peat survey, excavation and management was provided.</p> <p><u>Forest removal and forest waste</u></p> <p>SEPA state that significant felling relating to waste generated by managed techniques such as chipping, mulching or spreading will be a key concern because where material is classes as waste then waste management options are required for consideration and adoption where appropriate. They states that information regarding the waste hierarchy applied should be provided, otherwise SEPA are likely to object the application.</p> <p>SEPA note that where ecological benefit from waste is claimed then reliable site-specific evidence must be provided including on-site benefits and no ecological harms associated with deposition. They note that if there are significant amounts without a clear use and the scope for exemption is unclear then they may object to an application, and therefore state that it is essential for these issues to be addressed at an early stage.</p> <p>SEPA note that they would support key-holing approaches wherever possible or clear felling where planting took place on deep peat and it is reinstated through a Habitat Management plan for peat-forming habitats, of which details should be specifically referenced within the ES.</p> <p>SEPA note that the principle for use of forest residue for peatland restoration should be applied.</p> <p>SEPA state that a clear specification for contractors is required and that where the ecological benefit proposed by the fell to waste activity does not relate to improvement of peatland habitats the expected</p>

Consultee	Response
	<p>environmental benefit should be outlined and fully justified in the ES.</p> <p><u>Existing groundwater abstractions</u></p> <p>SEPA state that a list of groundwater abstractions should be provided, and that if any are identified that measures are taken to avoid engineering operations within close proximity or further information and investigations are required to show the potential impacts. A weblink to further information was provided.</p> <p><u>Engineering activities in the water environment</u></p> <p>SEPA state that demonstration is required showing that activities should prevent the deterioration of the water environment, i.e. burns, rivers, lochs, wetlands, groundwater and reservoirs, in line with the Water Framework Directive objectives. They note that unnecessary bridges, culverts, watercourse diversions, bank modifications and dams should be avoided if possible in line with SPP. A web link was provided for further and best practice guidance.</p> <p>SEPA state that if works are likely to increase the flood risk then a risk assessment is required and SEPA should be consulted.</p> <p>SEPA state that site surveys of existing water features, a proposed works map, potential impacts and mitigation of works, and the justification for activities should be state with the later a key issues for SEPA to assess at the planning stage.</p> <p>SEPA note that it is encourage to seek opportunities to avoid or offset environment impacts and incorporate improvements in the water environment required by the Water Framework Directive.</p> <p><u>Sustainable surface water drainage (SUDS)</u></p> <p>SEPA state that SUDS are a legal requirement for most forms of development, encourage that surface water runoff is treated by SUDS in line with SPP, PAN 61, PAN 79 and relevant local development plans/local policy.</p> <p>SEPA note that the local authority is required to ensure water deterioration does not occur at development sites.</p> <p>SEPA note that discharges to combined sewers should be avoided and that adequate space is provided to accommodated SUDS within the site layout.</p> <p>SEPA note that road schemes require two levels of treatment, that permeable paving or under drained swales can each qualify as two levels of control.</p> <p>SEPA state that the treatment train should be followed and provide links to technical guidance on SUDS techniques, systems and treatment</p>

Consultee	Response
	<p>levels.</p> <p>SEPA states that comments from the local authority roads department, flood prevention units and Scottish Water should be sought.</p> <p>SEPA state that where contamination exists infiltration SUDS will not be suitable and provide a web link to SUDS and brownfield sites advice note.</p> <p>SEPA note that details regarding the source, location, volume, abstraction timing, abstraction nature, operating regime, the existing water environment and the impacts and cumulative impacts upon the surrounding water environment are required where water abstraction is proposed.</p> <p><u>Water Framework Directive and River Basin Management Planning</u></p> <p>SEPA state that it is a requirement to provide information on measures undertaken to ensure no deterioration of the water environment and offer to provide advice once specific options have been chosen.</p> <p>SEPA state the water environment impacts or opportunities should be identified for the local authority to consider in order meet the requirements and compliance with objectives of the Water Framework Directive (200/60/EC).</p> <p>All coastal water out to three nautical miles seaward from the Scottish territorial baseline falls under the Directive which requires them to be considered in terms of their chemical, ecological and hydrological status.</p> <p>SEPA provide weblinks to River Basin Management Plans which support the Directive and state that the local authority should promote those measures already agreed.</p> <p><u>Site layout and nature of construction for marine developments</u></p> <p>SEPA state that detailed information on site layout should be provided with a supporting statement detailing the development and justification for site and design choices.</p> <p>Depending on the types and scale of construction the information below may be required.</p> <p><u>Land reclamation and construction</u></p> <p>SEPA state that plans and cross sections showing engineering works in the marine environment are required, and that hydrodynamic modelling may be required to predict the impacts on water quality and coastal processes in the longer term.</p> <p><u>Capital dredging for coastal development and maintenance dredging for navigation (including aggregate extraction and novel techniques eg agitation dredging).</u></p>

Consultee	Response
	<p>SEPA state that if dredging is like then detailed information on quantities, methods, mitigation measures, and potential impacts upon substrate type/habitats/species, and water quality should be provided.</p> <p>SEPA also note that hydrodynamic modelling to predict the impacts on water quality during construction and coastal processes in the longer term may be required.</p> <p><u>Coastal protection/flood defence</u></p> <p>SEPA state that detailed plans, cross sections should be produced relating to coastal protection in order to demonstrate that the works will not increase the risk of flooding in other locations.</p> <p>SEPA state that an appraisals and justification should be included he ES should include a section on the appraisal process and justification for the preferred defence option. The feasibility of soft engineering techniques should always be considered in the appraisal process. Any coastal defence scheme should be appropriate in scale and type for the area.</p> <p>SEPA note that there may be a need to carry out hydrodynamic modelling to investigate potential impacts upon water quality, coastal process, local hydrodynamics and sediment transport patterns and any proposed mitigation measures.</p> <p><u>Offshore water abstractions and discharges</u></p> <p>SEPA state that sensitive waters, existing discharges and designated areas should be assessed.</p> <p>Where a proposal involves shipping or port developments, it may be necessary to submit a detailed description of the actions to be taken to prevent the introduction of non-native marine species from ballast water transfers or hull-fouling, as both can result in a deterioration of a water body under The Water Framework Directive. Ships should carry and implement a ballast water management plan. Further guidance that is based on IMO (www.imo.org/index.htm) and OSPAR guidance is available at www.mcga.gov.uk/c4mca/mgn_363.pdf.</p> <p>Advice and guidance websites were also provided regarding ballast water docking, leisure craft and other vessels.</p> <p><u>Marine ecological interests</u></p> <p>SEPA state that a baseline assessment, including UK Biodiversity action Plan habitats and species, of existing intertidal and subtidal habitats and species should be submitted. SEPA state that this allows the establishment if in-field surveys are required.</p> <p>SEPA recommend exploration of how to contribute to sustainable development and enhance marine habitats in line with WFD, SSP and the</p>

Consultee	Response
	<p>Nature Conservation (Scotland) Act 2004.</p> <p>SEPA state than an Environmental Management Plan should mitigate habitat damage and advice on designated sites and European Protected Species should be sought from SNH.</p> <p><u>Coastal processes</u></p> <p>SPEA state that coastal process need a baseline assessment which identifies sediments, hydrodynamics, sedimentary environment, sedimentary structures and the typical suspended sediment concentrations.</p> <p><u>Pollution prevention and environmental management</u></p> <p>SEPA note that pollution prevention measures are of a key interest and advise the systematic identification of ‘all aspects of site work that might impact upon the environment, potential pollution risks associated with the proposals and identify the principles of preventative measures and mitigation’.</p> <p>SEPA also state that a draft Schedule of Mitigation should be produced covering all the environmental sensitivities, pollution prevention and mitigation measures identified to avoid or minimise environmental effects. A website for further Pollution Prevention and Environmental Management guidance was provided.</p> <p>SEPA state that a Construction Environmental Management Document is a key management tool to implement the Schedule of Mitigation and should form the basis of more detailed site specific Construction Environmental Management Plans.</p> <p>Advice and best practice websites were provided.</p> <p><u>Sustainable waste management</u></p> <p>SEPA note that details of how waste will be minimised at the construction stage should be included in the ES as part of the Construction Environmental Management Document. They note that it should demonstrate minimisation of raw material use, maximise use of recycled/renewable/secondary materials, and onsite reduce, re-use, recycling of materials.</p> <p>SEPA state that to do this effectively all waste streams and proposals for their management should be identified and recommend a site specific Site Waste Management Plan is developed to address these points in accordance with the objectives of Scottish Planning Policy and the Zero Waste Plan.</p> <p>Advice on site waste management plans, waste prevention and reuse of materials was provided in web links.</p>

Consultee	Response
	<p><u>Borrow pits</u></p> <p>SEPA state that investigations relating to the impact, at least as set out in Planning Advice Note PAN 50, and need for Borrow pits should be contain in the ES</p> <p>Additional information on groundwater is provided above.</p> <p><u>Air quality</u></p> <p>SEPA state that the local authority is the responsible authority for local air quality management and recommend that the Environmental Health department within the local authority be consulted.</p> <p>SEPA note that the local authority can advise upon the cumulative contribution to road traffic and potential impacts in the local area. A website for further guidance was provided.</p> <p><u>Flood risk</u></p> <p>The site should be assessed for flood risk in line with Scottish Planning Policy and the Local Authority, Scottish Water and SEPA can provide information to help the assessment. A web link for further guidance was also provided.</p> <p><u>Regulatory advice for the applicant</u></p> <p>SEPA state that advice provided on the Marine Environment and Water Environment (Controlled Activities) (Scotland) Regulations 2011 and other best practice advice can be found on their website.</p>
National Trust for Scotland	<p>Email response received on 24 January 2013.</p> <p>It states that Stromeferry Castle is owned by the National Trust for Scotland (NTS) which is also considered as a scheduled monument. It states that due to terrain and the locations of residential properties options for improving the road would be difficult.</p>
Marine Scotland	<p>Email response received on 28th November 2012.</p> <p>It stated the objectives for Marine Scotland under the Marine (Scotland) Act 2010.</p>
Network Rail	<p>Response received on 26 November 2012.</p> <p>Network rail note the current problems relating to rock falls and weathering events on the railway line causing disruption to services.</p> <p>Network Rail note that working next to a railway line is a project constraint and that their objectives regarding the project are to:</p>

Consultee	Response
	<ul style="list-style-type: none"> • Reduce/minimise risk to and the liability of the railway • Minimise disruption to rail services during construction.

The above consultation responses were circulated amongst the project team involved in producing the Stage 1 Assessment Report and the options design team in order to ensure that the concerns of the consultees was considered as part of the environmental assessment and scheme design processes.

It should be noted that other consultations have been carried out for other aspects of this project, for example with regards to the Ground Investigations, where these are relevant they have been included in the relevant topic section.

6.2 Policies and Plans

6.2.1 *Introduction*

This section provides a description of the current national, regional and local planning policies relevant to the corridors, and assesses the potential compliance of each against relevant policies.

6.2.2 *Methodology*

The assessment has been undertaken in line with DMRB Guidance Volume 11, Section 3, Part 12 – Impact on Plans and Policies. As addressed in Section 6.1.3, although the new DMRB guidance is followed for the rest of the environmental assessment topics, a separate assessment of policies and plans is included as given the level of detail this provides a clearer steer on policy compliance at this stage than inclusion in each environmental topic.

6.2.3 *National Planning Policy*

National Planning Framework 2

The NPF2 was published in 2009 by the Scottish Government and outlines the key principles that guide the wider planning system in Scotland until 2030. NPF2 guides Scotland's spatial development to 2030, setting out strategic development priorities to support the Scottish Governments central purpose of promoting sustainable economic growth. Plans that are beneath the NPF2 in the planning policy hierarchy are directly influenced by the goals and themes in the document.

NPF2 states:

'Scotland needs an effective national transport infrastructure which will facilitate sustainable economic growth' (paragraph 106).

'We need to reduce journey times and make them more reliable; make connections which build and sustain economic growth; and improve links between cities, towns and rural communities throughout the country' (paragraph 107).

'Many of the roads in the Highlands and Islands and the South of Scotland are lifeline routes for rural communities and of critical importance to the local economy. Their continued maintenance and improvement is essential to ensure the safety of the network and to support long term development' (paragraph 133).

NPF2 makes no specific reference to the need for improvements to the A890 at Stromeferry but clear reference is made to the need for reliable connections in rural areas to support sustainable economic growth.

The Scottish Government has commenced work in 2012 on the preparation of National Planning Framework 3 which will set the Governments development priorities over the next 20-30 years.

Scottish Planning Policy

The Scottish Planning Policy (SPP) document is a statement of the Scottish Governments policy on nationally important land use matters.

The planning system guides and facilitates development while at the same time “*protecting and enhancing the natural and built environment*”, and is considered to be central to the Scottish Government’s central purpose of achieving sustainable economic growth (paragraph 4).

Transport is addressed as a subject policy within SPP and it is recognised that the relationship between transport and land use has a strong influence on sustainable economic growth. The strategic transport network, which includes trunk roads, is identified as being critical in support a level of national connectivity that facilitates sustainable economic growth.

SPP states:

‘The primary purpose of the strategic transport network is to provide for the safe and efficient movement of strategic long distance traffic between major centres, although in rural areas it also performs important local functions’ (paragraph 174).

Rural Development is also addressed as a subject policy within SPP and there is recognition that the planning system has a significant role in supporting economic growth in rural area. The policy aim is stated as being *‘to enable development in all rural areas which supports prosperous and sustainable communities whilst protecting and enhancing environmental quality’ (paragraph 92)*

SPP also contains a number of other subject policies including but not limited to; economic development, historic environment, landscape and natural heritage, flooding and drainage and waste management.

A review of SPP was announced in 2012 and it is anticipated that an updated SPP will be published before the end of 2013.

6.2.4 *Regional and Local Policy*

Highland-wide Local Development (2012)

The Highland Council published the Highland-wide Local Development Plan (LDP) in 2012. The plan sets out the overarching vision statement, spatial strategy and general planning policies for the whole of the Highland Council area.

The Highland-wide LDP replaces the Highland Structure Plan (2001) and also supersedes the General Policies and other related material of the adopted Local Plans; in this case two local plans are of relevance: the Wester Ross Local Plan and the West Highlands and Island Local Plan. Highland Council have an intention to produce a new Local Development Plan for the West Highlands and Islands and this is due to commence in 2014.

A Parliamentary Order has been made to retain some elements of the adopted local plan until such time as the West Highland and Island Local Development Plan is adopted. Those retained elements of the Wester Ross Local Plan and the West Highlands and Island Local Plan are discussed further below.

The overall vision in the Highland-wide LDP has an overall vision which is as follows:

‘By 2030, Highland will be one of Europe’s leading regions. We will have created sustainable communities, balancing population growth, economic development and the safeguarding of the environment across the area, and have built a fairer and healthier Highlands’ (Chapter 5, paragraph 5.1)

In the accompanying proposals map Lochcarron is identified within the hierarchy of settlements as a 'Local Centre'. The majority of the wider area around Loch Carron and Stromeferry is identified as being of Local/Regional Importance as defined by Policy 57 where developments will be allowed if it can be satisfactorily demonstrated that they will not have an unacceptable impact on the natural environment, amenity and heritage resource. The Local/Regional importance is defined by a range of features, for example, Category B and C(S) Listed Buildings, Ancient Woodland, Wild Areas etc (as listed in Appendix 2). There are small pockets of land identified as being of National Importance within the area that relate to nationally designated sites as identified on Drawing 6.1 – General Environmental Constraints. Additionally the proposals map also identifies some land in the area as being 'Wider Countryside' and is therefore protected by Policy 36 – Development in the Wider Countryside' which has criteria against which development will be judged where it is out with Settlement Development Areas.

When addressing the West Highlands and Islands the LDP acknowledges the west coast's particular, peripheral and fragile nature and in setting a tailored and positive vision for the area one of the objectives is to 'be better connected' and to 'be a place of outstanding natural and cultural heritage' (Chapter 7). In the Vision and Spatial Strategy for the West Highland and Islands (Figure 2) Lochcarron is identified as a 'Larger life line village', improved rail connections are proposed along Loch Carron and the area around Kishorn is identified as a 'Renewable Resource'.

There are a range of general policies within the Highland-wide LDP that seek to safeguard the environment, address climate change and promote a healthier Highland; those that are relevant are listed below:

- Policy 51 – Trees and Development
- Policy 52 – Principle of Development in Woodland
- Policy 55 – Peat and soils
- Policy 56 – Travel
- Policy 57 – Natural, Built and Cultural Heritage
- Policy 58 – Protected Species
- Policy 59 – Other Important Species
- Policy 60 – Other Important Habitats and Article 10 Features
- Policy 61 – Landscape
- Policy 62 – Geodiversity
- Policy 63 – Water Environment
- Policy 64 – Flood Risk
- Policy 66 – Surface Water Drainage
- Policy 72- Pollution
- Policy 73 – Air Quality
- Policy 77 – Public Access

Wester Ross Local Plan (2006) and West Highland and Islands Local Plan (2010)

The study area is covered by two adopted Local Plans, the Wester Ross Local Plan covers the northern part of Loch Carron and the West Highland and Islands Local Plan extends just slightly north of Stromeferry.

The Highland Council adopted the Wester Ross Local Plan in June 2006 and the West Highland and Islands in September 2010. Only parts of the adopted local plans continue in force with the Highland-Wide Local Plan having updated/superseded the ‘general policies’ of the existing adopted Local Plans. The elements of the adopted Local Plans which remain in force are included in the Highland-wide Local Plan Appendix 7- Retention Schedule.

Wester Ross Local Plan

There is a part retention of the General Policies of the Wester Ross Local Plan limited to the provision of paragraph 8 (Development Factors) of Policy 4 – Other Development Considerations. Paragraph 8 (Development Factors) states:

‘Developers must take account of the details set out in the Proposals Maps. We will give particular consideration of the total effect of private water and sewerage systems.’ (page 14).

There are three retained proposals maps of relevance; Achintree, Strathcarron and Lochcarron. The Achintree proposals map, with relevance to Policy 4.8 (Development Factors) as detailed above states that footpath access to the hills beyond should be maintained. The Strathcarron proposals map with relevance to Policy 4.8 (Development Factors) states that; mature trees at the entrance to the village should be protected, that development to the west of the station should allow for access to the north for future possible development and that any development west of the station should include tree planting to enhance setting. The Lochcarron proposals map with relevance to Policy 4.8 (Development Factors) states that:

- The natural boundaries to the village formed by the burn and the golf course to the north and by woodland to the south should be respected.
- Views over Loch Carron afforded by open fields between Strome Road and the shoreline should be retained
- Development accessed from Croft Road may require additional passing places along the road to the satisfaction of the Roads Authority.
- Traffic calming measures will require to be put in place prior the granting of any new planning permission for further housing in the Kirkton Area.
- Development will require to connect into the existing or new public sewer with any necessary upgrading.

All of the proposals maps also refer to a ‘number of natural and cultural heritage features, as listed in Box 1, may occur within the SDA boundary’, however Box 1 is not included in the retained part of the Local Plan and this reference is now redundant.

West Highland and Islands Local Plan

The study area falls within the Skye and Lochalsh section of the Local Plan for which a strategy and vision is still retained. The Strategy states that ‘safeguarding and improving the physical identify of places’ is a key theme of good planning practice and that ‘improving accessibility and connectivity’ is an essential aim and theme for the Highlands, and Skye and Lochalsh in particular.

There are two retained proposals maps of relevance; South Strome and Achmore.

The South Strome proposals map identifies a 'Mixed Use' allocation at the Depot to the east of the existing pier at Old Macrooni Yard. Acceptable uses include community, business and tourism. The site allocation goes on to say that any development would require railway bridge improvement, contamination assessment, link to existing path network, exceptional siting and design quality, turning head, general needs parking, play space, visitor viewpoint. Furthermore it notes that the site may be at risk from flooding and a flood risk assessment will be required.

The Achmore proposals map identifies a number of site allocations for housing, community and business use. Two housing sites are identified, a 1.0 ha site 'South of Forrestry Houses' for 10 units and a 1.6ha site 'West of Former Council Housing' for 10 units. Under community uses a play area is identified and a car park for the Community Hall. There is an allocation for business use 'South of Achbeg Farm' which is 0.3ha.

6.2.5 *Planning Applications (pending or determined)*

Planning applications are addressed here as any pending or approved applications have the potential to impact on the route corridors.

A search of the wider area shows a large number of applications for alteration of dwelling houses and or erection of single or a small cluster of dwellings. These applications are numerous and it is therefore not practical to discuss them all here but as they are minor in nature it is not thought that they are likely to have any impact on the development of options.

There are currently a number of applications submitted around Attadale Estate for Hydro Schemes of varying sizes which if approved may influence the alignments of some of the On-line and Southern Corridor routes. The applications were all submitted in December 2012 and are pending consideration details are listed below:

- Construction of 1.35mw hydro-electric scheme, including erection of powerhouse and two bridges, installation of two intake weirs and formation of access track | Land At River Taodail Attadale Strathcarron (Application number 12/04685/FUL)
- Construction of 500kw hydro-electric scheme, including erection of powerhouse and two bridges, installation of three intake weirs and formation of access track | Strathan Attadale Estate Strathcarron (12/04686/FUL)
- Construction of 2.0mw hydro-electric scheme, including erection of powerhouse and two bridges, installation of two intake weirs and formation of access tracks | Land At Uisge Dubh Attadale Estate Strathcarron (12/04687/FUL)
- Construction of 1.0mw hydro-electric scheme, including erection of powerhouse and bridge, installation of intake weir and formation of access track | Land At Loch An Laoigh Attadale Estate Strathcarron (12/04688/FUL)

As the project progresses it will be necessary to monitor these applications and it is recommended as options are refined that discussions are held with Highland Council Planning Department.

6.2.6 *Assessment of Compliance*

All corridors support the NPF2 goal to have effect transport infrastructure that will facilitate sustainable economic growth and will seek to ensure that this lifeline route for rural communities in this part of the Highlands supports long term development. The options are also broadly consistent with SPP on rural development.

All options will support the vision for the West Highlands and Islands set out in the Highland-wide LDP to be 'better connected'.

However, for each corridor there are potential issues of non-compliance with individual policies of the Highland-wide LDP.

All of the corridors will result in an impact on the natural, built and cultural heritage to some extent, however at this stage survey work has not been carried out to determine the extent of the impact. Once the options are developed further and mitigation measures are proposed the impact may be reduced.

Table 6.2.1 shows the potential impacts relating to each option with reference to the Highland-Wide LDP.

Table 6.2.1 –Corridor Options Impacts with reference to the Highland-wide LDP Policies.

	Outer North Corridor	North Shore Corridor	On-line Corridor	Southern Corridor	Strome Narrows Crossing
Policy 51 – Trees and Development	Major impact on broadleaf semi-natural ancient woodland.	Moderate impact on broadleaf semi-natural ancient woodland.	Moderate/Major impact on broadleaf semi- natural ancient woodland.	Moderate/Major impact on broadleaf semi- natural ancient woodland.	Moderate/Major impact on broadleaf semi- natural ancient woodland.
Policy 52 –Principle of Development in Woodland	Major impact on broadleaf semi-natural ancient woodland.	Moderate impact on broadleaf semi-natural ancient woodland.	Moderate/Major impact on broadleaf semi- natural ancient woodland.	Moderate/Major impact on broadleaf semi- natural ancient woodland.	Moderate/Major impact on broadleaf semi- natural ancient woodland.
Policy 55 – Peat and soils	Minor/Moderate impact on peat and soils.	Minor/Moderate impact on peat and soils.	Minor/Moderate impact on peat and soils.	Minor/Moderate impact on peat and soils.	Minor/Moderate impact on peat and soils.
Policy 56 – Travel	Beneficial impact compared to existing situation.	Beneficial impact compared to existing situation.	Beneficial impact compared to existing situation.	Beneficial impact compared to existing situation.	Beneficial impact compared to existing situation.
Policy 57 – Natural, Built and Cultural Heritage	Major impact on Alt nan Carron SSSI. Moderate impact on Strome Castle Scheduled Monument and Major impact on Lochcarron Old Parish Church Scheduled	Moderate impact on Strome Castle Scheduled Monument	Major/Moderate impact on Loch Carron Marine Consultation Area. Major/Moderate impacts on Attadale SSSI. Major impact on Lochcarron Old		All options will have a moderate/major impact on the Loch Carron Marine Consultation Area. Major/ Moderate impact on Strome Castle Scheduled Monument.

	Outer North Corridor	North Shore Corridor	On-line Corridor	Southern Corridor	Strome Narrows Crossing
	Monument.		Parish Church Scheduled Monument for On-line 6 Option only.		
Policy 58 – Protected Species	Major impacts.	Major impacts.	Major/moderate Impacts.	Major/moderate Impacts.	
Policy 59 – Other Important Species	Major/moderate Impacts.	Major/moderate Impacts.	Major/moderate Impacts.	Major/moderate Impacts.	
Policy 60 – Other Important Habitats and Article 10 Features	Major/moderate Impacts.	Major/moderate Impacts.	Major/moderate Impacts.		
Policy 61 – Landscape	Moderate impact overall (localised major landscape and visual impacts).	Moderate impact overall (localised major landscape and visual impacts).	Minor impact (potential for localised significant negative impacts).	Moderate/minor Impact.	Major Impact.
Policy 62 – Geodiversity	Negligible/minor impact.	Negligible/minor impact.	Moderate/Major impact on Attadale SSSI.	Negligible/minor impact.	Negligible/minor impact.
Policy 63 – Water Environment	Minor/negligible impacts.	Minor/negligible impacts.	Minor/negligible impacts.	Moderate/minor impacts.	Minor/negligible impacts. Moderate/Major for Eastern Barrage option.
Policy 64 – Flood Risk	Negligible impacts.	Negligible impacts.	Negligible impacts.	Negligible impacts.	Negligible impacts

	Outer North Corridor	North Shore Corridor	On-line Corridor	Southern Corridor	Strome Narrows Crossing
					Moderate Major for Eastern Barrage option.
Policy 66 – Surface Water Drainage	Minor/negligible impacts.	Minor/negligible impacts.	Minor/negligible impacts.	Moderate/minor impacts.	
Policy 72- Pollution	Noise – minor impact.	Noise – Major/Moderate impact.	Noise- no impact.	Noise- no impact.	Noise – Minor/negligible impact.
Policy 73 – Air Quality	No impact.	Minor impact.	No impact.	No impact.	No impact.
Policy 77 – Public Access	Moderate impact on Core Paths and Rights of Way.	Moderate/minor impact on Core Paths and Rights of Way.	Moderate/minor impact on Core Paths and Rights of Way.	Moderate/minor impact on Core Paths and Rights of Way.	Moderate/minor impact on Core Paths and Rights of Way.

6.2.7 *Recommendations for further work*

Should a STAG Part 2 Appraisal/DMRB Stage 2 Report be progressed following this study, the assessment should be updated taking into account any updates to the Development Plan and other policy documents. A search should be carried out for any major approved planning applications within the area.

6.3 Nature Conservation

6.3.1 *Introduction*

This section describes the assessment of the effects of the four developed route corridors on ecology and nature conservation features. A desk study has been undertaken to identify the presence and status of ecological habitats, flora and fauna of conservation value. In addition, the value of the nature conservation features (ecological receptors) has been identified and potential effects and approaches to mitigation assessed.

6.3.2 *Methodology*

The assessment has been carried out using the STAG criteria and guidance provided in DMRB, see section 6.1.2 for further details.

The assessment has been undertaken in accordance with the requirements of DMRB Volume 11, Section 3, Part 4 and best practice guidance for ecological assessment including the Guidelines for Ecological Impact Assessment in the United Kingdom (IEEM, 2006).

A study area of 500m was established around the corridors (up to 2km for statutory designations) to ensure that adequate coverage would be available to inform the assessment of the emerging route options. The level of data available for the study area varies between nature conservation features. A lack of information does not confirm absence of a feature and may instead reflect lack of available data.

6.3.3 *Legislation*

This assessment has been undertaken giving full consideration to relevant European and national legislation/regulations, in particular:

- Conservation of Natural Habitats and Wild Flora and Fauna (the Habitats Directive, 1992) (92/43/EEC) (as amended);
- Conservation of Wild Birds (the Birds Directive, 1979) (79/409/EEC);
- Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) (Habitats Regulations);
- Wildlife and Countryside Act 1981 (as amended) (WCA);
- Nature Conservation (Scotland) Act (NCSA) 2004;
- Wildlife and Natural Environment (Scotland) Act 2011 (WANE);
- Environmental Protection Act (1990); and
- The UK Biodiversity Action Plan (UK BAP) and Local Biodiversity Action Plans (LBAPs).

6.3.4 *Desk Study*

A desk study was undertaken to identify any statutory and non-statutory designated sites of nature conservation interest and to obtain information on the occurrence of protected species and / or species of nature conservation interest. The desk study comprised a review of literature and web-based resources and consultation, as described below.

6.3.5 *Consultations*

Consultations to date have largely taken the form of workshops, involving statutory, non-statutory conservation organisations and members of the local community etc. To date only limited information relating to the presence of statutory designated receptors, has been made available for this study, with a number of records relating to protected species having been obtained from the Nature Conservancy Council for Scotland (NCCS), though they are dated February 1992. Additional general information has also been received from Scottish Natural Heritage (SNH) relating to a number of protected sites / species known to occur within the study corridors. See section 6.1.5 for more details.

6.3.6 *Web Resources*

The following resources were reviewed:

- The National Biodiversity Network (NBN) gateway website;
- The Multi-Agency Geographical Information for the Countryside website;
- Forestry Commission Scotland Map Viewer;
- Joint Nature Conservation Committee (JNCC) website ;
- SNH Information Service; and
- UK Biodiversity Action Plan (UK BAP) website.

Ordnance Survey maps were also studied to identify potential habitat areas of nature conservation importance within the study area.

6.3.7 *Evaluation of Nature Conservation Features*

The evaluation (or assessment of value / importance) of nature conservation features (ecological receptors) was undertaken taking into consideration professional judgement, advice provided by the DMRB Interim Advice Note 130/10 'Ecology and Nature Conservation: Criteria for Impact Assessment' (Highways Agency et al., 2010) and taking cognisance of guidance published by the Institute of Ecology and Environmental Management (IEEM, 2006). The separate criteria to assess the value of nature conservation features are set out in Table 6.3.1 below.

Table 6.3.1 Ecological Feature Evaluation

Ecological Importance	Criteria
International or European Value	Natura 2000 sites including: Sites of Community Importance (SCIs); Special Protection Areas (SPAs); potential SPAs (pSPAs); Special Areas of Conservation (SACs); candidate or possible SACs (cSACs or pSACs); and Wetlands of International Importance (Ramsar sites). Biogenetic Reserves, World Heritage Sites and Biosphere Reserves. Areas which meet the published selection criteria for those sites listed above but which are not themselves designated as such. Resident, or regularly occurring, populations of species which may be considered at an International or European level where: the loss of these populations would adversely affect the conservation status or distribution of the species at this geographic scale; or the population forms a critical

Ecological Importance	Criteria
	part of a wider population at this scale; or the species is at a critical phase of its life cycle at this scale.
UK or National Value	<p>Designated sites including: Sites of Special Scientific Interest (SSSIs) and National Nature Reserves (NNRs).</p> <p>Areas which meet the published selection criteria e.g. JNCC (1998) for those sites listed above but which are not themselves designated as such.</p> <p>Areas of key/priority habitats identified in the UK Biodiversity Action Plan (BAP), including those published in accordance with Section 41 of the Natural Environment and Rural Communities Act (2006) and those considered to be of principal importance for the conservation of biodiversity.</p> <p>Areas of Ancient Woodland e.g. woodland listed within the Ancient Woodland Inventory (AWI).</p> <p>Resident, or regularly occurring, populations of species which may be considered at an International, European, UK or National level where: the loss of these populations would adversely affect the conservation status or distribution of the species at this scale; or the population forms a critical part of a wider population at this scale; or the species is at a critical phase of its life cycle at this scale.</p>
Regional Value	<p>Areas of key/priority habitats identified in the Regional BAP (where available); areas of key/priority habitat identified as being of Regional value in the appropriate Natural Area Profile (or equivalent); areas that have been identified by regional plans or strategies as areas for restoration or re-creation of priority habitats.</p> <p>Resident, or regularly occurring, populations of species which may be considered at an International, European, UK or National level and key/priority species listed within the HABAP where: the loss of these populations would adversely affect the conservation status or distribution of the species at this scale; or the population forms a critical part of a wider population; or the species is at a critical phase of its life cycle.</p>
County or Unitary Authority Area Value	<p>Designated sites including: Sites of Nature Conservation Importance (SNCIs); and Local Nature Reserves (LNRs) designated in the county or unitary authority area context.</p> <p>Areas which meet the published selection criteria for those sites listed above but which are not themselves designated as such.</p> <p>Areas of key/priority habitats identified in the Local BAP; and areas of habitat identified in the appropriate Natural Area Profile (or equivalent).</p> <p>Resident, or regularly occurring, populations of species which may be considered at an International, European, UK or National level where: the loss of these populations would adversely affect the conservation status or distribution of the species across the County or Unitary Authority Area; or the population forms a critical part of a wider population; or the species is at a critical phase of its life cycle.</p>
Local Value	<p>Designated sites including: Local Nature Reserves (LNRs) designated in the local context.</p> <p>Trees that are protected by Tree Preservation Orders (TPOs).</p>

Ecological Importance	Criteria
	Areas of habitat; or populations/communities of species considered to appreciably enrich the habitat resource within the local context (such as veteran trees), including features of value for migration, dispersal or genetic exchange.

6.3.8 *Baseline*

This section provides a description of the baseline conditions over the area which could be affected by any of the four corridors.

Statutory Designated Sites

The following designated sites occur within the study area and are shown in Drawing 6.2- Nature Conservation Designations.

Rassal SSSI & SAC - Designated biological features:

- Mixed woodland on base-rich soils associated with rocky slopes;
- Base-rich fens;
- Hard-water springs depositing lime;
- Plants in crevices on base-rich rocks;
- Limestone pavements;
- Alpine and subalpine calcareous grasslands; and
- Mountain willow scrub.

Coille Mhor SSSI & SAC - Designated biological features:

- Western acidic oak woodland.

Rassal National Nature Reserve - Designated biological features:

- Upland mixed ash woodland.

Slumbay Island SSSI - Designated site for its geological features:

- Structural and metamorphic geology: Moine.

Attadale SSSI - Designated site for its geological features:

- Structural and metamorphic geology: Moine.

Allt nan Carnan SSSI - Designated biological features:

- Upland birch woodland.

Carn a' Bhealaich Mhoir SSSI - Designated site for its geological features:

- Structural and metamorphic geology: Moine.

Monar Forest SSSI - Designated biological features:

- Upland habitat assemblage.

Loch Carron Marine Consultation Area - Designated a Marine Consultation Area, although this is not a statutory designation, the designation does recognise the importance and diversity of the benthic habitats and species found within this area.

Marine Protected Area (MPA) search features recorded in Loch Carron include burrowed mud, horse mussel beds, kelp and seaweed communities on sublittoral sediments and tide-swept algal communities. Common skate and ocean quahog have also been recorded.

It was also noted that there are aggregations of flameshell beds on the northern side of the narrows.

Non-statutory Designated Sites

No locally designated sites of interest for nature conservation or woodlands listed on the AWI (SNH, 2008) are located within the study area.

Biodiversity Action Plan

The Stromeferry study area lies within both Skye and Lochalsh and the Wester Ross Biodiversity Action Plan areas. In brief the focus of the two action plans is to ensure that all habitats are managed in a sustainable manner that takes account of their biodiversity interests. To create more opportunities for individuals, communities and agencies to take action for biodiversity by promoting existing projects, securing additional support for new initiatives that help maintain or improve biodiversity, and by publicising existing sources of funding and advice.

Other objectives relate to raising awareness of the biodiversity of area amongst local people, visitors, funding organisations and policy makers by developing quality education at all levels, and by improving access to information about important species and habitats and their management requirements. Whilst also establishing a future mechanism to help individuals, community groups, businesses and partners to deliver the objectives of the two biodiversity action plans, monitor progress and share information on biodiversity matters.

As a means of implementing the biodiversity plans a list of broad habitat types and priority species has been compiled and work programmes developed. The habitat groups are:

- Sea and Coast;
- River, Loch & Wetland;
- Croft and Farm Land;
- Forest and Woodland;
- Mountain, Moorland and Grassland; and
- The Built Environment.

Note the headings vary slightly within the two biodiversity action plans.

Terrestrial Habitats

A review of satellite imagery and OS mapping indicates that to the south and east of Loch Carron is dominated by coniferous plantation woodland of varying ages, interspersed with areas of semi natural ancient woodland and broadleaf woodland of plantation origin, particularly in areas adjacent to Loch Carron.

Upland habitats include heath, blanket bog and exposed rock outcrops, it is also likely that other habitat types are present including acid grassland and bracken. Numerous minor watercourses occur in this area with their associated bogs and flushes, several larger waterbodies (lochans) are also present.

On the flatter ground at the bottom of the glens and intermittently along Loch Carron, there is evidence of agricultural improvement for grazing pasture. The grasslands appear to vary consisting of areas of marshy grassland (rush dominated) and semi-improved grasslands. Other grassland types may also occur.

Similar habitat features also occur to the north and west of Loch Carron; coastal habitats fringing Loch Carron include gravel / cobble foreshore, alluvial deltas also occur in several locations, associated with the sediment discharge from watercourses which feed into the Loch, other habitat features include steep areas of rocky foreshore and salt marsh, which principally occurs at the far north east end of the Loch.

Plants of Conservation Interest

There is only one record relating to the study area on the National Biodiversity Network (NBN) database pertaining to a local priority species, listed in both the Skye and Lochalsh and the Wester Ross Biodiversity Action Plans; namely the Small-white orchid *Pseudorchis albida*. A record for the Lesser Butterfly-orchid *Platanthera bifolia* is also held on the NBN database and relates to the study area.

Invasive Non-Native Plants

No records relating to the presence of Rhododendron *Rhododendron ponticum*, Japanese knotweed *Fallopia japonica* and Giant hogweed *Heracleum mantegazzianum* were obtained from the NBN database for study area.

Aquatic Habitats

Loch Carron

Central to the study area Loch Carron is a designated a Marine Consultation Area, although this is not a statutory designation, the designation does recognise the importance and diversity of the benthic habitats and species found within this area.

The Scottish Government Locational Guidelines, designated on the basis of Marine Scotland Science (MSS) predictive modelling to estimate nutrient enhancement and benthic impact in sea lochs or similar water bodies supporting aquaculture. Loch Carron has been designated a category 3 grade (1 – 3) Combined 'nutrient enhancement' and 'benthic impact' indices, the category 3 designation indicates that the current nutrient inputs are within the carrying capacity of the waterbody.

The seabed of the Loch largely consists of sublittoral mud, coarse sediments, mixed sediments and low energy rock, and totals an area of approximately 25.58 sq km.

Known activities and developments within the Loch Carron area include a harbour at Plockton and anchorages throughout the sea loch. There is some creel fishing although the extent of this activity is not well known because of a lack of data on fishing activity. There is a seabed cable at Strome Narrows.

Marine Protected Area (MPA) search features recorded in Loch Carron include burrowed mud, horse mussel *Modiolus modiolus* beds, kelp and seaweed communities on sublittoral sediments and tide-swept algal communities. Common skate *Dipturus batis* and ocean quahog *Arctica islandica* have also been recorded.

It was also noted that there are aggregations of flameshell *Limaria hians* beds on the northern side of the narrows.

River Carron

The River Carron Restoration Project was formally established in August 2009 via Inverness College UHI. The main objective of the project is to increase wild North Atlantic Salmon *Salmo salar* and Sea Trout *Salmo trutta* populations in the River Carron, and thus reinstating the river as a viable fishery.

Protected Species

Except for records collated by the NCCS dated February 1992, no other records relating to the presence of any protected species within the study area have been provided by consultees; however, a list of species which are known to occur or likely occur within the study area has been compiled below, following a review of the NBN database and other sources including professional experience.

Mammals

Otter (*Lutra lutra*)

Otters are considered to be a widespread species in Scotland, with the west coast area of the Highlands being considered a traditional stronghold. The NBN database contains several records relating to the presence of otter within the study corridors; additionally, previous studies relating to otters by the author within the locality, revealed a high level of otter activity with refuges being recorded both within coastal areas and along adjacent freshwater habitats.

Otters are known to utilise minor watercourses as a means of habitat connectivity, moving from coastal habitats to inland waterbodies, in order to exploit seasonal food resources.

Bats

No records relating to the presence of bats are held by the NBN database; however, a number of bat species including Common pipistrelle *Pipistrellus pipistrellus*, Soprano pipistrelle *Pipistrellus pygmaeus*, Brown long-eared bat *Plecotus auritus* and Daubenton's bat *Myotis daubentonii* are considered to be widespread in the Highlands of Scotland.

It is therefore considered highly likely that a number of the above species will occur within the study corridors, roosting in trees and built structures including bridges. Foraging habitat will include woodland edge, waterbodies and coastal foreshore habitats.

Badger (*Meles meles*)

No records relating to the presence of badger are held by the NBN database; however, badgers are considered to be widespread in Scotland, though their population structure is believed to be more fragmented within the Highlands of Scotland; however, it is considered highly likely that badger social groups will occur within the wooded areas associated with the study corridors, particularly within the Glen Udalain area, (source SNH).

Pine Marten (*Martes martes*)

The NBN database contains several records relating to the presence of pine marten within the study corridors. Given that favourable habitat in the form of both broadleaf and conifer woodland is present throughout the study corridors, it is likely that pine marten can be considered to be widespread; though density will tend to be highest in areas with semi-natural vegetation.

Red Squirrel (Sciurus vulgaris)

No records relating to the presence of red squirrel are currently held by the NBN database for the study areas, the far north west of Scotland is not considered to be a core population area for the species. However, given the presence of suitable habitat within the area in the form of both broadleaf and conifer woodland their presence cannot be totally ruled out.

Water Vole (Arvicola amphibius)

Water vole has been recorded on the western side of Loch Carron (NBN database), Uisge Dubh and Strathan (Source SNH); today water vole populations are often considered to be fragmented, due largely to habitat degradation and predation from the introduced American Mink *Mustela vison*.

Given the likelihood that similar habitat types to where the species was recorded will occur within the study corridors, further occurrences are considered likely.

Wildcat (Felis sylvestris)

No records relating to wildcat within the study area were noted during the desk study; however, several records pertaining to the presence of the species exist for immediately outwith the route corridors; given the extent to which the animal ranges it is considered likely that *Felis sylvestris* will occur within suitable habitats present within the study corridors.

Birds

NCCS and SNH have indicated that the following Annex 1 (Birds Directive 1979) and Schedule 1 (Wildlife & Countryside Act 1981 (As Amended)) species are likely to occur within sections of the study corridors:

- Peregrine falcon *Falco peregrinus*;
- Hen harrier *Circus cyaneus*;
- Short-eared owl *Asio flammeus*;
- Merlin *Falco columbarius*;
- Golden eagle *Aquila chrysaetos*;
- Red-throated diver *Gavia stellata*;
- Black-throated diver *Gavia arctica*;
- Greenshank *Tringa nebularia*;
- Golden plover *Pluvialis apricaria*;
- Wood sandpiper *Tringa glareola*; and
- Ruff *Philomachus pugnax*.

Other bird species of conservation interest including Spotted Flycatcher *Muscicapa striata*, Ring Ouzel *Turdus torquatus*, Wood Warbler *Phylloscopus sibilatrix* and Northern Lapwing *Vanellus vanellus* etc. have been recorded breeding within the study corridors.

Amphibians

No records of amphibians were obtained from the consultations, though the NBN database holds relevant records of the following:

- Common frog *Rana temporaria*; and
- *Triturus* species.

Reptiles

No records of reptiles were obtained from the consultations, though the NBN database holds relevant records of the following:

- Common lizard *Zootoca vivipara*; and
- Slow worm *Anguis fragilis*.

Fish

No records relating to fish were obtained from the consultations, though the NBN database holds relevant records of the following:

- European eel *Anguilla anguilla*;
- Atlantic salmon;
- Brown / Sea trout;
- Atlantic cod *Gadus morhua*;
- Ling *Molva molva*; and
- Plaice *Pleuronectes platessa*.

In-addition to the above species Horse mussel, Flameshell, Skate, Ocean quahog and various seaweed communities have also been recorded in Loch Carron.

6.3.9 *Evaluation of Nature Conservation Features*

An evaluation of features comprising designated sites, habitats and species in respect to their nature conservation value is presented in Table 6.3.2 (sites and habitats) and Table 6.3.3 (species). Value was assessed using methods detailed in Table (6.3.1) above. Where the desk study provided no specific evidence for the current presence of features these were excluded from the evaluation.

Information for justification of the ecological value is taken from NCC accounts for UK BAP list of priority habitats and from the UK BAP priority species list.

Table 6.3.2 - Ecological Importance of Nature Conservation Features (Sites and Habitats) Identified within the Study Area

Nature Conservation Feature	Ecological Importance	Justification
Designated Sites		
Rassal SSSI & SAC	International or European Value	International designated site for its biological features which is afforded protection under national legislation. Biological features: Mixed woodland on base-rich soils associated with rocky slopes; Base-rich fens; Hard-water springs depositing lime;

Nature Conservation Feature	Ecological Importance	Justification
		Plants in crevices on base-rich rocks; Limestone pavements; Alpine and subalpine calcareous grasslands; and Mountain willow scrub.
Coille Mhor SSSI & SAC	International or European Value	International designated site for its biological features which is afforded protection under national legislation. Biological features: Western acidic oak woodland.
Rassal National Nature reserve	National	National designated site for its biological features which is afforded protection under national legislation. Biological features: Upland mixed ash woodland.
Slumbay Island SSSI	National	National designated site for its geological features which is afforded protection under national legislation. Geological features: Structural and metamorphic geology: Moine.
Attadale SSSI	National	National designated site for its geological features which is afforded protection under national legislation. Geological features: Structural and metamorphic geology: Moine.
Allt nan Carnan SSSI	National	National designated site for its biological features which is afforded protection under national legislation. Biological features: Upland birch woodland.
Carn a' Bhealaich Mhoir SSSI	National	National designated site for its geological features which is afforded protection under national legislation. Geological features: Structural and metamorphic geology: Moine.
Monar Forest SSSI	National	National designated site for its biological features which is afforded protection under national legislation. Biological features: Upland habitat assemblage.
Loch Carron Marine Consultation Area	National	Designated a Marine Consultation Area, although this is not a statutory designation, the designation does recognise the importance and diversity of the benthic habitats and species found within this area. Marine Protected Area (MPA) search features recorded in Loch Carron include burrowed mud, horse mussel beds, kelp and seaweed communities on sublittoral sediments and tide-swept algal

Nature Conservation Feature	Ecological Importance	Justification
		communities. Common skate and ocean quahog have also been recorded. It was also noted that there are aggregations of flameshell beds on the northern side of the narrows.
Terrestrial Habitats		
Woodland, Broadleaf Semi-natural Ancient	National	National priority habitat in the UK BAP and LABAP habitat. This habitat type occurs in discrete locations throughout the study area and is likely to contain plant and animal communities of significant conservation interest.
Woodland, Broadleaf Long Established Plantation Origin	Authority	Key habitat type with a restrictive distribution within the study area, may possess characteristics in terms of plant and animal communities similar to semi-natural woodlands according to proximity.
Woodland, Coniferous Plantation	Local	Large areas occur within the study area, such habitat type may be utilised for foraging and refuge sites by animals such as badger, pine marten, red squirrel and raptors etc.
Grasslands, Agriculturally Improved	Local	This habitat type occurs within the study area particularly along the edge of Loch Carron and within adjacent glens. This habitat may be utilised by foraging animals such as badgers and raptors.
Upland Habitats	Authority / Local	Habitats such as upland heathland, blanket bog, and flushes are National priority habitats in the UK BAP and are LABAP short-listed habitats. However, the extent, composition and quality of these habitats within the study area are currently unknown.
Aquatic Habitats		
Fresh Waterbodies, Lochs, Rivers and Burns	Authority / Local	Fresh water features are national priority habitats in the UK BAP and are LABAP priority habitats. Such features are important for fish, aquatic plant and invertebrate communities, as well as providing foraging and refuges for otters and water vole etc.
Marine Waterbodies, Loch	National	Marine Protected Area (MPA) search features recorded in Loch Carron include burrowed mud, horse mussel beds, kelp

Nature Conservation Feature	Ecological Importance	Justification
Carron		and seaweed communities on sublittoral sediments and tide-swept algal communities. Common skate and ocean quahog have also been recorded. It was also noted that there are aggregations of flameshell beds on the northern side of the narrows.

Table (6.3.3) Ecological Importance of Nature Conservation Features (Species) Identified within the Study Area

Nature Conservation Feature	Ecological Importance	Justification
Mammals		
Otter	National	National priority species and LABAP priority species. Historic persecution has led to numbers or range having declined over 50%. Otters are protected under the Habitat Regulations and the NCSA.
Bats	National	National priority species and LABAP priority species. Threat to species from roost and foraging habitat loss / fragmentation. Bats are protected under the Habitat Regulations and the NCSA.
Badger	Authority	Badgers are protected under the PBA, the NCSA and the WANE.
Pine marten	Authority	National priority species. Threat to species from persecution and habitat loss / fragmentation. Pine martens are protected under the Habitat Regulations and the WCA.
Red squirrel	Regional	National priority species and LABAP priority species. This species is currently under threat from grey squirrel expansion and squirrel pox virus epidemics. Red squirrels are protected under the WCA and NCSA.
Water vole	Regional	National priority species and LABAP priority species. This species is currently under threat from mink expansion and habitat loss / fragmentation. Water voles are protected under the WCA and NCSA.
Wild cat	National	National priority species and LABAP priority species. Historic persecution has led to numbers or range having significantly declined; also breeding with domestic cats

Nature Conservation Feature	Ecological Importance	Justification
		is considered to be a significant threat to the viability of the species. Wild cats are protected under the Habitat Regulations and the NCSA.
Birds		
Golden eagle	National	LABAP priority species. The golden eagle is afforded the highest degree of legal protection under the Schedule 1 of the WCA. The NCSA provides additional protection for the golden eagle in Scotland.
Hen harrier	National	National priority species and LABAP priority species. The hen harrier is afforded the highest degree of legal protection under the Schedule 1 of the WCA for breeding birds and Birds Directive for migratory birds. The NCSA provides additional protection for the species in Scotland.
Merlin	Regional	LABAP priority species. The merlin is afforded the highest degree of legal protection under the Schedule 1 of the WCA for breeding birds and Birds Directive for migratory birds. The NCSA provides additional protection for the species in Scotland.
Red-throated diver	Regional	LABAP priority species. The red-throated diver is afforded the highest degree of legal protection under the Schedule 1 of the WCA for breeding birds and Birds Directive for migratory birds. The NCSA provides additional protection for the species in Scotland.
Black-throated diver	National	National priority species and LABAP priority species. The black-throated diver is afforded the highest degree of legal protection under the Schedule 1 of the WCA for breeding birds and Birds Directive for migratory birds. The NCSA provides additional protection for the species in Scotland.
Short-eared owl	Regional	LABAP priority species. The short-eared owl is afforded legal protection under the Schedule 1 of the WCA for breeding birds and Birds Directive for wintering birds. The NCSA provides additional protection for the species in Scotland.

Nature Conservation Feature	Ecological Importance	Justification
Greenshank	Regional	LABAP priority species. The greenshank is afforded the highest degree of legal protection under the Schedule 1 of the WCA for breeding birds and Birds Directive for migratory birds. The NCSA provides additional protection for the species in Scotland.
Golden plover	Regional	LABAP priority species. The golden plover is afforded the highest degree of legal protection under the Schedule 1 of the WCA for breeding birds and Birds Directive for migratory birds. The NCSA provides additional protection for the species in Scotland.
Wood sandpiper	Regional	LABAP priority species. The wood sandpiper is afforded the highest degree of legal protection under the Schedule 1 of the WCA for breeding birds and Birds Directive for migratory birds. The NCSA provides additional protection for the species in Scotland.
Fish		
Atlantic salmon	Regional	National priority species and LABAP priority species. Salmon is listed in Annex II of the EC Habitats Directive and are protected under the Habitats Regulations and the Salmon and Freshwater Fisheries Act.
European eel	Regional	National priority species. Currently there is evidence of decline relating to this species although little evidence exists of a reduction in geographical range.
Brown / Sea trout	Regional	National priority species and LABAP priority species. A number of populations are known to be under threat from habitat deterioration and the stocking of fish for recreational purposes.
Skate	Regional	National priority species, the skate is believed to be in severe decline, largely due to targeted and non-targeted fishing. Locations where common skate gather to reproduce and feed should be protected to aid in population recovery.

6.3.10 *Options Assessment***Future Baseline Conditions**

It is likely that the area would remain largely unchanged in the absence of the proposed scheme. No rapid changes to any species would be anticipated in the absence of development, although trees and woody vegetation could mature to provide more suitability for bats and breeding birds respectively. Climate change may cause a slow change in both plant and animal communities but this would be part of a larger scale (international) trend, not just a local phenomenon.

The above considerations do not discernibly alter the current baseline for the purposes of Stage 1 ecological assessment.

Potential Environmental Effects

The range of potential effects of road schemes and their significance on nature conservation would depend on the individual circumstances of each scheme/option. However, it is possible to identify a number of main areas of concern, which have general applicability (Highways Agency et al., 1993). These include:

- Direct mortality;
- Habitat loss;
- Habitat fragmentation and isolation;
- Disturbance; and
- Pollution and other indirect impacts (where applicable).

Construction**Effects Common to All Corridors**

Certain potential effects are common to some or all corridors, although the exact locations and extent may vary.

For all corridors there is the potential for the works to result in the death or injury of protected species which occur within the study area, in the absence of mitigation.

For all corridors, effects on aquatic habitats may lead to negative effects on marine and freshwater species present with in Loch Carron, River Carron and catchment, and on otter populations which utilise the waterbodies for refuges and foraging. This could be significant during the process of constructing structures within or adjacent to such waterbodies.

Outer North Corridor (ONC)*Major Effects*

The Outer North corridor consists of one route (ON3) option which commences south of the settlement of Achmore on the existing A89 trunk road prior to extending in a northerly direction via an offline section through woodland and open country prior to spanning the Strome Narrows, continuing north a second off-line section cuts through further woodland and open country before connecting with the existing A 896, the On-line section then heads south east towards the settlement of Lochcarron; approximately a kilometre north of Lochcarron a third

offline section leaves the trunk road and traverses the open hillside and woodland until reaching Strathcarron Junction where the routes re-joins the A896 trunk road.

Major effects relating to the Outer North include the likely destruction, fragmentation and disturbance of designated habitats within the Allt nan Carnan SSSI, similar effects are also likely to occur within several areas of broadleaf semi-natural ancient woodland.

Due to the requirement to span the area known as the narrows of Loch Carron and depending upon the design of the structure, potential to cause destruction, fragmentation and disturbance to benthic habitats within the Loch Carron MCA is considered likely.

Major effects relating to protected species include bats, badger and wildcat (if present) due to the likely loss of woodland habitat.

Moderate Effects

Associated moderate effects also considered likely include the loss of refuge sites, loss and fragmentation of foraging habitats and disturbance relating to several protected species including otter, birds and fish.

Night-time working during construction could lead to disturbance to bats, badger, pine marten and otter.

North Shore Corridor (NSC)

Major Effects

The North Shore corridor consists of three potential routes N2, N6 & N9, with N2 initially following the same course as ON3 up to the narrows, whilst N6 is likely to cross the Loch further east after deviating through woodland via an offline section from the A890. Both route options converge at Stromemore and follow an On-line route to Strome Wood, where the N2 option transverses through woodland and open hillside in a north easterly direction before joining the A896 On-line section to Lochcarron. The N6 option follows an existing minor road to Lochcarron where both options converge and continue On-line via the A896. N9 forms a northern bypass of Lochcarron.

Major effects relating to the North Shore corridor routes include the crossing of the narrows at Loch Carron, depending upon the design of the structure there is potential to cause destruction, fragmentation and disturbance to benthic habitats within the Loch Carron MCA.

Moderate Effects

Associated moderate effects relating to both the N2, N6 & N9 routes are likely include the destruction, fragmentation and disturbance to broadleaf semi-natural ancient woodland, which is also likely to affect refuges sites and foraging habitats for bats, birds and wild cat etc. Degradation of aquatic habits affecting fish is also considered likely.

Night time working during construction could lead to disturbance to bats, badger, pine marten and otter.

The N2 & N9 route options are considered to possess the highest potential in terms of detrimental impacts to both habitats and protected species, due to the greater length of offline sections associated with this option.

On-line Corridor (OC)

Major Effects

The On-line route corridor is made up of seven options; all except 03 and 06 broadly follow the current A890 trunk road which extends north from Achmore in a north easterly direction along the southern shoreline of Loch Carron.

Whilst route 04 the do minimum option, the existing road is maintained as it currently is, would have the least impact upon conservation interests of all the other route options and corridors (preferred option), the do minimum option would not address the problems associated with the current investigation.

Route 01 is regarded as the do minimum plus option, which involves the upgrade of the current single track road with passing places to two lanes along the whole route, to facilitate the extra lane would involve the excavation of large volumes of rock, which is likely to impact upon the Attadale SSSI.

Route 02 is considered to be the option with the greatest potential for impacts to ecological features, as it would involve the construction of a 2 kilometre long causeway / cantilever structure within Loch Carron MCA, major affects would likely include destruction, fragmentation and disturbance to benthic habitats.

Option 03 consists of the construction of an offline 2 kilometre long tunnel, which will link into one of the other proposed route options within this corridor. Although this section of the On-line route is considered to be favourable in terms of ecological impacts, it is likely that such a tunnel would generate a vast amount of spoil from the excavation, which will have stored on site prior to disposal.

The proposed option 05 consists of a shared road / rail track some 2 kilometres long, which will run along south shoreline of Loch Carron. Too little information is available in relation to the likely design of such a feature to allow an informed impact assessment to be made; however, if new bridges or viaducts would be required in order to facilitate this option, the associated impacts to the Loch Carron MCA benthic habitats are likely to be significant, though the extent is presently unclear. Impacts to the Attadale SSSI are also considered likely.

Route option 06 provides an alternative link between Attadale and Kirkton, which can be added to other route options. The major effect upon ecological features associated with this route section involves the destruction and fragmentation of salt marsh habitat, which the road will dissect if constructed; degradation of aquatic habits as consequence of diffuse contaminants is also considered likely.

The proposal relating to route option 07 consists of the construction of an extensive avalanche shelter extending some 2 kilometres. The provision of such a large structure would require a significant civil engineering input with extensive modification to the habitats adjacent to the On-line route, including likely impacts to the Attadale SSSI.

Moderate Effects

Moderate effects associated with all route options except 04 (do minimum), include the destruction, fragmentation and disturbance to areas of broadleaf semi-natural ancient woodland, which is also likely to affect refuges sites and foraging habitats for otters, bats, birds and wild cat etc. Degradation of aquatic habits affecting fish is also considered likely.

Night time working during construction could lead to disturbance to bats, badger, pine marten and otter.

Southern Corridor (SC)

The Southern corridor consists of four route options S1, S3 and S5b, which provide local alternative options to S4 the main route under consideration.

Route option S4 for the most part is an offline option incorporating areas of forestry plantation and upland habitats. The route extends in a north easterly direction from the A890 trunk road into the Glen Udalain valley and Loch nam Breac Mora prior to joining up with the current A890 near Attadale then On-line to Strathcarron.

Both the S1 and S3 route options extend from the existing A890 north of the main S4 alignment via an offline section through conifer plantation woodland, eventually linking into the main route.

S5b extends the route alignment to the north side of the Attadale valley; this offline section joins the main route option north west of Maman Hill.

Major Effects

Major effects relating to the Southern corridor concerns the likely impacts associated with constructing the majority of the route offline through montane habitats, plantation woodland and the need to cross a number of watercourses. Additionally, sections (S4) of the proposed road would occur in close proximity to several open waterbodies. Effects are likely to include disturbance, sedimentation and run-off.

Moderate Effects

Associated moderate effects considered likely include destruction, fragmentation and disturbance to areas of broadleaf semi-natural ancient woodland, extensive areas of conifer plantation and upland habitats, such impacts are also likely to affect refuges sites and foraging habitats for otters, bats, pine marten, wild cat and birds. Degradation of aquatic habits affecting fish is also considered likely.

Night time working during construction could lead to disturbance to bats, badger, pine marten and otter.

Operation

Operational effects are considered likely to apply to all route corridors, though the magnitude of the impact upon receptors is likely to be greater within offline corridors and those which span or run in close proximity to waterbodies.

Likely effects associated with the operation of the road scheme are considered to be:

- Water quality impacts due to contaminated surface water run-off, especially in sections of the route occurring within close proximity to watercourses / waterbodies;
- Increased risk of road mortality to protected species including badger, otter, bats and birds etc. where habitats have become fragmented and possibly due to increased road speeds; and
- Disturbance to protected species not habituated to vehicle traffic, enhanced noise levels and increased human presence; particularly within areas where offline sections are constructed.

6.3.11 *Overall Options Assessment of Construction and Operation Effects*

Assessment methodology for tables 6.3.4 to 6.3.17

In instances where individual route options are likely to vary considerably in terms of their potential impact upon features of ecological importance, separate assessments have been undertaken within each corridor.

On-line corridor route option 04, which relates to maintaining the existing road, has not been assessed as it has been assumed that such an option would maintain the status quo.

Route options ON3, N2, N6 & N9 are intrinsically linked to a crossing option (Strome Narrows); therefore, the impacts upon ecological receptors associated with each crossing option must also be taken into consideration. Likewise a number of other local route options i.e. On-line 03 and 06 cannot be assessed in isolation as they too will be linked to other option(s).

Due to the uncertainty associated with the demarcation of potential impacts upon terrestrial habitats associated with general road construction activities attributable to the route options and those associated with the crossing options i.e. bridges and the tunnel, all such impacts have been assigned to the appropriate route corridor option.

As a means of assessing the likely ecological impacts associated with each route option a significance index has been applied to each Route Corridor and Crossing Option. 'Significance Index' is a qualitative and indicative comparison of the level of overall impact of each option, from the simple allocation of 1, 2 or 3 etc. to each option (Minor equates to 1-2, Moderate equates to 3-4, Major equates to 5-6 and Severe equates to 7-8),which allows the option scores to be summed for each scheme. 'Lowest impact' overall may still entail major impacts, e.g. on some protected species which require further assessment. There is not a linear relationship between the scores (e.g. an option, which scores 12, is not necessarily 'twice as bad' as an option, which scores 6).

Table 6.3.4 - Summary of Scheme Crossing Option Western Bridge – ON3 & N2 with estimated significance

Scheme Options	Receptor & Sensitivity	Predicted Impacts	Significance of impact	Significance Index (lowest score = least ecological impact)
Western Bridge Crossing Option ON3 & N2				10
Designated Sites	Marine Waterbodies, Loch Carron including Salt Marsh – High / National Value	Disturbance; Destruction; Habitat fragmentation / modification	Major	5
Aquatic Habitats	Marine Waterbodies, Loch Carron – High / National Value	Disturbance; Destruction / modification of benthic habitats; Sedimentation and run-off.	Major	5

Table 6.3.5 - Summary of Scheme Crossing Option Western Tunnel –ON3 & N2 with estimated significance

Scheme Options	Receptor & Sensitivity	Predicted Impacts	Significance of impact	Significance Index (lowest score = least ecological impact)
Western Crossing Option Tunnel –ON3 & N2				4
Designated Sites	Marine Waterbodies, Loch Carron including Salt Marsh – High / National Value	Disturbance; Destruction; Habitat fragmentation / modification	Minor	2
Aquatic Habitats	Marine Waterbodies, Loch Carron – High / National Value	Disturbance; Destruction / modification of benthic habitats; Sedimentation and run-off.	Minor	2

Note relating to Table (6.3.5) Impacts associated with the disposal of tunnel arisings have not been included within the assessment.

Table 6.3.6 Summary of Scheme Crossing Option Eastern Bridge –N6 & N9 with estimated significance

Scheme Options	Receptor & Sensitivity	Predicted Impacts	Significance of impact	Significance Index (lowest score = least ecological impact)
Eastern Crossing Option Bridge –N6 & N9				10
Designated Sites	Marine Waterbodies, Loch Carron including Salt Marsh – High / National Value	Disturbance; Destruction; Habitat fragmentation / modification	Major	5
Aquatic Habitats	Marine Waterbodies, Loch Carron – High / National Value	Disturbance; Destruction / modification of benthic habitats; Sedimentation and run-off.	Major	5

Table 6.3.7 - Summary of Scheme Crossing Option Eastern Tidal Barrage – N6b with estimated significance

Scheme Options	Receptor & Sensitivity	Predicted Impacts	Significance of impact	Significance Index (lowest score = least ecological impact)
Eastern Crossing Option Tidal Barrage –N6b				16
Designated Sites	Marine Waterbodies, Loch Carron including Salt Marsh – High / National Value	Disturbance; Destruction; Habitat fragmentation / modification	Severe	8

Scheme Options	Receptor & Sensitivity	Predicted Impacts	Significance of impact	Significance Index (lowest score = least ecological impact)
Eastern Crossing Option Tidal Barrage –N6b				16
Aquatic Habitats	Marine Waterbodies, Loch Carron – High / National Value	Disturbance; Destruction / modification of benthic habitats; Sedimentation and run-off.	Severe	8

Table 6.3.8 - Summary of Scheme Corridor Options - (ON3) with estimated significance

Scheme Options	Receptor & Sensitivity	Predicted Impacts	Significance of impact	Significance Index (lowest score = least ecological impact)
Option (ON3)				47
Designated Sites	Rassal SSSI & SAC – Very High / International Value	None	N/A	0
	Coille Mhor SSSI & SAC – Very High / International Value	None	N/A	0
	Rassal National Nature reserve – High / UK Value	None	N/A	0
	Slumbay Island SSSI - High / UK Value	None	N/A	0
	Attadale SSSI - High / UK Value	None	N/A	0
	Allt nan Carnan SSSI - High / UK Value	Disturbance; Destruction; Habitat fragmentation / modification	Major	5
	Carn a' Bhealach Mhoir SSSI - High / UK Value	None	N/A	0
	Monar Forest SSSI - High / UK Value	None	N/A	0
Terrestrial Habitats	Woodland, Broadleaf Semi-natural Ancient - High / UK Value	Disturbance; Destruction; Habitat fragmentation / modification	Major	5
	Woodland, Broadleaf Long Established Plantation Origin – Medium / Authority Value	None	N/A	0

Scheme Options	Receptor & Sensitivity	Predicted Impacts	Significance of impact	Significance Index (lowest score = least ecological impact)
Option (ON3)				47
	Woodland, Coniferous Plantation – Medium or Low / Local Value	Disturbance; Destruction; Habitat fragmentation / modification	Minor	1
	Grasslands, Agriculturally Improved - Medium to Low / Local Value	Disturbance; Destruction; Habitat fragmentation / modification.	Minor	1
	Upland Habitats – Medium to Low / Authority & Local Value	Disturbance; Destruction; Habitat fragmentation / modification.	Minor	2
Aquatic Habitats				
	Fresh Waterbodies, Lochs, Rivers and Burns – High to Medium / Authority & Local Value	Disturbance; Sedimentation and run-off.	Moderate could be Major depending upon the quality of habitat.	3
Protected Species	Otter - High / National Value	Direct mortality; Habitat fragmentation; Disturbance; Sedimentation and run-off.	Moderate	3
	Bats - High / National Value	Direct mortality; Loss of roost sites; Foraging / commuting habitat fragmentation; Disturbance.	Major	5
	Badger – Medium / Authority Value	Direct mortality; Loss of refuge sites; Foraging / commuting habitat fragmentation; Disturbance.	Moderate	3
	Pine marten – Medium / Authority Value	Direct mortality; Loss of refuge sites; Foraging / commuting habitat fragmentation; Disturbance.	Moderate	3

Scheme Options	Receptor & Sensitivity	Predicted Impacts	Significance of impact	Significance Index (lowest score = least ecological impact)
Option (ON3)				47
	Red squirrel - Medium / Authority Value	Direct mortality; Loss of refuge sites; Foraging / commuting habitat fragmentation; Disturbance.	Minor	2
	Water vole - Medium / Authority Value	Direct mortality; Loss of refuge sites; Foraging / commuting habitat fragmentation; Disturbance.	Minor	2
	Wild cat - High / National Value	Direct mortality; Loss of refuge sites; Foraging / commuting habitat fragmentation; Disturbance.	Major	5
	Birds - High to Medium / National & Regional Value	Direct mortality; Loss of refuge sites; Foraging habitat fragmentation; Disturbance.	Moderate	4
	Fish – Medium / Regional Value	Degradation of habitat; Disturbance; Sedimentation and run-off.	Moderate	3

Table 6.3.9 - Summary of Scheme Corridor Options - (N2) with estimated significance

Scheme Options	Receptor & Sensitivity	Predicted Impacts	Significance of impact	Significance Index (lowest score = least ecological impact)
Corridor N2 Option				26
Designated Sites	Rassal SSSI & SAC – Very High / International Value	None	N/A	0
	Coille Mhor SSSI & SAC – Very High / International Value	None	N/A	0
	Rassal National Nature reserve – High / UK Value	None	N/A	0
	Slumbay Island SSSI - High / UK Value	None	N/A	0
	Attadale SSSI - High / UK Value	None	N/A	0

Scheme Options	Receptor & Sensitivity	Predicted Impacts	Significance of impact	Significance Index (lowest score = least ecological impact)
Corridor N2 Option				26
	Allt nan Carnan SSSI - High / UK Value	None	N/A	0
	Carn a' Bhealaich Mhoir SSSI - High / UK Value	None	N/A	0
	Monar Forest SSSI - High / UK Value	None	N/A	0
Terrestrial Habitats	Woodland, Broadleaf Semi-natural Ancient - High / UK Value	Disturbance; Destruction; Habitat fragmentation / modification	Moderate	3
	Woodland, Broadleaf Long Established Plantation Origin – Medium / Authority Value	Disturbance; Destruction; Habitat fragmentation / modification.	Minor	2
	Woodland, Coniferous Plantation – Medium or Low / Local Value	Disturbance; Destruction; Habitat fragmentation / modification.	Minor	1
	Grasslands, Agriculturally Improved - Medium to Low / Local Value	Disturbance; Destruction; Habitat fragmentation / modification.	Minor	2
	Upland Habitats – Medium to Low / Authority & Local Value	Disturbance; Destruction; Habitat fragmentation / modification.	Minor	2
Aquatic Habitats				
	Fresh Waterbodies, Lochs, Rivers and Burns – High to Medium / Authority & Local Value	Disturbance; Sedimentation and run-off.	Minor	1
Protected Species	Otter - High / National Value	Direct mortality; Habitat fragmentation; Disturbance; Sedimentation and run-off.	Minor	1

Scheme Options	Receptor & Sensitivity	Predicted Impacts	Significance of impact	Significance Index (lowest score = least ecological impact)
Corridor N2 Option				26
	Bats - High / National Value	Direct mortality; Loss of roost sites; Foraging / commuting habitat fragmentation; Disturbance.	Moderate	3
	Badger – Medium / Authority Value	Direct mortality; Loss of refuge sites; Foraging / commuting habitat fragmentation; Disturbance.	Minor	1
	Pine marten – Medium / Authority Value	Direct mortality; Loss of refuge sites; Foraging / commuting habitat fragmentation; Disturbance.	Minor	1
	Red squirrel - Medium / Authority Value	Direct mortality; Loss of refuge sites; Foraging / commuting habitat fragmentation; Disturbance.	Minor	1
	Water vole - Medium / Authority Value	Direct mortality; Loss of refuge sites; Foraging / commuting habitat fragmentation; Disturbance.	Minor	1
	Wild cat - High / National Value	Direct mortality; Loss of refuge sites; Foraging / commuting habitat fragmentation; Disturbance.	Moderate	3
	Birds - High to Medium / National & Regional Value	Direct mortality; Loss of refuge sites; Foraging habitat fragmentation; Disturbance.	Moderate	2
	Fish – Medium / Regional Value	Degradation of habitat; Disturbance; Sedimentation and run-off.	Moderate	2

Table 6.3.10 - Summary of Scheme Corridor Options - N6 with estimated significance

Scheme Options	Receptor & Sensitivity	Predicted Impacts	Significance of impact	Significance Index (lowest score = least ecological impact)
Corridor N6 Option				24
Designated Sites	Rassal SSSI & SAC – Very High / International Value	None	N/A	0
	Coille Mhor SSSI & SAC – Very High / International Value	None	N/A	0
	Rassal National Nature reserve – High / UK Value	None	N/A	0
	Slumbay Island SSSI - High / UK Value	None	N/A	0
	Attadale SSSI - High / UK Value	None	N/A	0
	Allt nan Carnan SSSI - High / UK Value	None	N/A	0
	Carn a' Bhealaich Mhoir SSSI - High / UK Value	None	N/A	0
	Monar Forest SSSI - High / UK Value	None	N/A	0
Terrestrial Habitats	Woodland, Broadleaf Semi-natural Ancient - High / UK Value	Disturbance; Destruction; Habitat fragmentation / modification	Minor	2
	Woodland, Broadleaf Long Established Plantation Origin – Medium / Authority Value	Disturbance; Destruction; Habitat fragmentation / modification.	Minor	2
	Woodland, Coniferous Plantation – Medium or Low / Local Value	Disturbance; Destruction; Habitat fragmentation / modification.	Minor	1
	Grasslands, Agriculturally Improved - Medium to Low / Local Value	Disturbance; Destruction; Habitat fragmentation / modification.	Minor	2
	Upland Habitats – Medium to Low / Authority & Local Value	Disturbance; Destruction; Habitat fragmentation / modification.	Minor	1

Scheme Options	Receptor & Sensitivity	Predicted Impacts	Significance of impact	Significance Index (lowest score = least ecological impact)
Corridor N6 Option				24
Aquatic Habitats				
	Fresh Waterbodies, Lochs, Rivers and Burns – High to Medium / Authority & Local Value	Disturbance; Sedimentation and run-off.	Minor	1
Protected Species	Otter - High / National Value	Direct mortality; Habitat fragmentation; Disturbance; Sedimentation and run-off.	Minor	1
	Bats - High / National Value	Direct mortality; Loss of roost sites; Foraging / commuting habitat fragmentation; Disturbance.	Moderate	3
	Badger – Medium / Authority Value	Direct mortality; Loss of refuge sites; Foraging / commuting habitat fragmentation; Disturbance.	Minor	1
	Pine marten – Medium / Authority Value	Direct mortality; Loss of refuge sites; Foraging / commuting habitat fragmentation; Disturbance.	Minor	1
	Red squirrel - Medium / Authority Value	Direct mortality; Loss of refuge sites; Foraging / commuting habitat fragmentation; Disturbance.	Minor	1
	Water vole - Medium / Authority Value	Direct mortality; Loss of refuge sites; Foraging / commuting habitat fragmentation; Disturbance.	Minor	1

Scheme Options	Receptor & Sensitivity	Predicted Impacts	Significance of impact	Significance Index (lowest score = least ecological impact)
Corridor N6 Option				24
	Wild cat - High / National Value	Direct mortality; Loss of refuge sites; Foraging / commuting habitat fragmentation; Disturbance.	Moderate	3
	Birds - High to Medium / National & Regional Value	Direct mortality; Loss of refuge sites; Foraging habitat fragmentation; Disturbance.	Minor	2
	Fish – Medium / Regional Value	Degradation of habitat; Disturbance; Sedimentation and run-off.	Minor	2

Table 6.3.11 - Summary of Scheme Corridor Options – N9 with estimated significance

Scheme Options	Receptor & Sensitivity	Predicted Impacts	Significance of impact	Significance Index (lowest score = least ecological impact)
Corridor N9 Option				41
Designated Sites	Rassal SSSI & SAC – Very High / International Value	None	N/A	0
	Coille Mhor SSSI & SAC – Very High / International Value	None	N/A	0
	Rassal National Nature reserve – High / UK Value	None	N/A	0
	Slumbay Island SSSI - High / UK Value	None	N/A	0
	Attadale SSSI - High / UK Value	None	N/A	0
	Allt nan Carnan SSSI - High / UK Value	Disturbance; Destruction; Habitat fragmentation / modification	Major	5
	Carn a' Bhealaich Mhoir SSSI - High / UK Value	None	N/A	0
	Monar Forest SSSI - High / UK Value	None	N/A	0

Scheme Options	Receptor & Sensitivity	Predicted Impacts	Significance of impact	Significance Index (lowest score = least ecological impact)
Corridor N9 Option				41
Terrestrial Habitats	Woodland, Broadleaf Semi-natural Ancient - High / UK Value	Disturbance; Destruction; Habitat fragmentation / modification	Moderate	3
	Woodland, Broadleaf Long Established Plantation Origin – Medium / Authority Value	Disturbance; Destruction; Habitat fragmentation / modification.	Minor	1
	Woodland, Coniferous Plantation – Medium or Low / Local Value	Disturbance; Destruction; Habitat fragmentation / modification.	Moderate	3
	Grasslands, Agriculturally Improved - Medium to Low / Local Value	Disturbance; Destruction; Habitat fragmentation / modification.	Minor	2
	Upland Habitats – Medium to Low / Authority & Local Value	Disturbance; Destruction; Habitat fragmentation / modification.	Moderate	3
Aquatic Habitats				
	Fresh Waterbodies, Lochs, Rivers and Burns – High to Medium / Authority & Local Value	Disturbance; Sedimentation and run-off.	Minor	2
Protected Species	Otter - High / National Value	Direct mortality; Habitat fragmentation; Disturbance; Sedimentation and run-off.	Minor	1
	Bats - High / National Value	Direct mortality; Loss of roost sites; Foraging / commuting habitat fragmentation; Disturbance.	Moderate	3

Scheme Options	Receptor & Sensitivity	Predicted Impacts	Significance of impact	Significance Index (lowest score = least ecological impact)
Corridor N9 Option				41
	Badger – Medium / Authority Value	Direct mortality; Loss of refuge sites; Foraging / commuting habitat fragmentation; Disturbance.	Moderate	3
	Pine marten – Medium / Authority Value	Direct mortality; Loss of refuge sites; Foraging / commuting habitat fragmentation; Disturbance.	Moderate	3
	Red squirrel - Medium / Authority Value	Direct mortality; Loss of refuge sites; Foraging / commuting habitat fragmentation; Disturbance.	Moderate	3
	Water vole - Medium / Authority Value	Direct mortality; Loss of refuge sites; Foraging / commuting habitat fragmentation; Disturbance.	Minor	1
	Wild cat - High / National Value	Direct mortality; Loss of refuge sites; Foraging / commuting habitat fragmentation; Disturbance.	Moderate	3
	Birds - High to Medium / National & Regional Value	Direct mortality; Loss of refuge sites; Foraging habitat fragmentation; Disturbance.	Moderate	3
	Fish – Medium / Regional Value	Degradation of habitat; Disturbance; Sedimentation and run-off.	Minor	2

On-line Route Notes: The general potential impacts associated with route option O1 (On-line upgrade) have been attributed to the local route options for the On-line corridor i.e. O3 & O6, as a means of assessing the likely impacts connected with the route as a whole.

Table 6.3.12 - Summary of Scheme Corridor Options - (O1) with estimated significance

Scheme Options	Receptor & Sensitivity	Predicted Impacts	Significance of impact	Significance Index (lowest score = least ecological impact)	
Corridor Option (O1) On-line Upgrade				42	
Designated Sites	Rassal SSSI & SAC – Very High / International Value	None	N/A	0	
	Coille Mhor SSSI & SAC – Very High / International Value	None	N/A	0	
	Rassal National Nature reserve – High / UK Value	None	N/A	0	
	Slumbay Island SSSI - High / UK Value	None	N/A	0	
	Attadale SSSI - High / UK Value	Disturbance; Destruction / Modification.	Moderate	4	
	Allt nan Carnan SSSI - High / UK Value	None	N/A	0	
	Carn a' Bhealaich Mhoir SSSI - High / UK Value	None	N/A	0	
	Monar Forest SSSI - High / UK Value	None	N/A	0	
	Terrestrial Habitats	Marine Waterbodies, Loch Carron including Salt Marsh – High / National Value	Disturbance; Destruction; Habitat fragmentation / modification.	Minor	2
		Woodland, Broadleaf Semi-natural Ancient - High / UK Value	Disturbance; Destruction; Habitat fragmentation / modification.	Moderate	3
Woodland, Broadleaf Long Established Plantation Origin – Medium / Authority Value		None	N/A	0	
Woodland, Coniferous Plantation – Medium or Low / Local Value		Disturbance; Destruction; Habitat fragmentation / modification	Minor	1	

Scheme Options	Receptor & Sensitivity	Predicted Impacts	Significance of impact	Significance Index (lowest score = least ecological impact)
Corridor Option (O1) On-line Upgrade				42
	Grasslands, Agriculturally Improved - Medium to Low / Local Value	Disturbance; Destruction; Habitat fragmentation / modification.	Minor	2
	Upland Habitats – Medium to Low / Authority & Local Value	Disturbance; Destruction; Habitat fragmentation / modification.	Minor	2
Aquatic Habitats				
	Fresh Waterbodies, Lochs, Rivers and Burns – High to Medium / Authority & Local Value	Disturbance; Sedimentation and run-off.	Moderate	3
	Marine Waterbodies, Loch Carron – High / National Value	Disturbance; Destruction / modification of benthic habitats; Sedimentation and run-off.	Minor	2
Protected Species	Otter - High / National Value	Direct mortality; Loss of refuge sites; Habitat fragmentation; Disturbance; Sedimentation and run-off.	Moderate	4
	Bats - High / National Value	Direct mortality; Loss of roost sites; Foraging / commuting habitat fragmentation; Disturbance.	Moderate	3
	Badger – Medium / Authority Value	Direct mortality; Loss of refuge sites; Foraging / commuting habitat fragmentation; Disturbance.	Minor	2
	Pine marten – Medium / Authority Value	Direct mortality; Loss of refuge sites; Foraging / commuting habitat fragmentation; Disturbance.	Minor	2

Scheme Options	Receptor & Sensitivity	Predicted Impacts	Significance of impact	Significance Index (lowest score = least ecological impact)
Corridor Option (O1) On-line Upgrade				42
	Red squirrel - Medium / Authority Value	Direct mortality; Loss of refuge sites; Foraging / commuting habitat fragmentation; Disturbance.	Minor	2
	Water vole - Medium / Authority Value	Direct mortality; Loss of refuge sites; Foraging / commuting habitat fragmentation; Disturbance.	Minor	1
	Wild cat - High / National Value	Direct mortality; Loss of refuge sites; Foraging / commuting habitat fragmentation; Disturbance.	Moderate	3
	Birds - High to Medium / National & Regional Value	Direct mortality; Loss of refuge sites; Foraging habitat fragmentation; Disturbance.	Moderate	3
	Fish – Medium / Regional Value	Degradation of habitat; Disturbance; Sedimentation and run-off.	Moderate	3

Table 6.3.13 - Summary of Scheme Corridor Options - (O2) with estimated significance

Scheme Options	Receptor & Sensitivity	Predicted Impacts	Significance of impact	Significance Index (lowest score = least ecological impact)
Corridor Option (O2) Causeway / Cantilever Structure				49
Designated Sites	Rassal SSSI & SAC – Very High / International Value	None	N/A	0
	Coille Mhor SSSI & SAC – Very High / International Value	None	N/A	0
	Rassal National Nature reserve – High / UK Value	None	N/A	0
	Slumbay Island SSSI - High / UK Value	None	N/A	0
	Attadale SSSI - High / UK Value	Disturbance; Destruction / Modification.	Minor	2

Scheme Options	Receptor & Sensitivity	Predicted Impacts	Significance of impact	Significance Index (lowest score = least ecological impact)
Corridor Option (O2) Causeway / Cantilever Structure				49
	Allt nan Carnan SSSI - High / UK Value	None	N/A	0
	Carn a' Bhealaich Mhoir SSSI - High / UK Value	None	N/A	0
	Monar Forest SSSI - High / UK Value	None	N/A	0
Terrestrial Habitats	Marine Waterbodies, Loch Carron including Salt Marsh – High / National Value	Disturbance; Destruction; Habitat fragmentation / modification.	Major	6
	Woodland, Broadleaf Semi-natural Ancient - High / UK Value	Disturbance; Destruction; Habitat fragmentation / modification.	Moderate	3
	Woodland, Broadleaf Long Established Plantation Origin – Medium / Authority Value	None	N/A	0
	Woodland, Coniferous Plantation – Medium or Low / Local Value	Disturbance; Destruction; Habitat fragmentation / modification	Minor	1
	Grasslands, Agriculturally Improved - Medium to Low / Local Value	Disturbance; Destruction; Habitat fragmentation / modification.	Minor	2
	Upland Habitats – Medium to Low / Authority & Local Value	Disturbance; Destruction; Habitat fragmentation / modification.	Minor	2
	Aquatic Habitats			
	Fresh Waterbodies, Lochs, Rivers and Burns – High to Medium / Authority & Local Value	Disturbance; Sedimentation and run-off.	Minor	2
	Marine Waterbodies, Loch Carron – High / National Value	Disturbance; Destruction / modification of benthic habitats; Sedimentation and run-off.	Major	6

Scheme Options	Receptor & Sensitivity	Predicted Impacts	Significance of impact	Significance Index (lowest score = least ecological impact)
Corridor Option (O2) Causeway / Cantilever Structure				49
Protected Species	Otter - High / National Value	Direct mortality; Loss of refuge sites; Habitat fragmentation; Disturbance; Sedimentation and run-off.	Moderate	4
	Bats - High / National Value	Direct mortality; Loss of roost sites; Foraging / commuting habitat fragmentation; Disturbance.	Moderate	3
	Badger – Medium / Authority Value	Direct mortality; Loss of refuge sites; Foraging / commuting habitat fragmentation; Disturbance.	Minor	2
	Pine marten – Medium / Authority Value	Direct mortality; Loss of refuge sites; Foraging / commuting habitat fragmentation; Disturbance.	Minor	2
	Red squirrel - Medium / Authority Value	Direct mortality; Loss of refuge sites; Foraging / commuting habitat fragmentation; Disturbance.	Minor	2
	Water vole - Medium / Authority Value	Direct mortality; Loss of refuge sites; Foraging / commuting habitat fragmentation; Disturbance.	Minor	1
	Wild cat - High / National Value	Direct mortality; Loss of refuge sites; Foraging / commuting habitat fragmentation; Disturbance.	Moderate	3

Scheme Options	Receptor & Sensitivity	Predicted Impacts	Significance of impact	Significance Index (lowest score = least ecological impact)
Corridor Option (O2) Causeway / Cantilever Structure				49
	Birds - High to Medium / National & Regional Value	Direct mortality; Loss of refuge sites; Foraging habitat fragmentation; Disturbance.	Moderate	4
	Fish – Medium / Regional Value	Degradation of habitat; Disturbance; Sedimentation and run-off.	Moderate	4

Table 6.3.14 - Summary of Scheme Corridor Options - (O3) with estimated significance

Scheme Options	Receptor & Sensitivity	Predicted Impacts	Significance of impact	Significance Index (lowest score = least ecological impact)
Corridor Option (O3) Tunnel				39
Designated Sites	Rassal SSSI & SAC – Very High / International Value	None	N/A	0
	Coille Mhor SSSI & SAC – Very High / International Value	None	N/A	0
	Rassal National Nature reserve – High / UK Value	None	N/A	0
	Slumbay Island SSSI - High / UK Value	None	N/A	0
	Attadale SSSI - High / UK Value	Disturbance; Destruction / Modification.	N/A	0
	Allt nan Carnan SSSI - High / UK Value	None	N/A	0
	Carn a' Bhealaich Mhoir SSSI - High / UK Value	None	N/A	0
	Monar Forest SSSI - High / UK Value	None	N/A	0
	Marine Waterbodies, Loch Carron including Salt Marsh – High / National Value	Disturbance; Destruction; Habitat fragmentation / modification.	Minor	2
Terrestrial Habitats	Woodland, Broadleaf Semi-natural Ancient - High / UK Value	Disturbance; Destruction; Habitat fragmentation / modification.	Moderate	4

Scheme Options	Receptor & Sensitivity	Predicted Impacts	Significance of impact	Significance Index (lowest score = least ecological impact)
Corridor Option (O3) Tunnel				39
	Woodland, Broadleaf Long Established Plantation Origin – Medium / Authority Value	None	N/A	0
	Woodland, Coniferous Plantation – Medium or Low / Local Value	Disturbance; Destruction; Habitat fragmentation / modification	Minor	1
	Grasslands, Agriculturally Improved - Medium to Low / Local Value	Disturbance; Destruction; Habitat fragmentation / modification.	Minor	2
	Upland Habitats – Medium to Low / Authority & Local Value	Disturbance; Destruction; Habitat fragmentation / modification.	Minor	2
Aquatic Habitats				
	Fresh Waterbodies, Lochs, Rivers and Burns – High to Medium / Authority & Local Value	Disturbance; Sedimentation and run-off.	Minor	2
	Marine Waterbodies, Loch Carron – High / National Value	Disturbance; Destruction / modification of benthic habitats; Sedimentation and run-off.	Minor	2
Protected Species	Otter - High / National Value	Direct mortality; Loss of refuge sites; Habitat fragmentation; Disturbance; Sedimentation and run-off.	Moderate	4
	Bats - High / National Value	Direct mortality; Loss of roost sites; Foraging / commuting habitat fragmentation; Disturbance.	Moderate	3

Scheme Options	Receptor & Sensitivity	Predicted Impacts	Significance of impact	Significance Index (lowest score = least ecological impact)
Corridor Option (O3) Tunnel				39
	Badger – Medium / Authority Value	Direct mortality; Loss of refuge sites; Foraging / commuting habitat fragmentation; Disturbance.	Minor	2
	Pine marten – Medium / Authority Value	Direct mortality; Loss of refuge sites; Foraging / commuting habitat fragmentation; Disturbance.	Minor	2
	Red squirrel - Medium / Authority Value	Direct mortality; Loss of refuge sites; Foraging / commuting habitat fragmentation; Disturbance.	Minor	2
	Water vole - Medium / Authority Value	Direct mortality; Loss of refuge sites; Foraging / commuting habitat fragmentation; Disturbance.	Minor	1
	Wild cat - High / National Value	Direct mortality; Loss of refuge sites; Foraging / commuting habitat fragmentation; Disturbance.	Moderate	3
	Birds - High to Medium / National & Regional Value	Direct mortality; Loss of refuge sites; Foraging habitat fragmentation; Disturbance.	Moderate	4
	Fish – Medium / Regional Value	Degradation of habitat; Disturbance; Sedimentation and run-off.	Moderate	3

Table 6.3.15 - Summary of Scheme Corridor Options - (O5) with estimated significance

Scheme Options	Receptor & Sensitivity	Predicted Impacts	Significance of impact	Significance Index (lowest score = least ecological impact)
Corridor Option (O5) Joint Road / Rail Solution				51
Designated Sites	Rassal SSSI & SAC – Very High / International Value	None	N/A	0
	Coille Mhor SSSI & SAC – Very High / International Value	None	N/A	0
	Rassal National Nature reserve – High / UK Value	None	N/A	0
	Slumbay Island SSSI - High / UK Value	None	N/A	0
	Attadale SSSI - High / UK Value	Disturbance; Destruction / Modification.	Major	5
	Allt nan Carnan SSSI - High / UK Value	None	N/A	0
	Carn a' Bhealaich Mhoir SSSI - High / UK Value	None	N/A	0
	Monar Forest SSSI - High / UK Value	None	N/A	0
	Marine Waterbodies, Loch Carron including Salt Marsh – High / National Value	Disturbance; Destruction; Habitat fragmentation / modification.	Major	5
Terrestrial Habitats	Woodland, Broadleaf Semi-natural Ancient - High / UK Value	Disturbance; Destruction; Habitat fragmentation / modification.	Moderate	4
	Woodland, Broadleaf Long Established Plantation Origin – Medium / Authority Value	None	N/A	0
	Woodland, Coniferous Plantation – Medium or Low / Local Value	Disturbance; Destruction; Habitat fragmentation / modification	Minor	1
	Grasslands, Agriculturally Improved - Medium to Low / Local Value	Disturbance; Destruction; Habitat fragmentation / modification.	Minor	2

Scheme Options	Receptor & Sensitivity	Predicted Impacts	Significance of impact	Significance Index (lowest score = least ecological impact)
Corridor Option (O5) Joint Road / Rail Solution				51
	Upland Habitats – Medium to Low / Authority & Local Value	Disturbance; Destruction; Habitat fragmentation / modification.	Minor	2
Aquatic Habitats				
	Fresh Waterbodies, Lochs, Rivers and Burns – High to Medium / Authority & Local Value	Disturbance; Sedimentation and run-off.	Minor	2
	Marine Waterbodies, Loch Carron – High / National Value	Disturbance; Destruction / modification of benthic habitats; Sedimentation and run-off.	Major	5
Protected Species	Otter - High / National Value	Direct mortality; Loss of refuge sites; Habitat fragmentation; Disturbance; Sedimentation and run-off.	Moderate	4
	Bats - High / National Value	Direct mortality; Loss of roost sites; Foraging / commuting habitat fragmentation; Disturbance.	Moderate	3
	Badger – Medium / Authority Value	Direct mortality; Loss of refuge sites; Foraging / commuting habitat fragmentation; Disturbance.	Minor	2
	Pine marten – Medium / Authority Value	Direct mortality; Loss of refuge sites; Foraging / commuting habitat fragmentation; Disturbance.	Minor	2
	Red squirrel - Medium / Authority Value	Direct mortality; Loss of refuge sites; Foraging / commuting habitat fragmentation; Disturbance.	Minor	2

Scheme Options	Receptor & Sensitivity	Predicted Impacts	Significance of impact	Significance Index (lowest score = least ecological impact)
Corridor Option (O5) Joint Road / Rail Solution				51
	Water vole - Medium / Authority Value	Direct mortality; Loss of refuge sites; Foraging / commuting habitat fragmentation; Disturbance.	Minor	1
	Wild cat - High / National Value	Direct mortality; Loss of refuge sites; Foraging / commuting habitat fragmentation; Disturbance.	Moderate	3
	Birds - High to Medium / National & Regional Value	Direct mortality; Loss of refuge sites; Foraging habitat fragmentation; Disturbance.	Moderate	4
	Fish – Medium / Regional Value	Degradation of habitat; Disturbance; Sedimentation and run-off.	Moderate	4

Table 6.3.16 - Summary of Scheme Corridor Options - (O6) with estimated significance

Scheme Options	Receptor & Sensitivity	Predicted Impacts	Significance of impact	Significance Index (lowest score = least ecological impact)
Corridor Option (O6) Attadale to Strathcarron Junction Link				48
Designated Sites	Rassal SSSI & SAC – Very High / International Value	None	N/A	0
	Coille Mhor SSSI & SAC – Very High / International Value	None	N/A	0
	Rassal National Nature reserve – High / UK Value	None	N/A	0
	Slumbay Island SSSI - High / UK Value	None	N/A	0
	Attadale SSSI - High / UK Value	Disturbance; Destruction / Modification.	Moderate	4
	Allt nan Carnan SSSI - High / UK Value	None	N/A	0
	Carn a' Bhealaich Mhoir SSSI - High / UK Value	None	N/A	0

Scheme Options	Receptor & Sensitivity	Predicted Impacts	Significance of impact	Significance Index (lowest score = least ecological impact)
Corridor Option (O6) Attadale to Strathcarron Junction Link				48
	Monar Forest SSSI - High / UK Value	None	N/A	0
	Marine Waterbodies, Loch Carron including Salt Marsh – High / National Value	Disturbance; Destruction; Habitat fragmentation / modification.	Major	5
Terrestrial Habitats	Woodland, Broadleaf Semi-natural Ancient - High / UK Value	Disturbance; Destruction; Habitat fragmentation / modification.	Moderate	3
	Woodland, Broadleaf Long Established Plantation Origin – Medium / Authority Value	None	N/A	0
	Woodland, Coniferous Plantation – Medium or Low / Local Value	Disturbance; Destruction; Habitat fragmentation / modification	Minor	1
	Grasslands, Agriculturally Improved - Medium to Low / Local Value	Disturbance; Destruction; Habitat fragmentation / modification.	Minor	2
	Upland Habitats – Medium to Low / Authority & Local Value	Disturbance; Destruction; Habitat fragmentation / modification.	Minor	2
Aquatic Habitats				
	Fresh Waterbodies, Lochs, Rivers and Burns – High to Medium / Authority & Local Value	Disturbance; Sedimentation and run-off.	Moderate	3
	Marine Waterbodies, Loch Carron including Salt Marsh Communities– High / National Value	Disturbance; Destruction / modification of benthic habitats; Sedimentation and run-off.	Major	5

Scheme Options	Receptor & Sensitivity	Predicted Impacts	Significance of impact	Significance Index (lowest score = least ecological impact)
Corridor Option (O6) Attadale to Strathcarron Junction Link				48
Protected Species	Otter - High / National Value	Direct mortality; Loss of refuge sites; Habitat fragmentation; Disturbance; Sedimentation and run-off.	Moderate	4
	Bats - High / National Value	Direct mortality; Loss of roost sites; Foraging / commuting habitat fragmentation; Disturbance.	Moderate	3
	Badger – Medium / Authority Value	Direct mortality; Loss of refuge sites; Foraging / commuting habitat fragmentation; Disturbance.	Minor	2
	Pine marten – Medium / Authority Value	Direct mortality; Loss of refuge sites; Foraging / commuting habitat fragmentation; Disturbance.	Minor	2
	Red squirrel - Medium / Authority Value	Direct mortality; Loss of refuge sites; Foraging / commuting habitat fragmentation; Disturbance.	Minor	2
	Water vole - Medium / Authority Value	Direct mortality; Loss of refuge sites; Foraging / commuting habitat fragmentation; Disturbance.	Minor	1
	Wild cat - High / National Value	Direct mortality; Loss of refuge sites; Foraging / commuting habitat fragmentation; Disturbance.	Moderate	3

Scheme Options	Receptor & Sensitivity	Predicted Impacts	Significance of impact	Significance Index (lowest score = least ecological impact)
Corridor Option (O6) Attadale to Strathcarron Junction Link				48
	Birds - High to Medium / National & Regional Value	Direct mortality; Loss of refuge sites; Foraging habitat fragmentation; Disturbance.	Moderate	3
	Fish – Medium / Regional Value	Degradation of habitat; Disturbance; Sedimentation and run-off.	Moderate	3

Table 6.3.17 - Summary of Scheme Corridor Options - (O7) with estimated significance

Scheme Options	Receptor & Sensitivity	Predicted Impacts	Significance of impact	Significance Index (lowest score = least ecological impact)
Corridor Option (O7) Extended Avalanche Shelter				45
Designated Sites	Rassal SSSI & SAC – Very High / International Value	None	N/A	0
	Coille Mhor SSSI & SAC – Very High / International Value	None	N/A	0
	Rassal National Nature reserve – High / UK Value	None	N/A	0
	Slumbay Island SSSI - High / UK Value	None	N/A	0
	Attadale SSSI - High / UK Value	Disturbance; Destruction / Modification.	Major	5
	Allt nan Carnan SSSI - High / UK Value	None	N/A	0
	Carn a' Bhealaich Mhoir SSSI - High / UK Value	None	N/A	0
	Monar Forest SSSI - High / UK Value	None	N/A	0
	Marine Waterbodies, Loch Carron including Salt Marsh – High / National Value	Disturbance; Destruction; Habitat fragmentation / modification.	Minor	2
Terrestrial Habitats	Woodland, Broadleaf Semi-natural Ancient - High / UK Value	Disturbance; Destruction; Habitat fragmentation / modification.	Moderate	4

Scheme Options	Receptor & Sensitivity	Predicted Impacts	Significance of impact	Significance Index (lowest score = least ecological impact)
Corridor Option (O7) Extended Avalanche Shelter				45
	Woodland, Broadleaf Long Established Plantation Origin – Medium / Authority Value	None	N/A	0
	Woodland, Coniferous Plantation – Medium or Low / Local Value	Disturbance; Destruction; Habitat fragmentation / modification	Minor	1
	Grasslands, Agriculturally Improved - Medium to Low / Local Value	Disturbance; Destruction; Habitat fragmentation / modification.	Minor	2
	Upland Habitats – Medium to Low / Authority & Local Value	Disturbance; Destruction; Habitat fragmentation / modification.	Minor	2
Aquatic Habitats				
	Fresh Waterbodies, Lochs, Rivers and Burns – High to Medium / Authority & Local Value	Disturbance; Sedimentation and run-off.	Minor	2
	Marine Waterbodies, Loch Carron – High / National Value	Disturbance; Destruction / modification of benthic habitats; Sedimentation and run-off.	Minor	2
Protected Species	Otter - High / National Value	Direct mortality; Loss of refuge sites; Habitat fragmentation; Disturbance; Sedimentation and run-off.	Moderate	4
	Bats - High / National Value	Direct mortality; Loss of roost sites; Foraging / commuting habitat fragmentation; Disturbance.	Moderate	3

Scheme Options	Receptor & Sensitivity	Predicted Impacts	Significance of impact	Significance Index (lowest score = least ecological impact)
Corridor Option (O7) Extended Avalanche Shelter				45
	Badger – Medium / Authority Value	Direct mortality; Loss of refuge sites; Foraging / commuting habitat fragmentation; Disturbance.	Minor	2
	Pine marten – Medium / Authority Value	Direct mortality; Loss of refuge sites; Foraging / commuting habitat fragmentation; Disturbance.	Minor	2
	Red squirrel - Medium / Authority Value	Direct mortality; Loss of refuge sites; Foraging / commuting habitat fragmentation; Disturbance.	Minor	2
	Water vole - Medium / Authority Value	Direct mortality; Loss of refuge sites; Foraging / commuting habitat fragmentation; Disturbance.	Minor	1
	Wild cat - High / National Value	Direct mortality; Loss of refuge sites; Foraging / commuting habitat fragmentation; Disturbance.	Moderate	3
	Birds - High to Medium / National & Regional Value	Direct mortality; Loss of refuge sites; Foraging habitat fragmentation; Disturbance.	Moderate	4
	Fish – Medium / Regional Value	Degradation of habitat; Disturbance; Sedimentation and run-off.	Moderate	4

Table 6.3.18 - Summary of Scheme Southern Corridor Options - with estimated significance

Scheme Options	Receptor & Sensitivity	Predicted Impacts	Significance of impact	Significance Index (lowest score = least ecological impact)
Corridor Option Routes S1, S3, S4 & S5b				50
Designated Sites	Rassal SSSI & SAC – Very High / International Value	None	N/A	0
	Coille Mhor SSSI & SAC – Very High / International Value	None	N/A	0
	Rassal National Nature reserve – High / UK Value	None	N/A	0
	Slumbay Island SSSI - High / UK Value	None	N/A	0
	Attadale SSSI - High / UK Value	None	N/A	0
	Allt nan Carnan SSSI - High / UK Value	None	N/A	0
	Carn a' Bhealaich Mhoir SSSI - High / UK Value	None	N/A	0
	Monar Forest SSSI - High / UK Value	None	N/A	0
	Loch Carron Marine Consultation Area - High / UK Value	None	N/A	0
	Terrestrial Habitats	Woodland, Broadleaf Semi-natural Ancient - High / UK Value	Disturbance; Destruction; Habitat fragmentation / modification.	Moderate
Woodland, Broadleaf Long Established Plantation Origin – Medium / Authority Value		None	N/A	0
Woodland, Coniferous Plantation – Medium or Low / Local Value		Disturbance; Destruction; Habitat fragmentation / modification.	Moderate	4
Grasslands, Agriculturally Improved - Medium to Low / Local Value		Disturbance; Destruction; Habitat fragmentation / modification.	Minor	1

Scheme Options	Receptor & Sensitivity	Predicted Impacts	Significance of impact	Significance Index (lowest score = least ecological impact)
Corridor Option Routes S1, S3, S4 & S5b				50
	Upland Habitats – Medium to Low / Authority & Local Value	Disturbance; Destruction; Habitat fragmentation / modification.	Moderate	3
Aquatic Habitats				
	Fresh Waterbodies, Lochs, Rivers and Burns – High to Medium / Authority & Local Value	Disturbance; Sedimentation and run-off.	Moderate	4
	Marine Waterbodies, Loch Carron – High / National Value	Disturbance; Sedimentation and run-off.	Minor	1
Protected Species	Otter - High / National Value	Direct mortality; Loss of refuge sites; Habitat fragmentation; Disturbance; Sedimentation and run-off.	Moderate	4
	Bats - High / National Value	Direct mortality; Loss of roost sites; Foraging / commuting habitat fragmentation; Disturbance.	Moderate	3
	Badger – Medium / Authority Value	Direct mortality; Loss of refuge sites; Foraging / commuting habitat fragmentation; Disturbance.	Moderate	4
	Pine marten – Medium / Authority Value	Direct mortality; Loss of refuge sites; Foraging / commuting habitat fragmentation; Disturbance.	Moderate	3
	Red squirrel - Medium / Authority Value	Direct mortality; Loss of refuge sites; Foraging / commuting habitat fragmentation; Disturbance.	Moderate	3

Scheme Options	Receptor & Sensitivity	Predicted Impacts	Significance of impact	Significance Index (lowest score = least ecological impact)
Corridor Option Routes S1, S3, S4 & S5b				50
	Water vole - Medium / Authority Value	Direct mortality; Loss of refuge sites; Foraging / commuting habitat fragmentation; Disturbance.	Moderate	4
	Wild cat - High / National Value	Direct mortality; Loss of refuge sites; Foraging / commuting habitat fragmentation; Disturbance.	Moderate	4
	Birds - High to Medium / National & Regional Value	Direct mortality; Loss of refuge sites; Foraging habitat fragmentation; Disturbance.	Major	5
	Fish – Medium / Regional Value	Degradation of habitat; Disturbance; Sedimentation and run-off.	Moderate	3

6.3.12 *Potential Mitigation Measures*

Principles of Mitigation

The principles of mitigation in order of priority are as follows:

- Avoid any negative impact on the target habitat or species;
- Minimise impacts by input into the scheme design.

If this is not possible, then:

- Minimise the scale and magnitude of the impact; and then
- Compensate for the impact through provision of alternatives

Subsequently, the objective of potential mitigating measures is to identify 'standard' or 'generic' measures taking into account best practice, legislation and guidance, which are deemed appropriate to the scheme.

Site-specific measures would be developed as the design for the proposed road scheme advanced and incorporated into a Project Environmental Management Plan, details of which are likely to incorporate the following measures.

Habitat Creation and Restoration

Likely mitigation for habitats lost to the scheme may include habitat creation i.e. grassland or woodland establishment using appropriately sourced local native species. Alternatively, if such

measures were constrained due to land availability, compensation areas could be established off-site as means of facilitating habitat creation and management.

Habitat creation / restoration should aim to replicate over an appropriate period time the key habitats lost or affected by the scheme.

Protected Species

Effects on species during construction can be mitigated through the provision of appropriate protection systems and/or exclusion zones. Mammal-proof fencing can be provided to mitigate against direct mortality of badger and otter. Exclusion zones around habitats and features such as resting places would minimise the impact on protected species and their habitats, and reduce disturbance.

Artificial refuges can be provided as a means of partially mitigating against the loss of natural sites such as otter holts, badger setts and bat roosts etc. Screening via appropriate planting can also be used to further facilitate the creation of additional refuges and foraging habitat for other species such as birds.

Appropriate planting can also help reduce the impacts upon species associated with the fragmentation of commuting routes and foraging habitat, this type of mitigation can be a particularly effective measure in relation to bats. Strategically sited mammal underpasses are an additional form of mitigation used to combat habitat fragmentation caused by roads, combined with mammal fencing they can be effective with species such as badgers, otters and other small to medium sized mammal species.

The restrictive use of artificial lighting in sensitive areas, combined with constraints on night time working are considered to be effective means of reducing disturbance to protected species. As is the programming of potentially damaging site activities to avoid sensitive periods, discrete planning is not only an effective means of reducing disturbance but also avoiding direct mortality i.e. undertaking tree / scrub clearance outwith the breeding bird season.

Erecting exclusion zones around protected habitats and other conservation interests clearly demarcates such features, whilst preventing accidental damage and disturbance occurring.

Control of Pollution

Pollution incidents affecting sensitive receptors during construction can be mitigated through the development of a project specific pollution prevention plan, part of the overall project environmental management plan. In-order to develop such as a project strategy, research and develop of prescriptions will be implemented, which as a minimum will demonstrate compliance with legislation, best practice measures and guidance, such as the SEPA Pollution Prevention Guidelines (PPGs), including appropriate fuel, chemical and bulk material storage. Pollution impacts during operation (i.e. hydro-carbon road run-off) can be mitigated through the provision of suds ponds as part of a sustainable drainage system (SUDS).

6.3.13 *Summary*

Crossing Options

Analysis of the SMRB Stage 1 assessment relating to the crossing options indicates that the Western Crossing – Tunnel option would have the lowest impact upon identified nature conservation features described within this assessment, principally the benthic communities present within the Loch Carron MCA.

Impacts to the Loch Carron MCA relating to either of the Bridge options would depend upon the design of the structures and whether there would be a requirement for bridge piers to be constructed within the narrows. If bridge piers are required then impacts to benthic communities are considered likely.

The eastern crossing Tidal Barrage is likely to have significant impacts upon both benthic and rocky shore plant and animal communities etc. within the Loch Carron MCA, due to the footprint of the structure and the artificial manipulation of water levels within the Loch. Subsequently, the Tidal Barrage is the least preferred crossing option.

Route Corridors

Analysis of the DMRB Stage 1 assessment relating to the route corridors indicates that the North Shore corridor and in particular route N6, would have the lowest impact upon the identified nature conservation features, although there is still a requirement to cross the narrows of Loch Carron.

In addition to crossing Loch Carron at the narrows, the Outer North corridor will result in the greater loss and fragmentation of broadleaf semi-natural ancient woodland, including part of the Allt nan Carnan SSSI. The loss of the woodland habitat is also likely to have a negative effect on a number of protected species.

The On-line corridor appears to have one of the lowest effects upon terrestrial habitats; major effects relate to the likely impacts to Loch Carron MCA, if the On-line route option includes the construction of a viaduct along a section of the Loch; likely impacts include destruction, fragmentation and disturbance to benthic habitats. Additionally it is also possible that this corridor (route 06) will also affect an area of salt marsh located within the northern extremities of the Loch.

The offline nature of the Southern corridor would likely entail major impacts upon freshwater features which occur within the corridor due to their close proximity, with likely impacts upon schedule 1 / annex 1 bird species, including black and red-throated divers. Habitat loss and fragmentation associated with this corridor would include large areas of conifer plantation and upland habitats, with related impacts upon a number of protected species including badgers and golden eagle.

Table 6.3.19 below shows a summary of the preferred options.

Table 6.3.19 – Nature Conservation Assessment Summary

	Preferred Option	Intermediate Option	Least Preferred Options
Outer North Corridor			
ON3			✓
North Shore Corridor			
N2		✓	
N6	✓		
N9		✓	
On-line Corridor			
O1		✓	
O2			✓
O3		✓	
O4	✓		
O5			✓
O6			✓

	Preferred Option	Intermediate Option	Least Preferred Options
O7		✓	
Southern Corridor			
S1			✓
S3			✓
S4			✓
S5 b			✓
Strome Narrows Crossings			
Western Crossing			
Bridge		✓	
Tunnel	✓		
Eastern Crossing			
Bridge		✓	
Tidal Barrage			✓

6.3.14 *Recommendations for further work*

Should a STAG Part 2 Appraisal/DMRB Stage 2 Report be progressed, it is recommended that field investigations are undertaken to determine the extent, make-up and quality of terrestrial and aquatic habitats, with a particular focus on designated sites which could be affected by the proposed scheme options.

Additionally should the corridor options which impact upon designated sites be progressed to Stage 2, it is recommended that consultations with SNH are undertaken. In-addition, non-statutory organisations should also be consulted as potential sources of protected species and habitat information.

Due to the poor historical data available for this area, it is also recommended that the appropriate protected species surveys are carried out, as a means of determining their presence and current status within the study area.

6.4 Landscape and Visual

6.4.1 *Introduction*

The following section provides a DMRB Stage 1 and STAG Part 1 assessment of potential impacts of the four identified route options corridors and the Strome Narrows crossing on the landscape character and visual amenity of the area.

6.4.2 *Methodology*

The assessment has been carried out using the STAG criteria and guidance provided in DMRB, see section 6.1.2 for further details.

The landscape and visual assessments have been undertaken in accordance with the methodology recommended by DMRB Volume 11, and with reference to Scottish Transport Appraisal Guidance and the Guidelines for Landscape and Visual Impact Assessment: Second Edition, 2002, the Landscape Institute and the Institute of Environment and Assessment.

The assessments are undertaken in the following broad stages:

- Establishment of the baseline;
- Assessment of potential impacts; and
- Identification of potential mitigation measures.

Establishment of the baseline

The baseline study provides an appraisal of the landscape character and visual resource of the area, focusing on the route option corridors, in order to establish a clear understanding of the existing conditions. The baseline study will also help to determine the broad sensitivities of the landscape and views of each area and help identify any key constraints and opportunities.

Assessment of potential impacts

The assessments focus primarily on potential impacts on the landscape character and visual amenity of each corridor but also identify where these impacts may extend to the wider area with particular reference to designated sites or other sensitive locations. The assessments will involve an evaluation of the level and significance of potential impacts as detailed in section 6.1.2.

Identification of potential mitigation measures

Potential mitigation measures will be identified for each corridor in order to help reduce any potential negative impacts. These will also be used to help inform the options appraisal and subsequent detailed design process.

6.4.3 *Consultations*

Initial consultation with various statutory bodies, including SNH and The Highland Council and local groups has been carried out through a series of stakeholder events in order to help inform the identification of the four potential route option corridors. In terms of landscape and visual aspects the need to protect areas of national importance for natural heritage has been identified as one of the key objectives by the stakeholders. In addition, the potential for

negative impacts on the natural heritage of the Strome Narrows area, which is undesignated, has also been identified as a potential concern. See section 6.1.5 for more details.

6.4.4 *Baseline*

The following provides a brief description of the broad area within which the options corridors are located, identifying any designated or protected landscapes and key viewpoints or receptors. It also provides a more detailed description of the key characteristics and features of each corridor. Drawing number 47065084 – 1002 shows the corridors and route options within the wider context of the area.

Landscape Designations

One national and two local landscape designations have been identified within the area and are shown on Drawing 6.3- Landscape Designations.

The Wester Ross National Scenic Area (NSA) is located to the north of the option corridors and covers a large area of Wester Ross from Loch Kishorn, northwards to Greenstone Point and Gruinard Bay. Although the NSA is located outwith any of the route option corridors the close proximity could result in localised indirect negative impacts.

The Kyle – Plockton Special Landscape Area (SLA) covers a small area of the coast around Kyle of Lochalsh and Plockton. A very small part of the Outer North and North Shore corridors are within this area and as such there is potential for some localised negative impacts on the character of this area.

The Strathconnon, Monar and Mullardoch SLA covers a large area in the southwest highlands between Loch Carron and Strathglass. It is located to the east of the area and although it is outwith any of the route option corridors the close proximity of part of the south corridor may lead to the potential for localised indirect negative impacts.

In addition to the above designated landscapes, two Search Areas for Wild Land (SAWL) have also been identified within the area and there is potential for some localised negative impacts.

Landscape Character

The overall area, within which the identified route option corridors are located, is covered by the Ross and Cromarty Landscape Character Assessment, (Scottish Natural Heritage Review No.119, Ferguson McIlveen, 1999) and the Skye and Lochalsh Landscape Assessment, (Scottish Natural Heritage Review No. 71, Caroline Stanton, 1996). Drawing 6.4 – Landscape Character Assessment shows the SNH landscape character types within the area.

This is a relatively diverse landscape, ranging from rocky moorland to wide farmed strath and enclosed inlets. The predominant character is one of rugged moorland and hills, divided by steep sided glens and inlets such as Loch Carron, Attadale and Strath Ascaig.

Land use tends to be crofting and agriculture along the coast and straths, with rough grazing on the higher slopes and hills and much of the interior. Land cover is predominantly rough moorland and grassland vegetation with some small areas of native woodland along lower slopes and sheltered glens and several larger areas of commercial forestry.

Settlement is relatively sparse throughout the overall area and is predominantly concentrated along the coast. The village of Lochcarron, which stretches along the north coast of Loch Carron, is the largest settlement in the area. In addition there are also numerous other small

coastal settlements such as Stromeferry, Stromemore, Achmore, Ardaneaskan, Achintraid and Strathcarron.

Outer North Corridor

This corridor passes through a number of areas of distinct landscape character including: wide farmed strath; rocky moorland; narrow enclosed valley; and enclosed loch. The initial section of this corridor, from Strathcarron Junction to Kirkton, is characterised by a wide, flat bottomed strath bounded by rugged moorland hills. Forestry blocks and shelterbelt planting provides some local containment of views within the otherwise, open large scale landscape. The existing A890 and A896 roads represent linear features along and across the valley floor. Key visual receptors in this area include a small number of residential properties and recreational routes.

The corridor passes through two areas of rocky moorland, to the north of Lochcarron and the east of Kishorn. These areas are characterised by sloping and undulating moorland with numerous rock outcrops and boulders. This is a large scale landscape with a varying degree of openness and containment defined by the nature of the topography and occasional blocks of forestry. From more elevated locations there are expansive attractive views over Loch Carron and Loch Kishorn and the surrounding hills. The settlements of Lochcarron, Ardarroch and Achintraid are key visual receptors to these sections of the corridor.

Between the two areas of rocky moorland the corridor follows a narrow, enclosed valley. The enclosed nature of this section contrasts strongly with the more open, large scale nature of the rocky moorland to the east and west. The steeply sloping valley sides, prevalence of exposed rocky outcrops and scrubby trees gives a rugged character to this area. The existing A896 road follows the base of the valley, influencing its character and sensitivity.

The corridor crosses Loch Carron at Strome Narrows before joining the existing A890 near Achmore. The steeply sloping topography on either side of Loch Carron provides a sense of lateral enclosure and focuses views along the loch. The slopes have a rugged appearance, with a prevalence of rocky outcrops and scrubby native woodland. The character of the sea and how it changes depending on weather conditions can have a strong influence on the impression of this landscape. The horizontal lines along the coast at low tide reinforce the linear nature of landscape and its relationship with the sea. A number of small settlements along the coast, existing minor roads and the railway represent key visual receptor locations in this area.

The Achmore/ Strath Ascaig valley displays similar characteristics to that of the wide farmed strath of Strathcarron, as described above. However, the Achmore area is of a smaller scale and is more enclosed, with steeply sloping rocky moorland and forested hills on three sides. Achmore and other properties scattered along the floor of Strath Ascaig are important visual receptors in this section of the corridor.

Although this corridor includes local areas of higher sensitivity, the majority is influenced by the existing road network and settlements and is therefore of medium to low sensitivity.

North Shore Corridor

This corridor follows the north side of Strathcarron and Loch Carron and passes through five main areas of differing landscape character: wide farmed strath; rocky moorland slopes; crofting/ settlement; narrow enclosed valley; and enclosed loch. The initial section of this corridor is similar to that of the Outer North route and as such the key characteristics and elements of the wide farmed strath landscape are described above. Similarly the

characteristics of the enclosed loch landscape at Strome Narrows and the narrow enclosed valley of Achmore/ Strath Ascaig are also described under the Outer North corridor.

The rocky moorland slopes area is found to the north of Lochcarron and west of Strome Carronach and is characterised by rough moorland with rocky outcrops and boulders. Slopes are relatively steep, falling towards Loch Carron. Blocks of forestry and sparse native woodland provide some local containment and division of the otherwise large scale, open landscape which often gains expansive views over and along Loch Carron. Key visual receptors in this area are likely to be residential properties and the railway along both the north and south shores of Loch Carron.

The landscape of the remaining section of this corridor consists of Lochcarron, the largest settlement of the area, and the surrounding farm land. Lochcarron stretches along the North Shore of Loch Carron and is stepped up the hillside a short way. Narrow linear fields stretch further up the slopes above the settlement providing a clear pattern to the landscape. A similar field pattern is found along the shoreline in areas where the settlement is slightly set back from the coast. The improved grassland of these fields provides a context to the settlement and contrasts with the rougher vegetation of the rocky moorland landscape beyond. There are potentially a large number of visual receptors in this area.

This corridor is strongly influenced by existing roads and settlement and is therefore considered to have a low landscape sensitivity.

On-line Corridor

This corridor follows the alignment of the existing road along the southern shore of Loch Carron and can be divided into three sections of differing landscape character. The first of these is the area of wide farmed strath which is described under the Outer North Corridor, above. Within this corridor, the area around Attadale also has similar characteristics and is therefore considered within the wide farmed strath character area.

The section of this corridor from Attadale to Ardnarff is defined by an area of very steep rocky moorland slopes which fall towards Loch Carron. The existing road and rail corridor and associated rock cutting faces are prominent features of this landscape and reinforce the linearity of the topography. Native woodland and scrub occupy the lower slopes along the roadside providing a degree of enclosure to some views. However, much of this area gains open views along or across Loch Carron. Properties in and around Lochcarron, on the opposite shore of the loch, represent the key visual receptors for this area.

Southwest from Ardnarff, forestry extends further up the slopes and becomes the predominant land cover and land use. The slopes are generally slightly less steep along this section and the forestry provides a greater uniformity to the landscape. Open views across Loch Carron are still available from the shoreline, with occasional glimpsed views through the forestry from further up the slopes. The Stromeferry viewpoint along the existing road is an important visual receptor for this area.

The strong influence of the existing road and rail corridor and the prevalence of commercial forestry in the west of the corridor lead to the impression of a landscape with a low sensitivity.

Southern Corridor

The Southern corridor covers the largest area of those identified and includes three main areas of differing landscape character; wide farmed strath, rocky moorland and forested hills. The initial section of this corridor includes the wide farmed strath landscape of Strathcarron and Attadale which is described in the Outer North corridor, above.

The majority of the area covered by this corridor is characterised by rocky moorland, similar in nature to parts of the Outer North route. The key characteristics of this landscape are undulating topography overlaid with moorland vegetation punctured by numerous rocky outcrops and boulders. There are few focal points or elements to help give an indication of the scale of this landscape or aid with orientation. The undulating topography provides a range of experiences and degrees of enclosure as one travels through the area, locally influencing the impression of the landscape. There are very few visual receptors with views into this area.

Commercial coniferous forestry is more widespread at the southwest end of this corridor, where it becomes the dominant land cover and land use, and has a strong influence on the impression of the landscape. The forestry tends to blanket the underlying landform disguising any landmarks and bringing uniformity to the landscape. The forestry and associated tracks and plough lines increase the impression of human influence further into the interior of the area where such influence is otherwise limited. The hard edges and geometric shapes of the forestry blocks are often unrelated to the underlying topography and contrast with the pattern of native woodland found elsewhere.

The impression of this landscape varies locally, with areas of medium sensitivity in the interior rocky moorland, and areas of low sensitivity along much of the remainder of the corridor.

6.4.5

Options Assessment

The following section provides an assessment of potential landscape and visual impacts on the defined option corridors, with reference to the initial route options identified in each area. The corridors and route options are shown on Drawing number 47065084 – 1002.

Outer North corridor

The main sections of this corridor that have the potential to result in landscape and visual impacts are the new sections of road within rocky moorland to the north of Lochcarron and east of Kishorn and the approaches to and crossing of Loch Carron at Strome Narrows.

Two sections of this corridor, north of Lochcarron and east of Kishorn, would require the construction of new sections of road and are likely to result in negative landscape and visual impacts. The introduction of new linear elements has the potential to contrast strongly with the undulating landform and general lack of orientating features and landmarks experienced within this landscape. Careful consideration of the detailed route alignment and design, such as utilising existing topographical features and avoiding cuttings and engineered slopes, would help to minimise potential negative impacts and achieve the best fit with the surrounding landscape. There may also be potential for negative visual impacts from locations in Achintraid, around Loch Kishorn and from the more distant Wester Ross NSA to the north, although these would be relatively small. The section to the north of Lochcarron would potentially be visible from locations along Strathcarron and the south side of Loch Carron, although negative visual impacts are likely to be minor. A route along this corridor would effectively bypass Lochcarron which may result in a reduction in traffic through the village, providing beneficial visual impacts to some locations.

In addition to the above sections, the Strome Narrows crossing would potentially result in significant negative landscape and visual impacts. The crossing corridors and route options are described and assessed in more detail at the end of this section.

To the south of the crossing the corridor follows Strath Ascaig before reconnecting with the existing road south of Achmore. There are likely to be negative landscape impacts on the character of the enclosed valley and negative visual impacts on properties in and around

Achmore. Due to its close proximity, there may also be some localised negative landscape impacts on a small part of the Kyle-Plockton SLA.

The remaining sections of this corridor largely follow the existing alignment of the A896 and it is therefore anticipated that potential landscape and visual impacts would largely be related to upgrading works. This may include widening or minor realignment of the existing road, potentially resulting in the requirement for additional cuttings or engineered slopes which have the potential to result in localised negative landscape and visual impacts.

As identified above there is potential for some limited and localised negative visual impacts on the Wester Ross NSA and the Kyle – Plockton SLA. This corridor is also in close proximity to an identified Search Area for Wild Land. However, the existing road, settlement and contemporary land use provide a context to this area and reduce the potential for negative wild land impacts from this corridor.

Although there are likely to be some localised major negative landscape and visual impacts from parts of this route the impact of the route as a whole is likely to be moderate and negative. In addition to potential negative impacts there is potential for some beneficial visual impacts to properties in Lochcarron.

North Shore corridor

This corridor broadly follows the north side of the Strathcarron and Loch Carron valley. Existing roads and settlement, including Lochcarron have a strong influence on the landscape character of this area and result in a reduced sensitivity to change. However, they also contribute to a large number of potential visual receptors in the area.

The initial section of this corridor, from Strathcarron Junction to Kirkton, generally follows the existing alignment of the A896. It is therefore anticipated that potential landscape and visual impacts on this section would largely be a result of upgrading works to the existing road.

The corridor then widens, allowing for the exploration of different route options in and around Lochcarron. Three potential indicative options for this section have been identified; the first (N2) involves the construction of a section of new road, diverging from the A896 to the north of Lochcarron and reconnecting to the coastal road near Strome Wood. The second option (N6) follows the existing alignment of the coastal road towards Stromemore. The third option (N9) involves the longest section of new road, diverging from the A896 at Kirkton, before joining the first option (N2) north of Lochcarron towards Strome Wood. The first option is likely to have greater negative impacts on the landscape character and be more visually prominent from the southern shore of Loch Carron than the second option, although it is also likely to have lower negative visual impacts on properties in Lochcarron. The second option would limit potential change to upgrading of the existing road and result in the lowest negative impacts on landscape character but the greatest negative visual impacts on the large number of properties that line the existing road. The third option would effectively bypass Lochcarron and as such would potentially result in beneficial visual impacts as a result of reduced traffic through the village. However, this option is also likely to result in the greatest negative landscape impacts and may be more visually prominent from the southern shore of Loch Carron. All three options are likely to require the upgrading of sections of the existing coastal road. Widening of this road may increase the need for cuttings and embankments and increase the prominence of the road corridor resulting in localised negative landscape and visual impacts, particularly during construction.

As with the Outer North corridor the Strome Narrows crossing would potentially result in locally significant negative landscape and visual impacts. A more detailed assessment of the potential crossing corridors and options is provided at the end of this section.

To the south of the crossing the route would pass to the east or west of the prominent hill of Creag Mhaol. The western option (N2) would follow the side of Strath Ascaig and may result in negative impacts on the landscape character of the valley and visual amenity of properties in and around Achmore. There is also potential for some limited and localised influence on a small part of the Kyle – Plockton SLA. The eastern option (N6) would have a lesser negative impacts on Strath Ascaig but is likely to be more visible from other areas such as Stromeferry and Stromemore.

There is potential for some limited and localised negative landscape impacts on the Kyle – Plockton SLA. This corridor is also in close proximity to an identified Search Area for Wild Land. However, the existing road, settlement and contemporary land use provide a context to this area and reduce the potential for negative wild land impacts from this corridor. This corridor is unlikely to result in negative impacts on any of the other landscape designations identified in the wider area.

Similar to the Outer North corridor, potential routes in this corridor would also result in some significant negative landscape and visual impacts. Two of the three identified indicative route options (N2 and N6) have the potential for moderate or major negative visual impacts on properties in Lochcarron due to increased traffic levels influencing the foreground of views. The third option (N9) would bypass Lochcarron and has the potential for beneficial visual impacts. However, this option would also represent the greatest potential negative landscape impacts. The overall landscape and visual impacts of this corridor are likely to be moderate and negative.

On-line corridor

This corridor broadly follows the existing alignment of the A890, although it encompasses a larger part of Strathcarron to allow the investigation of different options in this area. Starting in the north this corridor would involve a route crossing the flat valley floor from the A896 on the north side and joining the existing A890 on the south side. The valley crossing would either follow the existing alignment, requiring some upgrading works or involve the construction of a new route, such as indicative route O6. It is likely that using the existing alignment would have a lesser negative impact on the landscape character and overall visual amenity of the area. The alternative route would involve the construction of a new section of road across the Loch Carron foreshore on embankment and as such provide visual and physical separation of the loch and strath. This part of Strathcarron is also more open, with less tree cover and as such a road across it would be more visible than that of the existing route.

The corridor then roughly follows the alignment of the existing A890, and as such potential options for this corridor would largely involve varying degrees of upgrading of the existing route, from a do minimum option of limited stabilisation of existing rock faces (O4) to construction of a new road on embankment or cantilevered structure along the loch edge (O2) or within a short section of tunnel (O3). Other options include widening of the existing road to a two lane width (O1), a joint road and rail solution (O5), and extending of the avalanche shelter (O7). In general this corridor is likely to result in minor negative landscape and visual impacts on the wider area. However, depending on the option for dealing with the slope and rock stabilisation and narrow nature of the existing corridor there are potential for localised negative impacts, especially during construction. There is also potential for negative visual impacts on a large number of properties in Lochcarron, on the opposite shore of the loch.

Beyond Ardnarff the corridor is largely forested and as such landscape and visual impacts of the route would generally be limited. This section of the corridor remains relatively steeply sloping and therefore it is likely that the route would involve cuttings or engineered slopes and

felling of areas of forestry which would potentially increase the visual prominence and influence the impression of the landscape.

This corridor is unlikely to result in negative impacts on any of the designated landscapes identified within the wider area.

Although there is potential for some localised significant negative impacts, particularly during construction, the overall landscape and visual impacts of this corridor are likely to be minor and negative.

South corridor

The south corridor covers the largest area of the four and would require the longest section of new road. It initially follows the general alignment of the existing A890 across the base of Strathcarron and along the south side of the valley towards Attadale. Where the corridor follows the existing road alignment, landscape and visual impacts are likely to be relatively small and relate largely to upgrading works.

Two indicative route options have been identified for the next section along Strath Attadale. The first option (S4) follows the south side of the valley and the second option (S5b) follows the north side. Both routes have the potential to result in significant negative impacts on the local character and visual amenity of Strath Attadale. The majority of residential properties, and Attadale Gardens, are located along the north side of the strath and as such the northern route would pass in closer proximity. However, many of the properties are orientated towards the south and therefore the southern route, although slightly further away, may be more visually prominent. The northern route also makes better use of existing woodland screening and follows the rough alignment of an existing track. Due to the location of both potential routes along the lower slopes of the valley it will be important to make use of the existing topography in order to minimise the need for cuttings and embankments. Woodland planting may also be able to be incorporated to provide screening and aid the landscape fit.

The corridor and potential routes then continue south and west out of the valley and across an area of rocky moorland and forested slopes. There are few existing structures or human elements in this section, beyond those associated with the forestry plantations. This corridor therefore has the potential for locally significant negative landscape impacts as a result of the introduction of a new linear feature and increased activity and noise into the relatively remote landscape. The western end of the corridor is dominated by plantation forestry and as such potential negative landscape and visual impacts would be more limited. Careful consideration of the route alignment and design through this corridor would be important to help minimise potential negative landscape impacts. Three potential options have been identified within this part of the corridor and they all generally follow lower lying ground, making use of existing topographical and forestry screening. There are very few potential visual receptors along the central and western sections of the corridor and as such negative visual impacts are likely to be limited and localised to the area around the connection with the existing road to the south of Stromeferry.

Although this corridor passes in relatively close proximity to the Strathconon, Monar and Mullardoch SLA and a SAWL it is unlikely to result in significant negative impacts on the impression of these areas.

Although there is potential for some moderate negative visual impacts from a short section of this corridor the majority is likely to result in no or minor negative impacts. In general, landscape impacts are likely to be greater than visual impacts, particularly in the more remote interior area and upper Strath Attadale which are predicted to receive moderate negative

impacts. However, the prevalence of settlement and coniferous forestry along much of this corridor reduces the overall potential negative landscape impacts to minor.

Strome Narrows Crossing

The potential crossing at Strome Narrows and its approaches would result in increased activity and noise within this area, particularly during construction, and this has the potential to result in locally significant negative impacts on the enclosed loch landscape. The introduction of a new structure across the loch, potential cuttings and engineered slopes along the approaches and the associated traffic along the road would contribute to potential negative landscape impacts and also have the potential to result in significant negative visual impacts. Two crossing corridors have been identified for review with different route/ crossing options defined in each corridor.

The western corridor would cross from Leacanasigh on the North Shore towards Portchullin on the south. The two options identified within this corridor are for a bridge structure and a tunnel under the loch. Both options are likely to result in locally major negative landscape and visual impacts during construction. In the longer term, the bridge option is likely to result in major negative impacts on the enclosed loch landscape and the visual amenity of a number of properties in the local area. The most significant negative visual impacts are likely to be from Leacanasigh, Ardaneaskan, Portchullin, Stromemore and Stromeferry, with lesser, non-significant negative visual impacts on users of the railway and from more distant locations such as Plockton. There is also potential for some limited and localised minor negative impacts on the Kyle – Plockton SLA. The tunnel option would be less visible in the long term and is therefore unlikely to result in significant negative landscape and visual impacts on the surrounding area. However approach ramps in and out of the tunnel could cause significant short and long term impacts.

The eastern corridor would cross from Stromemore on the North Shore towards Stromeferry on the south. The two options identified within this corridor are for a bridge structure, similar to that identified for the western corridor, and a lower level tidal barrage structure. Both options are likely to result in major negative landscape and visual impacts on the local area during construction and in the longer term. The most significant negative visual impacts are likely to be from Stromemore, Stromeferry and Leacanasigh. There is also potential for negative visual impacts on users of the railway and from Ardaneaskan, Portchullin and other local properties. The higher level bridge crossing is likely to be more visible than the lower level barrage option, and therefore would have the potential for a wider extent of visual influence and negative impact.

6.4.6 *Potential Mitigation Measures*

General

Careful consideration of the detailed route alignment and design will be an important part of the options appraisal and design development process. The following outlines a number of key principles that could help minimise negative landscape and visual impacts.

- Make use of existing topographical features, landform and woodland to help restrict the visual envelope;
- identify and avoid key landscape features, such as rock outcrops, local high points and ridges;
- follow the existing undulating nature of the landscape and reduce the need for cuttings, embankments and engineered slopes which can increase the visual prominence and result in a poor landscape fit;

- where cuttings and embankments are unavoidable grading out the slopes can help to tie the scheme into the surrounding landscape;
- keep the need for barriers, signage etc. to a minimum, especially in more open, simple landscapes, as these can cause visual clutter and a poor landscape fit;
- where appropriate use planting to provide additional screening and help tie the scheme into the surrounding landscape;

In addition to these broad principles the following highlights potential mitigation measures that may help reduce negative landscape and visual impacts of each of the identified corridors.

Outer North corridor

When optimising a route through this corridor it will be important to make use of existing topography and forestry to minimise visibility from settlements such as Loch Carron, Ardarroch, Achintraid and Plockton and aid integration into the landscape. Where this corridor passes through rocky moorland landscape areas it will be important to ensure that the route respects the undulating landform and exhibits a simplicity of design to achieve the best possible landscape fit and minimise its visual prominence.

The location and detailed design of the Strome Narrows crossing and its approaches will also be important considerations as these have the potential to result in significant negative landscape and visual impacts. A simple structure is likely to have less impact on the landscape character and views than a more complex design, although the height of the structure is also an important consideration. Minimising the need for cuttings and embankments and the incorporation of woodland planting along the approaches may help reduce the visual prominence and complexity of the route, further improving the landscape fit.

Woodland planting along localised section of the corridor, such as Strath Ascaig and Strathcarron may also help to reduce the visual prominence and impact and help tie the route into the surrounding landscape.

North Shore corridor

Many of the same principles and measures identified above, for the Outer North corridor, particularly in relation to the Strome Narrows crossing, would also apply to this corridor. Several sections of this corridor follow the alignments of existing roads and as such would involve upgrading works, such as widening or minor realignment. Where widening would be required the grading out of cutting slopes and embankments and incorporation of planting would help tie the scheme into the surrounding landscape and therefore reduce potential negative impacts.

On-line corridor

This corridor follows the same broad alignment as that of the existing A890 along the south side of Loch Carron. Due to steep slopes and space constraints along the shoreline the potential for mitigation measures is somewhat reduced. Depending on the options identified, the sensitive design of structures and choice of materials could be important considerations in order to minimise visual prominence and achieve a good landscape fit. Careful consideration of the design and alignment of the forested section of this corridor, southwest of Ardnarff, will be required to help reduce the engineered appearance of slopes and the need for barriers and other structures. This in conjunction with woodland planting will help to ensure a good landscape fit and minimise visual prominence.

South corridor

The key considerations for this corridor will be to make use of existing forestry and topography, minimise the need for cuttings and embankments and reduce potential negative impacts on the rocky moorland landscape and Strath Attadale. The rocky moorland landscape is relatively open and uninhabited, with few obvious landmarks or orientating features. It is therefore important that the alignment and design of a route through this area utilises the existing topography and avoids key features such as rocky outcrops and local high points in order to minimise its visual prominence. Simplicity of design, achieved through avoiding the need for cuttings and embankments and other features such as barriers and signs will help minimise potential negative landscape and visual impacts.

Further south the corridor passes through a large area of forestry and the route alignment in this area should make use of existing topography and way leaves, tracks and corridors through the forestry in order to minimise potential negative impacts. Additional woodland planting may also help to further reduce negative impacts.

6.4.7 *Summary*

As outlined above, all of the identified options corridors are anticipated to result in locally significant negative landscape and/ or visual impacts. In general, impacts on the identified designated landscapes are likely to be very limited and localised. The greatest of these is potential negative landscape impacts on the Kyle – Plockton SLA from the Strome Narrows crossings.

The assessment has identified the approaches to and crossing of Loch Carron at Strome Narrows as the areas with the greatest potential to result in significant negative landscape and visual impacts. The high level bridge options are likely to have the greatest influence on visual amenity and character of the local area. The tidal barrage option would be a lower level structure and therefore may have a smaller visual envelope. However, it is still likely to result in significant negative landscape and visual impacts. The tunnel option would represent the best crossing option from a landscape and visual point of view as the majority of the structure would not be visible. The design of the approaches and tunnel entrances would require careful consideration.

The North Shore corridor would likely have the least negative impact on landscape character for much of its length, although the crossing over Loch Carron has the potential to result in locally significant negative impacts on the sensitive Strome Narrows area. This corridor includes a number of different options which would result in a range of potential visual impacts, from beneficial to significant negative, on properties in Lochcarron. The route options would also represent a range of negative landscape impacts on the rocky moorland slopes around Lochcarron, some of them significant.

The Outer North corridor would generally be a relatively good option in terms of visual impacts, with the potential for beneficial impacts on properties in Lochcarron due to the reduction of traffic through the village. The potential to use an existing road corridor for part of the route, and landform and woodland screening along some sections would also help to reduce potential negative landscape and visual impacts. However, like the North Shore corridor this route would also require a crossing over Loch Carron and this would potentially result in locally significant negative landscape and visual impacts.

The On-line corridor includes a do minimum option which is likely to represent the lowest potential landscape and visual impacts. However, some of the other identified options in this corridor, such as route O6 which would introduce a new section of road across Strathcarron or

option O2 which would involve the construction of an embankment or cantilevered structure along the southern shore of Loch Carron would potentially result in locally significant negative landscape and visual impacts. Any works on the southern shore of the loch have the potential to result in negative visual impacts on a relatively large number of receptors in Lochcarron. The do minimum option O4 and the shared road and rail option O5 are likely to have the least significant negative landscape and visual impacts of the options identified within this corridor.

The South corridor has the potential to result in significant negative landscape impacts on the more remote rocky moorland area. Careful route selection and design and the utilisation of existing forestry and topography would help reduce the overall potential negative landscape impacts. Although this corridor has the potential for some localised negative visual impacts, large parts of the identified routes would not be visible from existing settlements and receptors and as such are likely to have the lowest negative impact on the visual amenity of the area. It is considered that a combination of route S4 and S5b would have the lowest negative landscape and visual impacts within this corridor, however there is likely to be a localised negative visual impact on Attadale Gardens.

There is no corridor or route option that stands out as the obvious preferred option from a landscape and visual point of view. The do minimum option (O4) is likely to result in the lowest level of potential negative impacts, depending on the extent and nature of slope stabilisation requirements. It is considered that although there would be some localised negative landscape and visual impacts, the southern corridor would provide the best off line alternative as it avoids the need for the Strome Narrows crossing.

Table 6.4.1, below, provides a ranking of preference of route options from a landscape and visual perspective.

Table 6.4.1 Landscape and Visual Assessment Summary

	Preferred Option	Intermediate Option	Least Preferred Options
Outer North Corridor			
ON3			✓
North Shore Corridor			
N2			✓
N6			✓
N9			✓
On-line Corridor			
O1			✓
O2		✓	
O3		✓	
O4	✓		
O5	✓		
O6			✓
O7		✓	
Southern Corridor			
S1		✓	
S3			✓
S4		✓	
S5 b		✓	
Strome Narrows Crossings			
Western Crossing			

	Preferred Option	Intermediate Option	Least Preferred Options
Bridge			✓
Tunnel		✓	
Eastern Crossing			
Bridge			✓
Tidal Barrage			✓

6.4.8 *Recommendations for further work*

Should a STAG Part 2 Appraisal/DMRB Stage 2 Report be progressed, a more detailed landscape and visual assessment should be undertaken, describing each route option and considering the potential significance of its effects on the landscape.

6.5 Road Drainage and the Water Environment

6.5.1 *Introduction*

This section assesses the potential impacts on the surface water environment and takes into account surface and groundwater quality and hydrology; including geomorphology and flood risk. A preliminary desktop study of the hydrological and hydrogeological features associated with four proposed corridors and four proposed Strome Narrows crossings at an eastern and western location has been undertaken. This assessment effectively forms a high level 'scoping' study to highlight if any of the proposed corridors have the potential to significantly impact the water environment and to identify areas in which more in depth assessments are required.

6.5.2 *Methodology*

The assessment has been carried out using the STAG criteria and guidance provided in DMRB, see section 6.1.2 for further details.

The assessment of potential effects on the water environment has been carried out in accordance with the guidance and techniques presented within the "*Design Manual for Roads and Bridges*" (DMRB), Volume 11, Section 3, Part 10 "Road Drainage and the Water Environment"..

The study area is defined as the area within the corridor boundaries see Drawing 6.5 – Watercourses and Water bodies.

Water resources features within the study area were identified initially from the following sources:

- Ordinance Survey Map (1:25,000)
- SEPA River Basin Management Plan Interactive Map
- SEPA Indicative River and Coastal Flood Map
- SEPA Freshwater Fish Monitoring and Designations Map
- SEPA Superficial and Bedrock Aquifer and Groundwater Vulnerability Maps
- Previous Reports including the Stromeferry Bypass Feasibility Study (DRT, 1994)

The sensitivity of a water resource feature was evaluated using the guidance provided in DMRB Volume 11, Section 3, Part 10, Tables A4.1 "Water Features: Attributes and Indicators of Quality" & A4.3 "Estimating the Importance of Water Environment Attributes" (DMRB), as well as additional criteria based on the professional experience of the assessment team.

Identification of the possible range and magnitude of potential impacts was based on; the guidance within DMRB Volume 11, Section 3, Part 10, the professional experience of the assessment team, previous reports, and liaison with the other members of the environmental assessment team.

Some primary mitigation measures have been included in the assessment; these represent what are considered to be standard mitigation measures that would be applied to the construction and operation of such a road scheme. The requirement for secondary mitigation measures would need to be assessed at DMRB Stage 2 and 3 when an option(s) has been selected.

It should be noted that the study mainly focuses on the above mentioned transport **corridors** however, within these corridors route options have been identified and where it is considered necessary individual options have been assessed (i.e. where the impacts of a particular option vary from the impacts identified for the corridor). The Strome Narrows crossings have been assessed separately to the corridor options.

It is also noted that it is considered valuable to attribute a level of confidence to the predicted impact. In this assessment all impacts have been given at a medium confidence level (on a scale of low, medium, and high) except where stated otherwise. This is because the design details are at corridor selection stage, with individual options designed in plan form only, therefore preliminary concept designs are understood but no detailed concept designs or specific design details are available at this stage.

6.5.3 *Consultations*

Consultation with the relevant statutory and non-statutory organisations was undertaken, see section 6.1.5.

SEPA provided feedback on the key issues required to be addressed during the planning process, those relevant to the water environment are listed below:

- Flood Risk
- Disruption to wetlands
- Sustainable Urban Drainage
- Impacts on groundwater
- Engineering activities in the water environment
- Pollution Prevention and environmental

6.5.4 *Baseline*

Waterbodies and watercourses within the study area are shown on Drawing 6.5 – Watercourses and Water bodies.

Loch Carron is the principal surface water resources feature within the study area and portions of the loch fall within all four of the route corridors see Drawing 6.5 – Watercourses and Water bodies. The loch is a sea loch with a surface area of 25 km² and is the point where the River Carron, and a number of other watercourses described below, outlet to the sea. Tidal currents can reach up to 3 knots at the narrows.

The upper end of Loch Carron is characterised by a delta like tidal zone of approximately 1.5 km between mean high and mean low water springs, tidal pools are exposed in this zone as the tide recedes. Loch Carron is long and relatively narrow with a constricted section near Stromeferry called the Strome Narrows, beyond the narrows the loch opens out to the outer bay which continues to the west until it enters the Inner Sound. Whilst the loch catchment contains a number of national designations, the loch itself does not possess any specific ecological designation. However, it does provide a valuable habitat for fish, most notably salmon.

The southern loch shoreline in the vicinity of the proposals is very steep, rocky in places and heavily vegetated with trees and scrub. The northern shore is less steep. The loch is used as a recreational fishery and for water sports.

Loch Carron is a coastal water body and is currently classified by SEPA under the Water Framework Directive RBMP as having an overall status of 'Good' with High confidence (2008) with overall ecological status of Good and overall chemical status of Pass. No pressures on the water body have been identified.

The SEPA indicative flood map indicates that the tidal zone of Loch Carron and the flood plain area of the River Carron upstream of the tidal zone is prone to a combination of coastal and fluvial flooding in a 1:200 year event.

The **Morar and Torridon Groundwater Body** underlies all of the study corridors and is classified as a drinking water protection zone. The overall RBMP status of the waterbody is 'Good' with High confidence (2008). The quality and quantity of the groundwater has been classified as Good with High confidence, with no trend for pollutants or pressures identified for the water body.

The bedrock aquifer underlying the study area is generally classified as fracture dominated flow with very low productivity, the superficial aquifer is classified as being intergranular flow in places with a range of low to high productivity, the medium to high productivity areas are generally associated with the alluvial deposits of the more major watercourses in the area. The vulnerability of the upper most aquifer is considered to be relatively high in the study area.

The following surface water features have been grouped by corridor and within each group are described from south to north:

Outer North Corridor (ONC)

The downstream reach of the **Allt Cadh an Eas** watercourse lies within the Outer North Corridor and is located to the south of Loch Carron, draining into the loch west of Strome Narrows. This watercourse is classified under the RBMP system as having 'Good' overall status with Medium confidence (2008), with overall ecological status of Good and overall chemical status of Pass and no identified pressures. The SEPA indicative flood map indicates that within the study area the Allt Cadh an Eas watercourse is at risk from out of bank flooding in a 1:200 year event.

The ONC crosses the **Reraig Burn** which is an unclassified watercourse which outlets to Loch Reraig. The SEPA indicative flood map indicates that the burn is at risk of flooding in a 1:200 year event.

The **Abhainn Curnhang a Ghlinne** watercourses lies within the ONC and outlets to Loch Kishorn which is designated as a Shellfish Water. The overall RBMP status of the watercourse is 'Good' with Medium confidence (2008). The overall ecological status is Good and overall chemical status of Pass with no identified pressures on the watercourse. The SEPA indicative flood map indicates that the Abhainn Curnhang a Ghlinne watercourse is at risk from out of bank flooding in a 1:200 year event.

The corridor also crosses the **Allt nan Carnan** watercourse, at a section of deeply incised gorge. The watercourse flows south, draining to the loch at Lochcarron and is not classified as part of the RBMP system, however the gorge section is recognised a Site of special Scientific interest (SSSI). The SSSI is designated for its rare gorge woodland. The SEPA indicative flood map indicates that the Allt nan Carnan watercourse is at risk of flooding in a 1:200 year event.

Between Kirkton and the Strathcarron Junction the corridor crosses a number of unclassified watercourses which flow directly or indirectly to the North Shore of Loch Carron. At this point ON3 is On-line along the existing A896. The SEPA indicative flood map indicates that the

Abhainn Bhuachaig watercourse is at risk from out of bank flooding in a 1:200 year event and the floodplain at the top end of Loch Carron is also a flood risk area, including portion of the existing A896.

North Shore Corridor (NSC)

The downstream reach of the **Allt Cadh an Eas** watercourse lies within the area of the North Shore Corridor common with the ONC, baseline conditions for this watercourse are described in the section above.

Allt Port na Cloiche is a small unclassified watercourse which lies within the NSC, and drains north west through Stromeferry to the south shore of Loch Carron.

The corridor crosses various unnamed and unclassified drainage paths flowing to the northern shore of Loch Carron between the Strome Narrows and Lochcarron. The corridor crosses **Allt Torr nan Daoine** an unclassified watercourse which outlets to the North Shore of Loch Carron south of Strome Wood. The **Allt nan Carnan** (unclassified) lies partly within an area of NSC shared with the ONC, baseline conditions for this watercourse are described in the section above.

Between Allt nan Carnan and the Strathcarron Junction the corridor crosses a number of unclassified watercourses which flow directly or indirectly to the North Shore of Loch Carron. The SEPA indicative flood map indicates that the **Abhainn Bhuachaig** watercourse is at risk from out of bank flooding in a 1:200 year event and the floodplain at the top end of Loch Carron is also a flood risk area, including portion of the existing A896.

On-line Corridor (OC)

The On-line corridor crosses various unnamed and unclassified drainage paths flowing to southern shore of Loch Carron between the Strome Narrows and Achintee.

The corridor also crosses the **River Attadale** in its lower reaches near Attadale which drains to the south east corner of Loch Carron. The overall RBMP status of the watercourse is 'Good' with Medium confidence (2008). The overall ecological status is Good and overall chemical status of Pass with no identified pressures on the watercourse. The SEPA indicative flood map indicates that the River Attadale is at risk from out of bank flooding in a 1:200 year event.

The far north western portion of the OC crosses the **River Carron** near Strathcarron. The overall RBMP status of the watercourse is 'Good' with Medium confidence (2008). The overall ecological status is Good and overall chemical status of Pass with no identified pressures on the watercourse. The River Carron is designated as a Freshwater Fish protection area and a Salmonoid Water. The SEPA indicative flood map indicates that the downstream reach of the River Carron is at risk from extensive out of bank flooding in a 1:200 year event.

The far north western portion of the OC crosses the **River Taodail** near Strathcarron. The overall RBMP status of the watercourse is 'Good' with Medium confidence (2008). The overall ecological status is Good and overall chemical status of Pass with no identified pressures on the watercourse. The River Carron is designated as a Freshwater Fish protection area and a Salmonoid Water. The SEPA indicative flood map indicates that the downstream reach of the River Taodail is at risk from out of bank flooding in a 1:200 year event.

Southern Corridor (SC)

The upstream reach of the **Allt Cadh an Eas** watercourse lies within the Southern Corridor study area. This watercourse is classified under the RBMP system as having 'Good' overall status with Medium confidence (2008), with overall ecological status of Good and overall chemical status of Pass and no identified pressures. The SEPA indicative flood map indicates that within the SC study area the Allt Cadh an Eas watercourse is at risk from out of bank flooding in a 1:200 year event.

The upper reaches of **Allt Gleann Udalain** lie within the SC study area. This watercourse is classified under the RBMP system as being a heavily modified water body (HMWB) with an overall status of 'Good ecological potential' with Medium confidence in 2008 with overall ecological status of Poor and overall chemical status of Pass. The pressures associated with this water body are identified as Abstraction, Flow Regulation and Morphological Alterations (impoundment). The SEPA indicative flood map indicates that the Allt Gleann Udalain is at risk of out of bank flooding in a 1:200 year event.

The mid to upper reaches of **Allt Loch Innis nan Seangan** lie within the SC study area. The overall RBMP status of the watercourse is 'Good' with Medium confidence (2008). The overall ecological status is Good and overall chemical status of Pass with no identified pressures on the watercourse. The watercourse is a relatively major tributary of the River Ling which is designated as a Freshwater Fish protection area. The SEPA indicative flood map indicates that the watercourse is at risk of a small amount of flooding within the study area in a 1:200 year event.

The lower to mid reaches of the **River Attadale** lie within the SC study area. The overall RBMP status of the watercourse is 'Good' with Medium confidence (2008). The overall ecological status is Good and overall chemical status of Pass with no identified pressures on the watercourse. The SEPA indicative flood map indicates that the River Attadale is at risk from significant out of bank flooding in a 1:200 year event along its mid to lower reaches.

The SC shares a common area with the OC in relation to the River Carron and River Taodail, baseline information on these watercourses can be found in the section above.

A number of standing water bodies also lie within the SC study area, these are generally relatively small and unclassified and form the headwaters of tributaries flowing to the River Ling, Attadale and Taodail.

The sensitivities of the water features within the study area are outlined in Table 6.5.2, as this is a Stage 1/Part 1 assessment these have been broadly grouped into classified and unclassified water features.

Table 6.5.1 Summary of Water Resource Receptor Sensitivities

Receptor	Environmental Importance	Socio-Economic Value	Recreational Value	Resilience of Water Body	Flood Risk	Overall Sensitivity
Loch Carron	RBMP Status (2008) 'Good'	Tourism	Used for pleasure craft / water sports / and fishing	Large with reasonable ability to buffer discharges	Significant Floodplain (Coastal)	High
River Carron, River Taodail (Southern and On-line Corridors)	RBMP Status (2008) 'Good' Salmonid Water (Carron) Freshwater Fish (Carron and Taodail)	Tourism	Used for recreational fishing	Reasonable ability to buffer discharges	Floodplain	Very High

Receptor	Environmental Importance	Socio-Economic Value	Recreational Value	Resilience of Water Body	Flood Risk	Overall Sensitivity
only)						
Allt nan Carnan (Outer North and North Shore Corridors only)	Not RBMP classified, Designated SSSI for woodland.	Tourism	No direct uses known but indirectly related to water quality of Loch Carron and rec fishing	Medium ability to buffer discharges given catchment size	Limited floodplain	Medium
Other Classified Watercourses	RBMP Status (2008) 'Good' and 'Good Ecological Potential' (Allt Gleann Uladail)	N/A	No direct uses known but indirectly related to water quality of Loch Carron and rec fishing	Low to medium ability to buffer discharges given small to med catchment areas	Floodplain	Medium
Other Unclassified Watercourses/bodies	Not RBMP classified	N/A	No direct uses but indirectly related to water quality of the Loch	Low ability to buffer discharges given small catchment and low flows	None	Low
Groundwater	RBMP Status (2008) 'Good' The uppermost aquifer is likely to be "highly vulnerable"	Classified as a drinking water protection zone	Not directly applicable to groundwater (but indirectly related to water quality of the Loch and fisheries)	Overall groundwater body flowing to the study area is likely to be relatively large i.e. on a similar scale to the catchment of the Loch	N/A	Medium

6.5.5 Options Assessment

Potential effects of each corridor option has been considered for the construction and operational phases of the project.

The Strome Narrows crossings have been assessed separately to the corridor options. The crossing options are:

- Western crossing
 - Bridge
 - Tunnel
- Eastern Crossing
 - Bridge
 - Tidal barrage including a lock structure with a swing or opening bridge

Construction effects on the water environment are often of temporary and short term duration. Generally speaking, effects are more concentrated during construction compared with the operational phase due to activity levels and actions resulting in a higher likelihood of and potential for pollution and spillages during this period.

Effects on the water environment during the operational phase include road drainage, watercourse crossings and alterations to flood plains and natural drainage pathways.

The following tables set out the range of potential effects expected, their magnitude, and the overall significance based on the sensitivity of the receptor. The effects are split into construction (Table 6.5.3 and 6.5.4) and operation (Table 6.5.5 and 6.5.6) phase effects. The magnitude of effect is stated based on the inclusion of the primary mitigation measures noted in Section 6.5.6.

Potential impacts on watercourses are discussed throughout the tables at a high level, the detailed impacts in relation to hydrology of each of the identified corridors will be determined during future stages. It is anticipated that there will not be any factors preventing suitable networks being produced in order to achieve effective drainage solutions. Even though Loch Carron and its various tributaries present a constraint to the corridor options, they also present a potential drainage solution in terms of outfall locations.

Effects have generally been assessed by corridor and Strome Narrows crossings, individual route options have not been assessed at this stage unless the impacts of a particular option vary from the impacts generally identified for the corridor. Despite this consideration has been given, in a general sense, to the average proportion of corridor utilising existing roads and the requirement for new crossings of the Loch or sensitive watercourses. These are outline briefly below:

- Outer North Corridor – it is proposed approximately half of the route utilises existing roads with a significant new crossing required at Strome Narrows.
- North Shore Corridor – two options are proposed: On-line except new crossing at Strome Narrows and offline bypassing lochcarron.
- On-line Corridor – generally most of the route will utilise the existing road, with the exception of O3 which will require a tunnel, O2 which is a 2 km causeway or cantilever section and route O6 which includes a significant new crossing of the inter-tidal zone to north of loch.
- Southern Corridor – majority of proposed routes are off a current line.

Table 6.5.2 Construction Impacts – Corridor Options

Issue	Receptor & Sensitivity	Corridor Option							
		Outer North		North Shore		On-line		Southern	
		Magnitude (and Type) of Effect	Overall Significance	Magnitude (and Type) of Effect	Overall Significance	Magnitude (and Type) of Effect	Overall Significance	Magnitude (and Type) of Effect	Overall Significance
Surface Water Quality - Sediment mobilisation and spillage or discharge of other pollutants in water bodies	Loch Carron (High) and Classified Watercourses (Medium to Very High³) and Unclassified Watercourses (Low)	Minor (localised to area of works - at Strome Narrows for Loch and highly localised at new watercourse crossings, temporary)	Negligible for the unnamed watercourses & Minor for the Loch and Minor for the affected Classified Watercourses	Minor (localised to area of works - Strome Narrows - and highly localised at new watercourse crossings, temporary)	Negligible for the unnamed watercourses & Minor for the Loch and Minor for the affected Classified Watercourses	Minor (localised to area of works along southern loch shore and highly localised at new watercourse crossings, temporary)	Negligible for the unnamed watercourses & Minor for the Loch and Minor to Moderate for the Classified Watercourses	Minor (localised to area of works, temporary)	Negligible for the unnamed watercourses & Minor for the Loch and Minor to Moderate for the Classified Watercourses
Flooding - Flood risk to surrounding land from development	Surrounding Land & Infrastructure (Low – based on rural land)	Negligible (localised to watercourses, temporary)	Negligible for the surrounding land	Negligible (localised to watercourses, temporary)	Negligible for the surrounding land	Negligible to Minor depending on chosen route (localised to watercourses, temporary)	Negligible for the surrounding land	Negligible (localised around the watercourses, temporary)	Negligible for the surrounding land
Geomorphology and Hydrology - Alteration of water bodies	Loch Carron (High) and Classified Watercourses (Medium to Very High³) and	Minor (localised to Strome Narrows, temporary) for the Loch Minor	Minor for the Loch & Negligible to Minor for the affected watercourses	Minor (localised to Strome Narrows, temporary) for the Loch Minor	Minor for the Loch & Negligible to Minor for the affected watercourses	Minor⁴ (temporary) for the Loch assuming On-line option used Minor	Minor for the Loch & Negligible to Minor for the affected watercourses	Minor (localised, temporary) for the Loch Minor to Moderate (highly	Minor to Moderate for the watercourses Minor for the Loch

Issue	Receptor & Sensitivity	Corridor Option							
		Outer North		North Shore		On-line		Southern	
		Magnitude (and Type) of Effect	Overall Significance	Magnitude (and Type) of Effect	Overall Significance	Magnitude (and Type) of Effect	Overall Significance	Magnitude (and Type) of Effect	Overall Significance
	Unclassified Watercourses (Low)	(highly localised, temporary) for watercourses		(highly localised, temporary) for watercourses		(highly localised, temporary) for affected watercourses		localised but high numbers of crossings, corridor through virgin ground, permanent) for affected watercourses	
Groundwater Quality and Quantity/Movement	Groundwater beneath the site (Medium)	Minor to Moderate (localised to shallow aquifer in vicinity of proposed route, at least half of route offline, temporary, some permanent)	Negligible to Minor for groundwater	Minor (localised to shallow aquifer in vicinity of proposed route, temporary)	Negligible for groundwater	Minor (localised to shallow aquifer in vicinity of proposed route, temporary)	Negligible for groundwater	Moderate (localised to shallow aquifer in vicinity of proposed route which is long and offline, temporary/some permanent)	Minor for groundwater

Table 6.5.3 Construction Impacts – Strome Narrows Crossing Options

Issue	Receptor & Sensitivity	Strome Narrows Crossing Option							
		Western Bridge		Western Tunnel		Eastern Bridge		Eastern Tidal Barrage	
		Magnitude (and Type) of Effect	Overall Significance	Magnitude (and Type) of Effect	Overall Significance	Magnitude (and Type) of Effect	Overall Significance	Magnitude (and Type) of Effect	Overall Significance
Surface Water Quality - Sediment mobilisation and spillage or discharge of other pollutants in water bodies	Loch Carron (High)	Slight (localised to area of works, temporary)	Minor	Slight (localised to area of works, temporary)	Minor	As for Western Bridge	As for Western Bridge	Slight	Minor
Flooding - Flood risk to surrounding land from development	Surrounding Land & Infrastructure (Low – based on rural land)	Negligible	Negligible	Negligible	Negligible	As for Western Bridge	As for Western Bridge	Moderate (potential increased risk at upper loch)	Negligible
Geomorphology and Hydrology - Alteration of water bodies	Loch Carron (High)	Minor (localised to Strome Narrows)	Minor	Minor (localised to Strome Narrows)	Minor	As for Western Bridge	As for Western Bridge	Moderate (tidal regime impacted)	Moderate

Table 6.5.4 Operational Impacts – Corridor Options

Issue	Receptor & Sensitivity	Corridor Option							
		Outer North		North Shore		On-line		Southern	
		Magnitude (and Type) of Effect	Overall Significance	Magnitude (and Type) of Effect	Overall Significance	Magnitude (and Type) of Effect	Overall Significance	Magnitude (and Type) of Effect	Overall Significance
Surface Water Quality - Discharge of road run off to watercourses / loch, pollution from road and infrastructure maintenance	Loch Carron (High) and Classified Watercourses (Medium to Very High³) and Unclassified Watercourses (Low)	Minor (localised to chosen route/point of dispersion, permanent)	Negligible to minor for all affected receptors	Negligible (localised to chosen route/point of dispersion, permanent)	Negligible for all receptors	Negligible (localised to chosen route/point of dispersion, permanent)	Negligible for all receptors	Minor (localised to chosen route/point of dispersion, permanent)	Negligible to Moderate for all receptors
Flooding - Flood risk to surrounding land from development	Surrounding Land & Infrastructure (Low – based on rural land)	Negligible (localised to watercourses, permanent)	Negligible for the surrounding land	Negligible (localised to watercourses, permanent)	Negligible for the surrounding land	Negligible (localised to watercourses, permanent)	Negligible for the surrounding land	Negligible (localised to watercourses, permanent)	Negligible for the surrounding land
Geomorphology and Hydrology - Alteration of water bodies and alteration of drainage patterns	Loch Carron (High) and Classified Watercourses (Medium to Very High³) and Unclassified Watercourses (Low)	Minor (localised to Strome Narrows, permanent) for the Loch Slight (highly localised, permanent) for watercourses	Minor for the Loch & Negligible to Minor for the affected watercourses	Minor (localised to Strome Narrows, permanent) for the Loch Minor (highly localised, permanent) for watercourses	Minor for the Loch & Negligible to Minor for the affected watercourses	Minor⁴ (temporary) for the Loch assuming On-line option used Minor (highly localised, permanent) for affected watercourses	Minor to Moderate for the Loch & Negligible to Minor for the affected watercourses	Minor (localised to northern loch crossing, permanent) for the Loch Moderate (high number of new crossing required but	Minor to Moderate for the watercourses Minor for the Loch

Issue	Receptor & Sensitivity	Corridor Option							
		Outer North		North Shore		On-line		Southern	
		Magnitude (and Type) of Effect	Overall Significance	Magnitude (and Type) of Effect	Overall Significance	Magnitude (and Type) of Effect	Overall Significance	Magnitude (and Type) of Effect	Overall Significance
								localised, permanent) for affected watercourses	
Groundwater Quality and Quantity/Movement	Groundwater beneath the site (Medium)	Negligible (localised to shallow aquifer in vicinity of proposed routes)	Negligible for groundwater	Negligible (localised to shallow aquifer in vicinity of proposed routes)	Negligible for groundwater	Negligible (localised to shallow aquifer in vicinity of proposed routes)	Negligible for groundwater	Minor (localised to shallow aquifer in vicinity of proposed route, permanent)	Minor for groundwater

Table 6.5.5 Operational Impacts – Strome Narrows Crossing Options

Issue	Receptor & Sensitivity	Strome Narrows Crossing Option							
		Western Bridge		Western Tunnel		Eastern Bridge		Eastern Tidal Barrage	
		Magnitude (and Type) of Effect	Overall Significance	Magnitude (and Type) of Effect	Overall Significance	Magnitude (and Type) of Effect	Overall Significance	Magnitude (and Type) of Effect	Overall Significance
Surface Water Quality - Sediment mobilisation and spillage or discharge of other pollutants in water bodies	Loch Carron (High)	Negligible	Negligible	Negligible	Negligible	As for Western Bridge	As for Western Bridge	Minor	Minor

Issue	Receptor & Sensitivity	Strome Narrows Crossing Option							
		Western Bridge		Western Tunnel		Eastern Bridge		Eastern Tidal Barrage	
		Magnitude (and Type) of Effect	Overall Significance	Magnitude (and Type) of Effect	Overall Significance	Magnitude (and Type) of Effect	Overall Significance	Magnitude (and Type) of Effect	Overall Significance
Flooding - Flood risk to surrounding land from development	Surrounding Land & Infrastructure (Low – based on rural land)	Negligible	Negligible	Negligible	Negligible	As for Western Bridge	As for Western Bridge	Moderate (potential increased risk at upper loch)	Negligible
Geomorphology and Hydrology - Alteration of water bodies (including mixing of salt and fresh water)	Loch Carron (High) and Classified Watercourses (Very High)	Minor (Loch only, localised to Strome Narrows)	Minor (Loch only)	Minor (Loch only, localised to Strome Narrows)	Minor (Loch only)	As for Western Bridge	As for Western Bridge	Major for Loch (tidal regime/ loch salinity impacted), Moderate for Watercourses	Major for loch and Moderate for watercourses

Notes for all tables: -

- The assessments above are based on the options corridor level 'design' information (i.e. not detailed scheme design) and are meant to enable differences between the options to be highlighted rather than a definitive assessment of significant potential effects,
- All magnitudes and significances are adverse except where noted as beneficial
- 'Very High' sensitivity receptors only relevant to On-line and Southern corridors
- If route O2 chosen potential for 2 km of shore/loch to be impacted by causeway, magnitude would increase to Moderate and significance Moderate

When individual options/routes are assessed the magnitude of impacts and resulting significance may reduce due to the assessment being able to take account of the use of existing sections of the road.

6.5.6 *Potential Mitigation Measures*

Primary mitigation measures have been assumed to be included in the above assessments, and these measures represent what are considered to be standard mitigation measures that would be applied to the design, construction, and operation of such a scheme. These would include standard conditions that would usually be required by statutory authorities or measures that a designer or contractor would be expected to take based on current best practice. A summary of some of the key primary mitigation measures assumed are noted below: -

- The development and implementation of a detailed site management plan based on the best practice guidance detailed in Pollution Prevention Guidelines published by SEPA and CIRIA Report C532 & C648, as a minimum. In particular, the control of sediment disturbance on the bed of the loch and the control of concrete use in or over the loch should be covered in detail;
- The Contractor should have detailed method statements for working within the loch or a watercourse, and these should cover setting out a minimum working area to limit disturbance and surveying and recording the baseline conditions in advance of the works for reinstatement purposes.
- New surface water drainage infrastructure should be designed in accordance with Sustainable Urban Drainage System principles e.g. measures to attenuate and provide primary treatment of the surface water run off before discharge. The extent of these provisions and the discharge point should be derived based on the advice within the EIA.
- New road drainage outfalls and extensions to culverts should be designed in accordance with best practice to reduce loss of natural bed / bank and prevent erosion. Discharges from new road drainage outfalls should be limited to an appropriate rate for each watercourse.
- In addition, it is recommended that a detailed method statement be prepared for the tunnelling operation, and this should cover the storage, containment, treatment, etc. of the drilling fluids/lubricants used.

6.5.7 *Summary*

During construction the potential effects across the corridors will be of a similar nature but will vary in extent, this will be dependent on the length of new road being installed and the nature of any new watercourse crossings required. The preferred options are generally those with the potential to use a high proportion of existing road corridor especially where crossings of major water resource features are already in place.

The least preferred option (Southern Corridor) is the corridor as this has least potential for On-line routes being utilised.

The preferred Strome Narrows crossing option is the western tunnel as this will cause least impact to the water environment especially during the operational stage.

The least preferred option for the crossing is the eastern tidal barrage due to potential major impacts on the water environment of Loch Carron and migration of salmonoid species to the River Carron and River Taodail.

The preferred, intermediate and least preferred options for route corridors and Strome Narrows crossing are presented in Table 6.5.7 below:

Table 6.5.6 Road Drainage and the Water Environment Assessment Summary

	Preferred Option	Intermediate Option	Least Preferred Options
Outer North Corridor			
ON3		✓	
North Shore Corridor			
N2		✓	
N6		✓	
N9		✓	
On-line Corridor			
O1	✓		
O2		✓	
O3		✓	
O4	✓		
O5	✓		
O6			✓
O7	✓		
Southern Corridor			
S1			✓
S3			✓
S4			✓
S5 b			✓
Strome Narrows Crossings			
Western Crossing			
Bridge		✓	
Tunnel	✓		
Eastern Crossing			
Bridge		✓	
Tidal Barrage			✓

6.5.8 *Recommendations for further work*

Should a STAG Part 2 Appraisal/DMRB Stage 2 Report be progressed, it is recommended that for any of the corridors taken forward a simple assessment should be carried out.

6.6 NOISE & VIBRATION

6.6.1 *Introduction*

Noise from a flow of road traffic is generated by both vehicles' engines and the interaction of tyres with the road surface. The traffic noise level at a receptor, such as an observer at the roadside or residents within a property, is influenced by a number of factors including traffic flow, speed, composition (% HGV), gradient, type of road surface, distance from the road and the presence of any obstructions between the road and the receptor.

Noise from a stream of traffic is not constant; therefore, to assess the noise impact a single figure estimate of the overall noise level is necessary. The index adopted by the UK in 'The Calculation of Road Traffic Noise' (CRTN) to assess traffic noise is $L_{A10,18h}$. This value is determined by taking the highest 10 % of noise readings in each of the eighteen 1 hour periods between 06:00 and 24:00, and then calculating the arithmetic mean. A reasonably good correlation has been shown to exist between this index and residents' perception of traffic noise over a wide range of exposures.

The Design Manual for Roads and Bridges (DMRB) suggests that peoples perception of road traffic noise is different in the short and longer term. It therefore categorises changes in traffic volume on existing roads or new routes separately over the short and longer term. It suggests that negligible noise impacts in the short term result from road traffic noise level changes of up to 1 dB(A), and in the longer term up to 3 dB(A).

A change in the noise level of up to 1 dB(A) $L_{A10,18h}$ is equivalent to a 25% increase or a 20% decrease in road traffic flows, and a 3 dB(A) $L_{A10,18h}$ change is equivalent to a 100% increase or 50% decrease in traffic flow. This assumption does however rely on other factors remaining unchanged, for instance that there is no significant change in the traffic composition (i.e. percentage HGV traffic).

Vibration from traffic can be transmitted through the air or through the ground. Airborne vibration is produced by the engines and exhausts of road vehicles, with dominant frequencies typically in the range 50 - 100 Hz. Ground borne vibration is produced by the interaction of the vehicle tyres and the road surface with dominant frequencies typically in the range 8 - 20 Hz. The passage of vehicles over irregularities in the road surface can be a source of ground borne vibration.

Traffic vibration can potentially have an effect on buildings and cause disturbance to occupiers. DMRB reports that extensive research on a wide range of buildings has found no evidence of traffic induced ground borne vibration being a source of significant damage to buildings. And also, that there is no evidence that exposure to airborne vibration has caused even minor damage.

Airborne vibration is noticed by occupiers more often than ground borne vibration as it may result in detectable vibrations in building elements such as windows and doors.

DMRB states that perceptible vibration only occurs in rare cases and identifies that the normal use of a building, such as closing doors and operating domestic appliances can generate similar levels of vibration to that from traffic.

6.6.2 *Methodology*

The assessment has been carried out using the STAG criteria and guidance provided in DMRB, see section 6.1.2 for further details.

In accordance with the requirements of STAG Part 1 Appraisal, a quantitative assessment of the proposed route options has been undertaken with regard to the existing baseline.

The current Noise and Vibration section of the DMRB HA213/11 Revision 1 (issued November 2011) focuses on a risk based approach using three assessment levels:

- scoping;
- simple; and
- detailed.

All three assessment levels require traffic data for the proposed scheme and surrounding existing roads to be available. At this stage no traffic data is available for the Inverness West Link scheme. Therefore, a limited scoping level assessment has been carried out based on the design and location of each option in relation to potentially sensitive receptors.

The objective of a scoping assessment is to gather data to provide an appreciation of the likely noise and vibration consequences associated with the project. It involves determining if any of the following conditions are met:

1. the project alters the alignment of any existing carriageways or introduces a new section of road, junction, slip road;
2. changes in traffic volumes on existing or new roads cause an increase in traffic noise of 1dB(A) or more in the short term (on opening) or 3dB(A) or more in the long term (between opening and 15 years after opening);
3. changes in traffic speed or the proportion of heavy vehicles on existing roads or new roads cause a change in noise level of 1 dB(A) or more in the short term of 3 dB or more in the long term;
4. if sufficient traffic flow information is available, then it is acceptable to use this to determine whether there is likely to be a change of 1 dB(A) in the short term or 3 dB(A) in the long term which will result from a combination of traffic flow, speed and composition, instead of using 2 and 3 above in isolation;
5. changes in traffic volume, composition and speed on existing roads or new routes during the night may cause the long-term night time threshold value to be exceeded;
6. any changes to the infrastructure surrounding the road, or any change in the way in which an existing road is used, that could cause a change in traffic noise level of 1 dB(A) or more in the short term or 3 dB(A) or more in the long term.

If any of the conditions are met the assessment should progress to the simple stage, or direct to the detailed stage. As most of the options involve the construction of a new road, and new junctions on existing roads, criteria 1 and 6 are met. Therefore, if the scheme progresses a simple or detailed level assessment will be required. A decision on which assessment level is most appropriate can be made once traffic data is available and a full scoping assessment completed.

However, in the absence of sufficient information be able to provide a quantitative assessment at this stage, property counts along the proposed route corridors have been undertaken in order to provide an appraisal of the options.

Residential buildings and other sensitive receptors within 300m of the various scheme options have been identified from OS mapping and aerial photography. The likelihood of noise and vibration impacts occurring at the identified receptors has been considered in a qualitative

manner, by property counts in 100 metres bands from the road centreline up to a distance of 300 metres.

6.6.3 *Consultations*

A range of consultations were carried out as part of this assessment, see section 6.1.5 for more details.

6.6.4 *Baseline*

The 'Do Minimum' option is defined as the On-line 04 option and defines the baseline case. The existing A890 road corridor runs along the southern edge of Loch Carron from Stromeferry to Strathcarron Junction to the north-east of the Loch.

There are various On-line route options. For the purposes of the appraisal the On-line Option 1, 2, 3, 4, 5, and 7 are considered to be equivalent to the baseline case. This is as a result of the road alignment undergoing no significant change in areas where noise sensitive receptors have been identified. The On-line Option 3 would seek to provide a 2km stretch of the road within a tunnel. Whilst there are no sensitive receptor within 300m of the tunnel, properties on the northern side of Loch Carron at a distance of approximately 500m may experience a minor reduction in road traffic noise levels as a result. This is however, not identified within the qualitative property count assessment.

The Baseline indicates a total of 21 properties within 300m of the existing road corridor, with 3 properties within 100m, 9 within 200m and 9 within 300m of the road.

6.6.5 *Options Assessment*

On-line Option 6

The On-line Option 6 would provide an alternative link from Attadale to Kirkton via an upper level crossing thereby diverting traffic away from the Strathcarron and Achintee. The remainder of the road corridor would follow the Baseline route.

The proposed option would reduce the overall number of properties within 300m of the road corridor by 5. This is considered to result in no benefit/impact.

Outer North 3

The Outer North 3 Option would seek to cross the Strome Narrows and connect with the existing road network on the outskirts of Ardarroch with the A896. An additional road link is proposed on the outskirts of Lochcarron to bypass this area of population and connect to the A896 again at Kirkton.

The proposed option would slightly increase the overall number of properties within 300m of the road corridor by 13, and would result in a minor negative impact to the Baseline option.

North Shore 2

The North Shore 2 Option would seek to cross Loch Carron at Strome Narrows before connecting with the existing road network, traveling through Leacanasigh and Stromemore. At the point of Stromewood a new road link would connect with the A896 to the north of Lochcarron. The road route would then follow the A896 through Lochcarron and Kirkton to the Strathcarron Junction.

The proposed option would greatly increase the overall number of properties within 300m of the road corridor by 269. Furthermore a large proportion of the number of properties would lie within 100m of the proposed route. It is considered that the route option would result in a major negative impact.

North Shore 6

The North Shore 6 Option would seek to cross Loch Carron further east than the above option, tying into the road network at Stromemor. The route would follow the existing road network through Strome Wood, Lochcarron, Kirkton before connecting with Strathcarron Junction.

The proposed option would greatly increase the overall number of properties within 300m of the road corridor by 300. Furthermore the majority of the number of properties would lie within 100m of the proposed route. It is considered that the route option would result in a major negative impact.

North Shore 9

The North Shore 9 Option would seek to cross Loch Carron at Strome Narrows before connecting with the existing road network, traveling through Leacanasigh and Stromemore. At the point of Stromewood a new road link would connect with the A896 to the north of Lochcarron. A further new road link would be formed to Kirkton, thereby by-passing the majority of the Lochcarron settlement, before connecting into Strathcarron Junction.

The proposed option would increase the overall number of properties within 300m of the road corridor by 55. It is considered that the route option may result in a minor/moderate impact.

Southern 1

The Southern 1 Option would connect with the existing road network at Strome Ferry and circumnavigate Cnoc Nam Mult and follow the shoreline of Loch Carron via a route running along the southern side of the River Attadale Valley before connecting to the existing A890 road corridor to the north of Attadale, before passing through Achintee and Strathcarron before connecting into Strathcarron Junction.

The overall number of properties within 300m of the road corridor is reduced by 1, although it can be seen that the option increases the number of properties within the 100m banding of the route corridor.

Overall it is considered that the option results in no benefit or impact in noise terms.

Southern 3

The Southern 3 Option is similar to the above route except that at the southern end the road connects with the existing A890 road at Braeindra. The number of properties within 300m of the scheme is increased by 2.

It is considered that the option results in no benefit or impact in noise terms.

Southern 4

The Southern 4 Option is similar to the above route except that at the southern end the road connects with the existing A890 road at the location of the Glen Udalain Valley. The number of properties within 300m of the scheme is reduced by 2.

It is considered that the option results in no benefit or impact in noise terms.

Southern 5b

The Southern 5b Option would connect with the existing A890 at the location of the Glen Udalain Valley and circumnavigate Cnoc Nam Mult and follow the shoreline of Loch Carron via a route running along the northern side of the River Attadale Valley before connecting to the existing A890 road corridor to the north of Attadale, before passing through Achintee and Strathcarron and connecting into Strathcarron Junction.

The overall number of properties within 300m of the road corridor is reduced by 1. It is considered that the option results in no benefit or impact in noise terms.

Southern 3/5b

The Southern 3/5b Option is similar to the above route except that at the southern end the road connects with the existing A890 road at Braeintra. The number of properties within 300m of the scheme is increased by 5.

It is considered that the option results in no benefit or impact in noise terms.

Southern 1/5b

The Southern 4 Option is similar to the above route except that at the southern end the road connects with the existing A890 road at Strome Ferry. The number of properties within 300m of the scheme is increased by 2.

It is considered that the option results in no benefit or impact in noise terms.

6.6.6 *Potential Mitigation Measures*

For the North Shore routes, the proposed road would run in close proximity to existing properties that line the roadside. As such the implementation of mitigation in the form of noise barriers would not be practicable.

For the other route options mitigation measures in the form of noise barriers could be considered. However, as the areas are sparsely populated, the cost/benefit of the inclusion of barriers is likely to be prohibitive.

6.6.7 *Summary*

The assessed route options generally indicate that there would be no net benefit or impact from the majority of the routes. The Outer North 3 option is likely to have a minor negative impact. Both the the North Shore 2 and North Shore 6 options are identified in having major negative impacts, owing to the routing of the traffic though more densely populated areas. A summary of the properties numbers within distance bands from each of the options is shown in Table 6.6.1 and a summary of the noise and vibration assessment is shown in table 6.6.2.

Table 6.6.1 – Summary of Properties within distance bands from options

Route Option	Estimated Number of Properties			
	0 – 100m	100 – 200m	200 – 300m	Total
On-line 1	3	9	9	21

Route Option	Estimated Number of Properties			
	0 – 100m	100 – 200m	200 – 300m	Total
On-line 2	3	9	9	21
On-line 3	3	9	9	21
On-line 4 (Baseline)	3	9	9	21
On-line 5	3	9	9	21
On-line 6	5	6	5	16
On-line 7	3	9	9	21
Outer North 3	7	9	18	34
North Shore 2	138	103	49	290
North Shore 6	193	98	30	321
North Shore 9	19	18	39	76
Southern 1	8	9	3	20
Southern 3	8	9	6	23
Southern 4	8	9	2	19
Southern 1/5b	9	10	4	23
Southern 3/5b	9	10	7	26
Southern 4/5b	9	10	3	22

Table 6.6.2 – Noise and Vibration Assessment Summary

	Preferred Option	Intermediate Option	Least Preferred Options
Outer North Corridor			
ON3		✓	
North Shore Corridor			
N2			✓
N6			✓
N9		✓	
On-line Corridor			
O1	✓		
O2	✓		
O3	✓		
O4	✓		
O5	✓		
O6	✓		
O7	✓		
Southern Corridor			

	Preferred Option	Intermediate Option	Least Preferred Options
S1	✓		
S3	✓		
S4	✓		
S1/5 b	✓		
S3/5	✓		
S4/5 b	✓		
Strome Narrows Crossings			
Western Crossing			
Bridge		✓	
Tunnel	✓		
Eastern Crossing			
Bridge	✓		
Tidal Barrage	✓		

6.6.8 *Recommendations for further work*

Should a STAG Part 2 Appraisal/DMRB Stage 2 Report be progressed, if any of the North Shore Corridor Routes are progressed, further assessment should be undertaken given the potential for significant impacts. Should any of the other route corridor alignments change, assessment should also be undertaken for these.

6.7 **Air Quality**

6.7.1 *Introduction*

This section describes the potential air quality constraints with regard to the alignment options for the Stomeferry Bypass, taking into consideration local effects on human and ecological receptors.

The UK National Air Quality Strategy (Defra, 2000) was initially published in 2000, under the requirements of the Environment Act 1995 (H.M. Government 1995). The most recent revision of the strategy (Defra, 2007) sets objective values for key pollutants as a tool to help Local Authorities manage local air quality improvements in accordance with the EU Air Quality Framework Directive. Some of these objective values have subsequently been laid out within the Air Quality (England) Regulations 2000 (H.M. Government, 2000) and later amendments (H.M. Government, 2002).

The incomplete combustion of fuel in vehicle engines results in the presence of hydrocarbons (HC) such as benzene and 1,3-butadiene, and sulphur dioxide (SO₂), carbon monoxide (CO), PM₁₀ and PM_{2.5} in exhaust emissions. In addition, at the high temperatures and pressures found within vehicle engines, some of the nitrogen in the air and the fuel is oxidised to form NO_x, mainly in the form of nitric oxide (NO), which is then converted to NO₂ in the atmosphere. NO₂ is associated with adverse effects on human health. Better emission control technology and fuel specifications are expected to reduce emissions per vehicle in the long term.

Exhaust emissions from road vehicles affect the concentrations of principal pollutants of concern, NO₂ PM₁₀ and PM_{2.5}, at sensitive receptors in the vicinity of the proposed options.

Although SO₂, CO, benzene and 1,3-butadiene are also present in motor vehicle exhaust emissions, detailed consideration of the associated impacts on local air quality is not considered relevant in the context of this proposal. Road traffic emissions of these substances have been reviewed by the Highlands Council and nowhere within the administrative area is at risk of exceeding these objectives. The development proposals would not be capable of compromising the achievement of the relevant air quality objectives for the protection of human health. Emissions of SO₂, CO, benzene and 1, 3-butadiene from road traffic are therefore not considered further within this assessment.

Emissions of oxides of nitrogen can have an adverse effect on sites designated for importance to nature conservation. Also, the deposition of nitrogen can affect the nutrient balance of certain ecosystems.

The relevant UK national air quality objective values for the pollutants of relevance to this assessment are displayed in Table 6.7.1.

Table 6.7.1 – Air Quality Objective Values

Pollutant	Averaging Period	Value	Maximum Permitted Exceedances	Target Date
Set for the Protection of Human Health				
Nitrogen dioxide (NO ₂)	Annual Mean	40 µg/m ³	None	31/12/05
	1 Hour Mean	200 µg/m ³	18 times per year	31/12/05
Particulate Matter (PM ₁₀)	Annual Mean	18 µg/m ³	None	31/12/10
	24 Hour Mean	50 µg/m ³	35 times per year	31/12/10
Fine Particulate Matter (PM _{2.5})	Annual Mean	12 µg/m ³	None	2010
Set for the Protection of Vegetation and Ecosystems				
Oxides of nitrogen (NO _x)	Annual Mean	30 µg/m ³ (NO _x expressed as NO ₂)	None	19/07/01

6.7.2 *Methodology*

The assessment has been carried out using the STAG criteria and guidance provided in DMRB, see section 6.1.2 for further details.

The Stage 1 air quality assessment is consistent with the methodologies described within Section 3 of Volume 5 of the Design Manual for Roads and Bridges (DMRB) .

The steps taken at this preliminary options stage should include:

- The preparation of a map showing properties where people might possibly be subjected to a change in air quality within 20 m of the existing and proposed alignments;
- A count of the number of properties within 200 metres from the roadside of the existing and proposed alignments, in 50 m increment bands; and
- Highlighting on the map areas where air quality is likely to improve because of reduced flows, speed

House counts of properties within 200 m of each route corridor and associated options has been undertaken using 1:10,000 mapping and aerial photography.

Traffic surveys are currently underway but at present there is insufficient data to undertake a screening assessment to identify affected roads within the study area, as a result of the options.

6.7.3 *Consultations*

Consultations with SEPA were carried out as part of this assessment; see section 6.1.5 for more details. .

6.7.4 *Baseline*

Under the requirements of Part IV of the Environment Act the Highlands Council are required to undertake a phased review and assessment of air quality within their administrative area. To date, this process has identified potential air quality issues at locations in and around Inverness and Caithness. No air quality issues have been identified in Stromeferry and its surrounding area.

There is currently no baseline air quality monitoring or measurement data within Stromeferry or the surrounding area.

In the absence of an existing source of air quality data within the study area, it is strongly recommended that a short-term baseline nitrogen dioxide survey is undertaken to support the quantification of pollutant concentrations at sensitive locations adjacent to the scheme. The survey would be set up to gather concentrations of nitrogen dioxide at three or four locations in the vicinity of the scheme for a period of at least three [3] months.

6.7.5 *Options Assessment*

6.7.6 *Route Options*

This section describes the potential effects on air quality associated with each route corridors and associated options. Properties along the preliminary route options have been counted and segregated into 50 m bands on either side of the road. This banding is depicted for the Route Corridors in Drawings 6.6 – Stage 1 Air Quality Assessment Outer North Route Corridor Option, 6.7 – Stage 1 Air Quality Assessment North Shore Corridor Option, 6.8 – Stage 1 Air Quality Assessment On Line Corridor Option and 6.9 – Stage 1 Air Quality Assessment Southern Route Corridor Option with the results of the property counts given in Table 6.7.2.

Table 6.7.2 – Route Corridor Option House Counts

Route Option	0 – 50 m	50 – 100 m	100 – 150 m	100 – 200 m
<i>Outer North Corridor Route Option</i>				
ON3	5	4	10	10
<i>North Shore Corridor Route Option</i>				
N2	130	68	73	45
N6	187	79	77	41
N9	12	7	8	13

Route Option	0 – 50 m	50 – 100 m	100 – 150 m	100 – 200 m
On-line Corridor Route Option				
O1	13	14	15	3
O2	13	14	15	3
O3	13	14	15	3
O4	13	14	15	3
O5	13	14	15	3
O6	0	0	8	2
O7	3	0	8	2
Southern Corridor Route Option				
S1	11	11	11	7
S2	11	11	11	6
S3	11	11	11	7
S4	11	11	11	6
S5b	9	7	11	6
Existing Alignment				
EA	13	14	15	3

Existing Alignment

The majority of residential properties within 200 m of the existing alignment are located in or around the villages of Achintee and Stromeferry. There are also isolated properties located between these two villages, including those located at Attadale. The existing route also passes within 50 m of the Attadale Site of Special Scientific Interest.

Outer North Corridor Route Corridor

This route corridor currently has only one [option (ON3), which passes to the north of the village of Lochcarron at Kirkton. North of Lochcarron, the route bears east and intersects the Allt nan Carnan Site of Special Scientific Interest. Towards the western extent of the option, the route crosses the Loch via a bridge and passes with 200 m of a number of properties within and around the village of Achmore.

North Shore Route Corridor

This route corridor currently has three options that pass along the northern shore of Loch Carron. The alignment of option N6 passes through the village of Lochcarron where the majority of properties within 200 m are located. The alignment of option N2 passes through the eastern half of the village, before diverting north, bypassing the western part of the village, and rejoining the other two alignments to the west. The alignment of option N9 bypasses both eastern and western halves of Loch Carron, rejoining alignment option N6 at Kirkton in the east

and Strome Carronach in the west. Where options N2 and N9 head north from Lochcarron, they pass within 200 m of the Allt nan Carnan Site of Special Scientific Interest. All four route options pass through the hamlets of Mid Strome, North Strome and Stromemore, before crossing the Loch. On the southern side of the Loch, all three alignment options pass within 200 m of residential properties located in and around the village of Achmore.

On-line Corridor Route Option

This route corridor currently has seven alignment options that, for the most part, closely follow the existing route. The majority of residential properties within 200 m of alignment options O1 to O5 are located within and around the hamlet of Achintee. Alignment option O6 has fewer properties within 200 m as it bypasses Achintee, joining the other alignment options north of Attadale. All seven alignment options pass within 50 m of the Attadale SSSI.

Southern Corridor Route Option

This route corridor currently has five alignment options. Options S1 to S4 pass through Achintee where the majority of residential properties within 200 m of those alignments are located. Whilst option S5b also passes through the village, it bypasses the southern half, reducing the number of properties with 200 m of this alignment.

Strome Narrows Crossing Options

The crossings over the Strome Narrows include a bridge or tidal barrage at the eastern crossing point at Stromemore to Stromeferry, or a bridge or tunnel at the western crossing point at Leacanasigh to Portchullin.

Neither option is likely to be worse or better than any of the others with regards to effects on air quality.

6.7.7 *Potential Mitigation Measures*

No mitigation measures are suggested for the control of air quality effects at this stage, beyond the consideration for refined route options to be distanced as far from air quality sensitive receptors as possible.

6.7.8 *Summary*

A summary of the potential impact that each of the route corridors and associated options would have on local air quality is shown in Table 6.7.3. The definition of each impact is described in Section 6.1.2.

Table 6.7.3 – Summary of Potential Impacts

Route Option	Potential Impact
Outer North Corridor Route Option	
ON3	No benefit or impact
North Shore Corridor Route Option	
N2	Small minor cost or negative impact
N6	Small minor cost or negative impact
N9	No benefit or impact

Route Option	Potential Impact
On-line Corridor Route Option	
O1	No benefit or impact
O2	No benefit or impact
O3	No benefit or impact
O4	No benefit or impact
O5	No benefit or impact
O6	No benefit or impact
O7	No benefit or impact
Southern Corridor Route Option	
S1	No benefit or impact
S3	No benefit or impact
S4	No benefit or impact
S5	No benefit or impact

The North Shore corridor route is likely to have the worst effect on local air quality, when compared to the existing route alignment, as each of its associated options pass through the village of Lochcarron, the most significant residential area in the study area. Of the options within the North Shore corridor route, N9 would have the least impact as it bypasses Lochcarron, N2 would have a minor impact as it only bypasses the western half of the village.

The remaining corridor routes all pass through much less populated areas and would have no benefit or impact on local air quality, when compared against the existing alignment.

The Outer North corridor route and On-line corridor route both pass close to internationally designated sites of importance for nature conservation, as does the existing alignment. The Outer North corridor intersects the Allt nan Carnan Site of special Scientific Interest, and the options within the On-line corridor route pass within 50 m and 100 m of the Attadale Site of special Scientific Interest.

A summary of this assessment is provided in Table 6.7.4 below.

Table 6.7.4 – Air Quality Assessment Summary

	Preferred Option	Intermediate Option	Least Preferred Options
Outer North Corridor			
ON3		✓	
North Shore Corridor			
N2			✓
N6			✓
N9		✓	
On-line Corridor			

	Preferred Option	Intermediate Option	Least Preferred Options
O1		✓	
O2		✓	
O3		✓	
O4		✓	
O5		✓	
O6	✓		
O7		✓	
Southern Corridor			
S1		✓	
S3		✓	
S4		✓	
S5 b		✓	
Stromenarrow Crossings			
Western Crossing			
Bridge	✓		
Tunnel	✓		
Eastern Crossing			
Bridge	✓		
Tidal Barrage	✓		

6.7.9 *Recommendations for further work*

Should a STAG Part 2 Appraisal/DMRB Stage 2 Report be progressed, a simple assessment should be carried out for any of the North Shore Corridor options. In addition if any of the route options differ from those assessed here, these should also be reviewed.

6.8 Geology and Soils

6.8.1 *Introduction*

In accordance with DMRB guidance this section assesses the potential impacts effects of the proposed development on the study area geology and soils.

The consideration of the Geology and Soils directly associated with the proposed A890 Stromferry Bypass options has been undertaken with reference to DMRB Volume 11 Section 3 Part 7 (*Geology and Soils*).

The objective of this respective Stage 1 assessment is to:-

- “Undertake sufficient assessment to identify the possible geological/soil constraints associated with particular broadly defined routes, or corridors, as developed by the Design Organisation and agreed with the Overseeing Departments Project Manager”. (*Source DMRB Vol. 11 : Section 3, Part 7 – section 7*)

This DMRB Stage 1 appraisal of the Geology and Soils assesses, in broad terms, the effects of the route corridors on the geology, agricultural land and geologically designated sites within the Stromferry Bypass Study area and aims to inform future decision making regarding a preferred scheme option to be taken forward for more detailed assessment at DMRB Stage 2.

6.8.2 *Methodology*

The assessment has been carried out using the STAG criteria and guidance provided in DMRB, see section 6.1.2 for further details.

This geology and soils assessment has been undertaken following guidance in DMRB Volume 11, Section 3, Part 7 (*Geology and Soils*).

It should be noted that for ease of reference, and the avoidance of duplication, this assessment should also be read in conjunction with section 6.5 - Road Drainage and the Water Environment, for an assessment of the water quality and drainage impacts of the proposed route options on groundwater, surface water, flooding areas and designated sites, and section 6.11 - Community and Private Assets section, for an assessment of the agricultural land impacts of the proposed route options. .

The Stage 1 assessments are undertaken in the following broad stages:

- Establishment of the baseline;
- Assessment of potential impacts; and
- Identification of potential mitigation measures.

Establishment of the baseline

The development of the baseline allows the establishment of a clear understanding of the existing conditions to allow a sufficient assessment of the likely consequences of the scheme options and the baseline position to be made.

Baseline conditions were identified through a review of the following:-

- British Geological Survey (BGS), 1:50,000 Geological Sheets, 82 Lochcarron and 81E Loch Torridon;

- Historical Ground Investigation: A890 Stromeferry Bypass New Route Studies: Tunnel Route Preliminary Assessment, Mott MacDonald Scotland, August 1993 (ref. 4800/21973/004);
- Environment Scotland website: www.environment.scotland.gov.uk (Accessed 19/03/2013);
- The Highland Council: Contaminated Land and Petroleum Officers; and
- Scottish National Heritage (SNH).

Limitations to the Assessment

At this stage no historical geological or geotechnical data is available across the site area. To take account of this, the assessment has been undertaken using a conservative approach.

Identification of potential mitigation measures

Identification of potential mitigation measures, where appropriate, in order to minimise the effect on the Geology and Soils on the proposed Scheme as far as possible. Mitigation is designed to prevent/reduce and where possible offset the potential effects on the Geology and Soils baseline conditions. Mitigation will also be used to help inform the options appraisal and more detailed design stages.

6.8.3 *Consultations*

The DMRB Stage 1 assessment on the Geology and Soils does not require statutory consultation. However, consultation responses with relevance to access issues for this A890 Stromeferry Bypass project were received from various statutory bodies and local groups through a series of stakeholder events, see section 6.1.5 for more details.

This desk-based assessment has included a review of the Stromeferry Options Appraisal, Geotechnical Desk Study Report, URS, March 2013 (ref. 47065084/GLRP0001).

6.8.4 *Baseline*

Geology

Information regarding the geological conditions at the site was obtained from available published geological sheets¹ and from historical ground investigation reports and is summarised for each corridor in Table 6.8.1.

Table 6.8.1 – Baseline Geology

Corridor	Geology Description
Outer North	<p>Superficial deposits along the majority the corridor were recorded to comprise Moraine and undifferentiated drift, with the exception of the stretch of the corridor from Kirkton to Strathcarron Junction, which was recorded to be underlain by freshwater alluvia, historical investigation also revealed the presence of peat. No indication of the depth of the superficial deposits was given on the maps, although historical reports suggested that superficial deposits would be thin to non-existent.</p> <p>The solid strata along the corridor varied, although generally belong to</p>

¹ British Geological Survey, 1:50,000 Geological Sheets, 82: Lochcarron and 81E: Loch Torridon.

Corridor	Geology Description
	<p>either the Moine Series or Lewisian Series. At Creag Mhaol, the solid strata were recorded to comprise Epidiorite and Hornblende Schist affected by post-Cambrian (Caledonian) movement. Where the corridor crossed Loch Carron, the solid strata were recorded to comprise massive and foliated pyroxenic hornblendic and micaceous gneiss affected by post-Cambrian (Caledonian) movement, up to Loch Kishorn, where the strata were recorded to comprise the Daigbaig Formation and grey sandstone with shaly intercalations of the Terridonian Group up to where the route joins with the A896. The remainder of the route is recorded to be underlain by undifferentiated Granulitic Schists.</p> <p>The solid strata are generally recorded to dip towards Loch Carron at an unspecified angle, although the area around Craeg Mhaol was faulted in all directions, possibly due to the presence of the Moine Thrust.</p>
North Shore	<p>Superficial deposits along the majority of the North Shore corridor were recorded to comprise Moraine and undifferentiated drift, with the exception of the area between Kirkton and Strathcarron Junction, which was recorded to be underlain by freshwater alluvia. No indication of the depth of the superficial deposits is given on the maps, although historical reports suggested that superficial deposits would be thin to non-existent.</p> <p>Around Stromeferry and Ardnarff the solid strata was changeable with massive and foliated pyroxenic hornblendic and micaceous gneiss affected by post-Cambrian movement; epidiorite and hornblende-schist affected by post-Cambrian movement; and flaggy quartz-feldspar granulite being recorded. Around Stromemore the routes were recorded to be underlain by massive and foliated pyroxenic hornblendic and micaceous gneiss affected by post-Cambrian movement and epidiorite and hornblende-schist affected by post-Cambrian movement. Beyond that Mylonite was recorded up to, and around, Slumbay Island, with the remainder of the routes being underlain by undifferentiated granulitic schists of the Moine Series.</p> <p>The solid strata were generally recorded to dip towards Loch Carron at an unspecified angle.</p>
On-line	<p>Where superficial deposits were present they are generally recorded to comprise Moraine and undifferentiated drift of unspecified thickness, the exception being where route O6 crosses the head of Loch Carron, the superficial deposits are recorded to comprise marine alluvia.</p> <p>The solid strata varied across the corridor. Around Stromeferry and Ardnarff the strata is particularly changeable with massive and foliated pyroxenic hornblendic and micaceous gneiss affected by post-Cambrian movement; epidiorite and hornblende-schist affected by post-Cambrian movement; and flaggy quartz-feldspar granulite being noted. Along the remainder of the route, granulitic schists of the Moine series are noted to underlie the route. However, the strata immediately</p>

Corridor	Geology Description
	<p>to the south of the routes along Loch Carron are recorded to comprise acid and hornblende gneiss; amphibolite; and pelitic gneiss. Historical reports note that older rock formations were present above younger formations (as viewed on the exposed manmade slope). This was interpreted by Mott Macdonald (MM) in their report² as representing the lower limb of a large recumbent anticlinal fold, implying that the Moinian sequence exposed along the shore of Loch Carron was inverted. Thus the conglomerate within the pelitic gneiss was interpreted by MM as a 'basal' Moinian lithology. A site of specific scientific interest (SSSI) was established in the area surrounding the existing avalanche shelter to protect this interesting geological feature.</p> <p>The recorded dip varied from south east, to east, to north east.</p>
Southern	<p>The superficial deposits along the routes were recorded to comprise Morainic deposits with some undifferentiated drift, of unspecified thickness.</p> <p>The solid strata were recorded to comprise undifferentiated granulitic schists of the Moine Series, and were noted to dip to the south east.</p>
Strome Crossing	No geological data was available for the bed of Loch Carron.

Soils:

A map showing the soils situated within the Stromeferry Bypass study area is shown in Drawing 6.10 – Soil Classification. The majority of the soils within the study area are within the soil map unit of Lochinver. The parent material of this soil map unit is drifts derived from the Lewisian gneisses and predominantly consist of peat gley, peaty podzol and peat units.

The other notable soil units within the study area are the Arkaig association and Torridon Association both of which predominantly consist of peaty soils, although it also contains some mineral and mountain soils.

The remaining soil map units present within the study area include Alluvial soils, Organic soils and the Corby/Boyndie/Dinnet Association.

Man-made features:

The following existing man-made features (which potentially have associated made ground materials) have been recorded within the study area:

- Kyle of Lochalsh to Inverness Railway and its associated infrastructure including bridges and footbridges
- Bridges
- Existing road pavement with associated structures and earthworks;
- Side roads, farm tracks and foot paths;
- Developments within the local area

² 5.6 A890 Stromeferry Bypass New Route Studies: Tunnel Route Preliminary Assessment, Mott MacDonald Scotland, August 1993 (ref. 4800/21973/004)

- Quarry located south east of Ardarroch (identified on OS open data mapping).

Contaminated Land:

There is at present no information on contaminated land sites within the study area. It is not anticipated that there are any areas of contamination due to the rural nature of the area. In addition, no areas of land were highlighted during the consultation process. Contaminated land is therefore not considered any further at this stage.

When a DMRB Stage 2 assessment is undertaken information from The Highland Council regarding potentially contaminated sites within the study area will be obtained.

6.8.5 *Options Assessment*

All of the route corridors will impact upon the organic soils (described as basin and valley peats) and alluvial soils at the northern end of the Scheme around the Strathcarron Junction (A890/A896). Additionally, all of the route corridors will impact upon Lochinver (which are predominantly made up of brown forest soils, humic gleys, peaty gleys, peat, and brown forest soils, humus iron podzols).

All of the route corridors will have some impact on site geology.

Outer North Corridor

The majority of this route is concerned with the upgrade of existing roadways, therefore there is unlikely to be any adverse effect on existing geology. Where a new road is to be constructed there may be some need for cut and fill operations and some limited peat deposits may be encountered, although these are not likely to be of significant depth. It is considered that these will prove to be a negligible risk to the existing geology.

The majority of this route will impact upon Arkaig and Torridon soils both of which predominantly consist of peaty soils, although it also contains some mineral and mountain soils.

North Shore Corridor

The majority of this route is concerned with the upgrade of existing roadways, therefore there is unlikely to be any adverse effect on existing geology. Where a new road is to be constructed there may be some need for cut and fill operations and some limited peat deposits may be encountered, although these are not likely to be of significant depth. It is considered that these will prove to be a negligible risk to the existing geology.

The majority of the North Shore route corridor will impact upon Arkaig (peaty soils, although it also contains some mineral and mountain soils) around Lochcarron and Kirkton, and Lochinver (described as brown forest soils, humus-iron podzols) at the southern end of the corridor and at the Strome Narrows Crossings.

On-line Corridor

As these options involve either an upgrading of the existing route or the construction of viaduct/tunnel to bypass the problematic areas, there is unlikely to be an adverse effects on the existing geology. However, cognisance should be given to the SSSI located near the

existing avalanche shelter when considering any remedial option, particularly the extension of the avalanche shelter.

The On-line Corridor route option impacts upon alluvial, organic and corby/boyndie/dinnet soils between Strathcarron and Attadale. From Attadale to Stromeferry the On-line corridor impacts only upon Lochinver soils.

Southern Corridor

As a new road is to be constructed, there may be some need for cut and fill operations and some limited peat deposits may be encountered. However, it is considered that these will prove to be a negligible risk to the existing geology.

The Southern corridor impacts all of the soil types within the study area, dependant upon the route option taken. Much like the On-line corridor the Southern corridor impacts upon alluvial, organic and corby/boyndie/dinnet soils between Strathcarron and Attadale and Lochinver soils as it traverses further south. However as the Southern corridor options also pass through Arkaig soils areas till it splits east of Stromeferry where it then only impacts upon Lochinver soils.

Strome Crossing

Regardless of any crossing method selected, there is unlikely to be a major impact on the existing geology of the site.

The Strome Crossings impact upon Lochinver, brown forest soils, humus-iron podzols, soils.

6.8.6 *Potential Mitigation Measures*

In order to mitigate against the impact upon designated geological sites such as the SSSI's identified above, further consultation should be undertaken with SNH to establish the exact designated site boundary in advance of the choice of the route option.

A number of other potential mitigation measures should be implemented as option selection progressed and designs are prepared in more detail, these include:

- Ground investigation, ground improvement design and slope stability analysis.
- Contaminated land a desk top study

In addition there are a number of general construction mitigation measures relating to geology and soils which should be adhered to for any option, these include:

- Following the excavation of any topsoil that will be constructed across green fields, it should be stored, in managed stockpiles, and reused for covering verges, earthworks slopes and landscaping wherever possible.
- Minimise adverse effects on the geology and soils by implementing good operational practices. Effects on soil resources can be mitigated by employing high standards of soil handling and management during the construction and by avoiding the creation of bare areas of permanently exposed soil that would be vulnerable to erosion.
- Spoil and temporary stockpiles should be sited away from watercourses and drainage systems, and surface water should be directed away from stockpiles to prevent erosion. Any runoff from stockpiles will be treated appropriately prior to discharge.

6.8.7 *Summary of Assessment*

The majority of the routes are unlikely to have any adverse effects on the existing geology and are a negligible risk as the routes predominantly involve upgrades of existing and historical routes. However consideration should be given to the SSSI located near the existing avalanche shelter. As a result the options of O4 to O6 are seen as less preferred options and O7 is the least preferred.

If the mitigation measures highlighted above are adopted then all the route options could be designed and constructed to minimise the impact upon the geology and soils of the study area. The exception is where large volumes of imported materials are required.

Table 6.8.2 – Geology and Soils Assessment Summary

	Preferred Option	Intermediate Option	Least Preferred Options
Outer North Corridor			
ON3	✓		
North Shore Corridor			
N2	✓		
N6	✓		
N9	✓		
On-line Corridor			
O1		✓	
O2	✓		
O3	✓		
O4		✓	
O5		✓	
O6		✓	
O7			✓
Southern Corridor			
S1	✓		
S3	✓		
S4	✓		
S5 b	✓		
Stromenarrow Crossings			
Western Crossing			
Bridge	✓		
Tunnel	✓		
Eastern Crossing			
Bridge	✓		
Tidal Barrage	✓		

6.8.8 *Recommendations for further work*

When the DMRB Stage 2 assessment is progressed following this study, it is recommended that the presence of any private water supplies or areas of land contamination is confirmed.

6.9 Cultural Heritage

6.9.1 *Introduction*

This section of the report identifies the impacts upon the heritage resource of the options considered for the Stromeferry Bypass. The heritage resource consists of archaeology, historic buildings and historic landscape. Sixteen route options have been considered within this appraisal and recommendations have been made for the preferred option in terms of least impact on the heritage resource.

6.9.2 *Methodology*

The assessment has been carried out using the STAG criteria and guidance provided in DMRB, see section 6.1.2 for further details.

Study Area & Asset Identification

To set out search areas for the 16 route options, five route corridors including east and west bridge crossings were created which gave a buffer of 500m from the edge of the longest route of that particular group. In order to allow for any future movement of any route options, a further 500m buffer was placed around the route corridors. Therefore there is a search buffer of at least 1km around each route option. This 1km buffer zone was used to identify the designated assets. These include Scheduled Monuments, Listed Buildings, Conservation Areas, the Inventory of Gardens and Designed Landscapes, Inventory of Battlefields and World Heritage sites. To obtain this data, a search of the Historic Scotland GIS database was undertaken. The search area is shown on Drawing 6.11 – Cultural Heritage Designations.

The route corridors with their minimum buffer of 500m from the route options were used as the basis for the search for non-designated assets. These include archaeological sites, findspots and locally significant buildings. To obtain this data, a search of the Highland Historic Environment Record (HHER) was undertaken.

The Historic Landuse Assessment (HLA) study conducted by Historic Scotland was consulted and 193 HLA units were identified within the route corridor buffers.

Site Visit

A site visit was carried out by a URS Consultant in January 2013. The purpose of this visit was to photograph the surrounding landscape and to make a visual assessment of the general area to inform the baseline.

Sources

Historic Scotland

The Historic Scotland website has been used to obtain the GIS datasets for the designated assets along with the long descriptions where available.

Highland Council Historic Environment Record (HHER)

The HHER was consulted to obtain all records of non-designated assets, findspots, non-designated historic landscapes and buildings of historic interest and archaeological fieldwork events. The HHER was also consulted for any aerial photographs they may hold.

Internet Resources

Various On-line resources were accessed to research the baseline of this project, including the National Library of Scotland site.

6.9.3 *Assessment Methodology*

Each of the 16 route options will be assessed against criteria set out in the Design Manual for Roads and Bridges, Volume 5 Section 1 Part 2 TD 37/93 (DMRB, Highways Agency et al) and Volume 11 Section 3 Part 2 HA 208/07 Annexes 5, 6, 7 (Highways Agency et al 2007) and the Scottish Transport Appraisal Guidance 2013 (STAG). Both of these guidance documents outline the requirements of a Stage 1 appraisal with regards to assessing the impacts upon the heritage resource. The importance of the heritage assets, the magnitude of the impact and the resultant effect will be stated within the report using the terminology set out in the guidance stated above. From this, the route option with the lowest perceived impact will be taken forward as the recommended option.

All works have been undertaken in accordance with the Institute for Archaeologists Code of Conduct (IfA 2012) and the Managing Change in the Historic Environment: Setting document issued by Historic Scotland (Historic Scotland 2010).

6.9.4 *Consultations*

Consultation has been undertaken with Historic Scotland, the Archaeological Officer for the Highland Council and the National Trust for Scotland who own Strome Castle, see section 6.1.5.

6.9.5 *Baseline*

A total of 17 designated assets have been identified within the search area consisting of two scheduled monuments (SAM) and 15 listed buildings, one grade A, seven grade B, seven grade C(s), see Drawing 6.11 – Cultural Heritage Designations.. Although located outside of the search area, the village of Plockton is a Conservation Area located approximately 3km to the west of the Outer North Corridor Route Option. Plockton also lies within a Special Landscape Area as designated by the Highland Council (SLA14 Kyle – Plockton).

193 HLA units were identified through a search of the Historic Scotland database; see Drawing 6.12 – Historic Land Use Assessment. Although there are a large number of units, the majority belong to the same landscape type and have been split into smaller sections and each given different reference numbers. The number of different landscape types within the search area is nine.

A search of non-designated assets identified 178 within the search area, though a number of these are duplicate records where an asset has been given two numbers; see Drawing 6.13 – Undesignated Cultural Assets.

Designated Assets

The Scheduled Monument of Strome Castle (**8481**) is located on a promontory overlooking Loch Carron and guarding the narrowest point of the loch, and the sea entrance. The castle was constructed by the MacDonalds of Glengarry in the 15th century. The dominating form of the castle and its location meant that it became the source of dispute between the MacDonalds of Lochcarron and Lochalsh and the MacKenzies in Kintail. As a result of this dispute, the castle was attacked many times and changed hands throughout the 16th century. This rivalry came to a head in 1602 when the castle was blown up and caused substantial

damage. The explosion caused several large parts of the main tower to collapse and there are large chunks of masonry some distance from the castle giving an impression of the force of the explosion. The hall was also destroyed and the damage caused was so extensive that the castle was never occupied again. Archaeological excavations have found that substantial deposits lie undisturbed within the castle, offering potential for research and knowledge. The key characteristics of this monument are defined by its position as the ruins of a late medieval castle. It has historical value in the social history of the area and as the focus of tensions between the MacDonald and Mackenzie clans and excavation has shown it has the potential to contribute to the understanding of late medieval life, castle construction and how defensive structures of this period were designed. The setting of the castle is the loch and the Strome Narrows the castle overlooks as well as the southern shore. Positioned as it is overlooking the narrowest available crossing point of the loch, the castle occupies a strongly defensive position, with views towards the sea to identify approaching raiders and views across to the south identifying approaching attackers coming from the hills and forest. There are also views available up the loch to the north, which would allow early warning of any attack from this direction. The setting of the castle contributes to the understanding of the monument. Views from the southern shore towards the castle are also important. As a defensive site, the views afforded from and towards the castle are of particular significance and contribute towards the setting and understanding of the monument forming part of the key characteristics.

Lochcarron Old Parish Church (**8867**) is located 160m to the south of Lochcarron Parish Church. The monument consists of the remains of Lochcarron Old Church and burial ground. The church was built in 1751 and abandoned in 1845 after the current parish church was constructed in 1834-6. The church was known as the great Church of Lochcarron and was said to occupy the site of the medieval church of St. Maolrubha. The church of St. Maolrubha was a common kirk of the Canons of Ross and was granted in the 13th century. The chapel was still extant in the 16th century when Timothy Pont recorded the site as "*Clachean Mulray, with kirk and toun*". It is assumed that the toun that Pont refers to here is Kirkton. The parish was erected by the Court of Teinds in 1726 with the name changed to Lochcarron in 1775. The only parts of the church which remain upstanding are the southeast wall and the gables. The structure is rubble built with large rectangular windows. The setting of this monument is closely linked to the current church which lies to the northeast. The setting also encompasses the village of Kirkton and the road running alongside. The key characteristics of this asset are the ability to provide information on the archaeology of early modern church buildings with medieval origins and the information it can provide on the evolution of church architecture. It also has the ability to contribute to the understanding of medieval and early modern ecclesiastical practises and the material culture.

There are 15 listed buildings within the study area. These are stated below, with the description and setting set out below:

7262 – New Kelso House Grade A. High Importance.

Description – 1755 with 19th century alterations. 2 storey and attic, 17 bay range of varying dates. One of 3 linen factories established by the board of trustees of forfeited estate in the Highlands. Converted to domestic use in 1810. Listed grade A for historical importance.

Setting – Located at the northern end of Loch Carron, set back off the main road on the valley floor. Façade faces eastwards with a covering of trees to southern views. The building is set within its own plot and distinguished from the surrounding buildings with good access to the River Carron.

6995 – Achmore Fernaig farm barn Grade B. High Importance.

Description – Late 18th century early 19th century cruck barn, long elevations east to west. Off centre paired winnowing doorways, corrugated iron roof. Internally, 6 pairs of large and heavy cruck blades

Setting – The farm barn is located within a working farmyard, set back from a farm track. Setting of this is clearly defined by the agricultural land to the northwest of the barn.

6997 – Achmore farm barn – Grade B. High Importance.

Description – Early 19th century hay/threshing barn of Lochalsh/Kintail type. Long elevations east-west. Coursed rubble, square corners with later wooden shingle roof. Winnowing doors at centre.

Setting – The setting of the barn is within a farmyard with other agricultural buildings. Boundary is well defined and it sits within low lying agricultural ground.

7258 – Lochcarron old parish church – Grade B. High Importance.

Description – Built c.1840, tall rectangular church with 4 long Gothic Y-traced mullions with multi-pane glazing dominating the south elevation. Entrance in centre of west gable, 2 small headed windows in east gable. The present church replaced an older building of 1751, the ruins of which are located 160m to the south and are scheduled.

Setting – The setting of this church is linked to the older ruins to the south and therefore views towards this will be of significance. The church does not have a tower or spire and therefore there is not a dominant feature within this landscape, however due to the flat landscape at the loch head, the building is visible from a wide surrounding area.

7259 – Lochcarron Free Church – Grade B. High Importance.

Description – Constructed in 1846 with alterations in 1859. T-plan church, harled. Projecting gabled wing in centre north with wide centre doorway. Single round headed windows light north elevation, 4 similar symmetrically placed in south elevation. Still in use as a church.

Setting – The church is located on the loch shore and has open, panoramic views across the water. The church has no spire or tower and thus does not form a dominating feature in the landscape and although it shares the ecclesiastical setting with the other churches of the area, there is no visual link between them due to the lack of tall identifying elements which can be seen from a distance.

7263 – New Kelso Farm Square – Grade B. High Importance.

Description – Late 18th century walled courtyard. East and west side of square filled by cruck framed ranges including Kintail barn, north side by cartshed, stables and byres and to the south, an implement shed. Unusual courtyard steading.

Setting – The setting is clearly delineated by the courtyard layout of the buildings but also encompasses the surrounding agricultural land.

7267 – Tullich Farm Square – Grade B. High Importance.

Description – Early 19th century U-plan farmstead. Open courtyard facing south. Western arm comprises Kintail type threshing barn. Cruck framed. Mid-19th century range fills eastern arm

linked by a low centre byre with central segmented headed arch spanning path to farmhouse to the north. Unusually large barn but the farmhouse is not individually listed.

Setting – The setting of this farmstead is defined by the courtyard walls, forming an enclosed space. The farmhouse has a southerly outlook and has association with the surrounding agricultural land.

49299 – Lochcarron main street, Bank House inc. former stables, boundary walls, gatepiers and railings – Grade B. High Importance.

Description – 1870 banking house, 2-storeys, 3 bays. Principal elevation faces south. There is a later 20th century conservatory to centre of west elevation. The original interior layout is mostly intact. The stables are single storey 4-bay rubble walls. Now used as a garage built into the eastern boundary wall. The boundary wall and gatepiers are of coped square rubble with cast iron railings and floriated finials. The building is still in its original use, with half of the building used as a bank and half as a private residence.

Setting – The setting of this building is the main road which it overlooks and the village of Lochcarron itself. The bank faces out across a parkland towards the loch and these views do contribute to the setting of the asset as well as being in commercial use, it is partially residential and constructed in this location to take advantage of the street frontage, and the picturesque views.

6933 – Stromferry, former Church of Scotland Mission Church – Grade C(s). Medium Importance.

Description – Late 19th century rectangular plan church, small with spirelet bellcote. Rubble with red sandstone ashlar dressing. Slate roof. No longer in use as an ecclesiastical building.

Setting – Located overlooking the loch with extensive, panoramic views. Small spirelet gives this building a vertical presence within the landscape and there is a link with the former mission church which is located on higher ground to the south which is of a very similar architectural style and contemporary, with a spirelet bellcote. . The setting is the settlement of Stromeferry and the loch and the other contemporary churches.

6996 – Achmore farm, farmhouse and steading – Grade C(s). Medium Importance.

Description – 1868, farmhouse built by Alexander Ross. Centre door masked by later gabled porch. 2-storey with piended slate roof. Single storey wing to the rear. Steading is single storey, U-plan steading range.

Setting – The farmhouse is located adjacent to the road, but with the gable end fronting onto it. The setting of this house is the associated steading and the agricultural land surrounding the property. There are also setting associations with the settlement of Achmore itself.

7254 – Attadale House – Grade C(s). Medium Importance.

Description – Built 1755 with later additions. 2-storeys with attic, with wide irregular south front. Entrance turret as well as a later 19th century drum tower rising 3 storeys with a conical roof. Slate roofs.

Setting – The setting of this house is well defined by the associated designed gardens. The property is well screened with a band of woodland planting and although the tower gives the building a vertical presence, it is not easily visible within the landscape.

7260 – Lochcarron Hotel – Grade C(s). Medium Importance.

Description – Building of c.1800 with alter additions and alterations by James Ross in 1847. Core of 2 storeys an attice. Extension of 2 storeys with west gable. Slate roofs.

Setting – The setting of this building is the A896 along which is was constructed to take advantage of passing trade. In addition, the hotel has expansive, panoramic views across the loch. This loch side location was the reason for choosing this place for construction and therefore the loch and views form part of the setting.

7261 – Lochcarron Old Police Station – Grade C(s). Medium Importance

Description – Constructed in 1865, the station is a 3-bay house with central door and sash windows. Slate roof and renewed end stacks.

Setting – The A896 forms part of the setting of this building along with village of Lochcarron itself. The lochside location offers good views, but does not form the part of the setting of this building.

48207 – Stromferry former free church – Grade C(s). Medium Importance.

Description – Built in the late 19th century, small, rectangular plan church with spirelet bellcote. Square and snecked rubble with red sandstone ashlar dressings. No longer in use for ecclesiastical purposes.

Setting – Located on the loch edge with extensive, panoramic views. Small spirelet gives this building a vertical presence within the landscape and there is a link with the former mission church which is located on higher ground to the south which is of a very similar architectural style and contemporary, with a spirelet bellcote. . The setting is the settlement of Stromeferry and the loch.

7264 – New Kelso driveway pair of estate cottages – Grade C(s). Medium Importance.

Description – A pair of mid-19th century estate cottages, 3 bay both south facing. Both have corniced end stacks with slate roofs. Listed for their group value.

Setting – The setting of these assets is one another and the buildings around New Kelso farm square with which they are associated. They are also associated with the surrounding agricultural landscape.

Conservation Areas

The conservation area of Plockton is located approximately 3km to the west of the Outer North corridor route option. Although located outside of the study area, it contains a number of listed buildings including grade A structures. It is also a National Trust for Scotland Conservation Village. One of the key characteristics of the conservation area are the views towards Loch Carron and therefore the proposed route corridors have the potential to impact upon the setting of this heritage asset.

Non-Designated Assets

The earliest archaeological evidence from the search area dates from the prehistoric period. With the exception of a number of isolated findspots of bronze axes and some lithic scatters, the main evidence of settlement from this period comes from the sites of a number of hut circles dating from the Bronze Age and located to the north of Lochcarron set into the slopes

of the hills to the north. A possible dun dating from the Iron Age has been identified on the slopes to the northeast of Lochcarron.

A number of the prehistoric assets have been found in areas of raised beach which exists around the shores of the loch. A raised beach is an indicator of the former level of the coastline and evidence of sea level changes, tsunami incidents and evidence of changes resulting from the Ice Age. As the sea level drops, old wave cut platforms are exposed when the sea retreats and the area left exposed becomes a raised beach. These areas have archaeological potential.

Evidence of early medieval archaeology can be found in the form of a possible landing place or naust at Slumbay, the site of a possible boat shaped burial found to the east of Strome Wood and the site of a possible early chapel dedicated to St. Maelrubha. The early chapel is discussed in association with the scheduled monument of Lochcarron Old Parish church above as it is believed to occupy the same site.

The medieval period is characterised in the archaeological record of this area by a number of trackways, indicating the continued use of transport routes. The trackway from Ribhuachan to Coulags keeps to the higher ground formed by a raised beach and runs to the northwest of the A896 starting at Tullich. The trackway from Glen Carron to New Kelso was the main route between these two areas until the construction of the main road in 1819 and another trackway between Kishorn to Kirkton was probably used as a corpse road or drove road as it goes to the graveyard at Kirkton. This route fell out of use when the Parliamentary roads were constructed in 1817 and 1819.

The Timothy Pont map of Wester Ross surveyed from 1583-1614 shows Loch Carron and Strome Castle as well as a number of other farmsteads, many of which are no longer extant. On the northern shore, Slumbay is shown as *Slumba*, and Lochcarron is shown as *Heglith Loch Carron*. Farmsteads along the northern shore of the loch which are noted here but no longer extant include *Doun*, *Rango*, and *Kyleriiss*. On the southern and eastern shore, there is a settlement or farmstead labelled *Achnanty* which may be the modern Achintee and Attadale is shown on the 1583-1614 map as *Attadiel*. There are two settlements shown on the south shore which do not seem to be extant today. These are labelled as *Ardinerrur* and *Strahais*.

The Blaeu map of 1654 shows the main settlements on the northern shore as *Stron Carroun*, *Doun* and *Ribowachan*. To the east, the settlements along the loch edge are labelled as *Edira*, *Achnanty*, *Clachan Mulrui* and *Attadill*. Moving along the southern shore, the only settlement labelled is *Ardynerrur*. A number of those are still extant but there are a number which no longer exist and are therefore form areas of archaeological potential.

There are only two assets identified from the post-medieval period within the study area. One of these assets is the township of Strome Carronach of which only a few buildings are still extant. The other is a building on Slumbay Island which has been described as a fort with two associated longhouses on the lower ground. This building is no longer extant.

The majority of evidence from the study area dates from the early modern period, that is, from the 18th century onwards. It was during this period that the Highland clearances took place. There is evidence for this in the archaeological record of the study area with a number of lost farmsteads and villages along with a large number of shieling huts, scattered across the study area along with a number of crofting farmsteads. A large number of these are located to the north of Lochcarron which is itself a crofting township. The evidence from the post medieval mapping highlights the number of settlements and farmsteads which were located along the loch prior to the clearances which now no longer exist. For example, Braeintra located in the forest to the southeast of Achmore, Ribhuachan located on the northern shore of the loch and

Strome Meanach also located on the northern loch shore. Despite the loss of a number of settlements during the early modern period, the character of settlement can still be discerned, with settlements located on the lower ground near the loch edge and the higher ground surrounding the loch being used for agriculture, latterly sheep farming.

The dominance of farming in this area is clearly shown within the archaeological record. As described above, the settlement of Lochcarron was a crofting settlement with the remnants of the crofts, head dykes and shieling huts all extant here. There are a large number of farmsteads, buildings, head dykes, shieling huts and clearance cairns throughout the study area on the lower slopes of the surrounding hills.

A map of 1826 by John Thomson of the Northern part of Ross and Cromarty Shires is the first map to show any road network within the study area and is also the first to show the Strome Ferry crossing the entrance to Loch Carron. On the southern shore, a road is shown leading from Kirkton northwards running to the east of Achmore to the shore of Loch Carron and the ferry. The road then picks up on the northern shore near Strome Castle which then leads northeast-wards set back from the shore past Strom Mianach (sic), Strome Caranach and Slumbay. The road then moves closer to the shoreline to move past Loch Carron and Kirk, with the church here clearly illustrated. The road then moves northwards, forking at the apex of the loch to go towards New Kelso with the other spur running to the north.

Towards the latter half of the 19th century, the landscape remained rural with the economy based on agriculture. The crofting settlements such as that at Stromeferry remained small and nucleated. However, in the 1870s, the Dingwall and Skye Line of the Highland Railway was constructed. The terminus of this line was at Stromeferry and the village rapidly expanded accordingly to serve tourists who made the journey including the construction of a hotel. The extension of the line in 1897 to Kyle of Lochalsh resulted in a decline in the fortunes of Stromeferry. The village continued to survive due to the existence of the Strome Ferry crossing. Two of the final ships are now wrecks within the loch; the Pride of Strome and Strome Castle. The ferry crossing closed in 1970.

There are a large number of non-designated assets within the study area which cannot be dated to any specific period. The majority are farmsteads or other buildings shown on old mapping but no longer extant, thus making dating difficult. There are also a number of clearance cairns scattered throughout the study area which cannot be date with any certainty. These assets are indicative of continued activity throughout the centuries but cannot be used to identify a particular period.

Historic Landscape

The Historic Landuse Assessment (HLA) produced by Historic Scotland shows that that landscape is dominated by areas of woodland and areas of rough grazing. Nine different landscape types were identified within the search, and the number of different units within these types is given in Table 6.9.1.

Table 6.9.1 – Historic Landscape Types

Historic Landscape Type	No. of units of this type	Importance
Built up area	9	Low
Crofts and smallholdings	5	Low
Designed landscape	2	Low

Historic Landscape Type	No. of units of this type	Importance
Fields and farming	31	Low
Mineral, waste and peat industries – Quarrying	1	Negligible
Moorland and Rough grazing	55	Low
Recreation Area – golf course	1	Low
Water body	12	Negligible
Woodland and forestry	77	Low

Within these nine broad historic landscape types there are sub-divisions. For example the woodland and plantation type is split into:

- Coniferous Plantation – 18 units;
- Managed Woodland – 37 units;
- Woodland Plantation – 22 units.

All of these woodland units, the woodland plantation and coniferous plantation are modern in origin dating from the 20th century. The areas of managed woodland have more antiquity, potentially dating from the 18th century onwards.

The fields and farming historic unit is split into:

- Rectilinear Fields – 27 units;
- Amalgamated Field – 1 unit;
- New Field – 3 units.

The rectilinear fields are remnants of the agricultural history of this area, dating from the 18th and 19th century. The fact that fields and farming forms such a large part of the study area indicates the consequences of the clearances and the reduction in settlements.

The woodland landscape type and rough grazing landscape type which dominate the search area is found in the highland areas to the north and south of the loch. These areas are punctuated with small pockets of rectilinear fields and natural water bodies but as the land slopes downwards towards the loch shore and around the lower ground at the north of the loch within the valley of the River Carron, there is an increase in the variety of landscape types.

The topography of the study area has dictated much of the former and current use of the land, with much of the study area unviable for settlement due to the steep gradients of the surrounding hills, mountains and river valleys. These areas have been left for grazing and woodland. The other areas which are more heavily used are broadly located on the lower slopes towards the loch and in the valley floor of the River Carron where construction and alteration of the landscape would be easier to achieve.

6.9.6 *Options Assessment***Outer North Corridor Route Options (ONC)**

There is only one route option identified within this corridor, ON3. This route commences at Achmore on the A890. It moves northwards, crossing Loch Carron on a bridge approximately 600-900m in length (on tunnel). This crossing is subject to a separate route corridor appraisal. The route moves offline, northwards passing east of Achintraid and Ardarroch. The route then meets the A896 and travels On-line eastwards with an offline section north of Lochcarron, moving On-line at Kirkton and terminating at Strathcarron Junction.

There are two Scheduled Monuments and fourteen Listed Buildings located within this route corridor. 95 non-designated heritage assets have been identified within the search area for this route. Outside of the search area, but with the potential to be impacted by this route corridor is the Conservation Area of Plockton to the east which contains a number of listed buildings and is a National Trust for Scotland Conservation Village.

As the route comes off the eastern crossing bridge or tunnel, there is the potential for visual impacts upon Strome Castle scheduled monument (**8481**) with the increased traffic which may impact upon the setting of the monument.

The construction of any offline sections to the northwest of Achmore, towards the east of Creag Mhaol have the potential to impacts upon a number of non-designated heritage assets associated with the settlement of Achmore and the setting of three listed buildings; Achmore farm barn category B listed (**6997**), Achmore Farm farmhouse and farmsteading (**6996**), a category C(s) listed building. Any route options which involve the stopping up of existing access or increase in traffic in closer proximity to the listed buildings which may increase the risk of vehicle strike will have an adverse impact upon the setting of the listed assets. The Achmore Fermaig farm barn (**6995**) a category B listed building may also be impacted by route proposals within this corridor, in particular if access routes are stopped up.

As the route moves northwards on the northern shore, crossing Reraig Burn, there is the potential for impacts upon a number of non-designated assets associated with the settlement of Reraig including a coffin cairn, dyke, structure, culvert and a pathway. Further north and the route moves up the slope towards Achintraid, there is the potential to physically impact upon further non-designated assets associated with agriculture including a dyke and two enclosures with the township of Achintraid located further to the north.

The offline section of route corridor between Lochcarron and Kirkton has the potential to impact upon a number of non-designated assets including the location of hut circles, the head dyke at Lochcarron and the possible location of a dub or broch, a causeway. This offline section may also contain areas of raised beach which have the potential to contain prehistoric archaeological deposits.

The route corridor tie in to the A896 at Kirkton may potentially occur in close proximity to the scheduled monument of Lochcarron Old Parish Church (**8867**). If the proposed route corridor will impact upon the scheduled area, this would be a major adverse impact and result in a major adverse, effect. However there is an historical coffin or drive which ran from Kishorn to Kirkton, passing the site of the church. Route options which follow this route would bring this historical route back into use but with the potential of increased traffic, noise and vibration issues.

This route corridor will take traffic from the current A890 and move it to the northern shore. This will remove the visual and noise impacts on the grade C(s) listed Attadale House (**7254**)

and result in a beneficial impact. This will also be the case with the pair of estate cottages at New Kelso (7264) located just to the east of the carriageway, also resulting in a beneficial impact.

Potential for Unrecorded Archaeology

The potential for unrecorded archaeological remains in this corridor consists prehistoric archaeology which may be associated with the hut circles and dun site and early modern agricultural archaeology in the form of further shieling huts in the eastern portion of the route corridor. Also any areas of raised beach which may exist along the southern shore have the potential to contain archaeological deposits. This area of higher ground to the west of Lochcarron has the potential to contain more early modern archaeology in the form of shieling huts related to the sheep farming of this landscape. There is potential for the recovery of enclosures along the western portion of the route and for prehistoric archaeology as the route corridor drops down into the valley of the Abhainn Cumhang a Ghlinne before any On-line options with the A896.

Table 6.9.2 - Outer North Corridor Assessment

Site Ref	Asset name	Importance	Magnitude of Impact	Residual Effect (without mitigation)
8481	Strome Castle Scheduled Monument	High	Moderate	Moderate Adverse – Negative impact
8867	Lochcarron Old Parish Church (if any option runs into the scheduled area)	High	Major	Major Adverse – Negative Impact
8867	Lochcarron Old Parish Church (if any option avoids the scheduled area)	High	Slight	Minor Adverse – Negative Impact
n/a	Plockton Conservation Area	High	Slight	Minor Adverse – Negative impact
6933	Stromeferry, former Church of Scotland Mission Church	Medium	Slight	Minor Adverse
6996	Achmore farm, farmhouse and steading	Medium	Moderate	Minor Adverse
7254	Attadale House	Medium	Slight	Minor Beneficial
7264	New Kelso driveway, pair of estate cottages	Medium	Slight	Minor Beneficial

Site Ref	Asset name	Importance	Magnitude of Impact	Residual Effect (without mitigation)
n/a	Non-designated assets & unknown archaeological assets	Low	Major	Minor Adverse

North Shore Corridor Route Options (NC)

All three route options within this corridor will require the construction of a bridge to cross the mouth of Loch Carron. The current options involve an offline commencement of the new route on the southern shore of the loch around Creag Mhaol. The routes continue On-line until Strome Wood where option N2 moves offline northwards through the woodland to tie into the A896 north of Lochcarron. The other current route option of N6 remains On-line through Lochcarron to tie into the A896 at Kirkton. Given the steep gradients in the northwest of this corridor, it is unlikely that any other route options will be moved further west and routes around Lochcarron are limited. A bypass of Lochcarron route option N9 has also been developed which combines options N2 and ON3. Route N9 crosses Loch Carron as N2 and moves along the northern shore, bypassing Lochcarron and joining with the Outer North Corridor Route option ON3 at the A896.

Two Scheduled Monuments and fifteen Listed Buildings have been identified within this route corridor.

Any route option which utilises the A896 as it runs through Lochcarron will have an adverse impact upon the grade B listed building of Lochcarron bank house (49299) and associated features, the grade C (s) Lochcarron Hotel (7260) and Lochcarron old police station (7261). Although this carriageway is currently in use, the diversion of all traffic to pass through the village of Lochcarron will substantially increase the volume of vehicles. This will increase the levels of noise, vibration and dust which will impact upon the fabric of the buildings.

For the mainly On-line option of N6, there will be few potential impacts upon non-designated assets. There is the potential to impact upon croft sites located near the current road where further landtake may be required, but the existing road will have reduced the potential for unrecorded archaeology.

The offline option of N2 has the potential to impact upon a number of heritage assets as it splits to travel north of Lochcarron. In particular, the cleared farmsteads of Ribhuachan and Strome Meanach may be physically impacted. Any offline option would have to travel through an area of clearance cairns, possible hut circles and a possible boat shaped burial to the east of Black Mares Rock which may all be physically impacted by the route. The remainder of N2 travels along On-line corridors, including the link back to Lochcarron.

The bypass option of route N9 will cause the same potential impacts as N2, particularly on the route to the north of Lochcarron where the impacts upon the farmsteads at Ribhuachan and Strome Meanach will be the same. In addition, the route will pass through the area of clearance cairns, hut circles and boat-shaped burial as it joins up with option ON3 to travel along the A896. This option will remove traffic from Lochcarron and therefore reduce impacts upon the listed buildings which are located along the roadside, however this is balanced with the issue that the buildings within Lochcarron were intended to be located along a road which was in use for passing trade.

This route corridor will take traffic from the current A890 and move it to the northern shore. This will remove the visual and noise impacts on the grade C(s) listed Attadale House (7254) and result in a beneficial impact. This will also be the case with the pair of estate cottages at New Kelso (7264) located just to the east of the carriageway, also resulting in a beneficial impact.

Potential for Unrecorded Archaeology

A large number of non-designated assets have been located on the slopes to the west of the road from Lochcarron toe Mid Strome including a number of hut circles sites of findspots of Bronze Age axes. The slopes of An Sgurr and the area around Black Mares Rock have a high potential for the recovery of archaeological deposits, in particular as this is an area of raised beach, which will run all the way to the loch shore. In addition, offline section along the loch shore has the potential to locate assets relating to the settlements removed during the clearances which have not been recorded on the HER.

Table 6.9.3 - North Shore Corridor Assessment

Site Ref	Asset name	Importance	Magnitude of Impact	Residual Effect
8481	Strome Castle scheduled monument	High	Moderate	Moderate Adverse
n/a	Plockton Conservation Area	High	Slight	Minor Adverse
49299	Lochcarron bank house	High	Minor	Minor Adverse
6933	Stromferry, former Church of Scotland Mission Church	Medium	Slight	Minor Adverse
7260	Lochcarron Hotel	Medium	Moderate	Minor Adverse
7261	Lochcarron Old Police station	Medium	Moderate	Minor Adverse
7254	Attadale House	Medium	Slight	Minor Beneficial
7264	New Kelso driveway, pair of estate cottages	Medium	Slight	Minor Beneficial
n/a	Non-designated heritage assets & Unknown assets	Low	Major	Minor Adverse

On-line Corridor Route Options (OC)

This route corridor encompasses the route options which are based on the current road alignment and arrangement, with one of the proposed options thus far being a ‘do nothing’ option. This route commences to the south of the hill of Am Meallan and moves On-line to the east, with few offline routes available due to the steep gradients and woodland to the southeast. The route then travels to Attadale with one option cutting across the north apex of

the loch, and the remainder of the routes remaining On-line, turning at Achintee to tie into the A896 at Strathcarron Junction.

One Scheduled Monument and 12 Listed Buildings have been identified within this route corridor.

Route option O6 will have setting impact upon the scheduled monument of Lochcarron Old Parish Church. Although the church is currently located at the side of an existing carriageway, the proposed O6 route proposes an additional carriageway carrying all of the traffic across the upper shore of Loch Carron to tie into the A896 virtually opposite the church. As well as imposing a setting impact, there is also the increase vulnerability of this asset from vehicle strike.

Options which involve any deviation from the current carriageway, or widening of the carriageway have the potential to impact upon the non-designated asset of a farmstead to the northeast of Ardnarff and the asses of a farmstead at Cuddies Point.

Option O6 will remove traffic from the current A890 where it passes the pair of estate cottages at New Kelso (**7264**) thus reducing the noise, vibration and dust currently caused by the passing traffic. This will have a slight impact resulting in a beneficial impact.

Potential for Unrecorded Archaeology

The route options are broadly On-line with only a few offline opportunities. The topography of the land to the southeast of the proposed route is such that the steep gradients prevent any settlement and would not be a suitable location for funerary monuments such as cairns. The main areas for archaeological potential would be any potential embankments which extend into the loch edge and routes which would cut across the northern point of the loch where possible raised beach surfaces and paleo-environmental deposits may be recovered.

Table 6.9.4 - On-line Corridor Assessment

Site Ref	Asset name	Importance	Magnitude of Impact	Residual Effect
8867	Lochcarron Old Parish Church (O6 option only)	High	Major	Major adverse
7258	Lochcarron Parish Church Grade B listed building (O6 option only)	High	Moderate	Moderate adverse
7264	New Kelso driveway, pair of estate cottages (Option O6 only)	Medium	Slight	Minor Beneficial
n/a	Non-designated heritage assets & unknown archaeological assets	Low	Major	Minor Adverse

Southern Corridor Route Options (SC)

This route corridor has been assessed to the ends of the route options, however should On-line Corridor option O6 be added to the end of Southern Corridor options S 4 the potential impacts arising from O6 would be additional to those stated within this route option.

This route corridor occupies a large area to the south of the loch and all route options will run largely offline, utilising forest tracks where possible. The current route options have three potential commencement points all leading off the A890. The route then climbs or continues running along the higher ground before dropping down into the river valley of Attadale making use of the existing road and existing Strathcarron Junction.

No Scheduled Monuments and seven Listed Buildings have been identified within the route corridor.

There are a number of non-designated assets which may be impacted by this route. The western commencement of S3 has the potential to physically impact upon the former township of Allt Cadh an Eas. There may be unrecorded deposits associated with this asset such as buildings, shieling huts and enclosures which are currently masked by the plantation. Where all the routes join to run along the high ridge near Glen Ling there is the potential to impact upon the asset of another former township of Allt Loch Innis Nan Seangan with the possibility of unrecorded associated archaeological deposits in close proximity.

As the route drops down in the River Attadale valley, route option S5b has the potential to impact upon the setting of the grade C(s) listed Attadale House by effectively enclosing the house within transport routes; the railway to the west and the new road to the east. This would bring a significant increase in noise and sever the connection between the house and the surrounding designed landscape.

Potential for Unrecorded Archaeology

The potential unrecorded archaeology in this route corridor will mainly consist of early modern agricultural remains such as shieling huts, enclosures and dykes. Some prehistoric monuments have been identified within the study area and therefore there is potential for cairns on the higher ground and where the route corridor drops into the River Attadale valley. This is reinforced by the location of a possible henge site and a cairn in an area not currently under woodland near the western commencement point of this route corridor.

Table 6.9.5 – Southern Corridor Assessment

Site Ref	Asset name	Importance	Magnitude of Impact	Residual Effect
7254	Attadale House	Medium	Major	Moderate Adverse
n/a	Non-designated heritage assets & unknown archaeological assets	Low	Major	Minor Adverse

Strome Narrows Crossings

This route involves the eastern crossing consisting of either a bridge or a tidal barrage which travel from the southern shore to land near to Strome Castle. The western crossing consists of a bridge or tunnel option travelling from the southern shore to land to the west of Lecanasigh on the northern shore.

The construction of the western bridge crossing will potentially impact upon the setting of the scheduled monument of Strome Castle (8481). The key characteristics of this monument have been described in the baseline section above. The introduction of a bridge would reduce the significance of the setting of the castle by impacting upon the views afforded from the

castle. The impact of a bridge could be reduced by high quality, iconic design and by moving the bridge as far to the west as is possible to remove it from views from the castle and from views towards the castle.

The construction of the eastern crossing bridge will severely impact upon the setting of the scheduled monument of Strome Castle (8481). The construction of a bridge or a tidal barrage in such close proximity would reduce the significance of the setting of the castle by dominating the views afforded from the castle. In addition, one of the key characteristics of the site was its role as a defensive feature, guarding the sea entrance to the loch. The construction of a bridge opens up easy access from the north to the south shore and will reduce the isolation of the asset and reduce its function as a defensive site. The design of the bridge may also challenge the dominance of the castle at this low point in long distance views along the loch shore.

The eastern crossing would physically impact upon non-designated assets including former landing slips.

The construction of any bridge will impact upon the views from the conservation area at Plockton and from the grade C(s) listed Stromeferry former Church of Scotland Mission Church (6933) and the grade c(s) listed Stromeferry former Free Church (48207). It has been identified that an important view from the conservation area is focused upon Loch Carron. A bridge structure will restrict these views and remove the “open” feeling of views up the loch. From the church, there are extensive, open views across the loch which was clearly the reason for the placement of the buildings. A large bridge structure would reduce the openness of this view and introduce a large, modern engineered element into this wild and natural landscape. There is the potential that this impact could be reduced by high quality design. However the eastern crossing would be placed in extremely close proximity to the church which would bring an increased volume of traffic with noise and dust impacts as well as the commencement of the bridge which would be a significant visual impact and dominate the church building.

Potential for Unrecorded Archaeology

The potential for unrecorded archaeology within this corridor may consist of unrecorded wreck remains and unrecorded rock shelters near the shoreline and within the loch bed.

Table 6.9.6– Stromenarrows Crossing Assessment

Site Ref	Asset name	Importance	Magnitude of Impact	Residual Effect
6933	Stromeferry, former Church of Scotland Mission Church (listed grade C(s) (eastern crossing)	Medium	Moderate	Minor Adverse
6933	Stromeferry, former Church of Scotland Mission Church (listed grade C(s) (western crossing)	Medium	Slight	Minor Adverse
8481	Strome Castle Scheduled Monument (eastern crossing)	High	Major	Major Adverse
8481	Strome Castle Scheduled Monument (western crossing)	High	Moderate	Moderate Adverse

Site Ref	Asset name	Importance	Magnitude of Impact	Residual Effect
48207	Stromeferry, former Free Church of Scotland listed grade C(s) (eastern crossing)	Medium	Moderate	Minor Adverse
48207	Stromeferry, former Free Church of Scotland listed grade C(s) (western crossing)	Medium	Slight	Minor Adverse

6.9.7 *Potential Mitigation Measures*

A Stage 2 assessment will be required for emerging options which will highlight in greater detail any mitigation measures which may be required. Preservation in situ is the preferred option for the below-ground heritage assets and for those assets with a predicted setting impact, the aim will be to reduce this as far as possible in order to maintain the key characteristics of the asset.

Should preservation in situ not be achievable then preservation by record will be required to mitigate against the adverse impacts of the scheme. This may include:

- A programme of archaeological fieldwork either prior to or during the construction phase; and
- Building recording if any listed buildings or locally significant buildings were to be adversely impacted.

Any mitigation measures would be discussed with the Highland Archaeologist prior to implementation.

6.9.8 *Summary*

Any route option which includes the construction of a bridge would be the least preferred option due to the potential visual and setting impacts upon Strome Castle and the conservation area of Plockton, however within the Strome Narrows options, the option of the western tunnel is the preferred and the western bridge considered moderate adverse..

Within the preferred On-line route corridor, any option which involves the tie in to the A896 opposite the scheduled monument of Lochcarron Old Parish Church and within the view of the grade B listed Lochcarron Parish Church is to be avoided. This route option would be least preferred out of this route corridor. In addition, this tie in route over the end of Loch Carron should be avoided where possible for the terminus of Southern Corridor route options O6.

The preferred route corridor from the heritage perspective would be the On-line Corridor.

Table 6.9.7 – Cultural Heritage Assessment Summary

	Preferred Option	Intermediate Option	Least Preferred Options
Outer North Corridor			
ON3		✓	
North Shore Corridor			
N2		✓	
N6			✓
N9		✓	

	Preferred Option	Intermediate Option	Least Preferred Options
On-line Corridor			
O1	✓		
O2	✓		
O3	✓		
O4	✓		
O5	✓		
O6			✓
O7	✓		
Southern Corridor			
S1	✓		
S3	✓		
S4	✓		
S5 b			✓
Stromenarrow Crossings			
Western Crossing			
Bridge		✓	
Tunnel	✓		
Eastern Crossing			
Bridge			✓
Tidal Barrage			✓

6.9.9 *Recommendations for further work*

Should a STAG Part 2 Appraisal/DMRB Stage 2 Report be progressed a simple assessment should be undertaken, this should be desk based and potentially include a walkover survey.

6.10 Effects on all Travellers

6.10.1 *Introduction*

In accordance with DMRB guidance this section assesses the potential impacts on both motorised users and non-motorised users (NMUs, including pedestrians, cyclists and equestrians).

The consideration of the Effects on All Travellers directly associated with the proposed A890 Stromeferry Bypass options has been undertaken with reference to DMRB Volume 11 Section 3 Part 8 (*Pedestrians, Cyclists, Equestrians and Community Effects*) and Volume 11, Section 3, Part 9 (*Vehicle Travellers*), see section 6.1.3 for more details.

The objective of these respective Stage 1 assessments are to:-

- “Undertake sufficient assessment to provide an appreciation of the likely effects on pedestrians, cyclists and equestrians and for people’s ability to move around their local community, and to identify the relevant constraints associated with particular broadly defined routes, or corridors, as developed by the Design Organisation and agreed with the Overseeing Departments Project Manager”. (*Source DMRB Vol. 11 : Section 3, Part 8 – section 9*)
- Undertake sufficient assessment to provide an appreciation of the likely effects on vehicle travellers, to identify the relevant constraints, and “a forecast of whether the broadly defined routes as developed by the Design Organisation and agreed with the Overseeing Department’s Project Manager would be likely to produce low or moderate driver stress.” (*Source: DMRB Vol. 11: Section 3, Part 9 – section 5*)

This DMRB Stage 1 appraisal of the Effects on All Travellers assesses, in broad terms, the effects of the route corridors on both motorised and non-motorised users within the Stromeferry Bypass Study area and aims to inform future decision making regarding a preferred scheme option to be taken forward for more detailed assessment at DMRB Stage 2.

6.10.2 *Methodology*

The assessment has been carried out using the STAG criteria and guidance provided in DMRB, see section 6.1.2 for further details.

This assessment has been undertaken following guidance in both DMRB Volume 11, Section 3, Part 8 (*Pedestrians, Cyclists, Equestrians and Community Effects*), and DMRB Volume 11, Section 3, Part 9 (*Vehicle Travellers*) and with reference to guidance contained in the Scottish Natural Heritage (SNH) (*EIA Handbook Appendix 5: Outdoor Access Impact Assessment - 2009*) in respect of issues likely to arise in the EIA process with regards to outdoor access.

It should be noted that for ease of reference, and the avoidance of duplication, the changes in landscape quality/visual intrusion impacts (*which form part of the DMRB “Changes in Amenity” assessment requirements*) is detailed in section 6.4 - Landscape & Visual .

The Stage 1 assessments are undertaken in the following broad stages:

- Establishment of the baseline;
- Assessment of potential impacts; and
- Identification of potential mitigation measures.

Establishment of the baseline

The development of the baseline allows the establishment of a clear understanding of the existing conditions to allow a sufficient assessment of the likely consequences of the scheme options and the baseline position to be made.

Baseline conditions were identified through a review of the following:-

- Ordnance Survey (OS) Explorer Maps 428 and 429;
- The Highland Council Core Path Network Plans for the Map 35:Lochcarron (Ross & Cromarty area) 2011;
- The Highland Council Core Path Network Plans for the Map 21:Dornie, Plockton, Achmore & Kyle (Skye & Lochalsh area) 2011;
- Scottish Paths Record (SNH);
- URS' GIS Database;
- Forestry Commissions GLADE Land Information Search;
- Desk-top documentation review and web-based information sources (*relevant references/links provided*);
- Other various On-line information sources

Assessment of potential impacts

The scope of effects considered in this assessment includes:

- Permanent or temporary restriction of vehicular traveller access or severance of access to residential, community, and other civic facilities;
- Permanent or temporary restriction of vehicular traveller access or severance of access to local business operations;
- Permanent or temporary severance of public recreational amenities and routes e.g. existing public Rights of Way (RoW), proposed Highland Council core path networks, cycle-ways, bridleways etc;
- Scheme effects on existing pedestrians, cyclists, equestrians and local vehicular journey routes e.g. changes in journey lengths and times;
- Changes in amenity which DMRB Vol. 11 defines as "*the relative pleasantness of a journey*" – although this has excluded the changes in landscape quality/visual intrusion impact elements which, as previously stated, are covered in section 6.4- Landscape and Visual.
- Any adverse mental and physiological effects experienced by a driver traversing the Scheme section of the A890 ("*driver stress*"). The available research evidence does not permit the use of finely graded assessments of driver stress.

Identification of potential mitigation measures

Identification of potential mitigation measures, where appropriate, in order to minimise the Effects on All Travellers on the proposed Scheme as far as possible with the technical constraints of the project. Mitigation is designed to prevent/reduce and where possible offset the potential effects on the traveller's baseline conditions. Mitigation will also be used to help inform the options appraisal and more detailed design stages.

6.10.3 *Consultations*

The DMRB Stage 1 assessment on the effects on All Travellers does not require statutory consultation. However, consultation responses with relevance to access issues for this A890 Stromeferry Bypass project were received from various statutory bodies and local groups through a series of stakeholder events. See section 6.1.5 for more details.

- In terms of the effects on all travellers, the key objectives identified by the stakeholders were:
- Increasing accessibility and social inclusion by facilitating new opportunities for public transport and non-motorised users;
 - Providing new opportunities for enjoyment of the natural landscape
 - Removing the risk of disruption to users during operation and minimise disruptive closures during construction; and
 - Providing a deliverable, safe and reliable solution that reduces journey times.

In addition consultation was carried out with the Highland Council Access Officer to assist the collection of information on relevant core paths, rights of way and undesignated paths.

6.10.4 *Baseline*

Pedestrian, Cyclists and Equestrians

The Stromeferry Bypass Study area is surrounded by mountainous landscape including Creag Dhubh Mhor and Sgurr a' Gharaidh. It is popular with outdoor enthusiasts and there are therefore a number of designated and undesignated paths, as described below.

There is no National Cycle Route (NCR) which falls within the study area. However, there are nine designated core paths located within the Stromeferry Bypass Study area, shown on Drawing 6.14 – Core Paths and Rights of Way. These core paths are of various lengths, types and are spread throughout the study area. In addition the Forestry Commissions GLADE Land Information Search and information from The Highland Council shows numerous Rights of Way within the Stromeferry Bypass Area which are not included in the core paths network.

Table 6.10.1 lists each of the core paths described above, noting which Scheme corridor is relevant.

Table 6.10.1 – Core Paths and Route Corridors

Path Reference	Description	Route Corridor
Core Paths		
Core path Plan map21 (THC): Path Number SL01.01	Portchullin to Fernaig Road is a track/grass, 1.3km in length	Outer North Corridor North Shore Corridor
Core path Plan map21 (THC): Path Number SL01.02,	Stromewood is a track, 1.6km in length	North Shore Corridor
Core path Plan map35 (THC): Path Number RC29.01,	Croft Road to Shore Road vennels a,b c are constructed stone paths, 0.5km in length	North Shore

Path Reference	Description	Route Corridor
Core path Plan map35 (THC): Path Number RC29.02,	Achintraid to Leacanashie is a forest track/constructed path, 4.9km in length	Outer North Corridor
Core path Plan map35 (THC): Path Number RC29.03,	Attadale Circular is a estate track, 8.3km in length	On-line Corridor Southern Corridor
Core path Plan map35 (THC): Path Number RC29.04,	Smithy to New Kelso path is a farm track, 1.3km in length	All Corridors
Core path Plan map35 (THC): Path Number RC29.05,	New Kelso Paths is a forest track/grass, 3.7km in length	All Corridors
Core path Plan map35 (THC): Path Number RC29.06,	Ardeneaskan to Reraig Burn is a forest track, 2.2km in length	Outer North Corridor
Core path Plan map35 (THC): Path Number RC29.07,	Cnoc na Straing is a constructed stone path, 0.7km in length	Outer North Corridor North Shore Corridor

Vehicle Travellers

Driver stress is defined for the purposes of environmental assessment as the adverse mental and physiological effects experienced by a driver traversing a road network. Driver stress has three main components: frustration, fear of potential accidents, and uncertainty relating to the route being followed.

The section of the A890 between Stromeferry and the A890/A896 at Strathcarron Junction is a single lane trunk road. The trunk road travels in a mainly north-easterly direction and varies in level along the route. The majority of the road provides open views along or across Loch Carron but forestry blocks, shelterbelt planting, very steep rocky moorland slopes and native woodland provides some containment of views towards the east when travelling northbound. The route geometry is relatively straight along the whole length with the only significant curved alignment being between Attadale and Strathcarron.

There are two formal road junctions connecting to the A890 along the A890 between Stromeferry and the A890/A896 at Strathcarron Junction. These are detailed below:-

- Stromeferry main road and A890 junction South of South Strome - requires northbound traffic from railway terrace to make a right-turn across the southbound A890 carriageway.
- Railway terrace and A890 junction in Strathcarron - requires southbound traffic from Stromeferry main road to make a right-turn across the northbound A890 carriageway.

In addition to the above there are approximately sixteen direct access points along the Scheme corridor serving a mix of residential, agricultural and forestry land uses as well as 7 sets of vehicle lay-bys along the schemes length.

The existing single carriageway lay-out of the A890 between Stromeferry and the A890/A896 Strathcarron Junction, together with the two formal road junctions, several gated access

connections and the vehicle lay-by provision along this approximate 15km stretch of trunk road, creates a number of vehicle traveller considerations including:-

- Change of A890 road layout from a single carriageway section to a one lane road section before the Attadale section of the Scheme e.g. changes in vehicle speeds, braking etc;
- Potential driver frustration of travelling behind slow moving vehicles and general traffic congestion during busy periods along the Scheme corridor e.g. peak weekday times, weekends, the main tourism periods (April to October) and during periods of road maintenance works;
- Potential uncertainty/fear of overtaking on a single lane stretch of the A890 and using the one lane section near Attadale;
- Potential uncertainty/fear of turning manoeuvres across the northbound and southbound A890 carriageways respectively;
- Change in vehicle speeds as drivers enter/exit the formal road junctions and the vehicle lay-bys.

6.10.5 *Options Assessment*

Pedestrian, Cyclists and Equestrians (NMUs)

Core Paths

During construction and operation, NMUs using the core paths would be closer to traffic using the Outer North Corridor and may therefore experience adverse amenity effects in terms of visual, noise and air quality (e.g. dust) which are covered in more detail within section 6.4 – Landscape and Visual, section 6.6 – Noise and Vibration and section 6.7 – Air Quality..

Outer North Corridor

The Outer North Corridor will potentially have a construction and operation impact on seven of the nine core paths. However, two of the core paths (Croft Road to Shore Road and Strome Wood) are located near the boundary of the Outer North Corridor and potential effects are temporary and are likely to be experienced only along a short section of the path.

The Achintraid to Leacanashie path and the Portchullin to Fernaig Road path which cross the southern part of the Outer North Corridor could be affected during construction and operation through permanent severance, therefore affecting NMU journeys along either of these paths.

The Ardeneaskan to Reraig Burn, Smithy to New Kelso and Cnoc na Straing paths could be affected through the temporary disruption or severance to the north of their respective paths. There is also the potential, during operation, for the paths to experience journey disruption; however, it is possible that journey disruptions to these paths could be avoided.

North Shore Corridor

The North Shore Corridor will potentially have a construction and operation impact on six of the nine core paths. However, the Smithy to New Kelso Path is located near the boundary of the North Shore Corridor and potential effects are temporary and are likely to be experienced only along a short section of the path only.

There is potential for the permanent severance of Strome Wood path and the Portchullin to Fernaig Road core paths, for all of the North Shore route options, and therefore affects NMU journeys along either of these paths.

The Croft Road to Shore Road vennels and Cnoc na Straing core paths could potentially be affected during construction through the temporary disruption or severance to their respective paths. The Achintraid to Leacanashie could be affected, through temporary disruption at the southern end of the path when using route options 2 and 9 only for the North Shore.

On-line Corridor and Southern Corridors

The On-line and Southern Corridors will potentially have a construction and operation impact on four of the nine core paths. However, the Strome Wood core path is located near the boundary of these corridors and potential effects are temporary and are likely to be experienced only along a short section of the path.

There is the potential, during operation, for the Smithy to New Kelso, Attadale Circular and New Kelso paths to experience journey disruption during construction through the temporary disruption or severance to a small section of their respective paths.

The S5 route option also has the potential to permanently sever the Attadale Circular through bisecting the path. However, it may be possible that journey disruptions to these paths could be avoided.

Strome Narrows Crossings:

The Strome Narrows Crossings will potentially impact upon three core paths located around Stromemore and Stromeferry. However, two of these are located near the boundary and potential effects are temporary and are likely to be experienced only along a short section of the path.

Rights of Way

The Rights of Way (as identified for this Stage 1 assessment by the Highland Council) which are within each corridor are shown in Drawing 6.14 – Core Paths and Rights of Way and are summarised below.

- The On-line corridor will potentially have an impact on six Rights of Way;
- The Southern corridor will potentially have an impact on thirteen Rights of Way;
- The Outer North corridor will potentially have an impact on seven Rights of Way;
- The North Shore corridor will potentially have an impact on six Rights of Way, and
- The Strome Narrows Crossings will potentially have an impact on two Rights of Way.

Vehicle travellers

Driver Stress-

At the current time there is limited data available to undertake a quantitative assessment of Driver Stress, this will be processed in more detail as part of the DMRB Stage 2 assessment. However, we are able to provide anecdotal evidence regarding driver stress for each of the route corridors.

All options create the backdrop for enhanced mental and physiological effects on vehicle travellers through the removal of driver frustration created by the improvement of safety for vehicles joining/exiting the A890.

On-line Corridor

The Stromeferry Bypass On-line corridor is expected to decrease journey times for local traffic once the route is completed.

In the short term, there will be potential for driver stress and disruption to road users through a change in baseline conditions e.g. use of temporary vehicle traveller management measures such as temporary traffic lights, lane narrowing, and construction vehicle movements etc. In addition, the level of driver stress would depend on the type of traffic management implemented. However, this is expected to reduce once works are completed.

As a result of the road works, congestion and corresponding delays can be expected during construction. It is likely traffic restrictions will be required during construction. In addition, those vehicle travellers wishing to access minor roads junctions that are closed as a result of the scheme may experience driver stress and driver frustration.

Fear of potential accidents is unlikely to be affected during construction if appropriate vehicle traveller management measures are implemented, and the rock stabilisation measures and avalanche shelters would reduce the fear of potential accidents during operation and the amenity value could significantly increase. However, those options that require a shared crossing with rail, a tunnel or a bridge may cause a low level of fear of potential accidents, as incidents on involving these options can have a greater severity.

Safety provisions may also be improved by the separation of road and rail, the implementation of a tunnel therefore bypassing the rockfall area, and through extending the avalanche shelter/ securing the rockface, reducing the risk of landslide debris falling onto the road at this point.

The journey times along the On-line Corridor are likely to decrease or remain approximately the same due to the distance of the new route alignments within this corridor

Southern Corridor / North Shore Corridor / Outer North Corridor

As these corridor options are off-line, the majority of it can be constructed without affecting the travelling public along the A890 (Stromeferry Bypass).

However in the short term, as a result of road works there will be disruption for road users of roads surrounding the A890 and A896. The likely congestion and corresponding delays can be expected at locations where the proposed route would join the existing A890. This has the effect of increasing frustration amongst drivers, however this is expected to reduce once works are completed.

Fear of potential accidents is unlikely to be affected if appropriate traffic management measures are implemented during construction and with the new road alignment, safety will be improved and the amenity value could significantly increase.

Uncertainty of the route being followed is unlikely to be a factor during construction as most construction work is offline and diversions on existing routes shall not be necessary. However, uncertainty of the route being followed may be a factor during operation as driver decisions on which route to take may be necessary.

The journey times for the area are likely to be reduced in the long-term due to the resolution of route disruptions.

The journey times along the Southern Corridor and Outer North Corridor are likely to be greater than that experienced along the baseline route. However, the S3 option would likely result in no change in journey time.

The North Shore Corridor would potentially lead to either an increase in the journey times.

Strome Narrows Crossings:

As these crossing options are off-line, the majority of it can be constructed without affecting the travelling public along the A890 (Stromeferry Bypass). However in the short term, as a result of road works there will be disruption for road users of roads surrounding Stromeferry and Stromemore.

With the new road crossings, safety will be improved and the amenity value could significantly increase. However, for the Strome Narrows crossings the construction of a bridge or tunnel and this may cause a low level of fear of potential accidents, as incidents on bridges or within a tunnel can have a greater severity.

View from the road

The introduction of the road improvement may enable more people to see the landscape than was possible before. Views from the road also provide interest which may help alleviate driver stress. However, the physical impact on the surrounding landscape may have a negative impact on the local landscape character.

Construction

As several of the proposed corridors would be new off-line routes, it is not practicable to provide a comparison of views from the road during the construction phase. Construction of the On-line Corridor would result in disruption of views for travellers. Whilst some of the off-line options would be visible from the existing A890 during construction and would potentially adversely affect the quality of the view, the traveller's ability to see the surrounding landscape is unlikely to be altered.

Operation

Outer North Corridor

Along the Outer North corridor travellers would be likely to gain views to the west across Loch Kishorn. However, these views would likely be intermittent if any woodland can be retained on the hillside below the road.

North Shore Corridor

The views to the east across the Loch would remain open along the North Shore Corridors, whilst the extent of views to the north and west would remain restricted by the rising hillside /contained by the rising topography.

On-line Corridor

Along the On-line corridor views from the road would be essentially unchanged as it would not greatly alter the alignment of the road. The scenarios would involve more extensive slope stabilisation measures and the extension of the avalanche shelters, views would be likely to remain restricted by the rising topography, with the quality of the views to the north across the

Loch unaffected by the stabilisation measures but the extension of the avalanche shelter would restrict part of the view dependant on the design.

Views to the either side of the road south of Achintraid would be contained by the rising topography, with the extent of available views likely to be limited by the retained forestry.

Southern Corridor

The extent of views would remain restricted by the rising topography either side of the corridor, with the extent of available views likely to be limited by the retained forestry.

Views from the southern end of the Southern Corridor would be likely to be largely contained by rising topography and retained woodland, with potential glimpses across the Loch Carron.

Strome Narrows Crossings:

The crossings at the Strome Narrows would potentially lead to travellers gaining views to the east across the Loch Carron, with views likely to be partially contained by any retained woodland, and west along the Strome Narrows.

A more detailed assessment of Vehicle Travellers would be undertaken should a DMRB Stage 2 assessment be progressed following this Stage 1 study.

6.10.6

Potential Mitigation Measures

Pedestrian, Cyclists and Equestrians (NMUs)

Access along the main core path network should be maintained and any diversion requirements agreed with The Highland Council. Any temporary diversions should have advanced signage to minimise uncertainty of the route, but they may increase overall journey lengths. In addition, access can be managed by incorporating access mitigation measure or enhancement opportunities into the scheme design and ensuring that finalised scheme construction design avoids permanent severance of the existing paths.

To reduce effects on amenity, mitigation would include those specified in section 6.4- Landscape and Visual, section 6.6 – Noise and section 6.7 Air Quality

Potential mitigation requirements and recommendations would be subject to further consideration as the scheme proposals are progressed at Stage 2 and would take into account the consultation responses received with the Highland Council Access Officer for the Scheme area.

Vehicle travellers

Driver stress is a manageable problem which be mitigated against using advanced signage, appropriate traffic management, diversion routes and by incorporating it into scheme design.

For any diversions, frequent advanced signage can be used to minimise uncertainty of the route and reduce driver stress. In addition, providing adequate room for road users and for all vehicle types can help reduce driver stress.

Phasing of construction works can also be helpful in minimising disruption to vehicle travellers as can the establishment of agreed working methods in advance of construction works.

Mitigation regarding view from the road has been identified and summarised in Section 6.4 – Landscape and Visual.

6.10.7 *Summary*

Outer North Corridor

The Outer North Corridor will potentially have an impact on five of the nine core paths and nine Rights of Way, causing temporary severance to three paths and possibly permanent severance to two paths.

As these corridor options are off-line, the majority of it can be constructed without affecting the travelling public along the surrounding the A890 and A896, however congestion and corresponding delays at junctions with existing routes may increase frustration amongst drivers.

North Shore Corridor

The North Shore Corridor will potentially have an impact on six of the nine core paths, and seven Rights of Way, causing temporary severance to four paths and possibly permanent severance to two paths.

As this corridor is off-line, the majority of it can be constructed without affecting the travelling public along the surrounding the A890 and A896, however congestion and corresponding delays at junctions with existing routes may increase frustration amongst drivers.

Fear of potential accidents is unlikely to be affected but uncertainty of the route being followed may be a factor during operation as driver decisions on which route to take may be necessary.

As this proposed corridor would be new off-line it is not practicable to provide a comparison of views from the road during the construction phase. The corridor would be likely to provide similar views for travellers, but from the opposite side of the Loch and potentially gain views west along the Strome Narrows.

On-line Corridor

The On-line Corridor will potentially have an impact on three of the nine core paths and four Rights of Way, therefore potentially affecting amenity causing route access disruption and temporary severance to two paths.

The On-line corridor is expected to decrease journey times for local traffic once the route is completed.

Traffic management, the avalanche shelter and any bridges for this On-line corridor may create increased driver frustration during construction. If traffic restrictions are these may result in increased driver stress.

The view from the road for the On-line Corridor would not alter the views across the Loch greatly. However, dependent on the design of the avalanche shelters there would potentially be a loss of some scenic views across the Loch.

As a result of the tunnel on the On-line Corridor, the views from the Stromeferry Bypass would not be experienced by travellers, which would affect the scenic value of the route.

Fear of potential accidents is unlikely to be affected but uncertainty of the route being followed may be a factor during operation as driver decisions on which route to take may be necessary.

As this proposed corridor would be new off-line it is not practicable to provide a comparison of views from the road during the construction phase. However, during operation along the Outer North Corridor travellers would likely gain views across Loch Kishorn and at the southern end gain views to the east across the Loch Carron and west across the Strome Narrows.

Southern Corridor

The Southern Corridor will potentially have a construction and operation impact on three of the nine core paths and eleven Rights of Way, causing temporary severance to two paths and possibly permanent severance to one path.

As this corridor is off-line (with the exception of the northern part of S4), the majority of it can be constructed without affecting the travelling public along the surrounding the A890 and A896, however congestion and corresponding delays at junctions with existing routes may increase frustration amongst drivers.

Fear of potential accidents is unlikely to be affected but uncertainty of the route being followed may be a factor during operation as driver decisions on which route to take may be necessary.

As this proposed corridor would be new off-line it is not practicable to provide a comparison of views from the road during the construction phase. However, the extent of views for the Southern corridor would predominantly be restricted by either rising topography, retained forestry. Overall, this corridor may reduce the scenic value of the road.

Strome Narrows Crossings:

The Strome Narrows Crossings will potentially impact upon three cores paths and two Rights of Way located around Stromemore and Stromeferry and the causing temporary severance to two paths and possibly permanent severance to three paths.

As these crossing options are off-line, the majority of it can be constructed without affecting the travelling public along the A890 (Stromeferry Bypass). However in the short term, as a result of road works there will be disruption for road, train and ferry users surrounding Stromeferry and Stromemore.

As this proposed corridor would be new off-line it is not practicable to provide a comparison of views from the road during the construction phase. However, the crossings at the Strome Narrows would potentially lead to travellers gaining views to the east across the Loch Carron and west along the Strome Narrows, therefore potentially increasing the amenity value of the Crossings.

6.10.8 *Conclusions*

The journey times are likely to be increased for the Southern Corridor and Outer North Corridors. Whilst the On-line corridor will keep journey times approximately the same, the O1, O6 and ON3/N2 options are the only corridors likely to reduce the journey times.

The On-line, Outer North and Southern Corridors are the least preferred as they are likely to create greater congestion and delays therefore resulting in greater levels of driver stress, and have the greatest impact on the scenic views of the area. In addition, for the North Shore Corridor the Western Strome Narrows crossing would potentially, lead to an increase in journey time.

Outer North, North Shore and Southern Corridors are the least preferred as there are a number of paths located within them which could potentially be significantly affected. However, following development of an alignment in these corridors these paths could potentially be avoided.

Table 6.10.2 shows and assessment of the corridors against the non-motorised users and vehicle users. Table 6.10.3 provides and overall assessment for Effects on all Travellers.

Table 6.10.2 - Environmental Impacts Table – Effects on all users

Corridor Option	Preferred	Intermediate	Least Preferred
NMUS			
On-line	✓		
Outer North			✓
North Shore			✓
Southern		✓	
Eastern Crossing	✓		
Western Crossing		✓	
Vehicle Users			
On-line			✓
Outer North		✓	
North Shore	✓		
Southern			✓
Eastern Crossing		✓	
Western Crossing	✓		
Overall			
On-line	✓		
Outer North			✓
North Shore		✓	
Southern			✓
Eastern Crossing	✓		
Western Crossing		✓	

Table 6.10.3 – Effects on all Travellers Assessment Summary

	Preferred Option	Intermediate Option	Least Preferred Options
Outer North Corridor			
ON3			✓
North Shore Corridor			
N2		✓	
N6			✓
N9			✓
On-line Corridor			
O1	✓		
O2	✓		
O3		✓	
O4	✓		
O5		✓	
O6	✓		

	Preferred Option	Intermediate Option	Least Preferred Options
O7	✓		
Southern Corridor			
S1		✓	
S3		✓	
S4		✓	
S5 b			✓
Stromenarrow Crossings			
Western Crossing			
Bridge		✓	
Tunnel		✓	
Eastern Crossing			
Bridge	✓		
Tidal Barrage	✓		

6.10.9 *Recommendations for further work/*

Should a STAG Part 2 Appraisal/DMRB Stage 2 Report be progressed a more detailed assessment should be undertaken and the magnitude and significance of effects assessed. In addition the Vehicle Travellers assessment should be updated where necessary to take account of any further landscape assessment or selected route options, possible changes to journey times and changes in safety as a result of route disruption.

6.11 Community and Private Assets

6.11.1 *Introduction*

This section provides a DMRB Stage 1 assessment of the potential effects of the six corridors on community and private assets. Assets which have been considered include residential, commercial (agricultural and forestry), community and development land.

The consideration of the effects on Community & Private Assets directly associated with the proposed A890 Stromeferry Bypass has been undertaken with reference to DMRB Volume 11 Section 3 Part 6 (*Land Use*) and DMRB Volume 11 Section 3 Part 8 (*Pedestrians, Cyclists, Equestrians and Community Effects*).

The objective of these respective Stage 1 assessments are to:-

- “Undertake sufficient assessment to provide an appreciation of the likely effects on...people’s ability to move around their local community, and to identify the relevant constraints associated with particular broadly defined routes, or corridors, as developed by the Design Organisation and agreed with the Overseeing Departments Project Manager”. (*Source DMRB Vol. 11 : Section 3, Part 8 – section 9*)
- “Undertake sufficient assessment to provide an appreciation of the likely consequences of land-take for UK agriculture and to identify the agricultural land constraints associated with particular broadly defined routes, or corridors as developed by the Design Organisation and agreed with the Overseeing Department’s Project Manager” (*Source DMRB Vol. 11 : Section 3, Part 6 – section 10*).

6.11.2 *Methodology*

The assessment has been carried out using the STAG criteria and guidance provided in DMRB, see section 6.1.2 for further details.

DMRB Volume 11, Section 3, Part 6 (Land Use) provides guidance on assessing a scheme’s impact on community and private property and DMRB Volume 11 Section 3 Part 8 (Pedestrians, Cyclists, Equestrians and Community Effects) provides guidance on assessing the impact on the community. This assessment has been undertaken following this guidance.

The Stage 1 assessments are undertaken in the following broad stages:

- Establishment of the baseline;
- Assessment of potential impacts; and
- Identification of potential mitigation measures.

Establishment of the baseline

- Establishment of the baseline in order to establish a clear understanding of the existing conditions to allow a sufficient assessment of the likely consequences of the scheme options on the baseline position to be made. Baseline conditions were determined through a review of the following:
 - The Highland-Wide Local Development Plan (2012);
 - Wester Ross Local Plan (2006);
 - West Highlands and Islands Local Plan (2010);
 - Lochcaron and District Business Association (<http://www.lochcarron.org.uk/>);

- URS' GIS Database;
- Desk-top documentation review and web-based information sources (relevant references/links provided).
- Land Capability for Agriculture Map Sheet 4 (The Macaulay Institute for Soil Research (MLURI)); and
- Ordnance Survey (OS) Explorer Maps 428 and 429;

Assessment of potential impacts

- The assessment scope primarily focuses on:
- Temporary and permanent loss of private property (e.g. demolition) and associated land-take to accommodate the construction and operation of the Scheme options;
- Temporary and permanent loss of community land - "common ground such as village greens and open space e.g. any land laid out as public parks or used for the purpose of public recreation, or land which is a disused burial ground";
- Temporary and permanent loss of land which The Highland Council (THC) has already designated for future development required as land-take to accommodate the construction of the Scheme options;
- Any impacts of the Scheme options on the Council's development designations;
- A broad assessment of any loss of agricultural land required as land-take to accommodate the construction of the Scheme options and any likely effects on individual farm units;
- Assessment of any relevant planning applications or known proposed developments.

Identification of potential mitigation measures

- Identification of potential mitigation measures, where appropriate, in order to minimise the Community or Private Assets effects of the proposed Scheme as far as possible within the technical constraints of the project. Mitigation is designed to prevent, reduce, and where possible offset the potential effects upon the community baseline conditions. These will also be used to help inform the options appraisal and more detailed design stages.

At this stage the exact areas required for construction and the extent of permanent land-take cannot be quantified. For the purposes of comparing potential effects of the different route corridors at Stage 1, the areas required for construction and operation are assumed to be generally the same (i.e. land disturbed during construction would be permanent land-take during operation).

6.11.3 *Consultations*

DMRB Volume 11 Section 3 Paragraph 6 (10.3) requires consultation with the local planning authority (at Stage 1) for information on statutory and non-statutory areas designated for their agricultural importance. However, for this Stage 1 assessment there was no need to consult on this as information was obtained from the Macaulay Institute for Soil Research (MLURI) Land Capability for Agriculture Maps.

Initial consultation with various statutory bodies, including The Highland Council and local groups has been carried out through a series of stakeholder events in order to help inform the identification of the four potential route option corridors. See section 6.1.5.

In terms of community and private assets of the key objectives identified by stakeholders attention was brought to the need to:

- Remove the risk of disruption to users during operation and minimise disruptive closures during construction.
- Facilitate sustainable economic development by minimising the impact on existing economic operators and providing a local and strategic link

6.11.4 *Baseline*

For this assessment the receptors contained within 1 kilometre radius of a road corridor have been considered and this forms the defined study area. The baseline community facilities and the land uses are detailed below.

Population and Residential Properties

The National Records of Scotland (NRS) publishes population data for the Wester Ross, Strathpeffer and Lochalsh Ward of the Highland Council administrative area. The total population in 2011 was estimated at 11,372, but this covers a significantly larger area than that around the A890 Stromferry Bypass location.

The study area is predominantly rural with numerous dispersed notable residential areas. These are listed below, and show in Drawing 6.15 – Residential, Community Assets and Woodland.:

- Braeindra
- Achmore;
- South Strome;
- Ardnaff
- Attadale;
- Achintee;
- Strathcarron
- Kirkton;
- Lochcarron;
- Ardarroch;
- Achintraid;
- Ardaneaskan; and
- Stromemore.

There are approximately 350 residential properties in total located within the Stromeferry Bypass Study area. With Lochcarron the largest of these described as a local centre has a population of approximately 923 and approximately 200 residential properties.

In the geographic area directly adjacent to the defined study (1 kilometre radius for a route corridor) area boundary there are other residential areas. These are relevant as residents travelling to/from these properties may require to travel along the section of the A890 and A896 included in the study area.

Industrial/Business:

There are a wide range of industrial/businesses located within the study area. These range from accounting to hotels, restaurants and fish farming. The study area includes the Lochcarron Industrial Estate. The majority of the industrial/businesses located within the study area are related to travel, tourism and leisure. The majority of the businesses are located within the main residential areas (shown above), with Lochcarron having the greatest number.

Community Land (and facilities):

There are numerous community groups and facilities located within the study area (shown in Drawing 6.15 – Residential, Community Assets and Woodland). These include:

- Attadale Estate;
- Lochcarron Library;
- Smithy Heritage Centre;
- Ardaneaskan Museum;
- Strathcarron Centre and Post office;
- Strome Castle;
- Friends of the Kyle Line;
- Lochcarron Primary School;
- Lochcarron sub post office and o/s post office on A896;
- Kishorn post office;
- Inverness College the Highland School of Aquaculture;
- Seafield Centre;
- Scotland Episcopal Church;
- Free Presbyterian Church of Scotland;
- Lochcarron Church of Scotland;
- Lochcarron Burial Ground;
- Lochcarron Police Station;
- Lochcarron Village Hall;
- Lochcarron Hall and its associated car park and recreation ground;
- Achmore Hall;
- Places of Worship, in Ardaneaskan, Arradoch and north of Lochcarron;
- Lochcarron Fire Brigade; and
- Strome Wood.

Within the immediate area surrounding the defined study area, there are a limited number of additional community and visitor facilities for which the Stromferry Bypass is a route access option and therefore these would need to be further considered in Stage 2.

Scheduled Bus Services

There are numerous and a wide range of scheduled bus services within the study area. These are listed below:

- Ronnie Maclean's 'Flexi' Community Bus runs every Tuesday to and from Kyle;
- Toscaig to Inverness operated by Lochcarron Garage, Service 704 runs Wednesdays and Saturdays only;
- Strathcarron to Torridon operated by DMK Motors, Service 702 runs Mondays to Saturdays;
- Portree to Inverness operated by Stagecoach in Skye, Service 66x runs daily during the summer period only;
- Ardaneaskan to Kyle of Lochalsh operated by Stagecoach Highlands, Service 164 runs Monday to Friday;
- Gariloch to Inverness and Laide to Inverness operated by Westerbus, Service 700-0 runs Tuesdays, Thursdays and Fridays;

In addition there are also several school bus services and a subsidised taxi/ dial-a-bus service which operate within the study area and surrounding areas.

Scheduled Train Services

A scheduled rail service operated by First ScotRail runs between Kyle of Lochalsh and Inverness. The Railway stations located along the current Stromeferry Bypass include Stromeferry Station located in South Strome, Attadale Station and Strathcarron Station. The rail service runs beside the existing road and bisects the Stromferry Bypass A890 at Strathcarron, immediately prior to Strathcarron Station.

Woodland

The Forestry Commissions GLADE Land Information Search shows numerous commercial forestry plantation owned and managed by the Forestry Commission Scotland (FCS) within the Stromferry Bypass Study area.

The majority of these plantations are located to the south and south west of the study area to the south and east of South Strome and to the south of Achintraid. There are also areas of woodland located to the south and to the north of Lochcarron. Finally there are areas of tree felling located east of Achintraid and Ardarroch.

There is also a large amount of woodland throughout the study area which can be used for recreational, leisure and commercial purposes as identified by OS Streetview.

Agricultural:

Land Use capability for agriculture

Volume 11 of DMRB (Section 3, Part 6) recommends that the assessment of roads and bridge schemes should give an appreciation of the likely consequences of land take on agricultural land. The Macaulay Land Capability for Agriculture (LCA) classification is the official agricultural classification system widely used in Scotland as a basis of land evaluation. The Macaulay Institute classifies agricultural land into seven use capability classes with four of the classes further subdivided into divisions:-

- 1) Very Wide Range of Crops

- 2) Wide Range of Crops
- 3) Moderate Range of Crops
- 4) Narrow Range of Crops
- 5) Used as Improved Grassland
- 6) Used Only as Rough Grazing
- 7) Very Limited Agricultural Value

The “best and most versatile (BMV) land” is classified as Class 1, 2 and 3.1 – this is the land which is most flexible, productive and most likely to deliver future crops.

A desktop review of the Macaulay Institute’s “Land Capability for Agriculture – Western Scotland (Sheet 4, 1:250,000)” map, shown in Drawing 6.16 – Agricultural Land Classification, indicates that the agricultural land classification around the Scheme study area is predominantly category 6₃. However the land capability classifications range from 5₁ to 6₂ around the edge of the Loch Carron and the west of Ardaroch. There is one small area classified as 4₂ immediately north of Strathcarron/Achintee. Therefore none of the agricultural land falls within the Macaulay LCA BMV land classifications.

Agricultural buildings

There are numerous agricultural buildings located within the study area. These comprise of:

- Two farms within Achmore;
- A farm in Attadale;
- Sheep pens and cattle grids in close proximity to Achintee and Lochcarron;
- Sheep washes in close proximity to Achintee and Strathcarron;
- A sheep fold in Strathcarron; and
- A fish farm located north-west of the Smith Heritage Centre (along the A896).

Development Land:

The study area has some areas of development land. Development land has been identified by interrogation of The Highland Council Local Plan, relevant ward/county local plans and any active planning applications.

The ones found from the Local Plan Maps are listed below:

- Achmore has one area designated for housing, one designated for affordable housing, one area designated for business and two designated for community;
- South Strome has one area designated as mixed use, and
- Lochcarron has two areas designated for affordable housing, one area designated for housing and one area designated for redevelopment.

6.11.5 *Options Assessment*

It should be noted that impacts relating to increased journey times for all travellers are addressed in Section 6.10 – Effects On All Travellers.

A determination of the potential impact on properties in the area cannot be made at this time because options within the route corridor are not sufficiently developed to allow an estimation of the possible number of individual properties affected. However, the affected residential areas for each corridor have been listed, see Table 6.11.1.

For all of the corridors, the potential adverse effects to any community land and land uses in the study area are anticipated as a result of temporary land-take during the construction, for example the storage of materials in informal lay-bys. In addition, all of the corridors may cause temporary disruption of access to private properties and business premises during the construction phase. The On-line options in particular will result in significant impacts to the community and businesses during construction.

Table 6.11.1: Community and Private Assets - Assessment Table

Corridor	Residential	Agricultural	POTENTIAL IMPACTS	
			Community	Development
Outer North Shore	<ol style="list-style-type: none"> 1. Kirkton; 2. Lochcarron; 3. Achintraid, 4. Achmore, and; 5. South Strome. 	<p>Potentially directly affect land used for grazing by the farms that use nearby sheep pens in Lochcarron through land-take during construction.</p> <p>Passes through land classified from 6₃, 5₃, 5₂, and 5₁. No effects on prime agricultural land anticipated.</p> <p>Passes directly through the FCS plantation forestry; therefore there may be a loss of forestry areas through land-take during construction and operation.</p>	<p>Temporary land-take during the construction for example the storage of materials in informal lay-bys.</p> <p>Passes directly through the FCS plantation forestry and two designated areas for tree felling; therefore there may be a loss of forestry areas used by the community through land-take (i.e. to accommodate the route options and to use for compounds and/or storage of materials).</p> <p>Likely to affect those community facilities located north of Lochcarron, i.e. Lochcarron Primary School and the Smithy Heritage Museum. In addition, the facilities of Ardarroch and Achmore could be impacted. A total of 10 facilities could be potentially impacted.</p> <p>Disruption to rest stops along A890 and A896 through storage of materials and realignment work.</p> <p>The scheduled bus services are likely to be affected. In addition, the scheduled train services from Stromeferry would be impacted.</p>	<p>Potentially directly affect the area of development land designated in Lochcarron through temporary access disruption and severance during construction.</p>

Corridor	Residential	POTENTIAL IMPACTS		
		Agricultural	Community	Development
North Shore	1. Kirkton; 2. Lochcarron; 3. Stromemore; 4. Achmore, and; 5. South Strome	<p>Potentially directly affect land used for grazing by the farms that use nearby sheep pens in Lochcarron through land-take during construction.</p> <p>Passes through land classified from 6₃, 6₂, 5₃, 5₂, and 5₁. No effects on prime agricultural land anticipated.</p> <p>Temporary land-take from FCS plantation forestry through land-take during construction.</p>	<p>Temporary land-take during the construction for example the storage of materials in informal lay-bys.</p> <p>Temporary land-take from FCS plantation forestry through land-take during construction.</p> <p>Likely to affect 19 of the community facilities within the area including Lochcarron Hall, recreation ground and car park, Achmore Hall, Lochcarron Police Station and Lochcarron Primary School.</p> <p>Disruption to rest stops along A890 and A896 through storage of materials and realignment work.</p> <p>The scheduled bus services are likely to be affected. In addition, the scheduled train services from Stromeferry would be impacted.</p>	<p>Potentially directly affect the area of development land designated Lochcarron through temporary access disruption and severance during construction.</p>

Corridor	Residential	POTENTIAL IMPACTS		
		Agricultural	Community	Development
On-line	<ol style="list-style-type: none"> 1. Strathcarron; 2. Achintee; 3. Attadale; 4. Ardnaff; and 5. South Strome. 	<p>Potentially directly affect land used for grazing by the farms that use nearby sheep pens, cattle grids and sheep washes, located in Achintee and Strathcarron, through land-take during construction.</p> <p>Passes through land classified from 6₃, 6₁, 5₁ and 4₂. The land north of Strathcarron which is designated as 4₂ could potentially be affected. However, if option O6 was chosen this area would be located at the edge of the corridor and therefore not likely to be significantly affected.</p> <p>No effects on prime agricultural land anticipated.</p> <p>Temporary land-take from FCS plantation forestry through land-take during construction.</p>	<p>Temporary land-take during the construction for example the storage of materials in informal lay-bys.</p> <p>Potential temporary disruption and severance to the Attadale Estate, Strathcarron centre/post office, and Friends of the Kyle Line.</p> <p>Disruption to rest stops along A890 through storage of materials and realignment work.</p> <p>The scheduled bus services and rail services will potentially be impacted along the entire length of this corridor between Stromeferry and Strathcarron.</p>	<p>Potentially directly affect the area of development land designated in South Strome for housing through temporary access disruption and severance during construction.</p>
Southern	<ol style="list-style-type: none"> 1. Strathcarron; 2. Achintee; 3. Attadale, 4. Braeintra, and; 5. South Strome 	<p>Could potentially directly affect land used for grazing by the farms that use nearby sheep pens, cattle grids and sheep washes, located in Achintee, Strathcarron and at Achmore Farm, through land-take during construction.</p> <p>Passes through land classified from 6₃, 6₂, 6₁, 5₂, 5₁ and 4₂. Land north of Strathcarron which is designated as 4₂ could potentially be affected.</p> <p>No effects on prime agricultural land</p>	<p>Temporary land-take during the construction for example the storage of materials in informal lay-bys.</p> <p>Potential temporary disruption and severance to the Attadale Estate, Strathcarron centre/post office, Friends of the Kyle Line and Achmore Hall.</p> <p>Passes directly through the FCS plantation forestry; therefore there</p>	<p>Potentially directly affect the area of development land designated in South Strome for housing through temporary access disruption and severance during construction.</p>

		POTENTIAL IMPACTS		
Corridor	Residential	Agricultural	Community	Development
		<p>anticipated.</p> <p>Passes directly through the FCS plantation forestry; therefore there may be a loss of forestry areas through land-take during construction and operation</p>	<p>may be a loss of forestry areas used by the community through land-take (i.e. to accommodate the route options and to use for compounds and/or storage of materials).</p> <p>Disruption to rest stops along A890 through storage of materials and realignment work.</p> <p>The scheduled bus services and train services will potentially be impacted by this route at Stromeferry, Attadale and Strathcarron Stations.</p>	
Eastern Crossings	<ol style="list-style-type: none"> 1. South Strome, and 2. Stromemore. 	Passes through land classified as 5 ₂ , and 5 ₃ .	<p>Temporary land-take during the construction for example the storage of materials in informal lay-bys.</p> <p>Bridge/tunnel permanent land take.</p> <p>Potential impact upon the Friends of the Kyle Line.</p>	Potential to directly affect the area of development land designated in South Strome through temporary access disruption and severance during construction.

Corridor	Residential	POTENTIAL IMPACTS		
		Agricultural	Community	Development
Western Crossings	N/A	Passes through land classified as 6 ₂ , and 5 ₃ .	Temporary land-take during the construction for example the storage of materials in informal lay-bys. Bridge/tunnel permanent land take.	N/A

6.11.6 *Potential Mitigation Measures*

Specific mitigation recommendations for land use cannot be specifically defined at DMRB Stage 1. However, it is anticipated that the potential scope of mitigation to be considered should include:

- Ensure detailed scheme design minimises land take where possible.
- Appropriate compensation to Forestry Commission for permanent loss of managed forest and recreational area required to accommodate Scheme design.
- Appropriate compensation to land owner for permanent loss of private land area required to accommodate Scheme design.
- Ensure Appropriate compensation to land owners for permanent loss of agricultural land
- Consult with the Forestry Commission over scale and duration of impact and ensure access is maintained throughout construction period to woods and forests. Also provide temporary signposting and barriers to separate recreationalists from construction activity.
- Ensure access is maintained at all times and consultation is undertaken with landowners.
- Construction programme timing to ensure any new access are in place to avoid temporary severance.

Careful consideration of the detailed route alignment and design will be an important part of the options appraisal and design process. Site-specific measures would be developed as the design for the proposed road scheme advanced and incorporated into a Project Environmental Management Plan.

6.11.7 *Summary*

None of the corridors pass through any land classified as prime agricultural land (1, 2 or 3). However, of the corridors the On-line options (apart from O6) and the Southern route options have the potential to impact upon agricultural land classified as 4₂, the best within the study area.

However, the opposite is found regarding the impact upon community land and facilities, with the On-line and Southern corridors would potentially have the least impact, whilst the North Shore and Outer North corridors potentially have the most impact as they travel in close proximity to, or through, Lochcarron..

The development area within South Strome will potentially be impacted upon by all route option corridors and the Strome Narrows Crossings. The North Shore and Outer North corridors will potentially have the greatest impact within the study area as they potentially affect two other development areas. The Southern corridor affects only one other development area.

All of the route option corridors will potentially impact five residential areas within the study area. The population of each of the identified residential areas is not currently known, however, the North Shore and Outer North corridors pass through or in close proximity to Lochcarron, which is described as a local centre within the study area.

All of the corridors will impact upon the scheduled bus services to varying degrees. The magnitude of these potential impacts cannot be currently quantified. The On-line Corridor will have the greatest impact upon the scheduled train services compare to other options, as there is the potential for impacts on the railway line within the study area. This is likely to be short

term during construction allowing long term benefits. Impacts on the railway are discussed elsewhere in this report. The Outer North and north-shore corridors will have the least impact upon the scheduled rail services.

The Southern corridor will have the greatest impact upon the woodland areas within the scheme area. The North Shore and On-line corridors will have the least impact upon woodland as they are able to utilise existing and historical routes.

Table 6.11.2 shows an assessment of the options against the categories of residential, agricultural, community and development land. Table 6.11.3 provides an overall summary table for Community and Private Assets.

Table 6.11.2 – Assessment of corridors against Community and Private Assets categories.

Corridor Option	Preferred Option	Intermediate Option	Least Preferred Options
Residential			
Outer North		✓	
North Shore			✓
On-line	✓		
Southern		✓	
Eastern Crossing		✓	
Western Crossing	✓		
Agricultural			
Outer North	✓		
North Shore		✓	
On-line		✓	
Southern			✓
Eastern Crossing		✓	
Western Crossing	✓		
Community			
Outer North		✓	
North Shore			✓
On-line		✓	
Southern	✓		
Eastern Crossing	✓		
Western Crossing	✓		
Development Land			
Outer North		✓	
North Shore			✓
On-line	✓		
Southern		✓	
Eastern Crossing			✓
Western Crossing	✓		

Corridor Option	Preferred Option	Intermediate Option	Least Preferred Options
Overall			
Outer North		✓	
North Shore			✓
On-line	✓		
Southern			✓
Eastern Crossing		✓	
Western Crossing	✓		

Table 6.11.3 – Community and Private Assets Assessment Summary

	Preferred Option	Intermediate Option	Least Preferred Options
Outer North Corridor			
ON3		✓	
North Shore Corridor			
N2		✓	
N6			✓
N9	✓		
On-line Corridor			
O1	✓		
O2	✓		
O3	✓		
O4	✓		
O5	✓		
O6	✓		
O7	✓		
Southern Corridor			
S1		✓	
S3		✓	
S4		✓	
S5 b			✓
Stromenarrow Crossings			
Western Crossing			
Bridge	✓		
Tunnel	✓		
Eastern Crossing			
Bridge		✓	
Tidal Barrage		✓	

6.11.8 *Recommendations for further work/*

Should a STAG Part 2 Appraisal/DMRB Stage 2 Report be progressed a more detailed assessment should be undertaken to assess the likely effects of the scheme options on the community and private assets.

7 TRAFFIC AND ECONOMIC ASSESSEMENT

7.1 Introduction

A high level traffic and economic assessment has been carried out on the 17 options that emerged from the option sifting process. The economic appraisal has been conducted using standard economic welfare techniques consistent with STAG and provides a comparison of the performance of the options against the Do Minimum scenario.

The Do Minimum scenario uses the A890 / A832 / A835 / A832 / A862 / A833 / A82 / A887 / A87 (old military road) / A890 diversionary route during rock fall events closing the Stromeferry Bypass, substituting for the A890 between Strathcarron junction and Stromeferry junction during these closures, which may involve an additional 204 kilometres and 2 hours 58 minutes to the journey between these two points.

7.2 Impact of Rock Falls

Although relatively rare occurrences, rock falls, when they do occur can result in the closure of the road, and less frequently, the railway line for days, and some case weeks at a time.

Table 7.1 details the significant rock fall events since March 1990. affecting the A90 Stromeferry Bypass. This shows that between March 1990 and December 2012, there have been 10 significant rock fall events, of which at least two required road closure for two months or more. Although the lengths of road closures are not stated, inspections required after each of the other events would require road closure for short periods of time.

Table 7.1 – Closure Events

TABLE 7.1 CLOSURE EVENTS ON THE A890 STROME FERRY BYPASS SINCE 1990 DUE TO SIGNIFICANT ROCK FAILURE			
Date of Event	Rock Displacement on Road tonnes / m³	Length of Closure	Comments
March 1990	200t	8 Weeks	Blocked both road and railway
October 2001	500m ³	Not stated	Blocked both road and railway
October 2004	5 m ³	Not stated	
January 2007	20 m ³	Not stated	Road and railway unaffected
May 2007	0.5 – 1.0m ³	Not stated	Affected both road and railway
August 2008	Not stated	Not stated	Required traffic closure
September 2009	Not stated	Not stated	Affected Road
November 2011	Not stated	Not stated	No road closure
December 2011	Not stated	Approximately 4 months	Road closed from late December 2011 to late April 2012
December 2012	Not stated	2 days	

Source: Highland Council, 2013

There have been two closures that lasted for extended periods. The March 1990 event lasted two months or approximately 60 days. The rock fall in December 2011 lasted four months or approximately 120 days. Over a period of 21 years and nine months, the A890 has been closed for circa 182 days due to a major rock fall event. For appraisal purposes the total closure period of 182 days has been annualised to 8.4 days of closure per year.

There have been rock fall events where the length of closure has not been stated and where there have been a number of planned closures and emergency inspections as reported in the press, notably for the years 2008 and 2009. In terms of the latter, these closures were for short periods and on an intermittent basis.

For purposes of the appraisal it has been assumed that subsequent inspections to these events where the period of closure has not been stated, and for planned / emergency closures each event has required a day of road closure. There were 10 such events recorded between March 1990 and December 2012, so 0.5 days of road closure has been added to the 8.4 days noted above. A total of 8.9 days road closure, rounded to 9 days per annum, has necessitated the use of an alternative diversion route and has therefore been used in the economic appraisal.

7.3 Diversion Routes

When the A890 Stromeferry Bypass road is closed due to a rock fall, there is only one feasible option for undertaking an alternative route. Journeys from north to south, instead of using the A890 Strathcarron junction to A890 Stromeferry junction link, a distance of approximately 13.6 kilometres and taking 15.3 minutes, would require a trip of circa 204 kilometres and nearly 3 hours.

The route comprises of multiple sections, and these are:

- A890 eastbound via the Achnasheen roundabout
- A832 to the A835 junction
- A835 to the A832 junction
- A832 junction at the Muir of Ord
- A662 from the Muir of Ord to the junction with the A833
- A833 to the junction with the A831
- A831 to the junction with the A82 at Drumnadrochit
- A82 to the junction with the A887 at Invermoriston
- A887 to the junction with the A87
- A87 to the junction with the A890

Trips affected by rock falls on the A890 Stromeferry bypass would not be all those using the section of road between the Strathcarron junction and the Stromeferry junction. A proportion of trips would be between Strathcarron junction and the paired junctions at Achmore which links the A890 up with the C1222 serving Plockton, and a proportion of trips would travel via the junction with the A87, with a diversity of origins and destinations such as Kyle of Lochalsh, Dornie, and those further afield such as Fort William and Glasgow.

There will be small but distinct differences in distances and journey times associates with each of these, which have been summarized in Table 7.2 below.

Table 7.2 – Journey Time and Distance Impacts

TABLE 7.2 JOURNEY TIME AND DISTANCE IMPACTS ON DIVERTED FROM THE A890 STROME FERRY BYPASS			
	Strathcarron Junction to Stromeferry Junction	Strathcarron Junction to Achmore Junction	Strathcarron Junction to the A87 / A890 Junction
Journey in kilometres	204	203	194
Journey in minutes	178	177	169

7.4 Summary of Do-Minimum and Sifted Options

For the purpose of the economic assessment it is necessary to define a ‘Do-Minimum’ scenario, what will most likely happen without the intervention, with which to test the sifted options against. The route options being considered are briefly described below.

7.4.1 Do-Minimum Scenario

The Do Minimum scenario is the existing condition of the A890 Stromeferry Bypass, with the alternative or diversion route as described above during future road closures due to rock falls. This is expected to increase journey time delays and vehicle operating costs and negative subsequent economic impact compared with the sifted options under consideration.

7.4.2 Outer North ON3 Option

The Outer North ON3 scenario involves a bridge across the Strome Narrows , is offline to Achintraid, and continues offline north of Lochcarron before transferring On-line from Kirkton.

7.4.3 North Shore N2 Option

The North Shore N2 option involves as bridge for the Strome Narrows Crossing, is offline to the A896 but is on-line though Lochcarron, and on-line from Kirkton.

7.4.4 North Shore N2b Option

The North Shore N2b option uses the same alignment as the North Shore N2 option, but replaces a bridge with a tunnel.

7.4.5 North Shore N6 Option

The North Shore N6 option uses the Strome Narrows Crossing, remains on-line throughout Lochcarron, and is on-line from Kirkton.

7.4.6 North Shore N6b

The North Shore N6b option uses the Strome Narrows Crossing as option N6, but replaces a bridge with a tidal barrage.

7.4.7 North Shore N9

This option is based on option N2 above, but is fully offline throughout Lochcarron.

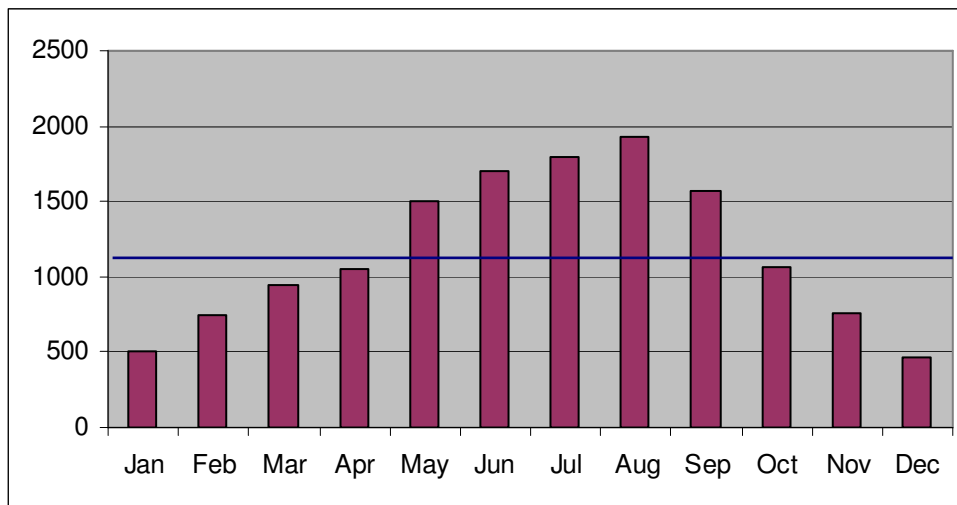
- 7.4.8 *On-line O1*
 This option uses the current alignment but replaces the carriageway with a new two-lane carriageway road throughout, with some rock face remodelling.
- 7.4.9 *On-line O2*
 This option uses the current alignment as On-line one and includes a new two-lane carriageway and rock face remodelling, but adopts an embankment viaduct on the side of Lochcarron.
- 7.4.10 *On-line O3*
 This represents the on-line option with an inland tunnel.
- 7.4.11 *On-line O4*
 Option 04 is the Do-Minimum option, remaining a single track option with some rock face remodelling. This option also includes considerations for contingency measures, such as temporary ferry operations.
- 7.4.12 *On-line O5*
 This option incorporates a road / rail share with a road alignment placed above the rail alignment.
- 7.4.13 *On-line O6*
 On-line O6 involves an upper loch crossing with a 1.5 meter freeboard.
- 7.4.14 *On-line O7*
 This on-line option involves the construction of one or more avalanche shelters on vulnerable parts of the route.
- 7.4.15 *South S1*
 From Stromeferry, this option passes east of Loch Nam Breac Mora, through Attadale valley, and becomes on-line from Attadale.
- 7.4.16 *South S3*
 This option passes from Braeintra, east of Loch Nam Breac Mora, through Attadale valley, and becomes on-line from Attadale.
- 7.4.17 *South S4*
 This route option takes an alignment through Glen Udalain, east of Loch Nam Breac Mora, through Attadale valley, and becomes on-line from Attadale.
- 7.4.18 *South S5b*
 This route option takes an alignment through Glen Udalain, east of Loch Nam Breac Mora, before passing across Attadale valley, east of Maman Hill, before reverting to on-line from Strathcarron.

7.5 Traffic Assessment

7.5.1 Mean Traffic Flows

Figure 7.1 below shows the monthly mean 24 hour two-way traffic counts from January 2012 to December 2012 at Achintee, close to Avalanche shelter site. The average of the monthly mean two-way traffic counts is 1170 vehicles per day. The daily flow is very seasonal with flows reaching a peak in August 2012 of 1934 vehicles per day.

FIGURE 7.1: MONTHLY MEAN 24 HOUR TWO WAY TRAFFIC COUNTS, JANUARY 2012 TO DECEMBER 2012, ACHINTEE (SOURCE: HIGHLAND COUNCIL, 2012)



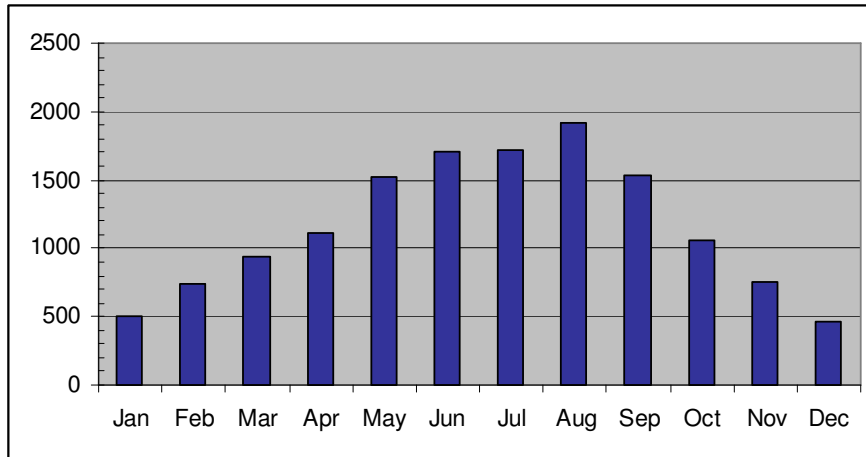
Note: The horizontal line represents the average of the monthly mean traffic counts from January 2012 or December 2012.

The opening of the selected alternative route to the A890 Stromeferry Bypass is unlikely to occur before 2015. Therefore an annual growth rate factor was applied to the mean 24 hour two way traffic flows based on the National Road Traffic Forecasts Central Growth Rate for Rural Roads (NRTF Growth Forecasts Great Britain, 1997). This growth rate was applied from the assumed opening year in 2015 through the 60 year appraisal period.

For the purposes of the appraisal, an average of two sets of average 24 hour data were used, that for Achintee and for Attadale, which is less than a kilometre from the avalanche shelter on the A890 Stromeferry Bypass. The Attadale data was for 2010 and therefore required to be adjusted for the additional two years traffic growth in order to correspond with the data for Achintee.

Figure 7.2 shows the average 24 hour data for both Achintee and Attadale for the opening year of 2015.

FIGURE 7.2: MONTHLY MEAN 24 HOUR TWO WAY TRAFFIC COUNTS FOR THE OPENING YEAR JANUARY 2015 TO DECEMBER 2015, AVERAGED FOR ATTADALE AND ACHINTEE (SOURCE HIGHLAND COUNCIL)



7.5.2 *Vehicle Composition*

There is no current data available within the study area that shows traffic flows broken down by vehicle type. Therefore Government Data from the Network Evaluation from Surveys and Assignment (NESA) Default User Class Proportions by Network Classification (NESA Vol 15 Section 1 Pt 5) were adopted. These are given for the Rural Tourist Road Category and values are shown in Table 7.3 below.

Table 7.3 – Default User Class Proportions

TABLE 7.3 DEFAULT USER CLASS PROPORTIONS BY NETWORK CLASSIFICATION - RURAL TOURIST ROAD	
Vehicle Type	Proportion
Car	0.841
LGV	0.076
OGV 1	0.045
OGV 2	0.028
Coach	0.010

Source: NESA Vol 15 Section 1 Pt 5, 1993

The values in Table 8.3 have been adopted in the economic assessment.

7.5.3 *Vehicle Speeds*

There is no reliable current data available within the study area that shows traffic speeds across the local road network. For the purposes of this assessment, NESA values have been adopted. These are based on the road classification provided by NESA and the default link speeds based on this road classification for both light and heavy vehicles (NESA Vol 15 Section 1 Table 5.3.1).

7.5.4 *Trip User Purpose*

There is no current information from available traffic data that indicates vehicle split by trip user purpose. This is especially important with respect to car users. The A890 Stromeferry Bypass is a popular tourist route and a substantial proportion of summer vehicle traffic will be tourists either visiting the Stromeferry / Lochcarron area or passing through to visit other areas of Wester Ross or the northwest Highlands in general.

It is quite possible that 60% of car traffic in the period from June to September will be tourists, but annualised values for this percentage would be lower. For the purposes of this assessment an annualised value of 15% will be adopted, although this value will be superseded when traffic survey results become available later on in the study. Meanwhile these values can be used as the basis of sensitivity analysis to test the importance of changes to them.

7.5.5 *Origin – Destination Data*

As with trip purpose, there is no current information from available traffic data that indicates traffic flow origin and destination. The pattern of traffic origins and destinations is likely to change on a seasonal basis reflecting trip purpose. Actual origin and destination data will become available with traffic surveys undertaken later in the study, and this information will be used in the Part 2 STAG appraisal.

7.6 Safety Appraisal

7.6.1 *Overview of Safety Appraisal*

The Safety objective identified within STAG is concerned with reducing the loss of life, injuries and damage to property resulting from transport accidents and crime. Two sub-objectives are considered, namely accidents and security. These are described below.

7.6.2 *Accidents*

Highland Council provided the information on accidents in the Strathcarron area. These accidents are classified into one of four categories; fatal, serious, slight or damage according to the most severely injured casualty. Table 7.4 shows the number of accidents and severity of casualties for the period from the 1st August 2007 to 31st July 2012 combined for both the A890 south of the Strathcarron junction and for the A896 Strathcarron to Kishorn road.

Table 7.4 – Personal Injury Accidents

TABLE 7.4 PERSONAL INJURY ACCIDENTS, A890 SOUTH OF STRATHCARRON JUNCTION & A896 STRATHCARRON TO KISHORN, 01 AUG 2007 TO 31 JULY 2012, AND PROPORTION OF ACCIDENTS BY SEVERITY (SOURCE- HIGHLAND COUNCIL)		
Severity	Number	Proportion
Fatal	1	3%
Serious Injury	2	6%
Slight Injury	7	22%
Damage	22	69%
Total	32	

The traffic accident rate for the Northern Region (as defined by Police Force coverage) as a whole is higher than for most regions in Scotland and the national average for Local Authority A roads.

Table 7.5 shows the accident rate for Local Authority A roads for a number of regions of Scotland and for Scotland as a whole, and illustrates this trend in terms of fatal, serious and all severity accidents, which include slight accidents, per 100 million vehicle-kilometres, for the years 2005 through to 2009.

Table 7.5 – Fatal & Severe Accidents

TABLE 7.5 FATAL AND SEVERE ACCIDENTS PER 100M VEH-KMS LOCAL AUTHORITY A ROADS 2005 - 2009			
Police Authority Region	Fatal	Serious	All Severities
Northern	1.8	10.3	32
Grampian	1.3	7.8	40.1
Tayside	1.2	12.1	38.5
Fife	0.8	7.6	30.7
Lothian & Borders	1	8.7	58.8
Central	1	10.7	36.5
Strathclyde	1	13.2	56.9
Dumfries & Galloway	1.4	11.1	36.5
Scotland	1.1	10.7	47.9

By taking the annual traffic flows from Figure 7.2 and road accident data shown in Table 7.4 it is possible to compare the accident rates for the A890 / A896 with those for both the Northern Region and for Scotland as a whole.

The Table below clearly shows that, even though the number of accidents is relatively low, accident rates per 100 million vehicle-kilometres for the A890 / A896 are much higher in terms of fatal accidents and also higher in terms of serious accidents and those of all severity. It should be noted that although the time frame between the A890 / A896 and Northern Region / Scotland data is slightly different, these values are per 100 million vehicle-kilometres and should not make much difference.

Table 7.6 – Comparison of Accident Rates

TABLE 7.6 COMPARISON OF ACCIDENT RATES BETWEEN A890 / A896, 2007- 2012 WITH AVERAGE FOR NORTHERN REGION AND SCOTLAND, 2005 - 2009			
	Fatal	Serious	All Severities
Northern Region	409%	143%	230%
Scotland	669%	138%	154%

Generally road traffic accidents tend to be more severe in rural areas than in urban areas. This would partially explain the differences in rates of casualty accidents, but the road alignment itself may also be partially to blame. Nevertheless It is reasonable to assume that upgrading the current On-line Option or establishing a now alternative road alignment altogether would reduce the number of fatal and serious injury accidents.

There is also the direct safety of removal of the threat of death or injury from falling rock material onto the road, and to a lesser extent, onto the railway. Under the Do-Something scenarios, all of the considered options would remove this threat in almost its entirety and provide a safer road environment. The degree this threat remains rests on the proportion of the current alignment that would remain open for local access where an offline option is chosen. This will relate to the amount of continuing remedial work carried out on vulnerable sections of the road still used.

7.6.3 *Security*

STAG Section 7.3 states that “when undertaking a Part 1 appraisal [for Security], planners should consider whether the proposal under consideration has any material impact on security for the users.”³ Detailed assessment, for example using GOMMMS⁴, is not required until a Part 2 appraisal. Nevertheless the GOMMMS security indicators provide a useful checklist for STAG Part 1 appraisal, namely:

- site perimeters, entrances and exits;
- formal and informal surveillance;
- landscaping;
- lighting and visibility; and
- emergency call facilities

As far as addressing the rock fall issue on the A890, the key element above that is directly relevant to this issue relates to the ability of emergency services to minimise response times to emergencies and to minimise their access times to key local and regional facilities, including access to hospitals in Dingwall and Inverness.

There is little doubt that all the Do-Something options, would, by removing the problem with rock fall blockages, potentially greatly improve both emergency response time and access to key facilities.

7.7 **Road Network Performance**

7.7.1 *Local Road Network and Data Collation*

The extent of the key road network was discussed with Highland Council officials. Traffic count data was sourced from Highland Council for Achintee close to Strathcarron, using 2010 data, and Attadale, which is near to the rock avalanche shelter on the A890, using 2012 data. The Achintee data was adjusted to 2012 levels by applying values from the National Road Traffic Forecasts Annual Central Growth Rate for Rural Roads (1997).

Control traffic data on the A87 trunk road was sourced from the Scottish Roads Traffic Database⁵ (SRTDb). The latter is a system which collects, validates, stores and disseminates traffic count data for the trunk road network, and limited parts of the non-trunk network. The SRTDb is operated and maintained by Transport Scotland, and has over 1,500 traffic count sites in the system at present.

7.7.2 *Existing Traffic Movements*

The road network should be appraised during times when it is at its most sensitive to new trips generated. This is during the peak hours of operation when background traffic flows are at

³ STAG, September 2003, section 7.3.1

⁴ Guidance on the Methodology for Multi-Modal Studies, DETR, March 2000

⁵ http://www.transportscotland.gov.uk/stag/td/National_Data_Sources/17.2.12

their highest levels during the day. A review of the data collected has shown that the highest road traffic flows are between circa 0900hrs and 1000hrs and between circa 1600hrs and 1700hrs. As noted above, traffic growth on the A890 Stromeferry Bypass was increased on annual basis by applying values from the National Road Traffic Forecasts Annual Central Growth Rate for Rural Roads (1997), and the rate of growth reduces over time.

As traffic on the A890 Stromeferry Bypass shows strong seasonal flows, two months were selected to indicate both a neutral month, March, and a peak season month, July, to take account of the seasonality effect. Table 7.7 shows daily am and pm peak base traffic flows, by direction, for March and July for Achintee and for Attadale for the year 2012, and projected for the years 2016, estimated opening year and 2046, estimated design Year.

Table 7.7 – Daily AM Peak Base Traffic Flows

TABLE 7.7 DAILY AM PEAK BASE TRAFFIC FLOWS, ACHINTEE & ATTADALE, FOR MARCH & JULY, FOR YEARS 2012, 2016 AND 2046, BY DIRECTION				
Location	Achintee		Attadale	
	March	July	March	July
2012 AM Peak Hr Eastbound	32	70	37	73
2012 AM Peak Hr Westbound	54	106	38	74
2012 PM Peak Hr Eastbound	44	74	41	69
2012 PM Peak Hr Westbound	52	97	42	70
2016 AM Peak Hr Eastbound	34	74	39	77
2016 AM Peak Hr Westbound	57	112	40	78
2016 PM Peak Hr Eastbound	47	78	43	73
2016 PM Peak Hr Westbound	55	103	45	74
2046 AM Peak Hr Eastbound	43	94	49	98
2046 AM Peak Hr Westbound	73	142	51	99
2046 PM Peak Hr Eastbound	59	99	55	93
2046 PM Peak Hr Westbound	70	130	57	94

It is clear from the Table the strength of the seasonality effect for both the AM and PM peak hours. For example for Achintee this averages an increase of 92% in both AM and PM traffic in both directions, and for Attadale this 82%. The strength of the daily tidal traffic, however, is much less significant.

7.7.3 Road Capacity

Network capacity was estimated using the Design Manual for Roads and Bridges (DMRB). Volume 15 of the DMRB sets out highway capacities for various road types, based on numbers of lanes and speed limits. The analysis was carried out for the current alignment and for the planned new alignment options. The method is summarised below.

Road capacity of the A890 Stromeferry Bypass is determined by its width, which for most of the links between the Attadale Estate and the Stromeferry Turnoff is 4.0 meters. It is this

section of the road that is most vulnerable to rock fall. For a Rural Poor 4.0m single lane road, road capacity is 140 vehicles per hour per direction.

Comparing the Design Flows with the network capacities on each link, we estimated the level of congestion. This is based on the ratio of flow to capacity (RFC). The RFC is the standard network indicator used to show the level of utilisation of capacity. An RFC of greater than 85% represents conditions of significant congestion, when safety and delay issues can be expected. An RFC of greater than 100% represents complete saturation.

Table 7.8 shows the road capacity of the A890 Stromeferry Bypass and its performance in meeting the Do-Minimum peak hour baseline traffic growth for the years 2012, 2016 and 2046. This is shown again by daily am and pm peak base traffic flows, by direction, for March and July for Achintee and for Attadale.

Table 7.8 – Road Capacity in RFCS

TABLE 7.8 ROAD CAPACITY IN RFCS OF THE A890 STROME FERRY BYPASS, BASELINE TRAFFIC FLOWS FOR MARCH & JULY, 2012, 2016 AND 2046, BY DIRECTION				
Location	Achintee		Attadale	
	March	July	March	July
2012 AM Peak Hr Eastbound	23%	50%	26%	52%
2012 AM Peak Hr Westbound	39%	76%	27%	53%
2012 PM Peak Hr Eastbound	31%	53%	29%	50%
2012 PM Peak Hr Westbound	37%	69%	30%	50%
2016 AM Peak Hr Eastbound	24%	53%	28%	55%
2016 AM Peak Hr Westbound	41%	80%	29%	56%
2016 PM Peak Hr Eastbound	33%	56%	31%	52%
2016 PM Peak Hr Westbound	39%	73%	32%	53%
2046 AM Peak Hr Eastbound	31%	67%	35%	70%
2046 AM Peak Hr Westbound	52%	102%	36%	71%
2046 PM Peak Hr Eastbound	42%	71%	39%	67%
2046 PM Peak Hr Westbound	50%	93%	40%	67%

The selected options, including the upgraded on-line options, the two lane road would be designed to a 6 meter carriageway width in each case. DMRB indicates that the capacity of a Rural Typical 6.0 meter road is 900 vehicles per hour per direction. Given this, a comparison of The RFCs is shown in Table 7.9 overleaf.

The comparison uses Achintee as the data point taken to represent Baseline conditions, as this has the worst capacity performance of the two. The Design Traffic Flows are representative of the selected alternative route options, including upgrade options for the current alignment. The comparison is shown only for the year 2046.

Table 7.9 – Comparison of RFCS

TABLE 7.9 COMPARISON OF RFCS FOR BASELINE AND DESIGN TRAFFIC FLOWS FOR MARCH & JULY, FOR THE YEAR 2046, BY DIRECTION		
Location	March Baseline/Design	July Baseline/Design
2046 AM Peak Hr Eastbound	31% / 5%	67% / 10%
2046 AM Peak Hr Westbound	52% / 8%	102% / 16%
2046 PM Peak Hr Eastbound	42% / 7%	71% / 11%
2046 PM Peak Hr Westbound	50% / 8%	93% / 14%

Clearly, Table 7.9 shows that the upgrade of the current road alignment from a 4 meter road to a 6 meter two lane carriageway, or implementation on a new alignment of the same width has large beneficial implications on route capacity. The current alignment experiences conditions, at least for part of the peak hour day, from significant congestion to complete route saturation over the tourist month of July. Table 7.1 shows higher traffic volumes for August for Achintee.

Therefore, for at least two months of the peak holiday season, part of the A890 Stromeferry Bypass between the Strathcarron Stromeferry Junction and the Stromeferry Junction experiences severe congestion. However this congestion is completely alleviated with the upgrade of the current alignment or implementation of a new route option. As the alternative routes are all designed to 6 meter carriageway widths, each has the same advantage.

7.8 Economic Assessment Methodology

The economic appraisal has been conducted using standard economic welfare techniques, as set out in the Scottish Transport Appraisal Guidance (STAG). In this analysis the change in economic welfare can be approximated using the change in travel time, vehicle operating costs and road maintenance costs.

In the case of rock falls close to Attadale on the A890 Stromeferry Bypass, this change in costs is determined by the number of journeys affected, the type of journeys affected (e.g. car, bus, train, freight) and whether or not use is made of the alternative route available.

The quantification from changes in accidents and environmental emissions resulting from the Do-Something options will be undertaken in the STAG Part 2 assessment. For purposes of the STAG Part 1 appraisal these have been assessed qualitatively at this stage. It has been assumed in the Part 1 appraisal there is no change in the number of tourists who visit Scotland as a result of the rock fall, but the road closure causes a proportion of visitors to use the alternative route to access the study area, and a proportion to travel to alternative destinations, delay or cancel their trip altogether. This is described in more detail below.

7.8.1 Vehicle Traffic Flow Diversion

In order to calculate the total economic benefits of a rock fall it is necessary to estimate the number of trips that use the diversion route compared to those who decide to delay or change their plans. Evidence from other studies relating to traffic diversion as a result of rock fall activity suggests that approximately 51% of traffic diverted while 49% made alternative plans and may have changed their destination, delayed their trip or cancelled their trip altogether.

For this assessment, the proportions noted above may be relatively high given that the individual travel cost change expected with closure of the A890 would be much higher than the increase of 107% noted in these studies. A significant proportion of tourists in particular may be expected to be cost-sensitive and may choose a different destination or delay their trip when faced with the risk of an additional 180 kilometres or more to reach their destination in the Lochcarron / Stromeferry / Strathcarron area.

For the assessment it is therefore assumed that:

- for the proportion of cars that represent tourist visitors, the elasticity value is -0.7 (i.e. relatively elastic);
- for non-tourist car and LGV traffic such as commuting, shopping, serving utilities etc. and
- for HGV / coach traffic it is the elasticity value is assumed to be inelastic, as all of this traffic would use the diversion route.

Using these proportions and the traffic count data in Figure 8.2 adjusted by NRTF values over the assessment period, the number of trips diverted due to a rock fall can be estimated. It is then assumed that those trips that do divert bear the full change in transport costs, whilst the cost for all the trips that are cancelled, delayed or made to an alternative destination are assumed to be half of this, as standard transport appraisal procedures⁶.

These values can be multiplied by the projected number of days a year that the road would be closed due to a rock fall to give the annual estimate of disbenefits of rock falls in the A890 Stromeferry Bypass Attadale area. These annual disbenefits are then expanded over the 60 year appraisal period using standard growth values for the variable used for STAG.

Once the disbenefits of rock falls on the A890 Stromeferry Bypass are estimated, then the benefits associated with the different options can be calculated. It has been assumed that the disbenefits associated with a rock fall will be avoided by using an alternative route, given that the intention is to close the A890 to all traffic with the exception of access to a very limited number of residences.

7.8.2 *Capital and Road Maintenance Costs*

Capital Expenditure

For the costs of the different option assumptions, capital costs, maintenance costs and rock fall clear up costs have been taken into account. For the capital costs for each option these have been adjusted for Optimism Bias, an upwards adjustment of 44% to reflect systematic bias in cost estimations that is recommended as standard practice in STAG.

Total capital costs between each option vary widely depending on route length and type of infrastructure proposed. The most expensive options include either a bridge or tunnel construction as seen in options ON3 and N2, a barrage as noted for option N6b, or an avalanche shelter as observed for the On-line option O7.

Maintenance and Reactive Maintenance Costs

In terms of the new route alignment options, it is understood that, although the current on-line route will be partially closed to public traffic, the road will continue to be maintained, albeit at a reduced annual maintenance outlay, assumed to £25,000 per annum. The reduced road

⁶ <http://www.dft.gov.uk/webtag/documents/expert/unit3.5.3.php>

maintenance costs for the road would still be passed on as an additional annual cost to the maintenance burden of the new offline routes.

In terms of the new on-line route options, the annual maintenance costs of these would need to be compared with the annual maintenance costs of the on-line route in its current condition. These are assumed to be approximately the same. Therefore, to include these in the appraisal of the on-line options would in effect be double counting the maintenance costs of these options and have been ignored for appraisal purposes.

With reference to the reactive maintenance costs, these have been assessed to be approximately £10 million over a 20 year period, undiscounted, or £30 million undiscounted over the full appraisal period of 60 years. This represents the reactive maintenance costs for the Do-Minimum scenario, (sourced from Highland Council Committee Report *G6 Option Do-Minimum*, August 2012). For both the on-line and offline options, reactive maintenance is no longer required, where the rock face stabilization work that removes this requirement is built into the capital costs of the respective on-line options, and is assessed to be £70 million in current prices.

In effect this represents an annual benefit of £500,000 in undiscounted terms to both the upgraded on-line and offline route options where the requirement for reactive maintenance would cease.

7.8.3 *Journey Time and Vehicle Operating Cost Benefits*

Changes in travel costs have been calculated using the travel times and distances provided in Table 8.3, with standard vehicle operating cost formulae being used to calculate fuel and non-fuel related costs. Standard values of time and vehicle operating costs applied have been derived from STAG.

7.8.4 *Accidents*

STAG emphasises the need to “*consider the impact of the proposal under consideration on accidents*”⁷. For proposals which change road traffic accident numbers, or their severity, standard methodologies exist for calculating the projected number of accidents, the types of accidents and associated casualties in the before and after scenarios.

For the identification of accident and casualty benefits, the DMRB / NESAs rate-based methodology has been used. This requires projections of vehicle-kilometres in the before and after scenarios. Standard cost values are attributed to fatal, serious and slight casualties allowing the monetisation of accidents in the before and after scenarios, and hence the calculation of the potential accident benefits of a proposed route option.

The methods relate the traffic on a road (measured by vehicle-kilometres) to the number of accidents via the application of an accident rate. Accident rates and costs for different road types are set out in Government appraisal guidance⁸ and which STAG suggests “*these should be adopted*”. The process and assumptions are set out below:

- In carrying out the accident data analysis, because there are very few junctions on the vulnerable parts of the A890 subject to rock fall, link only accident casualty rates were used, as described in Table 6/5/1 of the NESAs Manual. Subsequent calculations have therefore been based on link only accident casualty rates;

⁷ Section 7.2 in Chapter 7 of STAG

⁸ DMRB / NESAs Manual, (Volume 15, Section 1, Part 6 Ch5), July 2005

- It was assumed that the appropriate NESAs Road Category to derive appropriate PIA and casualty rates to use would be NESAs Road Category 24 (Rural Typical Single 6.0m) for the Do Something route option scenarios, and NESAs Road Category 21 (Rural Poor Single 4.0m) . Based on this the relevant personal injury accident (PIA) rates have been obtained directly from Table 6/5/1 of the NESAs Manual; and

Since the intention is to compare one option against another it was considered there was no requirement to re-base accident rates or apply growth/decline rates since such factors would be constant to each option appraised and would hence cancel out when options are compared to each other.

7.9 Public Transport

7.9.1 *Rail*

There is some separation between road and railway, which for minor rock failure provides some measure of safety for the railway. However, as Table 7.1 above shows, at least on three occasions over the last twenty two years both the road and railway have been blocked by rock fall in the Attadale – Ardnarff area.

It is only because the rail line is further from the rock face than the road that the rail line has been spared as frequent blockage. Nevertheless, rail services have to operate to a 30mph speed limit to counter the risk of rock fall debris on the track giving time for the train to stop if necessary, Network Rail's policy is to minimise operational risk and manage the residual risk.

The rail line between Inverness and Kyle is a passenger only line operated by 2 car class 155 trains. It operates Mondays to Saturdays with four services a day in each direction spaced out every two to three hours. Total journey time between Inverness and Kyle is approximately two and half hours, and the stops within the study area are:

- Strathcarron;
- Attadale; and
- Stromeferry.

For most of the year passenger traffic using the rail service is relatively light. At each end of the day the service is used by commuters to Inverness. However, in the peak summer months rail patronage on this line can become very heavy coinciding with the peak tourist season.

FIGURE 7.3: ANNUAL PASSENGER TRAFFIC ON THE INVERNESS – KYLE OF LOCALSH RAIL LINE 2006/07 to 2010/11 (SOURCE: ADAPTED FROM THE OFFICE OF RAIL REGULATOR (ORR) STATION USAGE, COMBINED ENTRIES FULL FARE AND ENTRIES REDUCED FARE, ALL STATIONS ON ROUTE, 2012)

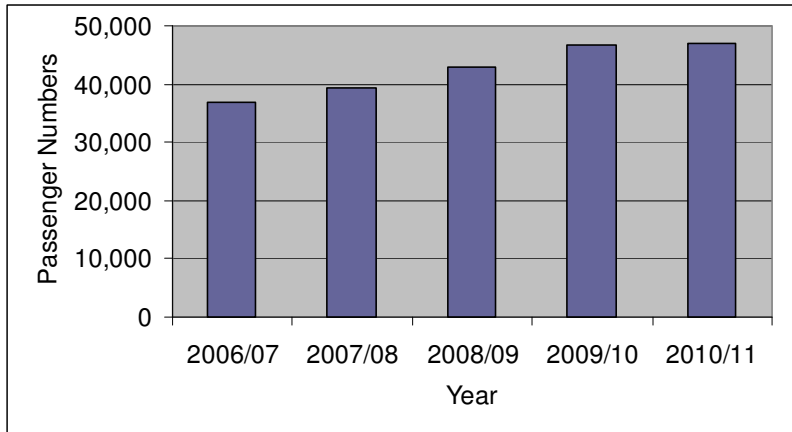


Figure 7.3 above shows annual passenger traffic on the Inverness to Kyle line from Garve, and includes each passenger alighting at each station between Garve and Kyle of Lochalsh. The Table indicates that there has been fairly significant growth rate in passenger traffic on this rail line.

For appraisal purpose, given the range in fares for each station on the line, annual changes in passenger entries have been taken for each station as represented by their appropriate linear regression (trend) curve, to project future passenger traffic. The average annual growth in passenger traffic averages out at 3.7%, and this growth rate is applied to the analysis up to the point where the capacity of the rail line for passenger traffic is reached.

Table 7.10 stresses the relative importance of the route between Strathcarron and Kyle of Lochalsh to access, in particular, Inverness. Any rock fall would impact on the vast majority of passenger using the line, assuming that the part of the route relatively unaffected between Garve and Strathcarron would remain open after such an event.

Table 7.10 – Rail Passenger Traffic Strathcarron to Kyle

TABLE 7.10 PASSENGER TRAFFIC BETWEEN STRATHCARRON AND KYLE					
	2006/07	2007/08	2008/09	2009/10	2010/11
Passenger traffic whole route	37,016	39,325	42,828	46,777	46,992
Kyle of Lochalsh	18,978	20,397	26,336	30,082	30,264
Plockton / Duncraig / Duirinish	4,695	5,368	5,180	5,865	6,298
Strathcarron / Attadale / Stromeferry	4,643	4,529	4,891	4,888	5,043
Proportion of passengers between Strathcarron & Kyle	76%	77%	85%	87%	89%

The benefits of the route options that address rock fall events on the A890 in terms of rail have been included in the cost – benefit analysis, albeit at a high level. There are benefits to the service provider and to rail service users; these are:

- ScotRail, in recovery of passenger revenues that might have been lost; and
- journey time savings where interruptions to the rail service are reduced, especially for commuters and for those on business.

For appraisal purposes, it is assumed that the whole route is closed between Garve and Kyle of Lochalsh when a rock fall event occurs, therefore fares and journey time losses affect the whole route. The main adjustments used in the appraisal are:

- 2013 fares have been used, these are weighted by proportion using each station on the route and adjusted back to 2010 prices to maintain consistency with the appraisal process;
- Market prices of the value of time have been used (TAG Unit 3.5.6 DfT Oct 2010);
- The “Rule of a Half” has been used to reduce full commuter and work related rail traffic costs to account for trip deferral or trips undertaken by different mode
- assumed that reduced fares are set at 50% of the level of full fares.

As noted earlier, road closure has been annualised to 9 days based on the information given in Table 7.1. It was also noted that the period of rail closure is approximately a third of this. The appraisal therefore assumes that the rail line is closed for an average of three days per year. As with periods of road closure, this length of rail closure may be subject to sensitivity testing.

In terms of freight, reference to the Scotland Rail Utilisation Strategy (RUS) 2007 it is noted that the rail section between Garve and Kyle of Lochalsh is constrained by being single line throughout, with passing loops. There is a restricted freight service over this section including timber, petroleum and mixed goods, the Radio Electric Token Block (RETB) signalling system is operating at close to its maximum capacity limit.

Ruling line speed is low (72 km/h) and, because of the single track configuration, route availability for freight is also low at RA5. Moreover the loading gauge, which governs the size of container and other loads that are able to taken on the line, is relatively small, at W7. Therefore, the potential for additional rail freight on the Kyle to Inverness line is very limited at present.

With the improvements to the existing A890 Bypass road alignment or the implementation of an alternative route that remove periodic rail line blockage, the results of the rail analysis indicates a discounted net present value of benefits in the order of £600,000 over the 60 year appraisal period. These benefits accrue to the service provider, ScotRail and are taken account in the economic appraisal.

7.9.2 *Bus Services*

CityLink provides a thrice weekly bus service, the 917 between Kyle and Inverness. Up to quite recently this served Lochcarron, but has now stopped calling at this point due to lack of demand. This service has been largely replaced by a dial-a-ride based in Lochcarron operating a service twice a week, Wednesdays and Saturdays, and calling in and dropping off passengers at their place of residence.

There are daily school bus services using the route both council run and private operators. School bus services are poorly publicised. Many tourists, as well as local residents, are not aware that the services exist not only to convey children to and from school, but that they are

also available for the general public. This is always subject to space permitting, but seating is usually available, especially for school bus runs using larger coaches. There is normally also space available when empty school buses return to their point of origin after dropping off children at their schools. There is an acute concern amongst the local community that rock fall may affect the amount of time schoolchildren spend on the bus to and from school.

7.10 Cost Benefit Appraisal

In accordance with the requirements of STAG, a cost benefit appraisal has been undertaken. The cost benefit appraisal was carried out using the estimated capital costs at the higher end stated in section 5.12 of this report.

On this basis, the results show that the Benefit to Cost Ratios are likely to be less than 1.0, with the best performing option being the on-line O5 route option considering road-rail share. The assumed capital costs of the options tend to be high for the traffic on the network, which means that it is unlikely that benefits from this level of analysis are unlikely to cover the costs.

However, sensitivity analysis would address the variations in the capital costs assumed for each option, and this would be undertaken in the STAG Part 2 process.

Although this core analysis suggest that none of the options provide a level of present value of benefits greater than present value of costs. However, with the application of monetised wider economic benefits (WEBs) and other benefits in the STAG Part 2 appraisal, these results may, of course, change. It should also be noted that no quantification of costs has been undertaken owing to road closure necessitated by option works. This may affect the sifted on-line route options disproportionately and will be taken account of, if required, in the STAG Part 2 appraisal.

7.11 Economic Efficiency and Locations Impact (EALI) Appraisal

7.11.1 *Introduction*

As part of the assessment of the economic impacts of different options, a review of the Economic Activity and Location Impacts (EALI) appraisal is required to allow the impact of an option to be expressed in terms of its distributional effects, that is the net effects of the option on the local, regional and / or national economy. For the STAG Part 1 the impacts are scoped qualitatively.

The Lochcarron – Stromeferry region of Wester Ross is relatively remote and unpopulated. The remarkable beauty of the region encourages significant tourist activity to the area and tourism remains an important part of the local economy.

There is significant tourist accommodation between the settlements of Lochcarron, Strathcarron Stromeferry and Plockton, and there are a number of restaurants. The local tourist attractions include, but are by no means restricted to:

- Attadale Estate and Gardens;
- Strome Castle;
- Balmacara Estate and Lochalsh Woodland Garden;
- Applecross Heritage Centre;
- Kirkton and Woodland Heritage Group;
- Balnacra Arts;
- Carron Craft Shop & Gallery; and

- Lochcarron Weavers.

There are a wide range of tourist activities available in the area, including walking and mountaineering in the nearby Torridon mountains, bird-watching, fishing, cycling and deer stalking in the Udalain valley to name a few.

Tourism however is only one of a number of important economic sectors in the region. Forestry and fish farming are important business activities in the regional hinterland. Approximately 10,000 tonnes of timber is harvested annually in the area and shipped out of Kishorn to processing plants in Ayrshire and further afield.

Green energy is also an increasingly important source of income. This is especially true in terms of local on-shore wind farms that assist in supplementing farming revenues. In addition, there is considerable potential business interest in the development of large scale offshore wind farms between the Scottish mainland and the Western Isles, which would be served by Kishorn for materials and supplies and possibly Broadford airfield for flying in personnel and staff.

7.11.2 *Business Surveys*

In order to gain a better understanding of the business impacts that might result from a rock fall on the A890 Bypass a survey questionnaire was distributed by post. Approximately 95 questionnaires were posted, and, to date 44 completed questionnaires have been returned.

Although the sample size is relatively small, the return rate on the postal surveys at 45% is consistent with a high rate of survey questionnaire return. In addition to the postal survey, a small number of questionnaires were distributed electronically, with a few of these returned.

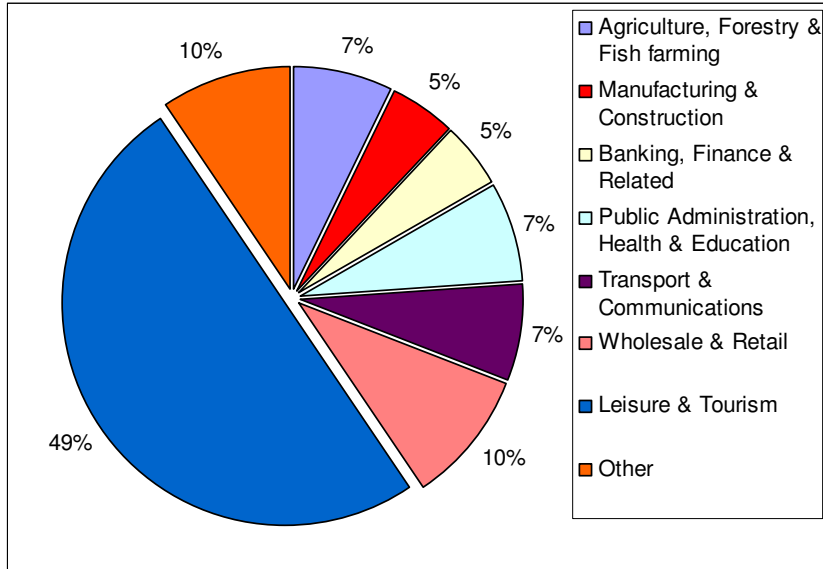
In order to achieve the data required for the EALI, information was sought on the following:

- headline financial and employment information;
- level of usage of the A890;
- scale and level of impacts of rock falls on the A890 related to length of closure;
- regional distribution of impacts on rock falls on the A890; and
- the importance of rock fall events in terms of business development, opportunities and investment.

The remainder of this chapter provides a review of the business sector and the level and scale of the impacts that road closure of the A890 resulting from rock fall has on businesses.

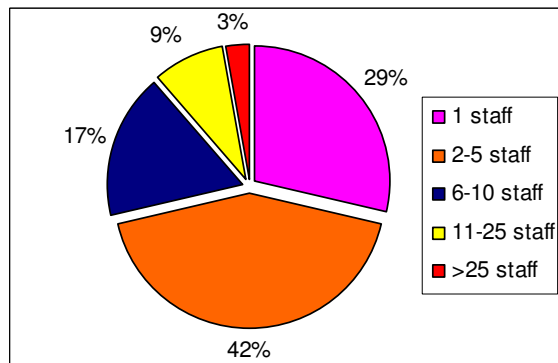
Figure 7.4 shows the dominance of tourist related businesses in the local economy where nearly half of all questionnaire returns are from businesses in the leisure and tourism sector. However, there was a good cross section of other business sectors represented, including wholesale and retail businesses, agriculture, forestry and fish farming, transport and communications and the public sector each representing over 5% of the businesses surveyed.

FIGURE 7.4: QUESTIONNAIRE RETURNS BY BUSINESS SECTOR, 2013



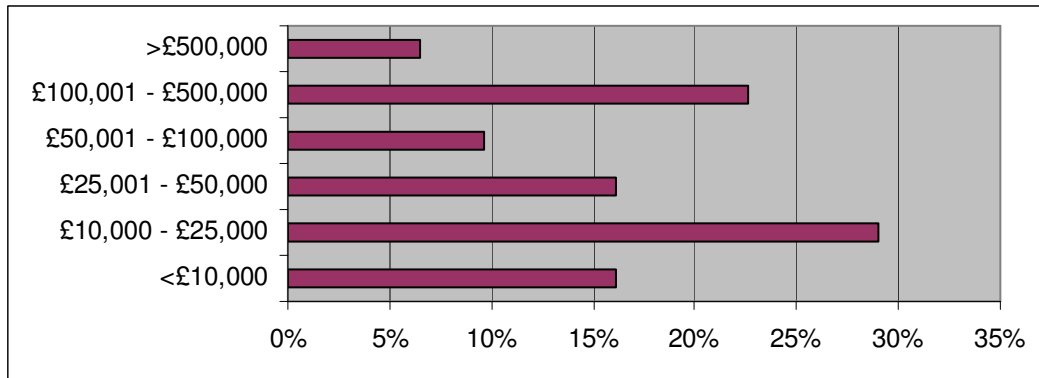
The businesses in the Lochcarron – Stromeferry area are small. Figure 7.5 overleaf indicates that a significant proportion are either sole traders (27%) or have five or fewer staff (43%). This is consistent with the predominance of tourism related businesses in the area. Only 12% of businesses surveyed had 11 or more staff, and 3% had more than 25 staff.

FIGURE 7.5: Business Size by Employment, 2013



The small scale of businesses was reflected by their annual turnover. As Figure 7.6 shows, over half of businesses surveyed had a turnover of less than £50,000. However, a significant minority of businesses, approximately 30% had a turnover of more than £100,000 of which circa 7% had a turnover of over £500,000.

FIGURE 7.6: Business Size by Turnover, 2013



Although businesses surveyed in the Lochcarron area are relatively small in terms of employment, a significant proportion of them contribute an important measure of economic activity in terms of regional income.

7.11.3 *Scale of Business Impacts*

Business use of the A890 is relatively heavy. Indications from the surveys suggest that even where businesses themselves do not use the A890 Stromeferry Bypass on a regular basis, they are dependent on the route for their customers and clients.

FIGURE 7.7: BUSINESS USE OF THE A890 BYPASS, 2013

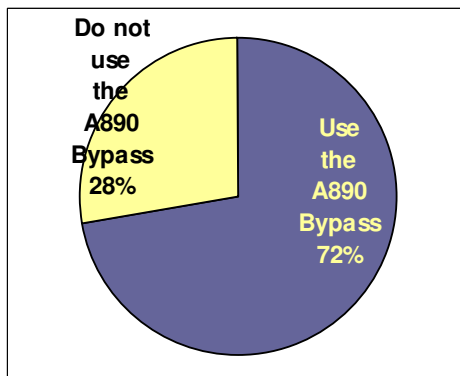
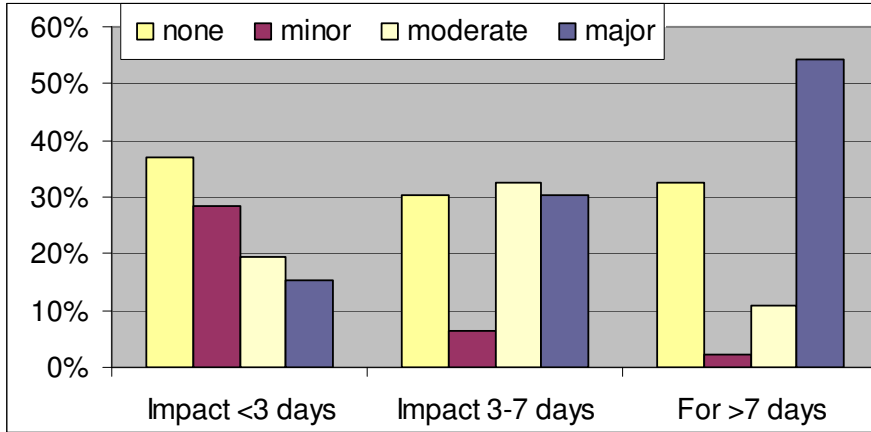


Figure 7.7 may therefore understate the business dependence on the A890. Nevertheless, nearly three-quarters of businesses use the route on a frequent basis.

Figure 7.8 below gives an indication of the potential scale of impact on businesses resulting from a rock fall on the A890 Stromeferry Bypass. It is apparent that for land slips lasting for more than seven days, by far the largest proportion of businesses indicate that the impact is major.

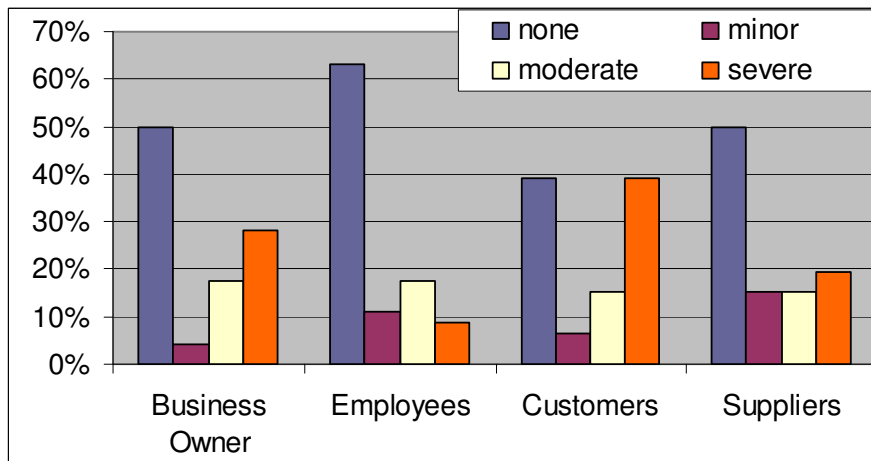
FIGURE 7.8: SCALE OF POTENTIAL IMPACT ON BUSINESSES BY ROCK FALL CLOSURE OF A890 BYPASS BY SEVERITY AND LENGTH OF CLOSURE



The category “none” is a record of both businesses who indicate that there is no impact or have not replied to this question. Therefore the results in the Figure may slightly understate the real impacts. Nevertheless, it suggests that the longer the rock fall event, the more major the impact on businesses, which is not entirely unsurprising.

7.11.4 *Scale of Business Impacts by Affected Group*

FIGURE 7.9: SCALE OF POTENTIAL IMPACTS ON BUSINESSES BY ROCK FALL CLOSURE OF A890 BYPASS ON AFFECTED GROUP



A large number of businesses in the region depend either on passing trade or on tourist visits. That being the case, it might be expected that business customers are amongst the hardest hit in the event of a rock fall. This is demonstrated in Figure 7.8. Business owners are another group that record relatively severe impacts. In many cases, as we have seen, many businesses are sole traders and therefore business owners will feel directly any loss in revenue resulting from road closure.

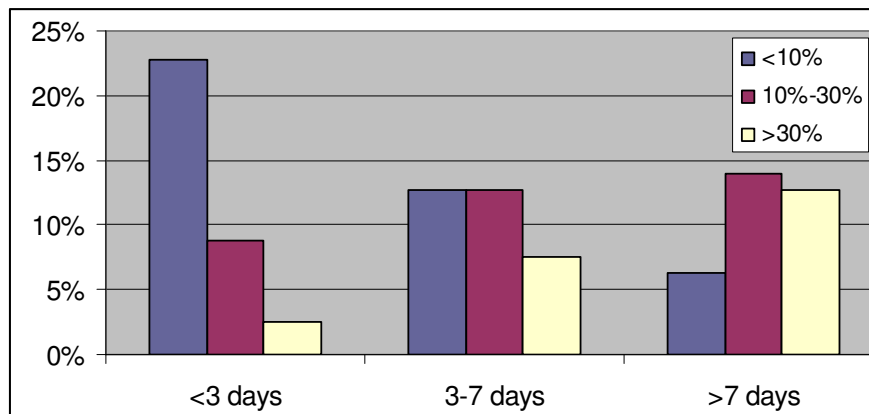
It should be noted that, as with Figure 7.7, the category “none” in Figure 8.8 is a record of both businesses who indicate that there is no impact or have not replied to this question.

Removal of those questionnaire returns that did not reply to the question would amplify the results without changing their relative scale.

7.11.5 *Scale of Business Impacts by Turnover*

Figure 7.10 shown overleaf registers the scale of potential impacts on business turnover under road closure periods of different lengths.

FIGURE 7.10: SCALE OF POTENTIAL LOSS ON BUSINESS TURNOVER BY ROCK FALL EVENT OF A890 BYPASS BY LENGTH OF ROAD CLOSURE



The results of the survey are as might be expected in that the longer the period that the road is closed the greater the number of businesses recording a large impact on business turnover, and naturally the converse is true. The Figure suggests that for a road closure of less than three days, only about 2% -3% of businesses might lose more than 30% of their turnover. This proportion rises to approximately 7% of businesses if the road is closed for three to seven days, and nearly doubles again to circa 13% of businesses who might expect to lose more than 30% of turnover if the road is closed for more than seven days.

This result suggests that rock fall impacts on businesses are very sensitive to the period for which the road is closed. Road closure over extended periods results in significant loss in revenue. Given that most businesses are small or very small, have a modest level of turnover, and many of these rely on passing trade, it would be expected that the majority of businesses are particularly vulnerable to road closure, and even more so for road closure for extended periods.

7.11.6 *Distribution of Business Impacts*

Businesses were asked where the impacts on their business would most be likely to be felt resulting from a rock fall related closure of the A890. Local impacts were defined as those resulting in an area bordered by Achnasheen in the east, Dornie in the south and Kyle of Lochalsh in the southwest. Regional impacts were those in Wester Ross outside the area defined as local, and up to and including an area bordered by Dingwall, Fort William and Mallaig. National impacts were defined as the rest of Scotland and the rest of the UK.

Of those businesses which responded, when averaged over the sample, over half of businesses indicated that the impacts were local, as seen in Figure 7.11. However, again when averaged over the sample, a substantial proportion, some 47% pointed out that the impacts were regional or national. With tourism a significant part of the economy, this is unsurprising as much of the tourism sector is dependent on visitors from other parts of Scotland, other parts of the UK and overseas.

FIGURE 7.11: GEOGRAPHICAL DISTRIBUTION OF BUSINESS IMPACTS

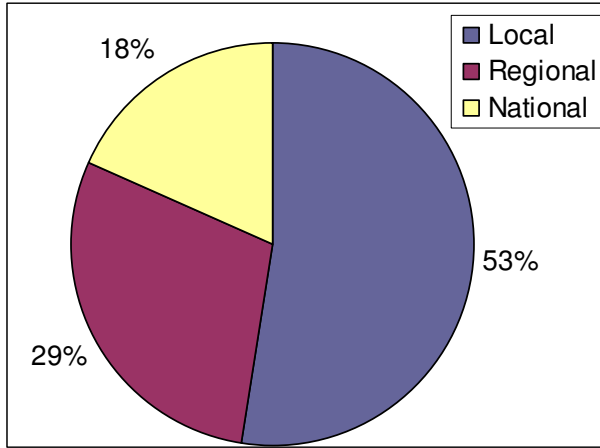
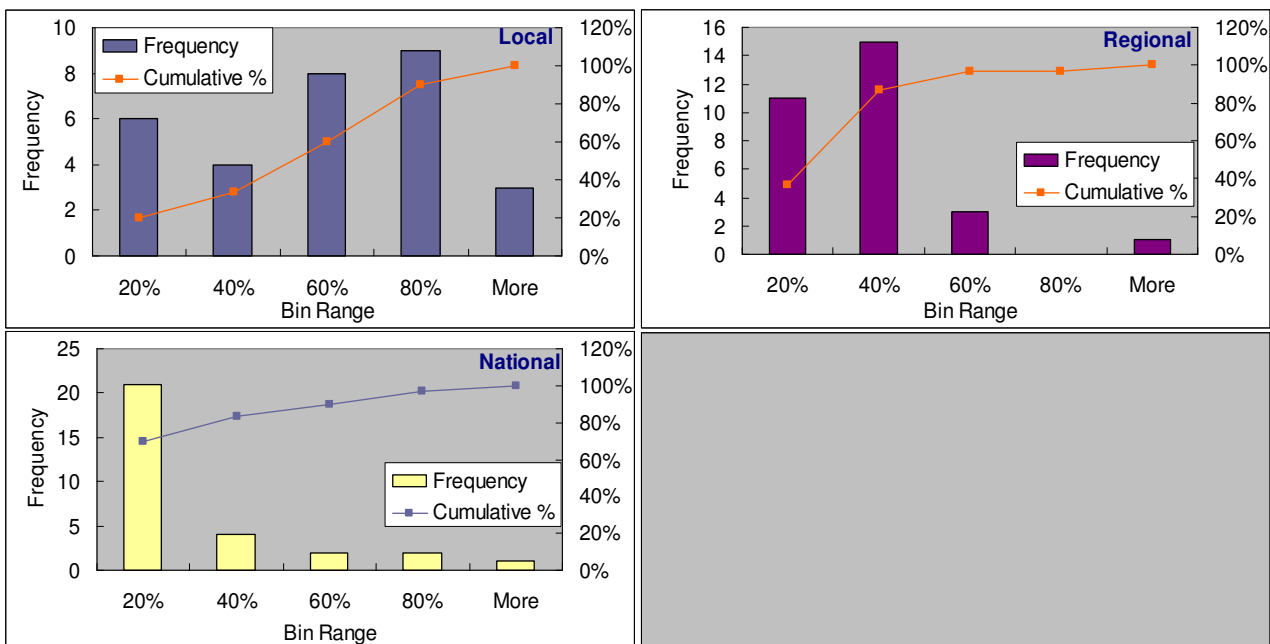


Figure 7.12 shows the cumulative frequency of businesses reporting local, regional and national impacts. The Figure may be interpreted as showing that for local impacts only a relatively low proportion of businesses (20%) report local impacts making up a fifth of the total impacts, a third of businesses report that local impacts constitute 40% of the total impacts, with only 10% of businesses reporting that local impacts make up 100% of all impacts.

Whereas for regional and especially national impacts, a much higher proportion of businesses record that regional and national impacts make up 20% of all impacts. For national impacts in particular, 70% of businesses say that national impacts make up 20% of impacts.

FIGURE 7.12: PROPORTION OF BUSINESSES REPORTING THE CUMULATIVE FREQUENCY OF IMPACTS OCCURRING LOCALLY, REGIONALLY AND NATIONALLY



The results of the cumulative frequency charts suggest that relatively more businesses are recording the proportion of local impacts more or less evenly across the business sample. This is not so for regional and national impacts, where a low proportion of regional and national impacts are recorded by relatively large proportion of businesses. Therefore in terms of distribution, local impacts are therefore more important to more businesses than regional impacts and the latter are more important to more businesses than national impacts.

7.11.7 *Distribution and Scale of Impacts for Route Options*

Table 7.11 indicates the distribution and scale of potential impacts for option groups. Route options have been grouped as the differences between each option within each group are minimal with regards to the distribution and scale of these impacts.

Table 7.11 – Distribution and Scale of potential Impacts

TABLE 7.11 DISTRIBUTION AND SCALE OF POTENTIAL IMPACTS				
Option Groups	Major Sector	Local Impacts	National Impacts	Indicative Level of Impact
Outer North Option	Tourism	Major	Slight	Slight
	Retail & Wholesale	Slight	Slight	Slight
	Agriculture, Forestry & Fish-farming	Moderate	Moderate	Moderate
	Green Energy	Major	Slight	Moderate
North Shore	Tourism	Major	Major	Major
	Retail & Wholesale	Major	Moderate	Major
	Agriculture, Forestry & Fish-farming	Moderate	Moderate	Moderate
	Green Energy	Moderate	Major	Moderate
On-line	Tourism	Major	Major	Major
	Retail & Wholesale	Major	Major	Major
	Agriculture, Forestry & Fish-farming	Moderate	Slight	Moderate
	Green Energy	Moderate	Moderate	Moderate
South	Tourism	Major	Major	Major
	Retail & Wholesale	Moderate	Major	Major
	Agriculture, Forestry & Fish-farming	Major	Major	Major
	Green Energy	Moderate	Moderate	Moderate

Outer North Option

The route of the Outer North option will only have a slight impact on tourism. The route links up the current alignment of the A890 with a new alignment to the west of Lochcarron to join up with the A896, bypassing the settlements and much of the tourist accommodation and attractions in the area. Bypassing the settlements of Lochcarron and to an extent Stromeferry means that there will be moderate impacts on retail supplies and deliveries. However, this will have an important effect in terms of business development and investment where revenue stream unpredictability will impede business borrowing and therefore growth.

In terms of forestry, this sector uses the A896 to access Kishorn in order to export timber through the port there. Facilitating access to the A896 will facilitate access to timber processing plants and timber markets further afield. This may encourage new employment opportunities and assist decisions in inward investment. However, impacts on the farming and fish farm sector is less certain, most of marketable produce and supplies use the A890, mostly for access to Inverness and on to other parts of Scotland. Therefore, taking the sector as a whole, the impact is moderate in terms of local access, and only moderate in terms of national access.

There are a number of fish farms and hatcheries close to Lochcarron, many of which are situated on or close to the A896/A890 Achnasheen Road.. For supplies and deliveries of inputs and export of young fish, it is assumed that the A896 / A890 Achnasheen road is principally used to provide relatively quick access to and from other parts of Scotland and further afield. In most cases, therefore, Outer North option would provide limited functionality, and have a limited impact in helping existing fish farm businesses. There is, however, one fish farm / hatchery located on the proposed alignment of the Outer North Route, and there is no doubt that this particular fish farm would benefit considerably from better access to the A896.

It is anticipated that the potential impacts of this route option is only moderate for the green energy sector. Investment has been earmarked for Kishorn to handle wind turbine assembly and distribution to the off-shore fields. Should the port become an assembly yard for wind turbines, then the impact of this route would be major for local accessibility, facilitating the transport of potential workers to Kishorn. However in terms of national access for wind turbine parts and for nationally (or internationally) based personnel, the route would only have a slight impact. The A896 would be used but it is unlikely the link between the A890 Stromeferry Bypass would.

North Shore Option

This route links up the South Shore at Stromeferry with the North Shore at Stromemore, with slight variations dependent on the bridge crossing considered. The North Shore option would be expected to have a moderate to major impact on tourism. The new route would mean quicker, more direct and reliable access to a considerable stock of holiday accommodation on the North Shore, especially accommodation units dependent on passing trade, as well as providing direct access to Lochcarron and a number of tourist based businesses located there. This should help existing businesses, and, in particular, encourage new investment. Furthermore, a greater number of tourists in this locality might encourage the development of local bus services.

The retail trade should also benefit substantially in both Lochcarron and Stromeferry. There would be quicker and more reliable access to shops and businesses in both locations for supplies and deliveries. A degree of uncertainty would be removed for businesses reliant on frequent deliveries and in terms of passing trade.

In terms of forestry, the route would facilitate access to the timber producing areas to the north of Lochcarron and assist in extracting timber, but does not provide a direct route to Kishorn from where, as noted above, a substantial amount of timber is shipped. In addition the route may, depending on the exact alignment, take timber lorries through Lochcarron itself for the proportion of the timber harvest that is trucked east to Dingwall and Inverness.

The North Shore route would facilitate access from the Stromeferry Bypass to the fish farms located to the east of Lochcarron. This may provide some advantage to the fish farms in providing an alternative route for both marketing / processing fish and for supplies that are sourced from southwest Scotland. However, as with timber trucks, there would be a need to avoid an alignment that passes through Lochcarron itself. For the timber and fish farm sectors the North Shore route would be expected to provide moderate impacts.

Should there be eventual investment in tidal based energy plant at the mouth of the Strome Narrows, then this route may have a major impact in terms of providing the equipment, supplies and raw materials necessary in establishing these. It would also provide good direct access for maintenance personnel required for running the plant. This should impact positively on energy related business development and inward investment. However, for accessing Kishorn and servicing the potential offshore wind farm sector, this route would only have a slight impact.

On-line Option

Many of the impacts associated with the North Shore route option is also valid for the On-line option. Tourists, tourist attractions and tourist accommodation in the whole area would benefit substantially from a quicker more reliable route on the South Shore. In addition there is an important attraction, Attadale Gardens, situated relatively close to the avalanche shelter which would particularly benefit.

Comments in the surveys frequently referred to the current unreliability of the on-line route, both through rock falls themselves and the frequent remedial work required to make the route safe, and the affect this has on passing trade. Both the tourist and also the retail sectors suffer substantially from potential loss of and unreliable revenue stream. This hinders both business development and investment, where businesses are unable to produce a dependable business plan required for loans.

An upgraded On-line route option would be expected to have a slight to moderate impact on the timber sector. Access to both Kishorn and to the east of Scotland for the timber stands based to the south of the area would be improved, but the current route alignment means that many of the benefits of a potentially quicker route are lost in terms of current route gradient. Most of the fish farms and fish hatcheries, as noted above, are based to the east of Lochcarron, and would be expected use the A890 Achnasheen for supplies and deliveries. In this context, upgrading the on-line route would probably only provide a marginal benefit.

The impacts on the green energy sector would be expected to be slight to moderate. The established on-shore wind farms based to the south of the area would be able to use the improved on-line route for maintenance access and supply of reasonably small components. However, for the off-shore wind farm sector, this option would be expected to have only a slight to moderate impact. Should the establishment of a wind turbine assembly yard at Kishorn proceed, most of the materials and components required would be shipped in by sea.

South Option

The impacts on tourism seen with an improved on-line route option would also apply to the South route option. However, Stromeferry itself would be expected to lose out on passing tourists seeking unplanned accommodation. Nevertheless, for the bulk of the tourism sector, a quicker, more reliable route through Glen Udalain would substantially benefit the tourism sector. In addition the retail sector would also lose out on potential passing trade.

The improved alignment of this route over the on-line options means that this route would assist accessibility to the timber stands present in the area. It may also present a reliable alternative to the eastbound A890 route for the proportion of timber traffic requiring to go south to the Central Belt and the sawmills in Ayrshire that is not being shipped from Kishorn. The fish farms may also benefit from a quicker route with an improved gradient over the current alignment, insofar that the markets for young brood fish and sources of supplies are in the southwest of Scotland. The scale of these impacts would be from moderate to major.

The greatly improved access to the on-shore wind farms to the south of the area would have a major impact on their accessibility. As with the improved on-line option, this would be important for maintenance personnel requiring to service the turbines and for the supply of reasonably small parts and components that go with this. It is possible that this route would also be suitable for supplying larger components for future investment in tidal energy plant at the Strome Narrows, and may encourage new employment opportunities and inward investment. However, for reasons noted above, it is unlikely that this route would have a major impact on investment in turbine assembly at Kishorn.

7.11.8 *Potential Impacts by Group*

Table 7.12 illustrates the potential impacts by affected group. In cases where the route option passes some considerable distance from local settlements, the losers from the route tend to be the tourism and retail sectors losing potential passing trade. This is especially true of the Outer North and South route options.

Table 7.12 – Potential Impacts by Affected Group

TABLE 7.12 POTENTIAL IMPACTS BY AFFECTED GROUP			
Option Groups	Major Sector	Groups Affected	Gainers / Losers
Outer North	Tourism	Owners of tourist accommodation, small tourist businesses	Gainers may be alternative locations competing for tourists, with small tourist businesses and tourist accommodation in the area losing out
	Retail & Wholesale	Shops and other retail businesses	Small shops lose out on passing trade, Gainers - larger stores outwith the region
	Agriculture, Forestry & Fish-farming	Timber operators and merchants	Forestry sector able to access Kishorn more easily, no real impact on fish farms
	Green Energy	Local workforce	Assists access for local workforce to potential wind turbine assembly being considered at Kishorn
North Shore	Tourism	Owners of tourist accommodation, small tourist businesses and larger attractions	Gainers - small tourist businesses and accommodation on North Shore, losers may be same on South Shore
	Retail & Wholesale	Shops and other retail businesses	Gainers – small shops and retail /wholesale businesses on North Shore, losers same categories on South Shore, in particular Stromeferry
	Agriculture, Forestry & Fish-farming	Timber operators and merchants and fish farm owners - operators	Gainers – timber operators accessing timber stands, fish farms improved access to markets south, losers residents and businesses in Locharron with heavy goods traffic passing through area
	Green Energy	Owners / operators and employees of potential tidal energy plant at Strome Narrows	Gainers - owners / operators and employees of potential tidal energy plant at Strome Narrows Losers – residents and businesses from potential increased traffic within and through Lochcarron

TABLE 7.12 POTENTIAL IMPACTS BY AFFECTED GROUP

Option Groups	Major Sector	Groups Affected	Gainers / Losers
On-line	Tourism	Owners of tourist accommodation, small tourist businesses and larger attractions	Gainers – owners of tourist businesses, tourist accommodation and larger tourist attractions Losers - none
	Retail & Wholesale	Shops and other retail businesses	Gainers – shops and other retail units especially in Lochcarron Losers – potentially retail sector in Stromeferry, losing passing trade
	Agriculture, Forestry & Fish-farming	Timber operators and merchants	Gainers – timber operators improved access to timber stands in south of area Losers - none
	Green Energy	Landowners with on-shore wind farms	Gainers – landowners with wind farms from quicker access to sites Losers - none
South	Tourism	Owners of tourist accommodation, small tourist businesses and larger attractions	Gainers – owners of tourist businesses, tourist accommodation and larger tourist attractions, especially Lochcarron / Strathcarron Losers – Tourist business owners and tourist accommodation owners and operators in Stromeferry
	Retail & Wholesale	Shops and other retail businesses	Gainers – shops and other retail units especially in Lochcarron Losers – potentially retail sector in Stromeferry, losing passing trade
	Agriculture, Forestry & Fish-farming	Timber operators and fish farm owners / operators,	Gainers – timber operators increased accessibility to forestry stands in south of area, faster more reliable route for timber extraction for processing Fish farm operators – alternative reliable route south to potential markets and source of supplies Losers - none
	Green Energy	Landowners with on-shore wind farms	Gainers – landowners with wind farms from quicker more reliable access to sites for maintenance purposes Losers - none

7.12 Emerging Findings

Tourism, forestry, fish farming, retail and increasingly green energy are important sectors of the local economy. Of these, tourism is predominant in terms of numbers of businesses, but tend to be small, which, on a per unit basis, employ relatively few people and enjoying only a modest level of income. There is little doubt that the A890 Stromeferry Bypass is an important route, used by nearly three-quarters of businesses surveyed. Even those that do not use the road themselves, rely on the route for customers and supplies.

Unsurprisingly, the scale of impact on businesses of road closure rises rapidly the longer the road is closed, either for rock fall clearance or on-going remedial rock face stabilisation work. Rock fall impacts on businesses most heavily in terms of customer access, particular from passing trade, supplier access and on business performance. In terms of the latter, a substantial proportion of businesses, nearly a sixth, indicate that for periods of a week or longer, they may lose more than 30% of their revenue. This proportion jumps to nearly a third of businesses who state that they would lose more than 10% of their revenue with a rock fall event last a week or longer. As many of the businesses are marginal at best, this scale of revenue loss may be lead to a significant level of foreclosure.

Although the majority of businesses suggest that the impacts on their business are local, a substantial proportion, nearly half, indicate that the impacts are also regional and national. This indicates that businesses in the area, and in particular, tourist related businesses, depend on visitors from both other parts of Scotland and further afield for a substantial proportion of their income.

The options being considered for upgrading the current alignment of the A890 Stromeferry Bypass, or replacing it altogether have a wide range and scale of local and national impacts on the key sectors that characterise the economy of the area. Those that follow an alignment furthest from the major settlements in the area would be expected to have the greatest impact on the tourism and retail sectors resulting from the loss of passing trade. This would be particularly true for the Outer North and South options. Nevertheless these same options may encourage greater levels of business development and inward investment in the forestry and emerging green energy sector, with improved access to both the forestry plantations in the South of the area and to Kishorn, which would be expected to have a relatively large impact on local employment, at least in the short to medium term.

These options contrast with the On-line (upgraded) and North Shore options. The latter may be expected to have some positive impact should inward investment in tidal energy be exploited in the Strome Narrows. However these two options would maximise the benefits from increased access to local tourist amenities, accommodation and attractions and to the retail trade in the main settlements of Lochcarron and Stromeferry. Tourist and retail related businesses would enjoy not only increased passing trade, but a more reliable financial performance that this entails, which in turn promotes business growth and safeguards existing employment.

7.13 Integration

7.13.1 *Overview of the Integration Appraisal*

In appraising the Government Objective STAG requires the consideration of:

- Transport integration;
- Transport land-use integration; and
- Policy integration.

7.13.2 *Transport Integration*

Consultation workshops identified as a key transport objective, the need to improve transport integration between all modes in the area (TPO 15). STAG makes clear that the TEE will capture most assessment of this sub-objective. Transport Integration needs only to be appraised if both of the following justifications apply:

- there is an identifiable impact on transport interchange; and
- aspects of this impact are not captured elsewhere in the appraisal (e.g. TEE).⁹

Transport Interchange as it affects people is subdivided by STAG into:

- services and ticketing; and
- infrastructure and information.

7.13.3 *Services and Ticketing*

The only concepts that STAG accepts may have an impact under this heading relate to “seamlessness” of movement or of ticketing. This must confer benefits additional to those of simple savings of time or money, such as greater convenience. STAG emphasises that the extent of this integration must be considerable and supported by shared-branding and whole-journey information.

There is clearly no doubt that improvements in journey times and journey time reliability resulting from improvements to the local road network, either upgrading the current alignment or selecting a new alignment, will result in greater convenience to the traveller in accessing the rail stations of Strathcarron, Attadale and Stromeferry. A major aspect of this is in regard of the need to plan ahead of a trip where both road and rail travel are used, and to both depend on and inform other parties of predicted journey time on a more reliable basis.

Improvements to the local road network would also help to mesh together the local bus services with the local rail services. This is especially true where these are now operated on a Dial-a-Ride basis, where passengers would benefit far more from a synchronised the on-demand bus service with local rail services when requesting a bus service.

7.13.4 *Infrastructure and Information*

This aspect relates to the attributes of an infrastructure investment such as an interchange site, and has limited relevance in this particular case.

7.13.5 *Appraisal of Transport Land-use Integration*

For STAG Part 1 Appraisal, STAG requires “a preliminary appraisal of the proposal’s fit with established land use policy and environmental designations at a local, and where appropriate,

⁹ STAG, section 9.2.1

national level ... [to] allow any serious conflicts to be identified early and so avoid any wasted effort in working up a proposal which is not viable.”¹⁰

It is specifically aimed at determining whether land required is preserved for uses that are entirely incompatible with transport, although there is also a need to ensure that proposals fit with transport land-use policies of local authorities and the Scottish Government.

There is a variety of different land use across the area within which the proposed transport schemes are situated. Much of the Stromeferry area is very hilly with settlement development restricted to the coastal littoral of Lochcarron itself. Much of the hinterland is forestry, open farmland devoted to cattle and sheep farming, and moorland suitable for and used for grouse shooting and deer stalking.

None of the on-line route options, which anyway would unlikely, by definition, to be incompatible with transport and transport land-use policies. In addition, to date, no land use has been identified with any of the offline road network options that is entirely incompatible with transport and transport land-use policies of either Highland Council and the Scottish Government.

7.13.6 *Policy Integration*

This aspect has been covered elsewhere, most notably in Section 6.2 of Chapter 6.

7.14 Accessibility and Social Inclusion

7.14.1 *Overview of the Accessibility and Social Inclusion Appraisal*

STAG requires the consideration of two aspects as part of the Accessibility and Social Integration Government Objective, namely:

- Community accessibility; and
- Comparative accessibility.

STAG advises “the scope and detail required in the accessibility analysis needs to be commensurate with the planning objectives”¹¹. STAG also states that “quite simple measurement approaches should be adequate” for appraising accessibility and identifying changes (improvements) as a result of new proposals. Hence, given the scale of the study and the STAG advice regarding scope, a qualitative approach has been undertaken.

7.14.2 *Community Accessibility*

This element of appraisal allows a focus on minority groups in society, and allows “Social Inclusion policy [to] be informed by accessibility measures to ensure that all relevant people groups and trip purposes are considered”¹². The qualitative approach here is examining at the potential benefits (or disbenefits) for public transport network coverage resulting from the improvements to the local road network.

In the Lochcarron – Stromeferry region this is largely related to both the Dial-a-Ride and school bus services that serve the area. By removing the existing periodic constraint on

¹⁰ STAG, sections 9.3.1 & 9.3.2

¹¹ STAG, paragraph 10.1.4

¹² STAG, paragraph 10.5.1

vehicle movements resulting from rock falls, and rock fall remedial work on the A890, both services can readily access the community centres, libraries, schools and other public buildings in the major towns in the area. School services may also become a more attractive proposition for both residents and tourists to use.

In terms of rail services, removal of the rock fall threat would secure commuter and tourist rail traffic to the Stromeferry - Lochcarron area, although benefits in terms of access to community facilities and amenities or for social reasons would be expected to benefit rather marginally owing the nature of rail facilities and their location in the area.

7.14.3 *Comparative Accessibility*

For STAG purposes this is divided into two further sub-headings:

- Impacts by People Group; and
- Impacts by Location.

For STAG Part 2 purposes a detailed examination of the impacts at very local levels (e.g. council wards) would be beneficial, but for the scoping purposes of Part 1 a wider and more qualitative approach has been adopted. The appraisal for the above criteria is set out below:

- Impacts by People Group – This looks at *the impact of the transport options on various groupings of individuals in society* (e.g. age group, socio-economic status, gender, ethnicity, and mobility status, as well as impacts split between car-owners and non car-owners). Enhancing the modal choice available to all residents in the area provided by a quicker more reliable local road and rail network will be beneficial to all people groups, including both car users and public transport users.
- Impacts by Location – STAG states “it is important to understand the locus of impact of transport investment. This is particularly when assessing ... major network changes ... [and] as a minimum the analysis should compare the impacts on designated areas of deprivation such as social inclusion partnership (SIP) areas or priority partnership areas.”¹³. There is little doubt that the scale and type of road network investment proposed for the Lochcarron / Stromeferry area will assist a broad range of beneficiaries. The road options will assist commuters and those seeking work, and provide easier and more reliable access for those visiting further afield, tourists and for businesses. One potential exception are some of the route options that use the North Shore that pass through Lochcarron which may suffer some congestion in the peak summer months, a possibility that Lochcarron residents are acutely aware of. In addition the route options in the south of the study area using Glen Udalain may, as has been noted in the EALI appraisal above, isolate Stromeferry businesses from passing trade, potentially affecting both employees and commuters.

¹³ STAG, sections 10.8.1 to 10.8.3

7.15 Implementability Appraisal

In addition to the 5 main Government objectives, STAG also recommends that the capability of delivering an option should also be considered. This can highlight any potential “implementability” problems with any proposal. The appraisal is summarised as follows:

- Technical Issues – the offline options considered in this study are relatively straight forward since they are all based on standard civil engineering practices and have been successfully implemented elsewhere; however some of the on-line options, N2b, involving a tunnel, O2 requiring embankment and viaducts and O5 with road / rail share may cause implementability problems owing to relatively complex technical requirements.
- Operational Aspects – the on-line options noted above that present a particular significant technical challenge in the hazard area. These are options O3 tunnel option, O5 shared road / rail option and O7 avalanche shelter option, each of which will require on-line road closure. Road closure would be a particularly unpopular scenario with local residents, as it may seriously affect their businesses and access to local shops and services.
- Public Acceptability – the public consultation has shown there is significant public interest in removing the rock fall threat to the A890 Stromeferry Bypass, and have shown support for most of the route options above. However, it should be noted that those options that require road closure and those that may add considerably to traffic congestion, particularly in Lochcarron, have much less public support.

8 APPRAISAL SUMMARY

8.1 Introduction

In keeping with an options appraisal in accordance with the DMRB Stage 1 Assessment, this appraisal of route and corridor options developed in connection with the Stromeferry Bypass has been carried out using mainly qualitative descriptions supplemented and supported with quantitative data where available. Any suitable option(s) emerging from this Stage 1 appraisal will be taken forward for further detailed assessments during a Stage 2 appraisal.

Appraisal Summary tables, outlining the findings of this, Stage 1, assessment, are included in the following sections of this report. The tables describe and summarise the findings in further detail And lead to chapter 9, which concludes on this appraisal.

In addition to an appraisal in accordance with the DMRB, developed options were considered with regards to performance against STAG Criteria and Transport Planning Objectives, identified during the Pre-Appraisal Stage of this process.

8.2 Summary of Appraisals

Route Options developed during the Pre-Appraisal process as described in chapter 4 of this document have been appraised and assessed as indicated below.

In accordance with Scottish Transport Appraisal Guidance against the following criteria:

- Developed Transport Planning Objectives;
- Performance in relation to 'strategic' Objectives;
- STAG Criteria (Environment, Safety, Economy, Integration and Accessibility & Social Inclusion);
- Implementability.

As part of the assessment into the 'implementability' of a developed option, an engineering, environmental and economic appraisal has also been carried out in accordance with the DMRB Stage 1 assessment, to establish the feasibility of an option considering the technical and environmental issues, as well as outline costs.

Developed route options that emerged after the first two stages of a sifting process were appraised against the above criteria, using the standard seven point scale as shown below:

Major benefit	✓✓✓
Moderate benefit	✓✓
Minor Benefit	✓
No benefit or impact	0
Minor negative impact	x
Moderate Negative Impact	xx
Major negative impact	xxx

8.2.1 *Route Options Appraised against Transport Planning Objectives*

A summary of the Options Appraisal carried out against the Transport Planning Objectives, together with a brief rationale for the selection or rejection of each route option, summarizing the discussions contained in this report, is shown on the summary tables 8.1 and 8.2 included in this chapter. Output from this appraisal table is then fed into the overall Appraisal Summary Table 8.8, which also includes a full appraisal against the STAG Criteria.

Tables 8.1 and 8.2 below summarise the appraisal of developed route options against the following Transport Planning Objectives, as outlined in chapter 3:

- A (1) Safeguard and, where possible and appropriate, enhance and provide access to the natural and built environment and areas of national, regional and local importance and heritage, during construction, maintenance and use of the scheme (with reference to environmental appraisal).
- B (1) Minimise **all risk** during design, construction, operation and maintenance (with reference to Risk Register).
- C (3) Ensure deliverability of the scheme within programme and to agreed overall cost and maintenance budgets, thus providing 'Value for Money'.
- D (4) Deliver a safe and reliable, 2 lane carriageway, by applying appropriate / proportionate design standards.
- E (5) Solution reduces, or does not increase, the risk to and liability of the railway and maintains suitable access over the life of the scheme.
- F (6) Keep the A 890 and peripheral road and railway network open during construction.
- G (7) Maintain and improve local social cohesion by improving accessibility for emergency services responding to call-outs, as well as for the local population making use of local and regional leisure, health and educational facilities.
- H (8) Maintain and improve choice of transport mode and integration of public transport links over the lifetime of the scheme.
- I (9) Scheme to take account of relevant local, regional and national planning policies (during the design stage).
- K (11) Maximise / improve network efficiency, sustainable connectivity and social cohesion in terms of journey times and journey reliability in the Wester Ross area.
- L (12) Deliver a scheme that assists local businesses to maximise opportunities for sustainable development and economic growth over the life of the scheme.
- J (10) was removed during Stakeholder workshop discussions.

Table 8.1 – Appraisal of Assessed Route Options against Transport Planning Objectives

APPRAISAL OF ASSESSED ROUTES AGAINST OBJECTIVES												Table 8.1
Options	Transport Planning SMART Objectives											Comment
	A (1)	B (1)	C (3)	D (4)	E (5)	F (6)	G (7)	H (8)	I (9)	K (11)	L (12)	
Outer North 3	xx	✓	0	✓✓✓	✓✓✓	✓✓✓	x	0	✓✓✓	✓	✓✓	Route provides feasible N-S linkage & bypasses Lochcarron village. Environmental impact from bridge crossing & green field construction. Option delivers on most of the Objectives and could open up direct link to Kishorn. Off-line option to consider longterm liability regarding existing route.
North Shore 2 (includes Western Narrows Bridge)	x	✓	0	✓✓✓	✓✓✓	✓✓✓	0	0	✓✓✓	✓✓	✓✓✓	Route provides good linkage, but only partially bypasses Lochcarron village. Environmental impact from bridge crossing & green field construction. Option delivers on most of the Objectives. Off-line option to consider longterm liability regarding existing route.

APPRAISAL OF ASSESSED ROUTES AGAINST OBJECTIVES												Table 8.1
Options	Transport Planning SMART Objectives											Comment
	A (1)	B (1)	C (3)	D (4)	E (5)	F (6)	G (7)	H (8)	I (9)	K(11)	L (12)	
North Shore 2b (includes Western Narrows Tunnel)	✓✓	x	0	✓✓✓	✓✓✓	✓✓✓	0	0	✓✓✓	✓✓	✓✓✓	Route provides good linkage, but only partially bypasses Lochcarron village. Environmental impact less than N2 due to below ground / tunnel construction. Option delivers on most of the Objectives but higher risk during construction and lower deliverability due to higher estimated costs. Off-line option to consider longterm liability regarding existing route.
North Shore 6 (includes Eastern Narrows Bridge)	x	✓	✓	✓✓✓	✓✓✓	✓✓✓	✓	✓	✓✓✓	✓	✓✓✓	Route provides good linkage, but on-line through Lochcarron village. Environmental impact from Narrows crossing. Option delivers on most of the Objectives. Off-line option to consider longterm liability regarding existing route.

APPRAISAL OF ASSESSED ROUTES AGAINST OBJECTIVES												Table 8.1
Options	Transport Planning SMART Objectives											Comment
	A (1)	B (1)	C (3)	D (4)	E (5)	F (6)	G (7)	H (8)	I (9)	K(11)	L (12)	
North Shore 6b (includes Renewables Consideration)	x	✓	✓	✓✓✓	✓✓✓	✓✓✓	✓	✓	✓✓✓	✓	✓✓✓	Route provides good linkage, but on-line through Lochcarron village. Environmental impact from Narrows crossing, but off-set by renewable energy considerations including barrage. Option delivers on most of the Objectives. Off-line option to consider longterm liability regarding existing route.
North Shore 9 (includes Western Narrows Bridge Crossing)	x	✓	0	✓✓✓	✓✓✓	✓✓✓	x	x	✓✓✓	✓✓	✓✓✓	Route provides good linkage, with a full bypass of Lochcarron village. Environmental impact from Narrows crossing. Option delivers on most of the Objectives but may have negative impact on connectivity bypassing Lochcarron. Off-line option to consider longterm liability regarding existing route.

APPRAISAL OF ASSESSED ROUTES AGAINST OBJECTIVES												Table 8.1
Options	Transport Planning SMART Objectives											Comment
	A (1)	B (1)	C (3)	D (4)	E (5)	F (6)	G (7)	H (8)	I (9)	K(11)	L (12)	
On-line 1 (On-line Improvement)	✓	xxx	xx	✓✓	xxx	xxx	0	0	✓✓	0	0	Option for on-line improvements does not score well against Objectives, due to risk with rock slopes during construction and beyond, cost uncertainty and railway interface issues. Most disruption during construction.
On-line 2 (Viaduct)	x	x	xx	✓✓✓	x	xx	0	0	✓✓✓	0	0	On-line proposal for an elevated structure to bypass rockfall area, providing scenic views over the loch. Environmental impact, railway interface and buildability issues (loch depth) results in low scoring against Objectives.
On-line 3 (Tunnel)	✓	x	xx	✓✓✓	0	x	0	0	✓✓✓	0	0	On-line tunnel option bypasses rockfall area, but potentially higher risks during construction. Lengthy disruptions along existing route during construction.

APPRAISAL OF ASSESSED ROUTES AGAINST OBJECTIVES												Table 8.1
Options	Transport Planning SMART Objectives											Comment
	A (1)	B (1)	C (3)	D (4)	E (5)	F (6)	G (7)	H (8)	I (9)	K(11)	L (12)	
On-line 4 ('Do-Minimum')	0	0	✓✓✓	xxx	0	✓✓	0	0	x	0	x	Do-minimum, low cost option, provides no improvements to c/way or reliability of route. Rock slope maintenance to programme and reactive measures, not satisfying local requirements (neutral score).
On-line 5 (Combined Road / Rail)	0	xx	✓✓✓	xx	xxx	xxx	0	0	✓	0	x	Option considers dual running of road and rail, resulting in construction and operational risk and therefore potential low deliverability. RETB equired. Potential disruption, but cost effective, not scoring well on Objectives in relation to risk, safety, reliability and modern standard road network.
On-line 6 (includes Upper Loch Crossing)	x	x	0	✓✓✓	xx	xxx	✓	x	✓✓	0	0	On-line improvements O1 combined with upper loch crossing, providing a better alignment and bypassing level crossing and Maman hill section. Environmental impact from bridge crossing and railway interface issues.

APPRAISAL OF ASSESSED ROUTES AGAINST OBJECTIVES												Table 8.1
Options	Transport Planning SMART Objectives											Comment
	A (1)	B (1)	C (3)	D (4)	E (5)	F (6)	G (7)	H (8)	I (9)	K(11)	L (12)	
												Link Option covers most Objectives, but high risks due to combination with O1.
On-line 7 (Extended Avalanche Shelter)	x	xx	xx	✓✓✓	xx	xx	0	0	✓✓✓	0	0	On-line options for an extended avalanche shelter delivers on long-term objectives for a safe and reliable route, but major disruption during construction, with railway interface issues. Overall negative score against Objectives
South 1 (includes Stromeferry Link)	xxx	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	x	x	✓✓	✓✓	x	South off-line route; negative environmental impact from new green field route and extended journey time. Proposed route remote from existing communities. Low cost least risk option, scoring well on Objectives regarding risk, deliverability and safety.

APPRAISAL OF ASSESSED ROUTES AGAINST OBJECTIVES												Table 8.1
Options	Transport Planning SMART Objectives											Comment
	A (1)	B (1)	C (3)	D (4)	E (5)	F (6)	G (7)	H (8)	I (9)	K(11)	L (12)	
												Off-line option to consider longterm liability regarding existing route.
South 3 (includes Braeintr Link)	xxx	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	xx	x	✓	✓	xx	<p>South off-line route; negative environmental impact from new green field route and extended journey time. Proposed route remote from existing communities.</p> <p>Low cost least risk option, scoring well on Objectives regarding risk, deliverability and safety.</p> <p>Off-line option to consider longterm liability regarding existing route.</p>
South 4 (Glen Udalain)	xxx	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	xxx	x	✓	✓	xxx	South off-line route; negative environmental impact from new green field route and extended journey time. Proposed route remote from existing

APPRAISAL OF ASSESSED ROUTES AGAINST OBJECTIVES												Table 8.1
Options	Transport Planning SMART Objectives											Comment
	A (1)	B (1)	C (3)	D (4)	E (5)	F (6)	G (7)	H (8)	I (9)	K(11)	L (12)	
												communities. Low cost least risk option, scoring well on Objectives regarding risk, deliverability and safety. Off-line option to consider longterm liability regarding existing route.
South 5b (includes Maman Hill Bypass)	xxx	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	xxx	x	✓	✓	xxx	South off-line route; negative environmental impact from new green field route and extended journey time. Proposed route remote from existing communities. Low cost least risk option, scoring well on Objectives regarding risk, deliverability and safety. Off-line option to consider longterm liability regarding existing route.

Table 8.2 – Appraisal of Rejected Route Options against Transport Planning Objectives

APPRAISAL OF REJECTED ROUTES												Table 8.2
Options	Transport Planning SMART Objectives											Comment
	A (1)	B (1)	C (3)	D (4)	E (5)	F (6)	G (7)	H (8)	I (9)	K (11)	L (12)	
Outer North 1	xxx	x	xxx	✓✓✓	✓✓✓	✓✓✓	xx	x	✓✓	x	x	Poor connectivity and general increased journey times, Option will not enhance social inclusion and provides no advantages over northern routes incorporating shorter Narrows crossings. Potential environmental impacts from major bridge crossing. Scheme considered undeliverable due to potential high cost. Difficult access to southern end of crossing with major upgrade of existing road network required between Achmore and Craig.
Outer North 2	xx	✓	0	✓✓✓	✓✓✓	✓✓✓	0	✓	✓✓	✓	✓✓✓	Route Option similar to ON3, with no added benefit but on-line through Lochcarron. Dismissed due to preference of full

APPRAISAL OF REJECTED ROUTES												Table 8.2
Options	Transport Planning SMART Objectives											Comment
	A (1)	B (1)	C (3)	D (4)	E (5)	F (6)	G (7)	H (8)	I (9)	K(11)	L (12)	
												bypass, otherwise scoring similar to ON3, with better access to Public Transport links.
North Shore 1 (Ferry)	x	✓	✓✓✓	x	✓✓✓	✓✓✓	xxx	xxx	0	xxx	xxx	Route Option includes a ferry link. Poor scoring on 'reliability of route to appropriate standards' due to likelihood of ferry breakdown, restricted timetable etc. Disruptions to traffic flow and added journey times. Preference for permanent, fixed link solution. Difficult road access on south shore. Restricted space for modern ferry facilities.
North Shore 3 (Central Tunnel)	xxx	x	xx	✓✓	✓✓✓	✓✓✓	✓	✓	✓✓	✓	✓✓✓	Route Option including a tunnel west of Stromeferry. Major excavations to achieve suitable

APPRAISAL OF REJECTED ROUTES												Table 8.2
Options	Transport Planning SMART Objectives											Comment
	A (1)	B (1)	C (3)	D (4)	E (5)	F (6)	G (7)	H (8)	I (9)	K(11)	L (12)	
												road access would result in major environmental impact and increased construction costs of scheme. Difficulties to achieve a suitable crossing of railway. Tunnel in principle to be considered at N2.
North Shore 4 (Central Bridge)	xxx	x	xx	✓✓	✓✓✓	✓✓✓	✓	✓	✓✓	✓	✓✓✓	Route Option including a proposed bridge west of Stromeferry. Major excavations to achieve access on the south side would result in major environmental impact and increased construction costs of scheme. Preference to consider more western crossings (N2).
North Shore 5 & 5b	x	✓	0	✓✓✓	✓✓✓	✓✓✓	0	0	0	xxx	xxx	Considered alternative alignment for western Narrows crossings; including a

APPRAISAL OF REJECTED ROUTES												Table 8.2
Options	Transport Planning SMART Objectives											Comment
	A (1)	B (1)	C (3)	D (4)	E (5)	F (6)	G (7)	H (8)	I (9)	K(11)	L (12)	
(Alternative alignment Western Tunnel and Ferry)												<p>tunnel (N5) and a ferry (N5b). N5 similar to N2, with no added benefit. N5b non-fixed link, refer to appraisal of N1 above.</p> <p>Best alignment for a Narrows Crossing will be further considered in the detailed assessment, including a bridge and tunnel at the most feasible location.</p> <p>Non-fixed links have been dismissed.</p>
North Shore 7 & 8 (Alternative alignments for Eastern Bridge and Barrage)	x	✓	✓	✓✓✓	✓✓✓	✓✓✓	✓	✓	✓✓	✓	✓✓✓	<p>Considered alternative alignment for an eastern Narrows bridge crossings, similar to and represented by N6. N7 did not provide particular advantages over N6 alignments and Narrows crossings in general will be assessed in further detail during the Stage 2 assessments.</p>

APPRAISAL OF REJECTED ROUTES												Table 8.2
Options	Transport Planning SMART Objectives											Comment
	A (1)	B (1)	C (3)	D (4)	E (5)	F (6)	G (7)	H (8)	I (9)	K(11)	L (12)	
												Integrated renewable energy solution is now included as option N6b.
Mid Loch 1 (1.7km long Loch Carron Bridge)	xx	xx	xx	✓✓✓	✓✓✓	✓✓✓	✓✓	✓✓	✓	✓✓	✓✓	<p>Proposed Loch Carron mid loch bridge crossing; resulting in a high visual impact on the natural landscape and with potential for a considerable environmental impact.</p> <p>The perceived complexity and potential cost of construction of this scheme are considered to make this scheme very difficult to undeliver.</p> <p>Difficult road alignments at tie-in on the northern shore.</p>
Mid Loch 2 (7.7km long)	xxx	xxx	xxx	✓✓✓	✓✓✓	✓✓✓	✓	0	x	✓✓	✓	Loch Carron mid loch bridge crossing of considerable length; iconic structure, but with high visual impact on natural

APPRAISAL OF REJECTED ROUTES												Table 8.2
Options	Transport Planning SMART Objectives											Comment
	A (1)	B (1)	C (3)	D (4)	E (5)	F (6)	G (7)	H (8)	I (9)	K(11)	L (12)	
Loch Carron Bridge)												<p>landscape and potential environmental impact.</p> <p>Complexity and potential excessive cost of construction are considered to make this scheme undeliverable.</p>
South 2 (Southern off-line route, including section of high ground near Loch nam Braec Mora)	xxx	✓✓	✓✓✓	✓✓	✓✓✓	✓✓✓	xx	x	✓	0	✓	<p>Southern off-line route; resulting in environmental impact from new green field route and extended journey time. Proposed route remote from existing communities.</p> <p>Low cost least risk option, scoring well on Objectives considering risk, deliverability and safety.</p> <p>Route alternative at higher altitude, resulting in more difficult winter maintenance issues and therefore dropped to preferred alignment of S4. Off-line option to consider long term</p>

APPRAISAL OF REJECTED ROUTES												Table 8.2
Options	Transport Planning SMART Objectives											Comment
	A (1)	B (1)	C (3)	D (4)	E (5)	F (6)	G (7)	H (8)	I (9)	K(11)	L (12)	
												liability regarding existing route.
South 6, 7 & 8 (Alternative southern route alignments across Cnoc nam Mult)	xxx	✓✓	✓✓✓	✓✓	✓✓✓	✓✓✓	xx	x	✓	✓	xxx	Proposed high altitude green field routes with steep gradients, extensive earthworks and substantial structures requirements. Potential environment issues and higher route winter maintenance requirements. Route would provide stunning views north and south.
Outer South 1 & 2 (Alternative Outer South route alignment with tie-in to A87 at Dornie)	xxx	✓✓✓	✓	✓✓✓	✓✓✓	✓✓✓	xxx	xx	x	x	xxx	Outer southern routes considered to provide direct link between the A87 Trunk road and Strathcarron Junction. Proposed routes would however result in extended journey times for local users, with inadequate connectivity and potential negative (economic) impact on the communities of Achmore and Stromeferry.

APPRAISAL OF REJECTED ROUTES												Table 8.2
Options	Transport Planning SMART Objectives											Comment
	A (1)	B (1)	C (3)	D (4)	E (5)	F (6)	G (7)	H (8)	I (9)	K(11)	L (12)	
												Green field solution with potential environmental impacts, and no advantage over southern routes.
Non Fixed Links (as NS1)	x	✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	xxx	✓	0	xxx	xxx	<p>Ferry and air travel do not satisfy objectives for a reliable, permanent link to modern standards.</p> <p>Improvements to slip ways and approaches required, with difficult access to Stromeferry and restricted space for modern ferry facilities.</p> <p>Air travel is not considered a suitable alternative to a fixed road link, but potential for connections by air to the Isle of Skye have been considered in a separate HIE study.</p>

8.2.2 *Summary of Findings from Environmental Appraisal*

Table 8.3 below summarises the findings of the environmental appraisal carried out as outlined in chapter 6 of this report. The appraisal was undertaken in accordance with the requirements of the DMRB Chapter 11, which sets out the various subject disciplines to be considered and assessed.

Environmental advantages, disadvantages and constraints associated with each route development, judged against the respective subject disciplines, are shown.

It should be noted, that the impacts identified and assessed as shown here are **prior** to mitigation. It has, at this stage, not been possible to identify specific mitigation measures, due to the level of information available at present. It may be that the impacts can be minimized once mitigation measures have been developed and proposed at the next stage of the assessment.

The output from Table 8.3 below is transferred into the overall Appraisal Summary Table 8.8 included at the end of this chapter.

Scale of assessment used:

Major benefit	✓✓✓
Moderate benefit	✓✓
Minor Benefit	✓
No benefit or impact	0
Minor negative impact	x
Moderate Negative Impact	xx
Major negative impact	xxx

Table 8.3 – Environmental Appraisal Summary

ENVIRONMENTAL APPRAISAL SUMMARY									
									TABLE 8.3
Option	Nature Conservation	Landscape	Road Drainage and Water Environment	Noise	Air	Geology and Soils	Cultural Heritage	Effects on all Travellers	Community and Private Assets
Outer North 3 (high bridge)	<p>*** Major impacts associated this route option include destruction and habitat fragmentation of designated habitats within the Allt nan Carnan SSSI and other areas containing Ancient Broadleaf Woodland habitat, with related impacts upon protected species.</p>	<p>** Moderate negative impact due to potential influence on impression of enclosed loch landscape and need for crossing over Loch Carron.</p>	<p>* - minor impact on SW environment (offline sections)</p>	<p>* Minor negative impact. Slight increase in the number of properties along the route corridor</p>	<p>0 No benefit or impact No change as assessed against baseline case</p>	<p>0: Limited superficial deposits along route, some possibility of peat.</p>	<p>* Direct impacts to non-designated assets however benefit to listed assets at New Kelso. Need for loch crossing is a negative factor unless tunnel option used</p>	<p>** Moderate negative impact as may increase journey times, causes driver stress and may sever paths</p>	<p>0 No benefit or impact as it diverts traffic away from Lochcarron but impacts some development areas.</p>
North Shore2 (high bridge and tunnel)	<p>** Moderate negative impacts associated with the N2 option relates to loss of Ancient Broadleaf Woodland habitat and Long Established Broadleaf Plantation woodland, with related impacts upon protected species.</p>	<p>** Moderate negative impact due to increased traffic through Lochcarron and need for crossing over Loch Carron.</p>	<p>* - minor impact on SW environment (offline sections)</p>	<p>*** Major negative impact Significant increase in the number of properties along the route corridor mainly through Lochcarron</p>	<p>* Increase in pollutant concentrations likely at receptors in Lochcarron. Any increase unlikely to breach national air quality objectives</p>	<p>0: Limited superficial deposits along route, some possibility of peat.</p>	<p>*** Major impacts on non-designated assets on offline section north of Lochcarron</p>	<p>* Minor negative impact as may increase journey times and may sever paths</p>	<p>** Moderate negative impact as increases traffic through north Lochcarron and impacts several community assets.</p>

ENVIRONMENTAL APPRAISAL SUMMARY									TABLE 8.3
Option	Nature Conservation	Landscape	Road Drainage and Water Environment	Noise	Air	Geology and Soils	Cultural Heritage	Effects on all Travellers	Community and Private Assets
North Shore 6 (high bridge and tidal barrage)	<p>**</p> <p>Moderate negative impacts associated with the N6 option relates to loss of Ancient Broadleaf Woodland habitat and Long Established Broadleaf Plantation woodland, with related impacts upon protected species.</p>	<p>**</p> <p>Moderate negative impact due to increased traffic through Lochcarron and need for crossing over Loch Carron.</p>	<p>* - minor impact on SW environment (offline sections)</p>	<p>***</p> <p>Major negative impact Significant increase in the number of properties along the route corridor mainly through Lochcarron</p>	<p>*</p> <p>Increase in pollutant concentrations likely at receptors in Lochcarron. Any increase unlikely to breach national air quality objectives</p>	<p>0: Limited superficial deposits along route, some possibility of peat.</p>	<p>0</p> <p>Mainly on-line benefits to listed assets at New Kelso however need for loch crossing cancels out those benefits unless tunnel option used</p>	<p>0 No benefit or impact as reduces journey times but may sever some paths</p>	<p>*** Major negative impact as increases traffic through Lochcarron and impacts numerous community assets.</p>
North Shore 9 (high bridge and tidal barrage)	<p>***</p> <p>Major impacts associated this route option include destruction and habitat fragmentation of designated habitats within the Allt nan Carnan SSSI and other areas containing Ancient Broadleaf Woodland habitat, with related impacts upon protected species.</p>	<p>**</p> <p>Moderate negative impact due potential influence on impression of enclosed loch landscape and need for crossing over Loch Carron.</p>	<p>* - minor impact on SW environment (offline sections)</p>	<p>**/*</p> <p>Moderate/Minor negative impact. Slight increase in the number of properties along the route corridor</p>	<p>*</p> <p>Increase in pollutant concentrations likely at receptors in Lochcarron. Any increase unlikely to breach national air quality objectives</p>	<p>0: Limited superficial deposits along route, some possibility of peat.</p>	<p>***</p> <p>Major impacts on non-designated assets on offline section north of Lochcarron</p>	<p>* Minor negative impact as may increase journey times and may sever paths</p>	<p>✓ Minor Benefit as it diverts traffic away from Lochcarron and impacts very few community/private assets</p>

ENVIRONMENTAL APPRAISAL SUMMARY									TABLE 8.3
Option	Nature Conservation	Landscape	Road Drainage and Water Environment	Noise	Air	Geology and Soils	Cultural Heritage	Effects on all Travellers	Community and Private Assets
On-line 1	** Moderate impacts including the Attadale SSSI, Ancient Broadleaf Woodland, and Aquatic habitats with related impacts upon protected species.	** Moderate negative impact due to potential for significant rock removal, leaving a larger visible scar in the landscape.	0 - all on-line, no impact on SW environment	0 No benefit or impact No change as assessed against baseline case	No benefit or impact No change as assessed against baseline case	0: Limited superficial deposits along route, little change to existing route.	0 Little significant change to existing baseline	✓ Minor benefit as creates long term reduction in driver stress but short term increases.	0 No benefit or impact as it impacts few residential, community and development areas.
On-line 2	*** Major impacts relate to affects upon benthic and rocky shore communities within the Loch Carron MCA.	* Minor negative impact due to introduction of new structure along short section of Loch Carron shoreline.	* - minor impact on water environment/shore of Loch Carron due to causeway	0 No benefit or impact No change as assessed against baseline case	No benefit or impact No change as assessed against baseline case	0: Limited superficial deposits along route	* Possible impacts upon loch bed deposits, palaeo-environmental remains	✓ Minor benefit as creates long term reduction in driver stress but short term increases.	0 No benefit or impact as it impacts few residential, community and development areas
On-line 3	** Minor negative impacts to adjacent terrestrial habitats are likely in relation to the construction of the tunnel option. Though additional moderate impacts associated with the connecting route option, also have to be considered.	* Minor negative impact due to small increased in visible rock face at tunnel entrance, opposite to Lochcarron.	* - potential impact on groundwater (tunnel)	0 No benefit or impact No change as assessed against baseline case	No benefit or impact No change as assessed against baseline case	0: Limited effect, although consideration may need to be given to geological feature (SSSI)	* Possible impact upon unknown archaeological assets	✓ Minor benefit as creates long term reduction in driver stress but short term increases.	0 No benefit or impact as it impacts few residential, community and development areas

ENVIRONMENTAL APPRAISAL SUMMARY									TABLE 8.3
Option	Nature Conservation	Landscape	Road Drainage and Water Environment	Noise	Air	Geology and Soils	Cultural Heritage	Effects on all Travellers	Community and Private Assets
On-line 4	0 Maintains the status quo, though will not resolve the problems associated with existing route.	0 Do minimum option therefore no benefit or impact.	0 – all On-line, no impact on SW environment	0 No benefit or impact Baseline Case	No benefit or impact No change as assessed against baseline case	0: Limited superficial deposits along route, no change to existing route.	0 No change to existing baseline	× Minor impact as driver stress still ongoing issue.	0 No benefit or impact as it impacts few residential, community and development areas
On-line 5	××× Major impacts relate to affects upon benthic and rocky shore communities within the Loch Carron MCA, if bridges / viaducts are required as part of this proposed solution.	0 Utilises existing road and rail corridor therefore limited discernable change, therefore no benefit or impact.	0 - all on-line, no impact on SW environment	0 No benefit or impact No change as assessed against baseline case	No benefit or impact No change as assessed against baseline case	0: Limited superficial deposits along route, little change to existing route.	0 No impacts identified to heritage assets	✓ Minor benefit as creates long term reduction in driver stress but short term increases.	0 No benefit or impact as it impacts few residential, community and development areas
On-line 6	××× A major negative impact associated with this option relates to the loss and fragmentation of saltmarsh habitat. Additional moderate impacts associated with the connecting route option, also have to be considered.	× Moderate negative impact due to introduction of new road across Strathcarron and Loch Carron foreshore, creating visual division.	×× - moderate impact on water environment due to upper loch crossing (in floodplain)	0 No benefit or impact No change as assessed against baseline case	No benefit or impact No change as assessed against baseline case	0: Some raised beach deposits at crossing of Loch Carron.	××× Tie in to A896 opposite SM of Lochcarron Old Parish Church – setting and physical impacts	✓ Minor benefit as creates long term reduction in driver stress but short term increases.	0 No benefit or impact as it impacts few residential, community and development areas

ENVIRONMENTAL APPRAISAL SUMMARY

TABLE 8.3

Option	Nature Conservation	Landscape	Road Drainage and Water Environment	Noise	Air	Geology and Soils	Cultural Heritage	Effects on all Travellers	Community and Private Assets
On-line 7	** Moderate impacts relate to loss and fragmentation of woodland habitats and related impacts upon protected species. A possible major impact may occur to the Attadale SSSI.	* Minor negative impact due to introduction of additional structures on south side of loch, opposite Lochcarron.	0 - all on-line, no impact on SW environment	0 No benefit or impact No change as assessed against baseline case	No benefit or impact No change as assessed against baseline case	*: Will obscure registered geological feature (SSSI).	0 No discernible change to baseline	✓ Minor benefit as creates long term reduction in driver stress but short term increases.	0 No benefit or impact as it impacts few residential, community and development areas
Southern 1	*** As S4	* Minor negative impact due to limited visibility and influence of impression of landscape.	** - moderate cumulative impact on water environment due to high numbers of new watercourse crossings required	0 No benefit or impact No significant change in number of properties along the route corridor	No benefit or impact No change as assessed against baseline case	0: Limited superficial deposits along route, some possibility of peat.	* Possible impacts upon unknown archaeological assets	0: No benefit or impact as bypasses problem area but may sever a few paths	** Moderate negative impact due to the impacts on community and woodland areas.
Southern 3	*** As S4	** Moderate negative impact due to crossing of steep slopes which may increase visibility and reduced landscape fit.	** - moderate cumulative impact on water environment due to high numbers of new watercourse crossings required	0 No benefit or impact No significant change in number of properties along the route corridor	No benefit or impact No change as assessed against baseline case	0: Limited superficial deposits along route, some possibility of peat.	* Physical impacts upon non-designated asset of former townships	0: No benefit or impact as bypasses problem area but may sever a few paths	** Moderate negative impact due to the impacts on community and woodland areas.

ENVIRONMENTAL APPRAISAL SUMMARY									TABLE 8.3
Option	Nature Conservation	Landscape	Road Drainage and Water Environment	Noise	Air	Geology and Soils	Cultural Heritage	Effects on all Travellers	Community and Private Assets
Southern 4	<p>***</p> <p>The offline nature of this route is the main factor relating to the associated major impacts, which include the loss and fragmentation of large areas of plantation woodland and montane habitats. Additionally, disturbance to a number of protected species is also likely to occur.</p>	<p>*</p> <p>Minor negative impact due to visibility from properties in Attadale and local influence on rocky moorland.</p>	<p>** - moderate cumulative impact on water environment due to high numbers of new watercourse crossings required</p>	<p>0</p> <p>No benefit or impact</p> <p>No significant change in number of properties along the route corridor</p>	<p>No benefit or impact</p> <p>No change as assessed against baseline case</p>	<p>0: Limited superficial deposits along route, some possibility of peat.</p>	<p>*</p> <p>Possible impacts upon unknown archaeological assets</p>	<p>*</p> <p>Minor negative impact as may increase journey times and may sever paths</p>	<p>**</p> <p>Moderate negative impact due to the impacts on community and woodland areas.</p>
Southern 5b	<p>***</p> <p>As S4</p>	<p>*</p> <p>Minor negative impact due to influence on Strath Attadale landscape.</p>	<p>** - moderate cumulative impact on water environment due to high numbers of new watercourse crossings required</p>	<p>0</p> <p>No benefit or impact</p> <p>No significant change in number of properties along the route corridor</p>	<p>No benefit or impact</p> <p>No change as assessed against baseline case</p>	<p>0: Limited superficial deposits along route, some possibility of peat.</p>	<p>**</p> <p>Physical impacts on Attadale designed landscape setting impacts on listed Attadale House</p>	<p>* Minor negative impact as may increase journey times and may sever paths</p>	<p>**</p> <p>Moderate negative impact due to the impacts on community and woodland areas.</p>

ENVIRONMENTAL APPRAISAL SUMMARY									TABLE 8.3
Option	Nature Conservation	Landscape	Road Drainage and Water Environment	Noise	Air	Geology and Soils	Cultural Heritage	Effects on all Travellers	Community and Private Assets
Western Crossing – Bridge (high level, 20m headroom)	** Impacts specific to the Loch Carron MCA would depend upon the design of the structure, if bridge piers are to be positioned within the Loch, then moderate negative (possibly higher) impacts are likely to occur.	*** Major negative impact due to visibility from local properties and influence on impression of enclosed loch landscape.	* - minor impact on water environment due to bridge abutments	* Minor negative impact A small number of sensitive receptors on both shorelines may experience slightly higher noise levels with a bridge rather than tunnel option	0 Not likely to have a significant effect on local air quality	0: Likely to be founded in rock, limited effect on geology.	*** Setting impacts on Strome Castle and Plockton Conservation Area	✓ Minor Benefit creates loch link but impacts upon several paths/RoW and may increase driver stress	✓✓ Moderate Benefit: creates loch link but may impact upon Achmore development areas
Western Crossing – Tunnel	* No impacts to Loch Carron MCA though likely minor negative impacts to adjacent terrestrial habitats.	* Minor negative impact due to limited influence of approaches and entrances of tunnel.		✓ Minor Benefit A small number of sensitive receptors on both shorelines may experience slightly lower noise levels with a tunnel rather than bridge option		0: Limited effect.	* Setting impacts from exit and entrance of tunnel portal on SM of Strome Castle, physical impacts non-designated assets		

ENVIRONMENTAL APPRAISAL SUMMARY

TABLE 8.3

Option	Nature Conservation	Landscape	Road Drainage and Water Environment	Noise	Air	Geology and Soils	Cultural Heritage	Effects on all Travellers	Community and Private Assets
Eastern Crossing – High level Bridge (20m headroom)	<p>**</p> <p>Impacts specific to the Loch Carron MCA would depend upon the design of the structure, if bridge piers are to be positioned within the Loch, then moderate negative (possibly higher) impacts are likely to occur</p>	<p>***</p> <p>Major negative impact due to visibility from local properties and influence on impression of enclosed loch landscape.</p>	<p>* - minor impact on water environment due to bridge abutments</p>	<p>0</p> <p>No benefit or impact</p> <p>No difference in crossing options in terms of acoustics for the barrage or bridge option at the eastern end of the Loch</p>	<p>0</p> <p>Not likely to have a significant effect on local air quality</p>	<p>0: Likely to be founded in rock, limited effect on geology.</p>	<p>***</p> <p>Major setting impacts on SM of Strome Castle</p>	<p>✓ Minor Benefit creates loch link but impacts upon several paths/RoW and may increase driver stress</p>	<p>✓✓ Moderate Benefit: creates loch link but may impact upon a South Strome development area</p>
Eastern Crossing – Tidal Barrage	<p>***</p> <p>Major negative impacts are likely to the benthic and rocky shore animal and plant communities etc. within the Loch Carron MCA. Such impacts are likely to result directly from the larger footprint associated with the structure and the artificial manipulation of water levels within the Loch.</p>		<p>*** – major impact on tidal regime/salinity of loch, potential for increased flood risk at upper loch</p>						

8.2.3 *Summary of Traffic and Economic Appraisal Results*

The economic appraisal was undertaken using standard economic welfare techniques consistent with STAG.

The output from this assessment is collected in the following 4 no. summary tables:

- Table 8.4 - Summary of Economic Appraisal Results
- Table 8.5 - Summary of Accessibility & Social Inclusion Appraisal
- Table 8.6 - Summary of Integration Appraisal
- Table 8.7 - Summary of Deliverability & Public Acceptance Appraisal

The output from the above tables is then rationalized and transferred to the main Appraisal Summary Table 8.8, included in this chapter of the report.

In addition to the 5 main Government objectives, STAG also recommends that the capability of delivering an option should also be considered. This can highlight any potential “implementability” problems with any proposal. The appraisal is summarised as follows:

- **Technical Issues** – the offline options considered in this study are relatively straight forward since they are all based on standard civil engineering practices and have been successfully implemented elsewhere; however some of the on-line options, N2b, involving a tunnel, O2 requiring embankment and viaducts and O5 with road / rail share may cause implementability problems owing to relatively complex technical requirements.
- **Operational Aspects** – the on-line options noted above that present a particular significant technical challenge in the hazard area. These are options O3 tunnel option, O5 shared road / rail option and O7 avalanche shelter option, each of which will require on-line road closure. Road closure would be a particularly unpopular scenario with local residents, as it may seriously affect their businesses and access to local shops and services.
- **Public Acceptability** – the public consultation has shown there is significant public interest in removing the rock fall threat to the A890 Stromeferry Bypass, and have shown support for most of the route options above. However, it should be noted that those options that require road closure and those that may add considerably to traffic congestion, particularly in Lochcarron, have much less public support.

Scale of assessment used:

Major benefit	✓✓✓
Moderate benefit	✓✓
Minor Benefit	✓
No benefit or impact	0
Minor negative impact	x
Moderate Negative Impact	x x
Major negative impact	x x x

Table 8.4 – Summary of Economic Appraisal Results

SUMMARY OF ECONOMIC APPRAISAL RESULTS				TABLE 8.4
Corridor	Route Option	Cost Benefit Analysis	Economic Activity & Locations Impact	Overall Appraisal
Outer North	ON3	x x x	✓	x x
	N2	x x x	✓✓	x
North Shore	N2b	x x x	✓✓	x
	N6	x x x	✓✓	x
	N6b	x x x	✓✓	x
	N9	x x x	✓✓	x
On-line	O1	x	✓✓	✓
	O2	x x	✓✓	0
	O3	x x	✓✓	0
	O5	x	✓✓	✓
	O6	x x x	✓✓	x
	O7	x x x	✓✓	x
South	S1	x	✓✓✓	✓✓
	S3	x	✓✓✓	✓✓
	S4	x	✓✓✓	✓✓
	S5b	x x	✓✓✓	✓

Table 8.5 – Summary of Accessibility & Social Inclusion Appraisal

SUMMARY OF ACCESSIBILITY & SOCIAL INCLUSION APPRAISAL				TABLE 8.5
Corridor	Route Option	Community Accessibility	Comparative Accessibility	Overall Appraisal
Outer North	ON3	O	O	O
North Shore	N2	✓✓	✓✓✓	✓✓✓
	N2b	✓✓	✓✓✓	✓✓✓
	N6	✓✓	✓✓✓	✓✓✓
	N6b	✓✓	✓✓✓	✓✓✓
	N9	✓✓	✓✓✓	✓✓✓
On-line	O1	✓✓✓✓	✓✓	✓✓✓
	O2	✓✓✓✓	✓✓	✓✓✓
	O3	✓✓✓✓	✓✓	✓✓✓
	O5	✓✓✓✓	✓✓	✓✓✓
	O6	✓✓✓✓	✓✓	✓✓✓
	O7	✓✓✓✓	✓✓	✓✓✓
South	S1	✓	✓✓✓	✓✓
	S3	✓	✓✓✓	✓✓
	S4	✓	✓✓✓	✓✓
	S5b	✓	✓✓✓	✓✓

Table 8.6 – Summary of Integration Appraisal

SUMMARY OF INTEGRATION APPRAISAL						TABLE 8.6
Corridor	Route Option	Transport Integration	Land-use Integration	Transport	Policy Integration	Overall Appraisal
Outer North	ON3	○	○	○	✓✓✓	○
North Shore	N2	✓	○	○	✓✓✓	✓
	N2b	✓	○	○	✓✓✓	✓
	N6	✓	○	○	✓✓✓	✓
	N6b	✓	○	○	✓✓✓	✓
	N9	✓	○	○	✓✓✓	✓
Online	O1	✓✓	○	○	✓✓	✓
	O2	✓✓	○	○	✓✓✓	✓✓
	O3	✓✓	○	○	✓✓✓	✓✓
	O5	✓✓	○	○	✓	✓
	O6	✓✓	○	○	✓✓	✓
	O7	✓✓	○	○	✓✓✓	✓✓
South	S1	○	○	○	✓✓	✓
	S3	○	○	○	✓	○
	S4	○	○	○	✓	○
	S5b	○	○	○	✓	○

Table 8.7 – Summary of Deliverability & Public Acceptability

SUMMARY OF DELIVERABILITY & PUBLIC ACCEPTABILITY							TABLE 8.7
Corridor	Route Option	Technical Issues	Operational Aspects	Public Acceptability	Public Affordability	Overall Appraisal	
Outer North	ON3	✓	✓	○	x x x	x	
	N2	✓	✓	x	x x x	x x	
North Shore	N2b	x	x	x	x x x	x x	
	N6	✓	✓	x	x x x	x	
	N6b	x x	x x	x x x	x x x	x x x	
	N9	✓	✓	✓	x x x	○	
On-line	O1	x x x	x x	x	x x	x x	
	O2	x x	x	x	x x x	x x	
	O3	x x	x x x	x	x x x	x x x	
	O5	x	x x x	x	x	x x	
	O6	x x x	x	x	x x x	x x	
	O7	x x x	x	x	x x x	x x	
	South	S1	✓	✓	✓	x x	○
S3		✓	✓	✓	x	✓	
S4		✓✓	✓✓	✓	x	✓✓	
S5b		✓	✓	x	x x	x	

8.2.4 *STAG Part 1 Summary*

Table 8.8 is the STAG Summary table, providing brief information on the rationale for the selection or rejection of a route option proposal during the 3rd stage of sifting of route options carried out during this Part1 / Stage 1 appraisal.

The table is set out to satisfy the requirement of the STAG Part 1 Appraisal, with each option judged against the set Scottish Government appraisal Criteria of

- Environment
- Safety
- Economy
- Integration
- Accessibility & Social Inclusion.

Also included is the appraisal of options against the deliverability considerations as required by STAG, which includes assessment of Public Acceptance and Affordability of an option.

The decision (3rd sift) on whether routes are being rejected or taken forward for further detailed assessment during the Stage 2 appraisal, is derived from the Appraisal Summary Table, which provides a brief commentary of the rationale applied for the selection or rejection of a respective route option.

The decision / 3rd sift process is then further described in chapter 9, which concludes on the assessment, appraisals and findings included in this report.

Scale of assessment used:

Major benefit	✓✓✓
Moderate benefit	✓✓
Minor Benefit	✓
No benefit or impact	0
Minor negative impact	x
Moderate Negative Impact	xx
Major negative impact	xxx

Table 8.8 – STAG Part 1 Summary Table

STAG PART 1 SUMMARY TABLE								TABLE 8.8
Assessed Options	Objectives	Government Criteria						Rationale for Selection or Rejection of Option during Stage 1 Appraisal
	Transport Planning Objectives	Environment	Safety	Economy	Integration	Accessibility Social Inclusion	Deliverability Public Acceptance / Affordability	
Outer North 3	✓	***	✓	**	✓	0	*	<p>General: Best N-S linkage, including link to Kishorn. Route bypasses village of Lochcarron. All northern routes bypass the rock fall area, steep gradients at Maman Hill and railway interface issues.</p> <p>Ecology: Major impact on Allt nan Carnan SSSI and ancient woodland. Major impact on Loch Carron Marine Consultation Area.</p> <p>Cultural Heritage: Moderate impact on setting of Stome Castle and potential moderate/minor impact on setting on Lochcarron Old Parish Church</p> <p>Landscape: Moderate impact</p> <p>Noise: Minor impact</p> <p>Community and Private Assets: No benefit or impact as diverts traffic away from Lochcarron.</p> <p>Effects on all Travelers: Moderate negative impact as may increase journey times, causes driver stress and may sever paths.</p> <p>Engineering: Green field construction of new road alignment, with gradients up to 10% in various sections. Involves major bridge crossing of the Narrows.</p> <p>Traffic, Economics: Does not perform well in economic appraisal due to high bridge construction costs.</p> <p>Costs: Most costly northern route, excluding barrage with turbines.</p> <p>Overall Assessment: Route option performs poorly against Objectives and Assessment Criteria, resulting in a zero to negative score overall.</p>

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	Transport Planning Objectives	Environment	Safety	Economy	Integration	Accessibility Social Inclusion	Deliverability Public Acceptance / Affordability	
North Shore 2 (Including Western Bridge Crossing)	✓✓	xxx	✓✓	x	✓✓	✓✓ ✓	xx	<p>General: Rote option includes western bridge crossing and partial Lochcarron bypass. Problem of no guaranteed use of bypass section.</p> <p>Ecology: Moderate impact on ancient woodland. Major impact on Loch Carron Marine Consultation Area.</p> <p>Cultural Heritage: Moderate impact on setting of Strome Castle and potential moderate/minor impact on setting on Lochcarron Old Parish Church</p> <p>Landscape: Major impact from proposed bridge crossing</p> <p>Noise: Major impact – significant increase of noise levels in properties along the route corridor</p> <p>Air: Increase in pollutant concentrations likely at receptors in Lochcarron</p> <p>Community and Private Assets: Moderate impact as route proposal increases traffic through Lochcarron and impacts several community assets.</p> <p>Effects on all Travelers: Minor negative impact, may increase journey times and sever paths.</p> <p>Engineering: Maximum road gradients of 8%. Involves major bridge crossing of the Narrows. Corridor availability on northern shore to be investigated due to existing dwellings on roadside.</p> <p>Economics: Does not perform well in economic appraisal due to high bridge construction costs.</p> <p>Costs: Compares favorably with cheapest northern route N6.</p> <p>Overall Assessment: Route option performs well against Objectives and Assessment Criteria , resulting in a positive score overall .</p>

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North Shore 2b (Including Western Tunnel)	✓✓	xxx	✓	x	✓✓	✓✓ ✓	xx	<p>General: Route proposal includes western tunnel crossing and partial Lochcarron bypass. Problem of no guaranteed use of bypass section.</p> <p>Ecology: Major impact on Loch Carron Marine Consultation Area.</p> <p>Cultural Heritage: Minor impact on setting of Strome Castle SM (TUNNEL) and potential moderate/minor impact on setting on Lochcarron Old Parish Church SM</p> <p>Landscape: Moderate impact (Minor for TUNNEL)</p> <p>Noise: Major impact – significant increase in properties along route corridor</p> <p>Air: increase in pollutant concentrations likely at receptors in Lochcarron</p> <p>Community and Private Assets: Moderate impact as increases traffic through Lochcarron and impacts several community assets.</p> <p>Effects on all Travelers: No benefit or impact as reduces journey times but may sever some paths.</p> <p>Engineering: Long steep road gradients in approaches to tunnel of 10%. Involves tunnel construction under the Narrows and portal structures. Corridor availability on northern shore to be investigated due to existing dwellings on roadside</p> <p>Economics: Does not perform well in economic appraisal due to high tunnel construction costs.</p> <p>Costs: Cost difference to N2 is resulting from higher tunnel cost.</p> <p>Overall Assessment: Route option performs reasonably well against Objectives and Assessment Criteria , but resulting in a lower score in comparison to N2 due to higher Capital cost</p>

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	Transport Planning Objectives	Environment	Safety	Economy	Integration	Accessibility Social Inclusion	Deliverability Public Acceptance / Affordability	
North Shore 6	✓✓	xxx	✓	x	✓✓	✓✓ ✓	x	<p>General: Route option provides good north south linkage. This proposed route option is the most economic northern option, but proposes on-line improvements through Slumbay and Lochcarron Village, rather than a bypass, with difficult route development due to existing frontage activity.</p> <p>Ecology: Generally moderate impact, but major impact on Loch Carron Marine Consultation Area.</p> <p>Cultural Heritage: Major impact on setting of Strome Castle and potential moderate/minor impact on setting on Lochcarron Old Parish Church</p> <p>Landscape: Major impact due to bridge crossing</p> <p>Noise: Major impact – significant increase at properties along route corridor</p> <p>Air: Increase in pollutant concentrations likely at receptors in Lochcarron and Slumbay</p> <p>Community and Private Assets: Moderate impact as increases traffic through Lochcarron and impacts numerous community assets.</p> <p>Effects on all Travellers: No benefit or impact as reduces journey times but may sever some paths</p> <p>Engineering: Green field construction of new road alignment, with gradients up to 10% in various sections. Involves major bridge crossing of the Narrows. Corridor availability on northern shore to be investigated due to existing dwellings on roadside.</p> <p>Economics: Does not perform well in economic appraisal due to high bridge construction costs.</p> <p>Costs: Most economical northern option due to reduced cost of an on-line route alignment.</p> <p>Overall Assessment: Route option performs well against Objectives and Assessment Criteria similar to N2, but with a lower score on Objectives due to on-line proposal through Lochcarron.</p>

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	Transport Planning Objectives	Environment	Safety	Economy	Integration	Accessibility Social Inclusion	Deliverability Public Acceptance / Affordability	
North Shore 6b (Including consideration for Renewable Energy Option)	✓✓	xxx	✓✓	x	✓✓	✓✓ ✓	xxx	<p>General: Route option provides good north south linkage, but proposes on-line improvements through Slumbay and Lochcarron Village, rather than a bypass, with difficult route development due to existing frontage activity. Environmental impacts from barrage construction and currently no adequate distribution network available?</p> <p>Ecology: Generally moderate impact, but major impact on Loch Carron Marine Consultation Area.</p> <p>Cultural Heritage: Major impact on setting of Strome Castle due to close vicinity of barrage and potential moderate/minor impact on setting of Lochcarron Old Parish Church</p> <p>Landscape: Major visual impact of proposed barrage on Strome Narrows</p> <p>Noise: Major impact – significant increase in noise levels at properties along route corridor</p> <p>Air: Increase in pollutant concentrations likely at receptors in Lochcarron</p> <p>Community and Private Assets: Moderate impact as increases traffic through Lochcarron and impacts numerous community assets.</p> <p>Effects on all Travellers: No benefit/ impact as reduces journey times but may sever some paths.</p> <p>Engineering: Green field construction of new alignment, gradients up to 10% in various sections. Involves major bridge crossing of the Narrows and interface issues with railway adjacent to Stromeferry station. Corridor availability on northern shore to be investigated due to existing dwellings on roadside.</p> <p>Economics: Does not perform well in economic appraisal due to high estimated construction costs of the barrage. Costs: Most expensive northern option with turbines, but potential cost offset by power generation revenues.</p> <p>Overall Assessment: Route option similar to N6, but with higher initial Capital cost offset by potential revenue from renewable energy generation.</p>

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North Shore 9	✓✓	xxx	✓✓ ✓	x	x	✓	0	<p>General: Additional route option considered to provide a full bypass of Lochcarron village. However, problem that no guaranteed use of bypass section.</p> <p>Ecology: Major impact on Allt nan Carnan SSSI and ancient woodland</p> <p>Landscape: Generally moderate impact, but major impact on Loch Carron Marine Consultation Area.</p> <p>Noise: Moderate impact – slight increase in properties along route corridor</p> <p>Community and Private Assets: Minor benefit as it diverts traffic away from Lochcarron and impacts very few community/private assets</p> <p>Effects on all Travelers: Minor negative impact as may increase journey times and may sever paths.</p> <p>Engineering: Green field construction of new road alignment, with gradients up to 10% in various sections. Involves major bridge crossing of the Narrows. Corridor availability on northern shore to be investigated due to existing dwellings on roadside.</p> <p>Economics: Does not perform well in economic appraisal due to high bridge construction costs.</p> <p>Costs: Cost is favorable for northern route option and is comparable to cheapest N6.</p> <p>Overall Assessment: Route option performs well against Objectives and reasonably well against Assessment Criteria similar to N2, with a higher acceptability score on due to proposal for a full bypass of Lochcarron.</p>

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On-line 1 (On-line Improvements)	x	xx	✓	✓	✓	✓ ✓	xx	<p>General: High risk associated with rock slope stability during construction and beyond, resulting in a certain cost uncertainty. Proposal has railway interface issues, and presents most disruption during construction.</p> <p>Ecology: Moderate impact on Attadale SSI and ancient woodland</p> <p>Landscape: Generally moderate Impact</p> <p>Community and Private Assets: No benefit or impact as it affects few residential, community and development areas.</p> <p>Effects on all Travelers: Minor benefit, as proposal creates long term reduction in driver stress. Major impact during construction.</p> <p>Engineering: Excavation of rock faces, some 40m high, may lead to new instabilities. Long-term integrity of rock faces and therefore reliability of route questionable. Will require closure of road and railway to allow construction. Alignment follows existing road and incorporates substandard geometry at Ardnarff and Maman Hill.</p> <p>Economics: Significant closures of existing road and railway during construction required.</p> <p>Costs: Cheapest on-line 2 way replacement solution but with high risk and buildability issues.</p> <p>Overall Assessment: Route option performs poorly against Objectives, as it does not provide confident long term solution. Major disruptions during construction produce a poor score on acceptability and therefore deliverability.</p>

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On-line 2 (Viaduct)	0	xxx	✓✓	0	✓✓	✓✓ ✓	xx	<p>General: This route option bypasses the rockfall area by means of a build-out viaduct, but there are potential railway interface and buildability issues. Some road closures during construction will be required. Option could potentially benefit Kishorn if option constructed using precast elements.</p> <p>Ecology: Major impact on Loch Carron Marine Consultation Area.</p> <p>Landscape: Minor impact due to introduction of new structure.</p> <p>Road Drainage and Water Environment: Minor impact on water environment due to viaduct.</p> <p>Community and Private Assets: No benefit or impact as it affects few residential, community and development areas.</p> <p>Effects on all Travelers: Minor benefit as proposal creates long term reduction in driver stress, but short term disruptions of traffic during construction.</p> <p>Engineering: 2km viaduct founded in potentially deep water, resulting in difficult construction and access and buildability issues. Two railway crossings would be required. Alignment follows existing road and therefore incorporates substandard geometry at Ardnarff and Maman Hill. Road closures during construction will be required, but solution does offer some off-line working.</p> <p>Economics: Cost of works and closures of existing road and railway during construction required affect scheme economics.</p> <p>Costs: This is the most costly option considering construction difficulty.</p> <p>Overall Assessment: Route option performs poorly against Objectives, due to estimated scheme costs and resulting deliverability issues. Due to some off-line construction this option provides least disruption during construction.</p>

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On-line 3 (Tunnel)	0	xx	✓✓	0	✓✓	✓✓ ✓	xxx	<p>General: Route option incorporates tunnel section to bypass the rockfall area. Challenging construction method, but off-line tunnel route offers distinct advantages.</p> <p>Ecology: Minor impacts</p> <p>Landscape: Minor impacts</p> <p>Road Drainage and Water Environment: Potential minor impact on groundwater</p> <p>Community and Private Assets: No benefit or impact as it affects few residential, community and development areas.</p> <p>Effects on all Travelers: Minor benefit as solution creates long term reduction in driver stress; but short term disruptions during construction to be expected.</p> <p>Engineering: Includes 1.6km long 2lane tunnel section and associated portal structures, all with inherent engineering and construction difficulty. Adequate working space will have to be generated. Alignment follows existing road and therefore incorporates substandard geometry at Ardnarff and Maman Hill. Delays to road and railway traffic during the construction period are to be expected. 1.0km long rock trap measures to be constructed along existing /abandoned road corridor.</p> <p>Economics: Cost of works and anticipated closures of existing road and railway during construction affect scheme economics.</p> <p>Costs: The second most expensive considered on-line option.</p> <p>Overall Assessment: Route option performs poorly against Objectives, due to estimated scheme costs but satisfies STAG criteria generally and offers advantages due to off-line construction.</p>

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On-line 4 'Do-Minimum'	0	0	0	0	✓✓	0	**	<p>General: Do-minimum option considered, low cost option, no improvements to carriageway or alignments. Ongoing rock slope maintenance to existing programme and reactive measures, as and when required. Option not satisfying local requirements. Minor negative impact to travelers as remains status quo.</p> <p>Costs: Least expensive, base-line option.</p> <p>Overall Assessment: Route does not satisfy Objectives or STAG criteria, and results in an overall neutral score, but required as the base-line case for comparison.</p>
Online 5 (Road / Rail)	x	***	✓	✓	✓	✓✓ ✓	**	<p>General: Proposes dual running of road and railway traffic. Some construction and operational risk and disruption, but cost effective solution. Possibly not satisfying local requirements.</p> <p>Ecology: Minor impacts.</p> <p>Community and Private Assets: No benefit or impact as it impacts few residential, community and development areas.</p> <p>Effects on all Travellers: Minor benefit as creates long term reduction in driver stress but short term increases. Dis-benefit to rail travelers.</p> <p>Engineering: Will require re-engineering of railway track which will be disruptive in short term. Alignment follows existing road and therefore incorporates substandard geometry at Ardnarff and Maman Hill.</p> <p>Economics: Perform well in economic appraisal due to lower capital costs.</p> <p>Costs: Cheapest on-line solution after Do-minimum</p> <p>Overall Assessment: Route does not satisfy the Objectives, but has potential as a medium term, low cost solution.</p>

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On-line 6 (Upper Loch Carron Crossing)	0	xxx	✓	x	✓	✓ ✓	xx	<p>General: Proposal for a better alignment at the northern end, bypassing Strathcarron level crossing and Maman Hill. Potential impact from bridge crossing and some railway interface issues.</p> <p>Ecology: Major impact relating to loss and fragmentation of saltmarsh habitat.</p> <p>Landscape: Moderate impact due to introduction of new road across foreshore.</p> <p>Road Drainage and Water Environment: Moderate impact on water environment due to upper loch crossing (in floodplain).</p> <p>Cultural Heritage: Potential minor/moderate impacts on setting on Lochcarron Old Parish Church SM.</p> <p>Community and Private Assets: No benefit or impact as it impacts few residential, community and development areas.</p> <p>Effects on all Travellers: Minor benefit as creates long term reduction in driver stress but short term increases.</p> <p>Engineering: Significant viaduct structure in tidal flood plain therefore construction difficulty moderate. All issues associated with option (01) apply here.</p> <p>Economics: Does not perform well in economics due to high bridge costs.</p> <p>Costs: Cost is third highest ion-line and in effect is a link to (01) and could be added to any on-line or southern option.</p> <p>Overall Assessment: Route option would satisfy criteria for easier access and lower gradients, but high structure costs and environmental impact of upper loch crossing.</p>

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On-line 7 (Extension to Avalanche Shelter)	x	xx	✓✓	x	✓✓	✓✓ ✓	xx	<p>General : Extended avalanche shelter provides protection to road and rail long term, but significant disruption during construction with railway interface issues. Option could utilize Kishorn yard for production or shipping of precast elements.</p> <p>Ecology: Major impact on Loch Carron – especially if bridges/viaducts are part of proposals.</p> <p>Landscape: Minor impact due to introduction of additional structures.</p> <p>Geology and Soils: Minor impact on Attadale SSSI</p> <p>Community and Private Assets: No benefit or impact as it impacts few residential, community and development areas.</p> <p>Effects on all Travellers: Minor benefit as creates long term reduction in driver stress but short term increases.</p> <p>Engineering: Complex engineering structures and rock treatment, will require closures of road and railway during construction. Does offer some element of off-line working. Adopts existing road alignment with inherent sub-standard sections.</p> <p>Economics: Does not perform well in economic appraisal due to high structures costs.</p> <p>Costs: This is the second cheapest on-line option after the rock face remodeling (01)</p> <p>Overall Assessment: Route option provides good long-term protection to the most difficult rock-fall area, but will involve complex engineering to minimize disruptions during construction.</p>

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	Transport Planning Objectives	Environment	Safety	Economy	Integration	Accessibility Social Inclusion	Deliverability Public Acceptance / Affordability	
South 1	✓✓	xxx	✓	✓✓	✓	✓✓	0	<p>General: Potential environmental impacts from new green field route and extended journey time. Promotes remote route alignment, with local link. Low cost and low risk option.</p> <p>Ecology: Major impacts due to offline nature of route – loss of ancient woodland and montane habitat and impacts likely to protected species.</p> <p>Landscape: Minor impact due to limited visibility and influence of impression of landscape.</p> <p>Road Drainage and Water Environment: Moderate impact due to high numbers of new watercourse crossings required.</p> <p>Community and Private Assets: Moderate negative impact due to the impacts on community and woodland areas.</p> <p>Effects on all Travellers: No benefit or impact as bypasses problem area but may sever a few paths.</p> <p>Engineering: Green field construction of new road alignment. Steep section near Stromeferry requiring large amount of earthworks. Steep gradients also at Attadale and retains existing gradients on Maman Hill. Small to medium size structures required.</p> <p>Economics: Provides direct linkage towards Stromeferry and Achmore, and due to lower costs performs better overall.</p> <p>Costs: Most expensive southern option due to earthworks required near Stromeferry.</p> <p>Overall Assessment: Route option provides more direct link of southern route towards Stromeferry and Achmore. Apart from environmental criteria, this option performs well against Objectives and STAG criteria, but results in longer journey times overall.</p>

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South 3	✓	xxx	✓	✓✓	0	✓✓	✓	<p>General: Potential environmental impacts from new green field route and extended journey time. Promotes remote route alignment, with local link. Low cost and low risk option.</p> <p>Ecology: Major impacts due to offline nature of route – loss of ancient woodland and montane habitat and impacts likely to protected species.</p> <p>Landscape: Moderate impact due to crossing of steep slopes which may increase visibility and reduce landscape fit</p> <p>Road Drainage and Water Environment: Moderate impact due to high numbers of new watercourse crossings required.</p> <p>Community and Private Assets: Moderate negative impact due to the impacts on community and woodland areas.</p> <p>Effects on all Travellers: : No benefit or impact as bypasses problem area but may sever a few paths</p> <p>Engineering: Longer route with acceptable horizontal geometry and earthworks, small to medium structures crossing water courses. Steeper gradients at Attadale and existing gradients on Maman Hill.</p> <p>Economics: Performs better due to reduced construction costs.</p> <p>Costs: Longest but cheapest southern route.</p> <p>Overall Assessment: Route performs similar to S1, with slightly less difficult vertical alignments.</p>

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South 4	✓	xxx	✓	✓✓	0	✓✓	✓✓	<p>General: Potential environmental impacts from new green field route and extended journey time. Promotes remote route alignment, with no direct link to communities. Low cost and least risk option.</p> <p>Ecology: Major impacts due to offline nature of route – loss of ancient woodland and montane habitat and impacts likely to protected species.</p> <p>Landscape: Minor impact due to visibility from properties in Attadale and local influence on rocky moorland.</p> <p>Road Drainage and Water Environment: Moderate impact due to high numbers of new watercourse crossings required.</p> <p>Community and Private Assets: Moderate negative impact due to the impacts on community and woodland areas.</p> <p>Effects on all Travellers: Minor negative impact as may increases journey times and may sever paths</p> <p>Engineering: Longer route with easy alignments and earthworks, small to medium structures crossing water courses. Steeper gradients at Attadale and existing gradients on Maman Hill.</p> <p>Economics: Best performing southern route and most economical route option overall.</p> <p>Costs: Longest but least expensive southern route.</p> <p>Overall Assessment: Route performs well against Objectives and STAG criteria, apart from integration and environment. Route promotes a remote alignment, potentially bypassing existing communities.</p>

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South 5b (Alternative Route to S5)	✓	xxx	✓	✓	0	✓✓	x	<p>General: Potential environmental impacts from new green field route and extended journey time. Promotes remote route alignment, with no direct link to communities.</p> <p>Ecology: Major impacts due to offline nature of route – loss of ancient woodland and montane habitat and impacts likely to protected species.</p> <p>Landscape: Significant impact on Strath Attadale landscape.</p> <p>Road Drainage and Water Environment: Moderate impact due to high numbers of new watercourse crossings required.</p> <p>Cultural Heritage: Minor impacts on setting on Attadale House (Category C Listed)</p> <p>Community and Private Assets: Moderate negative impact due to the impacts on community and woodland areas.</p> <p>Effects on all Travellers: Minor negative impact as may increases journey times and sever paths.</p> <p>Engineering: Green field construction of new road alignment, with gradients up to 10% in various sections. Improves on existing Maman Hill section, but requires major earthworks to achieve alignment through Attadale.</p> <p>Economics: Longer route than S4, therefore slightly less favorable economic performance.</p> <p>Costs: Substantial earthworks slopes make this the most expensive southern option.</p> <p>Overall Assessment: Route developed to provide alternative bypass of Attadale. Amended alignment will require substantial earthworks with major visual impact on existing landscape.</p>

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	Transport Planning Objectives	Environment	Safety	Economy	Integration	Accessibility Social Inclusion	Deliverability Public Acceptance / Affordability	
Western Bridge Crossing	✓	xxx	✓	x	0	0	0	<p>General: All Narrows crossings will have environmental and visual impact on existing landscape. Nevertheless, the considered crossings would replicate the original link across the Narrows and re-instate a direct north-south link.</p> <p>Ecology: Potential moderate impacts on Loch Carron MCA depending on design of structure – if bridge piers are to be position within the Loch, then moderate negative (possibly higher) impacts are likely to occur.</p> <p>Landscape: Major negative impact due to visibility from local properties and influence on impression of enclosed loch landscape.</p> <p>Cultural Heritage: Moderate impact on setting on Strome Castle and Plockton Conservation Area.</p> <p>Engineering: Green field construction of new road alignment, with gradients up to 10% in approaches. Involves construction of a major bridge crossing over the Narrows.</p> <p>Economics: Potential high bridge construction costs.</p> <p>Overall Assessment: Preliminary assessments indicate western crossing to be most feasible location. To be further investigated in Stage 2 appraisals.</p>

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Western Tunnel Crossing	✓✓	✓✓	x	xx	0	0	x	<p>General: All Narrows crossings will have environmental, with the tunnel resulting in a lesser visual impact on existing landscape. Nevertheless, the considered crossings would replicate the original link across the Narrows and re-instate a direct north-south link.</p> <p>Ecology: No impacts of Loch Carron MCA though negative impacts to adjacent habitats likely.</p> <p>Landscape: Minor impacts due to limited influence of approaches and entrances of tunnel.</p> <p>Road Drainage and Water Environment: Minor impact</p> <p>Cultural Heritage: Minor impact on setting of Strome Castle</p> <p>Economics: Potentially higher construction costs than a bridge structure, resulting in a poorer performance in economic terms.</p> <p>Overall Assessment: The tunnel crossing considered would present a feasible alternative to a bridge across the Narrows, with a lesser impact on the existing landscape. A suitable location for a tunnel crossing should be further investigated through Stage 2 appraisals.</p>

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Eastern Bridge Crossing	✓	xxx	✓	xx	0	0	0	<p>General: All Narrows crossings will have environmental and visual impact on existing landscape. Nevertheless, the considered crossings would replicate the original link across the Narrows and re-instate a direct north-south link.</p> <p>Ecology: Potential moderate impacts on Loch Carron MCA depending on design of structure – if bridge piers are to be position within the Loch, then moderate negative (possibly higher) impacts are likely to occur.</p> <p>Landscape: Major negative impact due to visibility from local properties and influence on impression of enclosed loch landscape.</p> <p>Cultural Heritage: Major impact on setting of Strome Castle.</p> <p>Engineering: Green field construction of new road alignments, with gradients up to 10% in approaches. Involves major bridge crossing of the Narrows, with particularly difficult topography on the southern shore..</p> <p>Economics: Does not perform well in economic appraisal due to potentially high bridge construction costs.</p> <p>Overall Assessment: Preliminary assessments indicate an eastern bridge to be the most difficult to achieve, due to topography near Stromeferry. The most feasible bridge location is to be further considered during the next stage of the appraisal.</p>

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Assessed Options	Objectives	Government Criteria						Rationale for Selection or Rejection of Option during Stage 1 Appraisal
	Transport Planning Objectives	Environment	Safety	Economy	Integration	Accessibility Social Inclusion	Deliverability Public Acceptance / Affordability	
Eastern Tidal Barrage Crossing	✓	xxx	✓	xx	0	0	✓	<p>General: All Narrows crossings will have environmental and visual impact on existing landscape. Nevertheless, the considered crossings would replicate the original link across the Narrows and re-instate a direct north-south link. This route option also considers an itegrated renewable energy solution as part of a Narrows crossing.</p> <p>Ecology: Major impact likely to Loch Carron MCA associated with the larger footprint and the artificial manipulation of water levels.</p> <p>Landscape: Major negative impact due to visibility from local properties and influence on impression of enclosed loch landscape.</p> <p>Cultural Heritage: Major impact on setting of Strome Castle.</p> <p>Engineering: Green field construction of new road alignment, with gradients up to 10% in approaches. Involves the construction of a major crossing of the Narrows, which is to incorporate a renewable energy generating solution.</p> <p>Economics: This option does not perform well in economic appraisal due to potentially high initial capital cost to construct the crossing as well as the renewable energy generators.</p> <p>Overall Assessment: A renewable energy generating solution was considered and assessed as an alternative option to the other proposed route options. High initial capital cost of such a solution will require alternative funding. Nevertheless, this option could be combined with any of the route options considered and could generate an income to offset the cost of a proposal.</p>

8.3 Risk and Uncertainty

Following the appraisal process detailed in the foregoing chapters, an initial, high level review of potential project delivery risks has been considered with regards to significant technical, economical, environmental or statutory risks.

Funding issues are not considered at this stage.

Table 8.9 below summarises the initial risks review findings. This list is not exhaustive and will be reviewed during the Stage 2 appraisal.

Table 8.9 – Risks & Uncertainty

RISKS & UNCERTAINTY		Table 8.9
Options	Risks & Uncertainty	
All Options	Engineering assessment. Ground Investigations, topographical, bathymetrical and traffic surveys have not been fully carried out. The results of these may affect the cost, ranking and construction periods. As all of the options other than the southern options involve significant structures, current outcomes may be affected by the results of these investigations and surveys.	
All Options	Environmental assessment. Work to date has been desk based, limited survey information is available. Impacts on international & national designations, scheduled monuments and listed buildings may be more severe than anticipated. The results of these may affect ranking and cost. As all of the options other than the on-line options involve construction through 'green field' areas impacts on protected species, birds and woodlands may be more significant than anticipated.	
All Options (apart from Dominium)	An assumption has been made that simple drainage outfalls will suffice. Problems may be encountered with SEPA over discharge requirements and obtaining CAR licences. This may affect programme particularly construction start dates.	
All Options	The frequency of future rock falls along the existing road is uncertain. A closure period of 9 days per annum has been assumed. This is not a prediction of future events, these may cause more or less disruption than this.	
All Options	Key Stakeholders and Landowners may contest outcomes. Statutory processes will be required as all of the options involve work outside the existing highway boundary and will require land acquisition or land owner agreements and this could result in the need for a Public Local Inquiry and project delays. Objections are expected from Statutory and Non-Statutory objectors.	
All Options	Appropriate standards have resulted in relaxtions and departures from standard. If these are not granted costs, landtake and environmental impacts will increase.	
All Options	An initial assessment of PU apparatus has been undertaken and the information provided is limited. Services may impact on the works and dealing with PU's could be problematic and time consuming.	
All Options	Traffic and economic modelling is based on limited information and assumptions have been made that may downgrade BCR/NPV. Sensitivity testing should be carried out.	

RISKS & UNCERTAINTY		Table 8.9
Options	Risks & Uncertainty	
All Options	Traffic Management and Network Rail supervision costs have been recognised. These costs could be very significant particularly in summer months.	
On-line Options	Rock slope stability has not been fully assessed at this stage	
On-line Options	Discussion with Network Rail are at an early stage, outcomes could affect costs and route selection particularly maintenance liability if off-line route selected.	
On-line Options	All on-line solutions require co-operation with Network Rail. Discussions are at a very early stage. The demands placed by them to create a 'fail safe operation during construction may make on-line solutions unviable.	
On-line Options	Limited road corridor to allow safe working areas, compounds, lay-down, storage during construction	
On-line Options	Options require mitigation measure during construction to maintain free flow traffic. Acceptable negotiated measures are likely to affect construction programme, cost and possibly route selection.	
On-line Options	An economic design requires cut-fill balance, disposal of surplus material from O3 and O1 could be problem unless O6 chosen.	
Off-line Options	A cost premium is required for off-line options to compensate for ongoing maintenance liability for existing road. This may not be sufficient.	
All Southern Options	Likely to be strong landowner objections leading to lengthy statutory processes and delays, mitigation costs to ensure road/railway remain operational will increase	
All Southern Options	Mainly 'greenfield' solutions with unknown ground conditions and environmental sensitivities	
Outer North 3	Mainly 'greenfield' solution with unknown ground conditions and environmental sensitivities (SSSI)	
Outer North 3	Significant bridge crossing across Narrows. Construction and cost uncertainty, strong tidal flow and requirement for marine works.	
North Shore 2	Significant bridge crossing across Narrows. Construction and cost uncertainty, strong tidal flow and requirement for marine works.	
North Shore 2b	Construction of tunnels has inherent and unknown risk due to unforeseen ground conditions that are likely to affect programme and or cost. Material disposal problem to create cut/fill balance.	
North Shore 6	Existing corridor is narrow, option requires retention and protection of PU's. Costs/ extent unknown.	
North Shore 6	Deep cuttings approaching south abutment to significant bridge crossing across Narrows. Construction and cost uncertainty, strong tidal flow and requirement for marine works.	
North Shore 6b	Preliminary work on the barrage/renewable energy option has been undertaken. The viability of this is not yet proven.	
North Shore 6b	Railway interface issues on south side due to alignments to achieve lower bridge crossing.	
North Shore 9	Mainly 'greenfield' solution with unknown ground conditions and environmental sensitivities.	
North Shore 9	Significant bridge crossing across Narrows. Construction and cost uncertainty, strong tidal flow and requirement for marine works.	

RISKS & UNCERTAINTY		Table 8.9
Options	Risks & Uncertainty	
On-line 1	Assumes the existing rock face can be cut back and maintained. Further work is required to confirm this. In addition possibility of unstable rock faces at higher level.	
On-line 1	Cost of option will depend on any agreed closure of existing road (and possibly railway). Assumptions made for closures and mitigation strategy (ferry) may not be sufficient.	
On-line 2	The build out of a viaduct (or causeway) requires foundation bearing at a reasonable level. This has not been confirmed. Buildability issues require to be explored further.	
On-line 2	Option requires expensive marine works and unknown down-time.	
On-line 3	Construction of tunnels has inherent and unknown risk due to unforeseen ground conditions that are likely to affect programme and or cost. Material disposal problem to create cut/fill balance.	
On-line 4 Do-minimum	Allowances included for further rockfalls and associated mitigation may be insufficient.	
On-line 5	Option will be aborted if dual running not accepted by Network Rail and THC.	
On-line 7	Solution requires rock excavation and disposal, disruption to road and railway. Assumptions made for closures and mitigation strategy (ferry) may not be sufficient.	

9 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

9.1 Summary

URS have undertaken a STAG Part 1 and DMRB Stage 1 Options Appraisal in accordance with the requirements of their appointment by The Highland Council, AR1185 dated October 2012. The various assessments undertaken have been presented in this report.

During the development of the report, the URS team considered relevant historical information abstracted from THC archives. In accordance with the requirements of STAG, extensive Stakeholder consultation was undertaken to advise the project, in particular to identify problems, opportunities and constraints and develop Transport Planning Objectives, during the Pre-Appraisal stage of the process.

Route corridors were identified, and an option generation and sifting process then took place to identify alignments adequate to progress to further detailed assessment work. This Pre-Appraisal Stage was concluded in January 2013 when the Stage 1 assessment commenced in earnest.

The conclusions to that work are presented below with recommendations on which of the options should be taken forward to a STAG Part 2 and DMRB Stage 2 assessment.

9.2 Conclusions

A review of the summary tables contained in chapter 8 has been undertaken. Considering individual disciplines it can be seen in general terms:

- New (greenfield) routes score poorly on environmental grounds;
- Outer routes satisfy less of the Transport Planning Objectives;
- On-line routes are expensive, have buildability and rail interface issues and will require some element of road and railway closures;
- Northern routes require expensive crossings of the Strome Narrows.

However, it is essential at this stage of the process, that the full range of assessment criteria, ie. Transport Planning Objectives, Environment, Safety, Economy, Integration, Accessibility & Social Inclusion, Deliverability, Public Acceptability & Affordability, are all considered to result in a balanced view.

A rationale has been developed as follows, to allow routes to be either rejected or selected, to be taken taken forward and assessed as part of the Stage 2 work:

Northern Routes. The most advantageous northern route will be taken forward. There are pros and cons for routes N2, N6 and N9 and their variations regarding the Strome Narrows crossings, and a good balance has to be achieved considering all aspects of environmental, technical and socio-economic issues as well as compliance with the Transport Planning Objectives. Consideration will be given to views obtained following further consultation with the Stakeholder Groups and general public.

On-line Routes. The majority of the on-line routes will be taken forward to Stage 2, as it is not possible at this early, preliminary stage, to identify the most advantageous on-line option, with all of these route options heavily cost driven. Considerations do not just focus on construction cost, but it is recognized that further work is required on buildability issues, construction periods, road and railway closures and railway interface issues, all of which potentially impact on cost. It is also recognized that The Highland Council have liability obligations with regard to long term maintenance of the route.

A recognized benefit of the on-line routes is that they lend themselves to phased construction, which may aid deliverability of a scheme and therefore satisfy the Project Objective. Phase 1 would cover the construction works required for the section near the avalanche shelter, to alleviate the on-going rock fall issues on that section of road first. Further phases would cover the sections between Stromeferry and Ardnarff, and from Cuddies' Point east to Strathcarron and Starthcarron Junction.

Southern Routes. Southern routes will be taken forward and a primary route identified. Links will be investigated to overcome community exclusion and journey time/ bypass issues.

Strome Narrows Crossings. Options including a bridge and a tunnel will be taken forward to the Stage 2 assessment, where analysis will determine the best location for the bridge or tunnel solution and structural form of the bridging structure across the Narrows. It is expected that any Northern route could be aligned to match this identified location.

Do-Minimum Scenario. A 'Do Minimum' scenario will be taken forward. This is the base case to measure the performance of alternative route options against and is representing the existing condition of the A890 Stromeferry Bypass, with known issues of a long diversion route and rail/ferry contingency measures during road closures due to rock falls.

9.3 Recommendation

It is recommended that the assessed routes are either rejected or carried forward to the Stage 2 assessment as reasoned below. To assist in this process, reference is made to the corridors as set out on drawing number 47065084 – 1002.

9.3.1 *Outer North Corridor*

Only one route remained in this corridor **ON3** after the 1st and 2nd sifts. (The Outer North ON3 scenario involves a crossing of the Strome Narrows, is offline to Achintraid, joining the A869 near Kishorn and continues offline north of Lochcarron before transferring on-line from Kirkton).

Whilst there were perceived benefits in progressing this route, particularly to assist in creating a N-S strategic link and opening up better access to Kishorn yard, this option performs poorly with regard to scheme economics, cost, environment and satisfying the Transport Planning Objectives. As a consequence **this route is rejected.**

9.3.2 *Northern Corridor*

All northern route options could be considered for a phased approach, aiding both overall affordability and deliverability of the scheme, as well as public acceptability. Phase 1 of the works could include the required Strome Narrows crossing and approach roads, with an upgrade of the existing road alignment up to Strome Wood. Phases 2 and 3 could cover the

required works from Strome Wood east up to the Strathcarron Junction, and would involve either on-line improvements, or the construction of the proposed bypass alignment, depending on the preferred route option chosen.

Route **N6**. (The North Shore N6 option requires a crossing of the Strome Narrows, remains on-line on existing minor road alignments from Stromemore through Lochcarron, and is on-line from Kirkton to Strathcarron Junction).

This route is on-line on the existing public road and there are expected to be difficulties developing the route due to existing frontage activity. In addition there was reluctance from the Economic Stakeholders to embrace this solution due to perceived safety and noise issues with traffic through Lochcarron Village. However this option satisfies a significant number of the Transport Planning Objectives, is the most affordable and least intrusive northern option and the engineering difficulties are expected to be readily addressed during Stage 2.

Route **N9**. (The North Shore N9 option involves a crossing of the Strome Narrows, continues along existing road alignments up to Strome Wood, bypassing Lochcarron from Strome Wood to Kirkton and is on-line from Kirkton to Strathcarron Junction).

This route includes a significant section of a new greenfield route bypassing Lochcarron Village. There will be some environmental issues to mitigate against and due to topography relatively steep gradients have been introduced at this stage. Otherwise this route performs well against all criteria and was supported by the community, as it addresses the issues of heavy traffic through Lochcarron Village. However a concern would be to enforce use of the bypass to prevent heavier traffic still using the existing road through Lochcarron.

Route **N2**. (The North Shore N2 option involves a bridge crossing of the Strome Narrows, continues along existing road alignments up to Strome Wood, then continues offline to the A896 but is on-line through Lochcarron, and on-line from Kirkton to Strathcarron Junction).

This route is a hybrid of N6 and N9 offering access to Lochcarron on the A896.

There are pros and cons for routes options N2, N6 and N9, and a good balance has to be achieved considering all aspects of environmental, technical and socio-economic issues as well as compliance with the Transport Planning Objectives. Consideration will be given to views obtained following further consultation with the Stakeholder Groups and general public.

At this stage, **N2 as a route will be rejected, however the bridge will be further considered in Stage 2**, and linkage to the village will still be provided by the existing road.

The most advantageous northern route will be taken forward to Stage 2.

Route **N2b**. (The North Shore N2b option uses the same alignment as the North Shore N2 option, but considers a tunnel).

Whilst the tunnel will have engineering difficulties and uncertainties, it offers distinct benefits on environmental grounds in comparison to the bridge option. Cost wise it is estimated some £23million more than a bridge, however it is recognised that the costs of both of these options requires more interrogation at Stage 2. **As a route this option is rejected, however the tunnel will be taken forward.**

Route **N6b**. (The North Shore N6b option requires a Strome Narrows Crossing similar to option N6, but replaces a bridge with a tidal barrage).

It should be noted that if a renewable energy scheme is viable, options are available that could be developed within the Narrows that do not require a barrage N6b type solution or Narrows crossing as considered as part of this assessment to date. Therefore any financial gains from the tidal barrage/renewable energy option could potentially offer a benefit to any of the route options being considered. N6b should be rejected as a stand alone option due to difficulties in access and on environmental grounds, but renewable energy within the Narrows in principle should be progressed and if viable, the benefit applied to all options being considered at Stage 2.

This philosophy may re-introduce Option N6b. **As a route this option is rejected, however a tidal renewable energy scheme as a concept will be taken forward.**

9.3.3

On-line Corridor

Route **01**. (This option utilises the current A890 road alignment but replaces the carriageway with a new two-lane carriageway road throughout, with some rock face remodelling).

Whilst this option offers the least expensive on-line solution, there are significant technical difficulties envisaged. Rock cuts some 40m high would have to be established and whilst detailed analysis may reduce risks during construction and in the short term, there will always be a concern over the stability of the cut face long term, and instability issues of the hillside above the cut will remain.

In addition to geotechnical concerns, there will be significant construction issues requiring closure of the road and railway for what is likely to be unacceptable lengths of time. The management of the interface and dialogue with Network Rail will be challenging.

As a consequence **this route option is rejected.**

Route **02**. (This option utilises the current alignment similar to route 01 and includes a new two-lane carriageway and rock face remodelling, but adopts a 2km viaduct on the side of Lochcarron to by-pass the worst section of rock fall).

This route option has been assessed to be the most costly on-line option and has some visual landscape impacts. The main disadvantages are associated with constructing sub-structure within the shores of Loch Carron where deep water is expected and ground conditions are unknown. Although interface issues with the railway would be encountered, the main advantage of this option would be that, whilst there would be some road and railway closures required during construction of this solution, a significant amount of this option could be built off-line, and from the water side. This option could also be considered as a joint road-rail solution, subject to Network Rail agreement.

Further assessment to better assess these issues is required so as a consequence **this route will be taken forward.**

Route **03**. (This represents the on-line option 01 with an inland tunnel some 1.6km in length to bypass the worst section of rock fall).

Whilst the tunnel is an expensive option it does offer benefits with regard to buildability/rail interface issues and the environment and possibly least disruption to the existing road during construction. Further investigation on rock quality, alignment and appropriate tunnel standards will remove some risk from this option so as a consequence **this route will be taken forward.**

Route **04**. (The Do Minimum scenario)

This route option provides the baseline comparison to all other considered route alternatives, and therefore this option **will be taken forward.**

Route **05**. (This option incorporates a road / rail shared corridor, with a road alignment placed on the track bed on the vulnerable part of the route, some 2km in length).

This is a 'free thinking' option running the road and rail traffic on the same track, an extension of the mitigation strategy put in place after the rockfall in 2012. It requires open mindedness and co-operation from all affected parties. Examples have been found where similar systems operate abroad.

Because the option has the least cost for an on-line improvement **this route will be taken forward.**

Route **07**. (This on-line option involves the construction of an extended avalanche shelter on the vulnerable part of the route some 2km in length).

This solution appears to be a cost effective on-line option but has engineering difficulties with regard to excavation in rock, maintaining stability of the railway and maintaining traffic on road and railway to acceptable levels during construction. There are several configurations that could be adopted providing direct or indirect protection to road and railway long term and as a consequence **this route will be taken forward.**

Route **06**. (On-line O6 involves an upper loch crossing from Attadale to Kirkton with a 1.5 metre freeboard viaduct. The option is a link and can be aligned to any on-line or southern route option).

The main benefit of this option is that it bypasses the steep gradients (14%) encountered on the existing A890 at Maman Hill. However, it does this at a cost. Visually this option has raised negative comment and linked to option 01 it becomes one of the most costly on-line options. **As a consequence this option is rejected.**

However, efforts will be made during the Stage 2 assessment to improve gradients at Maman Hill by more local re-alignments.

9.3.4

Southern Corridor

Route **S4** (This route option takes an alignment through Glen Udalain, east of Loch Nam Breac Mora, through Attadale valley, and continues on-line from Attadale to Strathcarron Junction).

This option is the main southern 'Glen Udalain' route. It has been derived from historical work and offers the best route alignment through the valley to satisfy the design parameters set. As a greenfield route there are environmental issues to overcome. The route is the least expensive of all options considered and therefore performs well when compared to others with regard to scheme economics.

However, due to the relative remoteness of this route, some of the developed Transport Planning Objectives regarding connectivity are not satisfied. Options to consider community links are expected to overcome this. **As a consequence this route will be taken forward.**

Route **S1** (This route option leaves the existing A890 at Stromeferry and passes east of Loch Nam Breac Mora, through Attadale valley, and continues on-line from Attadale to Strathcarron Junction).

Route **S3** (This option passes from the A890 at Braeintra, east of Loch Nam Breac Mora, through Attadale valley, and becomes on-line from Attadale to Strathcarron Junction).

Initial assessments were undertaken to identify the most advantageous southern route and in addition to S4, potential alternative routes S1 and S3 were developed. The assessment has proved that S4 is the most advantageous route. However in solely progressing this route option it has been identified that the communities of Stromeferry and Achmore would be bypassed. To overcome this it is recommended that the best link is identified from a junction point on S4 to a point on the A890 between Achmore and Stromeferry. It is therefore recommended that **S1/S3 is taken forward as a community link** and investigated further during the Stage 2 work.

Route **S5b** (This route option takes an alignment through Glen Udalain, east of Loch Nam Breac Mora, before passing across Attadale valley, east of Maman Hill, before reverting to on-line from Strathcarron to Strathcarron Junction).

This route was developed from an earlier proposed route S5, to the rear of Attadale bypassing Maman Hill and joining the existing road at Achintee. Due to vertical alignment constraints this route was dismissed and route S5b emerged as an option to bypass the existing 14% gradients with a more adequate alternative alignment. Whilst this was achieved, (gradients reduced to 12%), the proposed new alignment is still difficult and would be strongly resisted on landscape grounds due to large sidelong cuts required on the northern side of Attadale Valley.

Other than the nominal reduction in gradient, this route does not offer benefits over option S4 and consequently **this option is rejected**.

However efforts will be made during the Stage 2 assessment to improve gradients at Maman Hill by more local re-alignment.

9.3.5 *Routes being taken forward to the Stage 2 Assessment*

Table 9.1 – Summary Table of Emerging Route Options

CORRIDOR	OPTION	DETAIL	DESCRIPTION
Northern Corridor			
	N6	Route off-line from A890, but on-line through Lochcarron Village	Route North N6 is an off-line route option originating at Achmore, considering (an eastern) Strome Narrows crossing and following the route of the existing minor road along the northern shore of Loch Carron, upgraded to agreed design standards. This route remains on-line through Lochcarron Village
	N6b	Route as above, considering a renewable energy option	This route follows the alignment, in principle, as route N6 (or alternatively N9). This route considers using the Narrows crossing to incorporate devices to generate renewable energy.

CORRIDOR	OPTION	DETAIL	DESCRIPTION
	N9	Route off-line from A890, bypass of Lochcarron Village	Route N9 is an additional route option proposed to provide a full bypass of Lochcarron Village. This route is an off-line route option considering a western bridge crossing of the Strome Narrows, and follows the route of the existing minor road along the northern shore of Loch Carron, upgraded to agreed design standards.
On-line Corridor			
	02	Viaduct	Route On-line O2 considers on-line improvement of the existing carriageway and a local 1.8km bypass of the rock fall area west of Cuddies' Point by means of a cantilevered structure along the shoreline.
	03	Tunnel	Route On-line O3 considers on-line improvement of the existing carriageway and a local 1.6km bypass of the rock fall area west of Cuddies' Point by means of an inland tunnel structure.
	04	Do-minimum	Route On-line O4 is the 'Do-Minimum' scenario, with no proposed improvements to the existing route. This option also includes considerations for suitable contingency measures during (future) road closures.
	05	Shared use	Route On-line O5 considers on-line improvement of the existing carriageway and a local 1.8km shared road / rail corridor west of Cuddies' Point .
	07	Avalanche Shelter	Route On-line O7 considers on-line improvement of the existing carriageway and a local 2.0km extended rock shelter west of Cuddies' Point.

CORRIDOR	OPTION	DETAIL	DESCRIPTION
Southern Corridor			
	S4	Glen Udalain	Route South S4 considers a principal southern off-line bypass route from the A890 through Glen Udalain and Attadale valley, and on-line improvements of the existing A890 carriageway from Attadale north. In addition, local link routes to the Stromeferry / Achmore area (S1/3) are also to be considered.
Strome Narrow Crossings			
	Any northern route option	Bridge	Considerations for the most suitable location for a bridge crossing of the Strome Narrows.
		Tunnel	Considerations for the most suitable location for a tunnel crossing of the Strome Narrows.

9.4 Public Consultation

Findings of the (draft) STAG Part 1 / DMRB Stage 1 report were presented at a Public Exhibition which was held on the 27th April 2013 at the Lochcarron Village Hall.

Feedback received after this exhibition is included in Appendix B of this document. In summary, the findings of this report were well received, reflected also in the unanimous acceptance and following endorsement of this Part 1 / Stage 1 appraisal by The Highland Council TECS Committee on the 16th May 2013.

Comments received have, where appropriate, been included into this report and minor amendments made prior to this final issue. All comments will be further considered during the Stage 2 appraisal work.

10 RECOMMENDATIONS FOR FURTHER WORK

10.1 Introduction

To satisfy the Client's brief for this commission, a STAG Part2 and DMRB Stage 2 appraisal will commence on the acceptance of this Stage 1 report by The Highland Council. This work will be carried out in accordance with the requirements of the above documents, however in order to advise the Stage 2 work the following work requires to be undertaken:

10.1.1 *Network Rail*

Further consultation discussions with Network Rail are required to establish:

- Confirmation of landownership between The Highland Council and Network Rail (and Attadale Estates) should be confirmed to allow options to be fully developed.
- Confirmation of any formal agreements between The Highland Council and Network Rail with regard to liability of inspection and maintenance of rock slopes, considering situation of off line solution being selected.
- Confirmation if dual running is a practical option.
- Confirm if Network Rail would agree to local re-alignment of the line to consider combined road and rail solutions as per proposed options O2 and O7.
- Confirmation of cost of reconfiguring and maintaining existing road corridor should off-line option emerge as preferred solution.
- Confirmation of Network Rail historical spend and expected future capital and maintenance spend.

10.1.2 *Environmental*

Materials Assessment is not considered in the Stage 1 report.

As all of the route corridors considered are likely to have project costs of greater than £300,000, it is proposed that at least a 'simple' level of assessment should be undertaken at the next stage of the project (DMRB Stage 2) when options are more refined.

The Stage 1 assessment should be updated taking into account any updates to the Development Plan and other policy documents. A search should be carried out for any major approved planning applications within the area.

It is recommended that field investigations are undertaken to determine the extent, make-up and quality of terrestrial and aquatic habitats, with a particular focus on designated sites which could be affected by the proposed scheme options.

Additionally should the corridor options which impact upon designated sites be progressed to Stage 2, it is recommended that consultations with SNH are undertaken. In-addition, non-statutory organisations should also be consulted as potential sources of protected species and habitat information.

Due to the poor historical data available for this area, it is also recommended that the appropriate protected species surveys are carried out, as a means of determining their presence and current status within the study area.

A more detailed landscape and visual assessment should be undertaken, describing each route option and considering the potential significance of its effects on the landscape.

10.1.3 *Renewable Energy*

A tidal energy scheme may be a viable option to generate revenue to offset scheme costs. Insufficient data is currently available to assess the full or any opportunity in this regard. As the Stage 2 work progresses, it is recommended that discussions are progressed with power generating companies with regards to potential for grid connections and costs and technical data as set out in section 5.11 of this report is gathered.

10.1.4 *Traffic & Economics*

Traffic and scheme economics are reported in chapter 7 of this report. In some areas the data is sparse. Traffic surveys and wider economic surveys should be completed and sensitivity tests undertaken to confirm outcomes reported here are still valid and decisions made are appropriate.

10.1.5 *Buildability*

The cost of the various route options considered is critical and heavily influences the choice of the preferred route selection, in particular considering any on-line option.

As well as construction costs, buildability is a major issue. On this project there are two main components affecting scheme costs. Firstly how the complexities of the project will influence costs, particularly potentially working in a very restricted works corridor / Network Rail issues / deep loch crossings etc. and secondly, how long the construction period is likely to be considering potential road closures during the works.

It is therefore recommended that further, more detailed discussions are held with civil engineering contractors to better inform the conclusion to the Stage 2 work.

Appendix A
Drawings
(separate folio)

Appendix B
Copy of Feedback received after Public Exhibition
27 April 2013

Our ref: PCS/126086
Your ref: None

Garry Smith
The Highland Council
Inverness

If telephoning ask for:

~~Cosmin Haslam~~

13 May 2013

By email only to: stromeferryoptions@highland.gov.uk

Dear Mr Smith

**Pre-planning enquiry
Options Appraisal Draft STAG Report
Stromeferry, Ross-shire**

Thank you for consulting SEPA on the above proposal by way of the council's emails of 30 April and 3 May 2013. These included a link to the draft STAG Stage 1 Report.

We provide our comments on the document below. We ask that these are taken into consideration in the finalisation of the Report or be considered in the next Part 2 Appraisal. We would be happy to meet with you and discuss in more detail the scope of the further assessment works in relation to our interests. We will especially be interested in ensuring that potential impacts on the water environment (including groundwater and groundwater dependant terrestrial ecosystems), on peatland and in relation to flood risk are adequately considered.

1. Section 3.2.14: We suggest that our *About us* page of our website - www.sepa.org.uk/about_us.aspx - provides a more balanced explanation of our roles and responsibilities and much of the text could be adapted and used here.
2. Section 5.7: The second paragraph of this section states that the majority of the area is considered as "non-aquifer" due to their low permeability. We highlight that this is incorrect as even low productivity aquifers may be of greater localised potential e.g. bedrock with high fractures or till with gravelly lenses.

In relation to hydrogeology we welcome the references later on for need for intrusive site investigation. Once the ground investigation is complete the conceptual hydrogeological model and any associated risk assessment should be reviewed and revised as appropriate.

We presume that a number of options will require cuttings of a significant depth. Where these cutting are likely to be below the groundwater table you will need to estimate the dewatering required and carry out a water feature survey. Further advice on is available from WAT-RM-11 section 2.1.3; Table 1 (available from www.sepa.org.uk/water/water_regulation/guidance/abstraction_and_impoundment.aspx) but when it gets to that stage we can provide more detailed advice on this aspect.

3. Section 5.9: As the assessments go forward we suggest that it would be helpful if it was clearer which existing structures will be retained and for those that are, whether they will require any form of alternation. Any proposed short-listed routes should demonstrate how



Chairman
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Chief Executive
James Curran

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they have minimised watercourse crossings and other potential impacts on the water environment. Watercourses will need to be surveyed and proposals for environmentally sensitive crossings outlined. This should include, for example, ensuring any crossing structures have set-back abutments. As you will be aware any engineering works in the fresh water environment will require authorisation from SEPA under the Water Environment (Controlled Activities) (Scotland) Regulations (CAR). Higher standards of crossing design will result in lower levels of authorisation and we would encourage you to take this approach.

4. Section 5.10: We note that the Western Tunnel option includes grouting as a potential mitigation measure. We highlight that groundwater flow directions may be disrupted when grouting is used. If this proposal is brought forward then we would expect a detailed risk assessment to be undertaken on sensitive groundwater receptors at sites where grouting is envisaged.
5. Section 6.3: In relation to evaluation of ecological features, recommendations for further work, avoidance of impacts and mitigation measures then we highlight the need to give appropriate consideration to groundwater dependant terrestrial ecosystems, types of wetlands specifically protected by the Water Framework Directive. We provide information on how to identify and protect these types of habitats in our earlier scoping response.
6. Section 6.5: In relation to flood risk we generally concur with the conclusions reached and the justifications provided for the preferred options. However, we would highlight that any crossings for watercourses will need to be appropriately designed and consideration needs to be given to all parts of the route being designed and constructed to remain operational during extreme flood events. Generally speaking, crossings should be designed so that they do not interfere with any flood, up to and including the estimated 1 in 200 year event (0.5% annual probability), plus an appropriate freeboard allowance. In line with Scottish Planning Policy "Watercourses should not be culverted as part of a new development unless there is no practical alternative, and existing culverts should be opened whenever possible." Please note that these requirements also apply to small watercourses (i.e. those which are not incorporated into the indicative flood map - those with catchment areas < 3 km²).
7. Section 6.8: We note that most of the soils for each of the options are peaty in nature. We suggest that the next stage of assessment needs to identify if there are any areas of deep peat in the preferred corridors and final routes be designed to avoid such areas. There are important waste management implications of measures to deal with surplus peat as set out within our [Regulatory Position Statement - Developments on Peat](#). Landscaping with surplus peat (or soil) may not be of ecological benefit and consequently a waste management exemption may not apply. In addition we consider disposal of significant depth of peat as being landfilled waste, and this again may not be consentable under our regulatory regimes. Information should be provided on the measures proposed for reuse of peat.
8. Other comments: For your information the marine non-native species *Styela clava* has been found in inner Loch Carron and its presence has resulted in a downgrade from High to Good status for the alien species parameters in the latest River Basin Management Plan classification. This invasive species has a high ability to spread. As a result any options which come forward which include working in the marine environment need to include suitable mitigation measures to prevent spreading. In particular to reduce the risk of introducing marine non-native species attached to marine plant and specialised equipment transported to the area before the constructional phase of the project begins and before

any maintenance works commence during the operation of the new development.
Guidance that may be drawn upon includes:

- Scottish Government Code of Practice on non-natives (www.scotland.gov.uk/Topics/Environment/Wildlife-Habitats/InvasiveSpecies/legislation/CodeofPracticeonNonNativeSpecies)
- The alien invasive species and the oil and gas industry guidance produced by the oil and gas industry (www.ogp.org.uk/pubs/436.pdf).
- SNH web-based advice on Marine non-native species (www.snh.gov.uk/land-and-sea/managing-coasts-and-sea/marine-nonnatives/)
- Marine Non-Native guidance from the GreenBlue (recreation advice) (www.thegreenblue.org.uk/clubs_and_training_centres/antifoul_and_invasive_species/best_practice_invasive_species.aspx).

Should you wish to discuss this consultation please do not hesitate to contact me on 01349 860359 or planning.dingwall@sepa.org.uk.

Yours sincerely

Susan Haslam
Senior Planning Officer
Planning Service

Ecopy: Garry.Smith@highland.gov.uk

14 people responded in writing during the public meeting and made comment on the routes which were part of the display materials. (14 people represent about 10% of all of those who attended the public consultation).

Note: there were no comments relating to any routes which were sifted out in the Stage 1 report, the only comments received were on one or other of the nine draft stage 2 routes.

Summary of comments included:-

- Favoured a bridge crossing
- Kishorn should be the main priority therefore favoured a bridge and link across the narrows and a bypass of Lochcarron. Link to the east should be improved
- Bridge with a bypass of Lochcarron, the existing route is not safe.
- Online solution favoured making the most of what we have O2 or O3
- Online solution favoured making the most of what we have O2 or O3
- Bridge over the narrows with a bypass of Lochcarron
- Route through Lochcarron is not favoured (N6)
- Protection of railway is essential, joint rail/road bridge across Strome narrows should be considered. Glen Udalain is not a favoured option.
- Options which take additional traffic through Lochcarron should be discounted.
- The presentation had too much information and should be simplified.
- N6 (through Lochcarron) should not be considered.
- The study area does not cover all of the road users using the Stromeferry Bypass
- Glen Udalain is the only option that should be considered.
- N6 is unsuitable and should not be considered. Glen Udalain is the most suitable solution.

Summary

- 5 favoured a bridge
- 2 favoured Glen Udalain
- 1 against Glen Udalain
- 7 said a bypass of Lochcarron was essential
- 2 favoured an on-line solution

**Public Consultation - Stromeferry Appraisal, Stage 1
Comments – April 2013**

NAME & ADDRESS (optional)
<p>Achmone resident. (Stromeferry)</p>
COMMENTS
<p>Preferred option 02 or 03, preferably 07 most direct route for residents, to Dingwall, whether shopping or agricultural business ie a bid to or Auction market. The North route is our main artery to the East coast, make it as viable as possible hence the above suggestion of the route we already have.</p>

For further information or comment contact:-

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You can fill in the comment slip above and return it to the above address.



**Public Consultation - Stromeferry Appraisal, Stage 1
Comments – April 2013**

NAME & ADDRESS (optional)
<i>Achnone resident.</i>
COMMENTS
<i>make the most of <u>what is there</u> Railway line would have to be maintained, therefore additional on-going costs if there was a preferred option. ie option 2 or 3</i>

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**Public Consultation - Strome ferry Appraisal, Stage 1
Comments – April 2013**

NAME & ADDRESS (optional)
COMMENTS
<p>Can I suggest that such a lot of information would be easier to digest at leisure, with a copy of the Summary sheet.</p> <p>Thank you</p>

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**Public Consultation - Stromeferry Appraisal, Stage 1
Comments – April 2013**

NAME & ADDRESS (optional)
COMMENTS
EXCELLENT WORK ON ALL THE OPTIONS. OPTION N9 IS MY FAVOURITE. IT DIVERTS TRAFFIC (ESPECIALLY HGV) AWAY FROM LOCHARRON VILLAGE BUT STILL ALLOWS DIRECT ACCESS TO IT FOR TOURISTS ETC. COULD REVITALISE LOCHARRON FROM A VISITOR PERSPECTIVE. IT ALSO OPENS UP LAND NORTH OF THE VILLAGE FOR FUTURE HOUSING DEVELOPMENT.

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**Public Consultation - Stromeferry Appraisal, Stage 1
Comments – April 2013**

NAME & ADDRESS (optional)
COMMENTS
<p>Many thanks for producing today's information. Much appreciated!</p> <p>My personal views are as follows:</p> <ul style="list-style-type: none"> • We should aim for the gold standard solution. Something that in 50 years time people will look at and say – "wow! that innovative and far seeing. Didn't they do well!" NOT to rate cost as the main factor. Sadly too many folk here today are considering cost as the main driver. • I think that some form of crossing at Stromeferry is the

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pto

best way to proceed. The benefits of this are: much reduced travel time for children attending High School. Quicker connection to hospital services in Broadford (? single hosp there in future?) Potential quicker/shorter/safer connection to Kishorn Port.

A bridge seems the obvious solution. A garage would have the added benefit of protection of the low-lying houses from flooding in the event of tidal rise. (The houses at Dalachladidh flood on H.W. Springs at a lately storm event once every 5 years.)

• Overall I hope that Highland Council will look to the long term future of these communities. Closer/faster links to Plockton/Kyle/Broadford might help to improve our mobility. Presently our population is ageing enormously. ~~Over 40%~~^{44%} are aged over 60.

Good luck with the decision making!

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**Public Consultation - Stromeferry Appraisal, Stage 1
Comments – April 2013**

NAME & ADDRESS (optional)

COMMENTS
<p>As the owner of the above property I would like to comment on the proposals put forward recently. I live on the corner of the main road at the tightest bend in the village and the current amount of cars and, especially, heavy lorry traffic is already a cause for concern. I would therefore be most unwilling to see adoption of any North route passing through the village. For locals and visitors the nearness of the loch and its lochside path is much enjoyed, adding to the amenity of the village. The access to this pathway and to the drying "greens" on the beach for those several houses with no real back garden would be very difficult with a much busier road through the village.</p>

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P.T.O.

As it is, the parking available along Main Street is barely adequate and on-street parking outside shops (which is inevitable) makes transit along the street often subject to problems when vans/lorries are driving through the village.

I would therefore strongly resist this option and believe, for all sorts of reasons, that a route along the southern route should be foremost in planning.



**Public Consultation - Stromeferry Appraisal, Stage 1
Comments – April 2013**

NAME & ADDRESS (optional)
COMMENTS
<p>N16 is the worst possible option the difficulty of improving the road through the village of Lochcarron, Slumbury a shame doesn't bear thinking about</p>

For further information or comment contact:-

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**Public Consultation - Strome ferry Appraisal, Stage 1
Comments – April 2013**

NAME & ADDRESS (optional)
COMMENTS
<p>Would be interested to know origin + destinations of other road users (I commute to Portree daily) I think the 'catchment area' of the road is probably wider than we think.</p>

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Dear Sir/Madam,

Following on from the above meeting, here is my response to your request for feedback regarding the By-Pass and the 9 possible routes which are on the table for consideration. The points I would like to make, firstly regarding the Northern Corridor, are as follows:-

- Many people in this area derive their livelihoods either partially or wholly from tourism. It's the one local industry which can always be relied upon to provide earnings. Those earnings inevitably fluctuate year to year but nevertheless they are always there and the reason is quite simply that we have a "product" which people will always want: magnificent scenery, peace and tranquillity, escape from the rat-race, a feeling of excitement, even, that one has travelled to a remote place far removed from the big towns and cities of the rest of the UK.
- For those involved in the tourism industry, "personal" and "business" considerations are directly intertwined because local residents and holiday visitors alike are looking for essentially the same things – as outlined above.
- Unlike tourism which is a fairly reliable constant, attempts to "manufacture" other types of industry locally tend to be of a more transient nature as the build-up and subsequent decline of the Kishorn Yard some 30 or 40 years ago amply demonstrated. Therefore, whilst it is undoubtedly beneficial to encourage the creation of jobs in industries other than tourism, at the same time it is very important that the "artificial" short-term industries are not allowed to impinge adversely upon the "natural" permanent industry.
- It follows, therefore, that any replacement for the Strome Ferry By-Pass, which will inevitably carry commercial traffic of all kinds as well as tourism traffic, must be routed and constructed in such a way as to cause the absolute minimum of collateral damage to the natural environment and the outstanding natural beauty of the area as well as to the very pleasant ambience, appearance and relative tranquillity of Lochcarron village. This applies not only during the comparatively short term period of actual construction but also, much more importantly, in the long term once the new road is complete and in use.
- Consequently, a bridge or barrage crossing at Strome Narrows would definitely fall foul of the need to minimise damage to the environment and the natural beauty of the area. Such a major man-made construction would totally destroy the natural beauty of that place. No matter how elegant the bridge might be, there is no way that it can ever be an improvement on what Nature has already provided. As regards a barrage or causeway, that would simply be an eyesore.
- I am also extremely concerned that two suggestions are for on-line routes passing through the Main Street of Lochcarron. There seems to be a popular misconception that if you increase traffic volumes through a town or village, it automatically leads to increased business. My own personal experience from living for a number of years in Bewdley in Worcestershire which used to be severely blighted by heavy traffic passing through would suggest that, in fact, the exact opposite is the case. An increase in traffic passing along the Main Street would be an unmitigated disaster, leading to substantially increased traffic noise, pollution and danger, as well as acting as a physical barrier between the village and the foreshore. Access to the foreshore is an amenity enjoyed by both visitors and local residents alike and, during the season, you can see many visitors, either those staying in the village or those simply "passing through", sitting looking at the view and enjoying the peace and tranquillity whilst their children and dogs can play in complete safety on the beach. These are all people who are likely to frequent the local shops, pub, restaurants, filling stations, etc. Destroy that idyll and what is likely to happen? They will all go elsewhere, won't they? As a result, not only will the local shopkeepers lose out but also the B & Bs, guest houses, hotel, restaurants, holiday cottages, etc.
- We're told that Kishorn Port, if developed, may ultimately employ up to 2,000 people. Just imagine the substantial increase in traffic movements which will inevitably result from that, much of it from people wanting to travel east/west back and forth between Inverness and Kishorn, and a fair proportion of it, inevitably, HGVs. In this day and age when there are towns and villages all over the UK screaming out for by-passes to be built to alleviate their traffic problems, to have all that passing through the main part of our village would be sheer irresponsibility and total madness!
- The inevitable result of a major increase in traffic volumes along the Main Street of Lochcarron would be a fall in house prices – and house prices in the UK are known to have a direct link to economic activity.

For the above reasons I believe that the Northern Corridor options should be discarded completely apart from possibly implementing part of the N9 route between Kirkton and the A896 Kishorn Hill to the north of Lochcarron. This would certainly be needed if the Kishorn Port development comes to fruition in order to keep through traffic travelling to and from the Kishorn facility out of Lochcarron Village.

As regards the On-Line Corridor, the main disadvantages would seem to be cost coupled with the difficulty of avoiding major and prolonged traffic disruption whilst works were in progress. The only one of these options not to suffer such problems would be the "Do-Minimum" option – and that simply doesn't address the problem we are all trying to resolve. One of the other suggested options is to share the railway line with the road but: is it really wise – or practical – to have trains and road vehicles sharing the same space over a protracted length and on a permanent basis? The potential for accidents doesn't bear thinking about! To avoid the risk of such accidents, the road would have to be closed for lengthy periods when trains were due, thus causing considerable disruption to traffic flow.

We are therefore left with the South Corridor which, to my mind, is the only viable solution. It's not 100% ideal because it is a high-level route with potential issues as regards adverse weather in winter. However, that problem already exists as regards the existing road once the top is reached above Auchtertyre and does not seem to cause undue disruption. The advantages of the Southern Corridor are:-

- It is far more affordable than any of the other options by a very substantial margin.
- The construction of the road can be undertaken with no disruption whatsoever to traffic flow whilst the work is ongoing.
- It will keep traffic noise and pollution well away from villages and other communities.
- Although it will inevitably spoil the tract of landscape through which it will pass, it will nevertheless represent considerably less of an eyesore than a water crossing at Strome, for example.
- It will cause the least amount of annoyance and disruption to the smallest number of people, both during construction, and also afterwards once in use.

Consequently, the South Corridor would be my preferred option, preferably in conjunction with the section of the N9 route between Kirkton and the Kishorn Hill, as outlined above. If this latter were included, there should be prominent brown Tourist Information signs at either end of this by-pass of Lochcarron village, listing the various amenities available in the village, thus ensuring that local businesses are not disadvantaged.

One of the criticisms levelled by several people to whom I have spoken about this matter is that the chosen route will inevitably be the least expensive one as much as to say that the least expensive has no place in the equation. I feel those people are rather missing the point. Of course cost is a factor – a very important one. Why? Because it will almost certainly make the difference between having a viable replacement for the existing road or having nothing at all. For goodness' sake, let's choose an option which is viable and affordable **and then get on with it!** We need that new road **now**, not in 20 years time!

I hope this is useful.

Yours faithfully,

Comments on the URS Strome ferry Appraisal

Having studied the parts of the report pertaining to the 03 tunnel option there are several observations I would like to make.

Many of the regulations regarding tunnels apply to trunkroads, A890 isn't one of them, and as it is not part of the Trans European network, isn't covered by the EU directive 2004/54/EC. This said it leaves room for manoeuvre within the design process even within the regulations that do apply, namely BD78/99.

Upon first viewing the tunnel design I was immediately struck by its apparent "over-design" and in particular the need for the concrete separation wall. According to the manual BD78/99 in "pedestrians and animals would not be permitted in the tunnel". In section 5.10.3 a separate structural cell is needed within the tunnel. Nowhere in the report could I find figures for actual pedestrian usage. Are there any figures available? I also note there are no core paths or Rights of Way in existence in the area of the 03 tunnel. However, the residents of Ardenarff, when asked, said that 20 pedestrians a year would be an over-estimation and that animals have never been seen to be taken along the road.

Why would pedestrians want to use a tunnel when access to the old road would need to be maintained in order to access the railway line? A dedicated pathway could be established separate obviating the need for any pedestrian provision within the tunnel. This would presumably greatly reduce the cost of tunnel fabrication.

Under BD78/99 the 03 tunnel is classed as category B and also it doesn't mention the need for escape doors and ventilation but does however make mention of ventilation for smoke control. In fact in the documents covering design of tunnels of this type, only emergency is required. It is unclear to me from the drawings if the ventilation system shown is for permanent ventilation use or for emergency use. Here again a cost saving would appear possible.

With regard to emergency evacuation of the tunnel, if an accident did occur, resulting in a fire, the number of people involved would be minimal due to the very nature of the AADT flow (less than 600 each way a day). Would they immediately leave the scene? More realistically they would stay and use the extinguishers in place as required by BD78/99.

It would be more appropriate to exit along the roadway they had come in order to warn following traffic of the hazard. These vehicles could then turn around or reverse in order to leave the tunnel. I don't imagine drivers abandoning their vehicles and then allowing following traffic to head towards the incident unawares. So here again, another reason for not needing the concrete separation wall and passageway.

Page 110 describes the separate pedestrian access/escape route with a separate ventilation system "at a higher airpressure and firedoors at 100m intervals" (15 in total) firedoors. Is this provision absolutely necessary due to the low traffic flow, the possible non-existence of pedestrians and the low risk of major fire?

Page 111 describes the methodology of construction and simply put it is; drill and blast, followed by rock bolting and sprayed concrete, with or without steel mesh or fibre reinforcement. Is the need for a further lining absolutely necessary if it is also to be sprayed on, or the placement of pre-fabricated cast linings? With the latter in place, close inspection of the rockface isn't possible and any rockfalling goes undetected.

The recent roadtunnel collapse in Japan last year was a failure of the concrete lining while the underlying rockface remained intact.

Timings and costings.

I am very much aware of the high financial outlay required and the lack of funding available to HC. It appears that many if not all the options will take several years to totally complete and adequately join them to the current road network. The 03 tunnel option is the ideal choice for staged development as and when funding is available.

Indications I gleaned from representatives at the recent open day in Lochcarron were that initial finances were in place to make a start but then it would be some time before the next allocation of funds would be available. I suggest that the 03 tunnel could be advanced in the following way:

- a. portal construction
- b. drilling and blasting through
- c. rock bolted and shotcreted
- d. lined, if appropriate
- e. carriageway laid down with service requirements
- f. connection to current road system.

Each of these stages could be delayed until finances were to hand and following stage c, the tunnel could be inspected regularly over time and the necessity for a further lining assessed.

It would appear that there is considerable opportunity to reduce the overall cost of construction of option 03, to stage its progress in line with funding availability.

It also avoids the protracted and costly legal procedures of all the other options.



**Public Consultation - Stromeferry Appraisal, Stage 1
Comments – April 2013**

NAME & ADDRESS (optional)
COMMENTS
<p>South Option from Attadale to Gubhann Udalinn Valley</p> <p>FOR ME</p> <hr/>

For further information or comment contact:-

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**Public Consultation - Stromeferry Appraisal, Stage 1
Comments – April 2013**

NAME & ADDRESS (optional)

COMMENTS

My family members have used the By-Pass almost every day since the 1970's. I feel that it is quite shocking that a safe alternative has not yet been provided.

The bridge with a bypass of Lochcarron is the only sensible option and the enormous surpluses collected from road users every year in the Highlands will pay for this scheme at least 3 times over.

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**Public Consultation - Stromeferry Appraisal, Stage 1
Comments – April 2013**

NAME & ADDRESS (optional)
COMMENTS
<p>① The development of N6 (lower of two northern routes) would have a negative impact on Leckcarron village & local residents along the route.</p> <p>② During construction of the Ninian platform at Kishorn, heavy traffic caused considerable disruption in the village, which was only relieved by bringing in construction materials by sea.</p>

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**Public Consultation - Stromeferry Appraisal, Stage 1
Comments – April 2013**

NAME & ADDRESS (optional)
COMMENTS
<p>Prefered Option STROME BRIDGE plus BYPASS ROAD OF LOCHCARROON VILLAGE with slip roads to village.</p> <p>This would also have advantage of Reducing Articulated, Pet homes (10 per day) not using main street in Lochcarroon and any other developments at Kishorn/Jocks.</p> <p>Please let me know if I can help with Goats and Common Grazing in this area.</p>

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Direct communication with
Brussels should speed up
emergency funding and
reduce the amount time for
school bus on A890.

**Public Consultation - Stromeferry Appraisal, Stage 1
Comments – April 2013**

NAME & ADDRESS (optional)

COMMENTS

railway:

A solution which at least protects the railway is essential. Both are vital links funded by public money, so a solution which addresses both together is more efficient. But preferably enhance the railway.

My ideal would be a bridge carrying both road + rail together, bring a rail connection to the largest settlement between Plaxha + Dingwall, and improving the current very slow line speed - I don't know if heights + gradients allow this.

Lock carrow ~~could~~ may not cope with ~~extra~~ increased through road traffic - it is awkward even now. So a by-pass makes sense.

The Gleann Udaquin option is madness - as high as Mam Patagan, with a steep 10km stretch facing north is asking for trouble.

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**Public Consultation - Stromeferry Appraisal, Stage 1
Comments – April 2013**

NAME & ADDRESS (optional)
COMMENTS
<p>My principle concern is the proposed route N6; and, in particular, with that part going through the actual village of Lochcarron. Were this route to be adopted I would challenge it very strongly, my reasons being both subjective and also, I hope, objective:</p> <ol style="list-style-type: none">1. My house is only 4m from the kerb of the present carriageway and the combination of noise, vibration, speed and physical bulk of passing HGVs is even now highly intrusive; N6 would not improve things.2. Even now, loading and unloading my car is problematic for other road users, but I have no alternative but to park outside my front door; N6 would only make matters worse.3. The value of my house has already dropped following the installation of a sewage pumping station opposite; a further adverse effect would result from N6.4. The impact of hugely increased traffic volume on the main street in general can only be detrimental, bringing increased noise, alarm, pollution and hazard.5. Lochcarron's principle attraction is its proximity to the shore line, giving villagers and visitors alike a sense of connection with the water; N6 and the attendant road-widening would sever that.6. Economic benefit, I believe, would be marginal as all additional traffic would be going to/coming from Kyle &/or Skye whose greater facilities are likely to be more attractive.7. But even before that, the village would be blighted both economically and physically by the necessary roadworks and demolition entailed, to an even greater extent than was the case while the new drainage system was being installed. <p>Surely the south corridor option is by far the most elegant way forward?</p>

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Garry Smith

From: Robbie Bain
Sent: 01 May 2013 10:12
To: Colin Howell; Garry Smith; Sam MacNaughton
Subject: FW: Stromeferry Bypass - barrage route option

Please see below, for info.

Robbie

Robert K. Bain

Ward Manager (Wester Ross, Strathpeffer & Lochalsh)
Chief Executive's Service,
The Highland Council,
Council Offices,
High Street,
Dingwall, IV15 9QN.

Tel: (01349) 868626

Pat, I see from the online papers that you attended the Stakeholders Workshop for the Stromeferry Options Appraisal.

I am amazed and astonished that the option of building a road on a barrage/causeway across the Strome Narrows, linked to a tidal energy scheme, has persisted as an option to be further considered in the next stage of the appraisal process. While I can understand why there might be political pressure not to simply dismiss this option, I would have thought the long list of environmental disbenefits of such a scheme, not least to the flameshell reef in the narrows and to one of the best dive sites in Scotland, would have been more than enough to discount the practicality of such an option.

In particular, can I ask you whether SEPA would be content for the Strome More Fish Farm to remain open, given the extent to which waste flushing from the fishfarm would inevitably be reduced once the current was impeded by any system of tidal turbines and a tide-retarding barrage?

I have always thought that the narrows might well suit a run-of-stream turbine system, like that proposed for Kylesheha, but I cannot believe that a barrage here would be environmentally acceptable. That does not, of course, discount the option of a bridge across the narrows, although I believe the option of a road route between Stromeferry and North Strome persists as an option largely because it could be associated with a barrage scheme. Given that I currently have two houses close to the jetty at North Strome, you will understand why I am concerned that this fanciful option is still being considered.

The Highland Council is nearing the end of Stage 1 of the options appraisal process for Stromeferry Bypass. A draft report of the findings will be presented at a public meeting in Lochcarron Village Hall on Saturday 27 April between 1 – 5 pm. Representatives of The Highland Council and its consultant - URS Infrastructure and Environment UK Ltd will be available at the public meeting to discuss the findings which will be taken to the next stage of the appraisal process. The findings of the draft report will be presented to the Council's TECS Committee in May. The report will identify the options which have been considered and the routes which will be taken forward to the next stage where detailed evaluation will be undertaken to identify the preferred option.

Stage 1 has included input from representatives of the local community and regulatory bodies through a series of stakeholder workshops held in Strathcarron and Inverness.

The options appraisal is being prepared using the Scottish Transport Appraisal Guidance (STAG) and the Design Manual for Roads and Bridges (DMRB). Refer to the External Links section on the right hand panel for the STAG and DMRB website pages.

Stakeholder Groups

Two stakeholder groups have been formed to generate and evaluate all options.

Regulatory Stakeholders	Economic Stakeholders
Transport Scotland Highlands & Islands Enterprise Network Rail First Scotrail Scottish Natural Heritage Scottish Environmental Protection Agency Historic Scotland Marine Scotland THC Planning Authority	THC Planning Authority Highlands & Islands Enterprise Lochcarron Community Council Stromeferry & Achmore Community Council Plockton Community Council Applecross Community Council Lochcarron And District Business Association Councillor Biz Campbell Councillor Audrey Sinclair Robbie Bain Forest Enterprise

If you wish to contribute ideas or opinions you can do so through the community councils, local members or directly to The Highland Council on stromeferryoptions@highland.gov.uk

Photo galleries:



Stromeferryoptions
 @
 highland.gov.uk.

Dear Sirs,

I would like to give you, Seaforth Highlander's view on possible vision before he passed away 2 yrs. ago, was born and brought up at Ardaneaskan and attended Plockton School: taught by Tom Mackenzie. This route was the most sensible and should have been done years ago. to open up all routes. Lochcarron, Achmore, & Applecross. Hope you choose most sensible.

Figure 1.1

Location of Study Area

Key



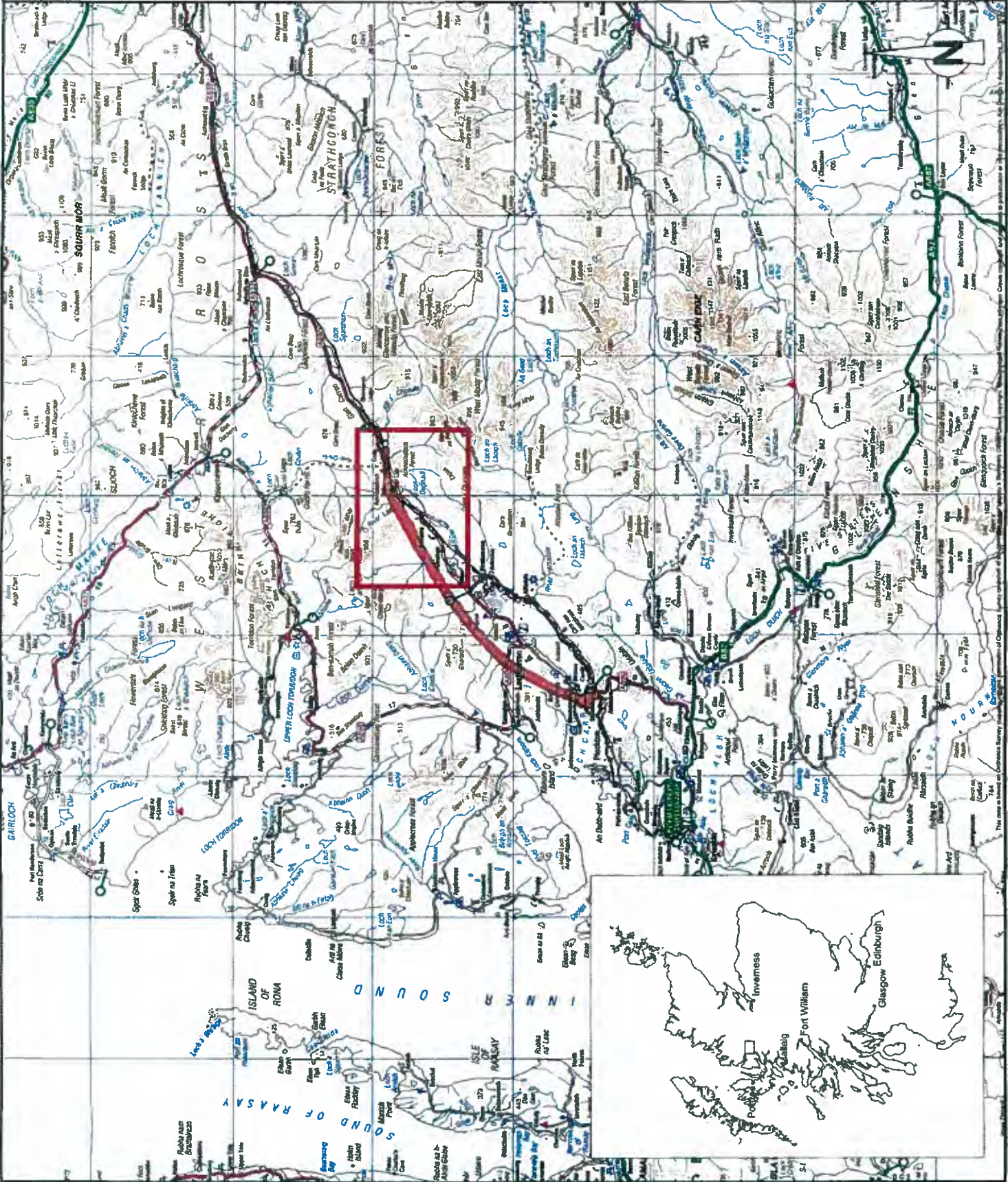
RECEIVED

- 1 MAY 2013



BALNACRA TO LAIR
ST. KOMIE
Location Plan

Project No. 10001271.1
Scale 1:250,000
Date 10/01/2013





**Public Consultation - Strome ferry Appraisal, Stage 1
Comments – April 2013**

NAME & ADDRESS (optional)
COMMENTS
No option that involves move traffic through the village.

For further information or comment contact:-

Garry Smith
The Highland Council
Transport Environmental and Community Services
Project Design Unit
Drummuie
Golspie
Sutherland
KW10 6TA

Tel No.: 01408 635313

E-mail: garry.smith@highland.gov.uk or stromeferryoptions@highland.gov.uk

You can fill in the comment slip above and return it to the above address.



**Public Consultation - Stromeferry Appraisal, Stage 1
Comments – April 2013**

NAME & ADDRESS (optional)
COMMENTS
<p>SINGLE LANE TUNNEL WITH PASSING PLACES, DOES NOT SEEM TO HAVE HAD ANY SERIOUS CONSIDERATION. TRAFFIC FIGURES, EVEN TWENTY YEARS INTO FUTURE, DOES NOT JUSTIFY A DOUBLE TRACK TUNNEL THE SIZE OF THAT AT DARTFORD! WHY CAN'T ENGINEERS, ETC, FIT THE JOB TO THE NEED - WE ARE NO LONGER IN THE VICTORIAN ERA OF OVER-ENGINEERING!</p> <p>TUNNEL FROM AINSMORE TO AINSMARFF IS MOST LOGICAL AND LEAST DISTURBING TO EXISTING ROUTE, ENVIRONMENT, ETC.</p> <p>My concern is that nowhere did I see any emphasis placed on the fact that the future of this community, namely our young people, are at risk everyday as they travel to & from Plockton High School!! Surely this should have been noted as a reason for an urgent solution?</p>

For further information or comment contact:-

Garry Smith
The Highland Council
Transport Environmental and Community Services
Project Design Unit
Drummuie
Golspie
Sutherland
KW10 6TA

Tel No.: 01408 635313

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You can fill in the comment slip above and return it to the above address.

Garry Smith

Dear Garry Smith,

The option I think is best, cheapest and has with the least visual impact is the Glen Udalain. It is an area of land that has little use by anyone at the moment, any other options would cause huge disruption to many.

Others will say you need to do a renewable option with it, well with hydro energy going to be done in the area, the cable infrastructure will be in place

for you to do something like this <http://www.innowattech.co.il/slnRoads.aspx> . It is road energy.

Yours faithfully

Dear Sir

I am really worried about the adverse effects, that the bridge option making traffic pass through Lochcarron, will have on the village.

There would be a huge increase in traffic, noise and pollution all of which making the main street a pretty horrible place to have a house....which we do.

The village main street would become very dangerous for children and elderly people.

It will also drive many holiday makers away from the village thereby removing a vital source of income from the locals.

This option would cause such heartache to the whole population of Lochcarron whereas the option over Attadale for example would have a minimal impact on very few people.

Kind Regards

**Public Consultation - Stromeferry Appraisal, Stage 1
Comments – April 2013**

NAME & ADDRESS (optional)
COMMENTS
<p>① The exhibition/consultation has been very valuable indeed.</p> <p>② The National requirement I would have thought is for good communication by road from Inverness to the West Coast.</p> <p>③ The development at Kishorn is something which should weigh heavily with planners.</p> <p>④ I support the western bridge option with a new road to Kishorn and an upgraded road from</p>

Kishorn to the existing road by passing Lochadnan and on to Achrasheen.

For further information or comment contact:-

Garry Smith
The Highland Council
Transport Environmental and Community Services
Project Design Unit
Drummuie
Golspie
Sutherland
KW10 6TA

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Wednesday, 01 May 2013

is a well-established tourist destination and passing trade business. Our options only concern the routes on the east/south side of the loch; all other routes would by-pass us completely. Any bridge, barrage or tunnel across the Strome narrows presents a huge financial and social upheaval with new infrastructure displacing housing and spoiling the whole nature of Lochcarron village and the approaches from North Strome. A by-pass around Lochcarron is inconceivable in the present monetary situation.

Of the routes on the east/south side of the loch only one presents the least amount of disruption to the existing route and that is Glen Udalain. The unfortunate facts about this route are the height and exposure to the north, and also the environmental impact on virgin land. This leaves the tunnel option as an elegant solution with the least environmental impact and added visitor interest in the future. The fractured rock is taken care of with a tunnel lining I am told by the engineer. The tunnel would be our preferred option with the Glen Udalain route a close second.

Carolyn Smith,
The Highland Council
Project Design Unit,
TEC Services,
Drummuie,
Golspie,
Sutherland KW10 6TA

10th May 2013

Dear Carolyn Smith,

Further to your e-mail dated 3rd May, and a subsequent constructive conversation with Colin Howell earlier this week, please regard this letter as the Lochcarron and District Business Association's comment on the Draft **STAG Part 1 DMRB Stage 1 Stromeferry Appraisal Report**. Colin requested that copies of this letter be sent to him, and to Garry Smith, and a copy is also being sent to URS's Anke Mensinger.

Firstly, although LaDBA has over 90 members from Lochcarron and district, we do not represent all of the business community and the views of non-members should also be taken into consideration.

We have circulated our Membership, seeking their comments, following the public meeting/exhibition in Lochcarron on 27th April.

Members may have responded separately and individually in their own right, but their comments as members of LaDBA can be summarised (as briefly as possible) as follows:

General Comment on the Process

Whilst it is appreciated that an enormous amount of work by URS was put into producing the Draft Stage 1 Report as a whole, it is a pity that it (and particularly the final Nine Route Options) could not have been presented in a more concise form (possibly by means of a spoken, illustrated, presentation), more easily understood by the general public.

Comment on the nine Options selected to be taken forward

No LaDBA member has commented that the wrong options have been chosen, or that the wrong options have been rejected.

Specific Comments on the assessments and proposals

A phasing of the investment in the northern corridor routes is suggested, and promoted as an ADVANTAGE of the northern route options. LaDBA members strongly disagree, and regard this as dangerously impracticable and likely to cause massive inconvenience, uncertainty and damage to the business community. How can a new bridge be built (diverting a very large number of extra vehicles a day through Lochcarron) without *simultaneously* providing for a road upgrade or new by-pass for the village? The present road through Lochcarron is completely inadequate to handle the extra volume of traffic, and there would be enormous negative impacts on public safety, traffic speeds, congestion and the residential/business environment. You only have to drive the 2 miles, from one end of Lochcarron to the other, to realise this and most businesses and residents in the village would be directly adversely

affected. PHASING THE CONSTRUCTION OF THE NORTHERN CORRIDOR ROUTES WOULD BE COMPLETELY UNACCEPTABLE.

Many businesses in this area derive their livelihoods from tourism, both directly and indirectly. Tourists come here for various reasons, but the magnificent scenery, and the peace and tranquillity rank very highly. A bridge, or barrage, at the Strome Narrows would permanently damage the perceived natural beauty and feeling of remoteness in that area of Loch Carron - with a great negative impact on the tourism on which this area so relies. Although a bridge with a Lochcarron by-pass might increase the number of tourists *passing through* the area, they would simply stay in holiday accommodation elsewhere.

Salmon farming, and salmon fishing on the River Carron, both bring money into this area – and, in the case of salmon farming, this input is extremely important in terms of employment. Incorporating devices to generate renewable energy at the Strome Narrows could have a negative impact on the salmon industry and would be unacceptable if this was the case.

THERE IS A FEELING THAT ALL THE NORTH CORRIDOR OPTIONS, INCLUDING A BRIDGE OR BARAGE, SHOULD PROBABLY BE REJECTED NOW.

Of the Online Options, a tunnel is much preferred (although the 1.6 km version (OC/03) *could* be of insufficient length to ensure a lasting solution to the rock-fall problem). If a tunnel is chosen, thought and planning must be given to ensure that the existing A890 remains open to traffic for the great majority of the time. Although it is appreciated that it could be necessary to close the through road for certain short periods during the construction of a tunnel, this must be for the bare minimum of time - with closure to take place during

the middle of the night. Lochcarron resident Mr. Jan Overmeer has submitted a long and detailed report on the technicalities and construction of a tunnel, to Highland Council and URS. He makes some very good points and LaDBA would urge that this report is taken seriously and investigated thoroughly by URS.

Of the Southern Corridor Options, only one remains i.e. the Glen Udalain Route (S4), with the possible links S1/3. The unfortunate facts about this route are its height and exposure to the north, and the impact on the environment and the Attadale estate. The same comments about the A890 remaining open throughout, as detailed above for the Tunnel Option, also apply.

On balance, the Lochcarron and District Business Association feel that the only serious Options available are:

OC/03 (tunnel)

and

S4, with desirable links S1/3 (Glen Udalain).

It could be argued that, rather than devote further considerable time and money resources to investigating the other remaining Options, all resources should now be concentrated on the two serious options above, with a view to having the whole project completed in the shortest possible time, for the best value in terms of cost and impact. However, it is appreciated that due process has to be seen to have been followed.

I would like to add a personal comment, at this stage. There is a truly shocking degree of apathy and cynicism towards the whole Stromeferry By-Pass project, within the Lochcarron and district community. I can only assume that this has been born by experience, gained over the years since the last major rock-fall on the A890. I would urge Highland Council, and URS, to continue to take every opportunity to reassure the community that “it’s different this time”, and that one of the Options will indeed be carried forward and implemented as soon as is practical.

Having taken part in the three Stakeholder Workshops, and attended all public meetings, I have personally been impressed with the process and have confidence that the right answer will emerge at the end - and be implemented. We recognise the huge amount of work being done by Highland Council and URS on this project, and offer our continued support.

Yours sincerely,

Alastair Baxter

Chairman

Lochcarron and District Business Association (LaDBA)

Dear Ms Anke Menzinger,

Unfortunately I was unable to make the open meeting on Saturday due to family commitments.

I have read all the council and TEC reports online and I thought I have to contribute my thoughts on the plans outlined.

I am a business owner in Lochcarron and have been for 13 years, we rely on tourism to survive. Back in the summer of 2012 we were affected by the road closure in the winter, as people had not booked holidays in Lochcarron because we could not tell them if the road would be open or not. This caused many people to holiday elsewhere as they were not prepared to travel the 150 mile detour if the road was still not open. During the works the village became deserted by 6pm as the road closed at 7pm forcing people to return home. A lot of the coach companies that used to use the A890 had to re-route while the road was closed and have not returned to this route, and I am sure the rest would also leave if you started closing roads and building tunnels.

My concerns for the future, if the suggested work is carried out on the A890, it would cause the same problems as mentioned above stopping people from choosing this area to holiday.

A bridge with traffic diverted through the village could be good for business, but the road is narrow and this would probably lead to yellow lines, which would again be disastrous for the businesses of Lochcarron.

If there was a bypass around the village this would kill all business's, Kyleakin on Skye is a prime example of this.

So in my view, the road over glen udalain is the only option. The work could be carried out without causing any disruption to the village, all businesses, and both north and south, would keep their passing trade. The new view created by this road may even encourage new visitors to the area, as the views over Lochcarron have to be one of the best in Scotland whilst building tunnels and longer shelters would take this away.

As to needing to upgrade the bridges at the Strath, there is no need. There would be the same volume of traffic using the high road as using the low road. And as for keeping the road open in winter, hiring a full time man and gritter for 3 months of the year would still be a cheaper option than maintaining what we already have.

Yours Sincerely