Access to Argyll & Bute (A83) Strategic Environmental Assessment & Preliminary Engineering Services
Route Corridor Preliminary Assessment
Route Corridor 1 – Glen Croe

Route Corridor Details	
Route Corridor Option	Route Corridor 1 - Glen Croe
Route Corridor Description	The Glen Croe route corridor generally follows the existing A83 Trunk Road, starting from a point approximately 0.2km south-east of the junction between the A83 Trunk Road and the Old Military Road. It typically follows the route of the existing A83 Trunk Road as it rises through Glen Croe and then past Loch Restil. The route corridor ends where the A83 Trunk Road passes by the south-west end of Glen Kinglas. The route corridor is approximately 6.0 kilometres long.
Rationale for Route Corridor	The Glen Croe route corridor was identified in the 'A83 Trunk Road Route Study, Part A - A83 Rest and Be Thankful' Report, published in 2013. This route corridor currently provides an access route into Argyll and Bute and within the corridor there are options available to improve the existing road or provide off-line routes to address the landslide risk.
Geographic Context	The route corridor lies within the Argyll & Bute region, which comprises solely of the entirety of the Argyll & Bute local authority area. The route corridor is located a straight line distance of approximately 32 - 35 miles from the city of Glasgow. The route corridor is located within the western extremities of The Loch Lomond and The Trossachs National Park (LLTNP) and there are environmentally designated sites both within and in proximity of the route corridor.
Social Context	Given the geographically remote nature of large areas of Argyll & Bute, reducing the duration of journey times and improving journey time reliability for both strategic and local traffic has the potential to impact positively on deprivation levels, both geographic and economic. The Scottish Index of Multiple Deprivation (SIMD) identifies concentrations of deprived areas across Scotland. Argyll & Bute consists of 125 data zones, with 10 data zones (8%) identified as being amongst the 15% most overall deprived data zones in Scotland. These are located in the region's 5 main towns - Helensburgh, Oban, Dunoon, Campbeltown and Rothesay. The Geographic Access to Services considers deprivation in terms of drive times and public transport times to a selection of basic services such as schools, health services and retail centres. Forty-eight (38%) of Argyll and Bute's data zones are within the 15% most 'access deprived' data zones in Scotland – most of which are located outside the main towns. The region's population has been in decline for over a decade, against a backdrop of a population increase at the national level.

	Data from NHS Highland estimates that there are 26,000 referrals for Argyll & Bute patients each year, of which 44% are to hospitals within the region and 56% are to hospitals in the NHS Greater Glasgow and Clyde area. Disruption on the transport network can lead to missed appointments and have an adverse impact on patients' health and wellbeing. The region has twenty-three inhabited islands, more than any other local authority in Scotland, with seventeen percent of the regions' population inhabiting the islands. The A83 Trunk Road provides accessibility to services on the mainland via Kennacraig port, where ferry services depart to Islay with onward connections to Jura and Collonsay.
Economic Context	The A83 Trunk Road is one of only two east-west strategic trunk road network connections between Argyll & Bute and the central belt. The lack of a reliable strategic route linking Argyll & Bute with the rest of the country is understood to be constraining economic growth in the region. When the road connection via the A83 Trunk Road is severed, the impact on residents, visitors and businesses is severe due to the lack of alternative transport options. The A83 Trunk Road is known to carry goods of significant value to both the regional and national economy (including whisky and seafood). The A83 Trunk Road is also a key route for tourism, and a proposal to transform the Crinan Canal into a major tourism attraction in Mid-Argyll, could benefit significantly from improved resilience and / or access to the region. Anecdotal evidence suggests closures and restrictions cost the local economy £50k-£60k per day in addition to longer-term impacts on business investment within the region and, subsequently, the region's job market. Due to a large proportion of the region's geographic remoteness from the major economic centres of the central belt, only a few large scale, high skill industries are located within the area. The region's economy tends to be heavily influenced by sectors with lower growth, such as agriculture and public services. Given the focus on economic recovery post-COVID-19, enhanced connectivity for the Argyll & Bute region could contribute towards increasing inward investment and job opportunities for local communities. Improved and reliable access for Bute and Cowal and Mid-Argyll, Kintyre and Islay has the potential to have a transformational effect on local / regional economies.

Transport Planning Objectives		
Objective		Performance against planning objective
TPO1	Resilience – reduce the impact of disruption for travel to, from and between key towns within Argyll & Bute, and for communities accessed via the strategic road network.	This route corridor offers enhanced resilience for both strategic A83 Trunk Road traffic accessing Cowal & Bute and Mid-Argyll, Kintyre and the Islands, and for local traffic travelling to / from and between key towns and communities within Argyll & Bute. The impact of landslide induced closures at the main landslide risk area on the A83 Trunk Road, at the Rest and be Thankful, is effectively bypassed by this route corridor. Communities located within close proximity to Glen Croe, including Arrochar, Inveraray and Lochgoilhead, which are subject to the longest diversion routes during closure of the A83 Trunk Road at the Rest and Be Thankful, are likely to benefit significantly from the enhanced resilience provided by this route corridor. In providing an alternative route to the existing A83 Trunk Road, enhanced resilience will be provided for large parts of Argyll & Bute, offering a more reliable connection between the region, the central belt and beyond.
TPO2	Safety – positively contribute towards the Scottish Government's Vision Zero road safety target by reducing accidents on the road network and their severity.	Minor reductions in transport related casualties could, potentially, be realised as a result of reductions in vehicle kilometres associated with fewer landslide induced road closures and the associated long diversion routes for strategic traffic travelling to and from Argyll & Bute.
TPO3	Economy – reduce geographic and economic inequalities within Argyll & Bute through improved connectivity and resilience.	The route corridor offers potential enhancements in resilience provided as a result of mitigating landslide induced closures, improving access to key domestic and international markets.
TPO4	Sustainable travel – encourage sustainable travel to, from and within Argyll & Bute through facilitating bus, active travel and sustainable travel choices.	It is considered unlikely that this route corridor would have any significant impact on public transport usage, active travel, reducing transport poverty or reducing reliance on private cars. This is primarily due to the nature of the route corridor and the areas within which it is located. Investment in a new route within the region would however provide an opportunity to include enhanced active travel provision as part of the design.

TPO5	Environment – Protect the environment, including the benefits local communities and visitors obtain from the natural environment, by enhancing natural capital assets and ecosystem service provision through delivery of sustainable transport infrastructure. An example of ecosystem service provision is improving water quality regulation.	The range and scale of potential environmental effects identified for this route corridor is such that it is likely that a preferred scheme can be developed with appropriate mitigation to support ecosystem service provision, although the various route options available within the route corridor results in the potential for some adverse effects.

Existing Route Corridor Conditions		
Engineering	Route Corridor Length	The route corridor is approximately 6.0km long.
	Existing Roads	The route corridor includes the A83 Trunk Road. The route corridor includes Local Authority operated / maintained 'A' / 'B' / 'C' roads as follows: B828 only.
	Existing Accesses	A class road: 0 B class road: 1 C class road: 0 Unclassified road/direct access: 6 Relative to the other route corridors, the low number of accesses noted above is attributed to the short route corridor length and rural setting of the route corridor. All local accesses from the A83 in the area around Glen Croe would be retained should this route corridor be taken forward; however, the additional work to retain these accesses has not been included in the Preliminary Assessment of this route corridor.

	Topography and Land Use	Ground levels along the route corridor centre generally rise from the south east extents of the corridor, which is approximately 90m above ordnance datum, to a height of approximately 265m above ordnance datum, near the Rest and Be Thankful car park. Ground levels to the north east of the route corridor rise steeply towards the summits of The Cobbler and Beinn Luibhean and ground levels to the south west of the corridor fall steeply towards the valley floor which is elevated between approximately 100m and 130m above ordnance datum. On the south west side of Glen Croe, ground levels rise steeply again towards the summit of Coire Culach which is elevated approximately 660m above ordnance datum. As the route corridor passes Loch Restil, ground levels along the corridor centre gradually fall, down to a height of approximately 180m above ordnance datum where the corridor ends at Glen Kinglas. On the west side of the route corridor here, ground levels rise steeply towards the summit of Bein an Lochain which is elevated in excess of 900m above ordnance datum. On the east side of the route corridor, ground levels also rise steeply towards the summit of Beinn Luibhean which is elevated approximately 860m above ordnance datum. Land use within the route corridor is generally agricultural with commercial interests in the form of coniferous plantation woodland on the surrounding hillsides. including parts of The Brack, Ben Dornich on the south-western side and The Cobbler to the north-east. There are six properties within the Glen Croe route corridor which consist of two residential properties, one situated at the northern end of the corridor on the valley floor below the Rest and Be Thankful car park and the other to the south adjacent to the A83 Trunk Road, south of the bridge crossing the Croe Water. Along the valley floor there are four outbuildings/ livestock sheds which are located next to the Old Military Road.
	Geology / Geomorphology	The route corridor is characterised by the U-shaped valley of Glen Croe. Numerous channels of varying size provide drainage pathways from the upper slopes down steep hillsides into the valley; notable is the channel accommodating the Croe Water on the northeast side of Upper Glen Croe. This drains Coire Croe which in turn accommodates surface water run-off from the surrounding hills on three of its sides, namely Beinn Luibhean, Beinn Ime, Beinn Narnain and The Cobbler. The corridor extends north of High Glencroe to the top of the Rest and Be Thankful and beyond Loch Restil, following the Bealach an Easain Duibh between Beinn an Lochain and Beinn Luibhean, and ends where this runs into Glen Kinglas, another U-shaped valley, at Butterbridge. The superficial deposits beneath Route Corridor 1 are mapped as comprising primarily glacial Till – Diamicton. Local to the lower parts of the valleys between Beinn an Lochain and Ben Donich, and Beinn an Lochain and Beinn

		Luibhean (i.e. the alignment of the B828 and A83 Trunk Road west and north of the Rest and Be Thankful car park respectively), the superficial deposits recorded are Hummocky (Moundy) Glacial Deposits comprising diamicton, sand and gravel. The deposits along the floor of Glen Croe are recorded either as Alluvium (clay, silt, sand, gravel) or River Terrace Deposits (gravel, sand, silt, clay). These deposits underlie and are likely to form the banks of the Croe Water. It is considered likely that these deposits are of the same origin and may contain soft or loose deposits. Alluvium is also recorded in the vicinity of Kinglas Water in low-lying areas in the north-eastern extents of the corridor, and immediately north, west and south of Loch Restil. A thin ribbon of Alluvium is identified between the B828 and the forestry track to the west of High Glencroe. The middle and upper slopes of Beinn an Lochain and Ben Donich, and the upper slopes of The Cobbler and Beinn Luibhean have no deposits recorded, indicative of thin or absent superficial deposits. There are also no superficial deposits recorded in High Glencroe south of the junction of the A83 Trunk Road, Old Military Road and B828. Between the south of the corridor and Ardgartan, superficial deposits are not recorded on the upper slopes of the Cobbler and are also largely absent from the slopes of The Brack and Cruach Fhiarach. The remainder of this area is underlain by Glacial Till – Diamicton, with River Terrace Deposits recorded following the Croe Water to its mouth and underlying the village of Ardgartan. No artificial ground is mapped within the route corridor; however, made ground is anticipated within the corridor in association with existing development. The proposed route corridor is underlain by Dalradian metamorphic rocks of the Southern Highland Group, comprising predominantly psammites, pelites, semipelites, schists and metawackes of the Beinn Bheula Schist Formation. The strata typically dip between 15 and 40 degrees northwest. This formation also underlies the area between the southern extent of the corridor and Ardgartan. An extensive intrusion of pyroxene-mica diorite belonging to the South of Scotland Granitic Suite is recorded between Beinn Luibhean and The Cobbler. This underlies the A83 Trunk Road north of where it crosses Croe Water but does not extend further west. Localised smaller areas of other igneous rocks associated with the same suite are recorded both within and at the extents of the diorite, underlying the A83 Trunk Road where it crosses Croe Water. Numerous igneous dykes are recorded in the west of the route corridor; orientations are variable but are mostly northwest to southeast or northeast to southwest.

		Faulting is recorded in the western section of the corridor; orientations are variable, although many are orientated northeast to southwest, with a few crossing the existing A83 Trunk Road close to High Glencroe. Historic ground investigation has been undertaken within the route corridor. A number of boreholes with records available are recorded to have been undertaken at High Glencroe on both the A83 Trunk Road and the Old Military Road, identifying rockhead approximately 7.0 m below the A83 Trunk Road and 2.8 m to 15.9 m below the Old Military Road. A group of boreholes is also recorded at the location of the Rest and Be Thankful viewpoint and car park, for which records are not currently available. References: • British Geological Survey, Geological Survey of Scotland, 1:63,360/1:50,000 geological map series. Accessed via BGS maps portal https://www.bgs.ac.uk/information-hub/bgs-maps-portal/, October to December 2020. • British Geological Survey, Onshore GeoIndex, https://mapapps2.bgs.ac.uk/geoindex/home.html, accessed October to December 2020. Datasets used include National Landslide Database (NLD), Mass Movement Deposits (1:50,000 scale), Superficial Deposits (1:50,000 scale), Bedrock Geology (1:50,000 scale), Linear Features (1:50,000 scale), Borehole Records. • British Geological Survey, The BGS Lexicon of Named Rock Units, https://webapps.bgs.ac.uk/lexicon/home.cfm. Accessed October to December 2020.
	Hydrology and Drainage	This is covered under 'Water Environment' in the 'Environment' part of this table
	Structures	The following structures are noted within this route corridor. There are a number of existing structures within the route corridor. These include frequent culverts and a number of small structures across minor watercourses on both the A83 Trunk Road and the Old Military Road. These watercourses typically flow into either the Croe Water or Loch Restil depending on their location. There are also a number of other structures associated with the ongoing construction of landslide mitigation measures which include debris flow fences and small lengths of retaining walls to support with existing A83 Trunk Road.

Environment Considerations	Biodiversity, Fauna and Flora	The route corridor passes through Beinn an Lochain Site of Special Scientific Interest (SSSI). Glen Etive and Glen Fyne Special Protection Area (SPA) is directly north of the corridor. There is no Ancient Woodland Inventory (AWI) within the corridor.
	Population and Human Health	The route corridor is rural in nature and there are no population centres within the corridor. There are <10 residential receptors within the route corridor. A LLTNP Authority core path traverses the west of Croe Water, through the centre of the route corridor and continues west at the Rest and Be Thankful. There are Corbetts and Munros popular with hill-walkers within the corridor, including The Cobbler. Currently, accidents or incidents (e.g. roadworks, landslips, flooding) occurring on any part of the A83 Trunk Road in Argyll and Bute can effectively cut off parts of the region for a period, significantly impacting residents, business and visitors due to the significant length of alternative routes and the travel times involved.
	Water Environment	The route corridor follows the Croe Water, a river water body classified under the Water Framework Directive. The corridor also another river waterbody classified under the Water Framework Directive, Kinglas Water and a coastal waterbody Loch Long, which is located downstream of the corridor and is classified under WFD. The route corridor also contains between approximately 30-40 minor watercourses. SEPA Flood Maps (SEPA, 2020) indicates that the route corridor may be at fluvial flood risk from Croe Water during a medium likelihood event (0.5% Annual Exceedance Probability (200-year) event). There are no designated sites protected for water environment interests within the route corridor. There are no Shellfish Water Protected Areas, Active Aquaculture Sites, CAR licenced fish farms and Classified Shellfish Harvesting Areas within the vicinity of the route corridor. The route corridor passes through one surface water Drinking Water Protected Area. No bathing waters are in the vicinity of the route corridor.

	Soils	Soil type within the route corridor study area is peaty podzols adjacent to the existing A83 Trunk Road with montane soils on the higher slopes. The route corridor study area transects peat identified as Class 3 (not priority peatland habitat with carbon rich soils and some areas of deep peat) and Class 5 (no peatland habitat recorded, soils are carbon rich and deep peat) on the Carbon and Peatland 2016 Map. Given the combination of soils, climactic conditions and topography, the Land Capability for Agriculture (LCA) Class within the route corridor is Class 6.1. There is a Geological Conservation Review (GCR) site (unnotified) on The Cobbler which falls partly within the route corridor. The Land Capability for Forestry (LCF) class is F4 (land with moderate flexibility for the growth and management of tree crops) and there are existing stands of commercial forestry on the south western slopes of the valley and adjacent to the existing A83 Trunk Road on the lower eastern slopes. The northern extents of the corridor is identified in the Argyll & Bute Council Woodland Forestry Strategy as including areas of existing woodland, potential woodland (considerable potential to accommodate future expansion of a range of woodland types, but where at least one 'sensitivity' exists) and sensitive areas (areas where the nature or combination of sensitivities restricts the scope to accommodate further woodland expansion or removal).
	Air Quality	The route corridor is rural in nature with no population centres in close proximity. There are <10 residential receptors within the corridor. There are no Air Quality Management Areas (AQMAs) in the route corridor or in the Argyll and Bute council area and current and past annual assessments suggest that it will be very unlikely to be necessary to declare any AQMAs in the future based on current air quality objectives (Argyll & Bute Air Quality Annual Progress Report, 2020). Air quality in Argyll and Bute is considered to be generally very good and complies with all the air quality objectives for Scotland (Argyll and Bute Air Quality Annual Progress Report, 2020). Modelling results for sources of nitrogen dioxide and fine particulates in the Argyll and Bute Air Quality Annual Progress Report (APR) illustrate that background concentrations are very low, with the traffic considered as the main potential source of pollution in the absence of industry hotspots in the region. The Argyll and Bute APR did not identify any areas where air quality objectives may be under threat and where specific actions would be required to improve air quality.

	Climatic Factors	The baseline for climatic factors is not considered to differ between the 11 route corridor options. However, due to the northern location of the route corridor it considered to be more vulnerable to the impacts of climate change, such as landslides or flooding, due to the steep topography in the area. The route corridor is within a location which may be at risk of fluvial flooding from the watercourse adjacent to the carriageway, as stated in the 'Water Environment' section. This section of the A83 Trunk Road is affected by precautionary and forced closures due to the topography of the land and slope instability during periods of prolonged rainfall. There are significant quantities of forested land in the route corridor. As described in the 'Soils' section, there are several areas of peatland, and some forested area in the northern both with high carbon sink value.
	Material Assets	The route corridor contains a variety of natural material assets. As indicated in the Climatic Factors section, there are significant areas of forestry within the route corridor and as listed in the Soils section, there are peat soils present. The route corridor is located in a rural environment with few built material assets. The existing A83 is the main piece of infrastructure within the route corridor. The region contains several pieces of energy infrastructure, but none fall within the route corridor. There is a car park at the Rest and Be Thankful Viewpoint where the B828 meets the A83. The closest waste disposal facilities to the route corridor are approximately 25km to the south in Helensburgh.
	Cultural Heritage	There is one Category C Listed Building within the 2km route corridor and one Category B listed building 30m beyond the north-east boundary of the study area. The A83 Trunk Road follows the line of the Old Military Road, an undesignated cultural heritage resource.
	Landscape and Visual Amenity	The route corridor is situated within the LLTNP boundary. There are no National Scenic Areas (NSAs) or Wild Land Areas within the corridor. This route corridor is located within the Highland Summits Landscape Character Type (LCT), Upland Glens – Loch Lomond & the Trossachs LCT and Steep Ridges and Mountains LCT and would traverse the forested glen slopes.

		There are existing roads (A83 Trunk Road and Old Military Road) present within Glen Croe and there is an existing car park at Rest and Be Thankful viewpoint at the northern end of this route option. This section of the existing A83 Trunk Road is part of the Argyll Coastal Route. Land cover within the route corridor comprises mainly blocks of coniferous forestry with small areas of open grassland, moorland, rocky outcrops and numerous watercourses. Almost the entire western section of the route corridor is located within the Argyll Forest Park.
Traffic		Annual average daily traffic (AADT) flow levels on the A83 Trunk Road in 2019 were 2,300 vpd (vehicles per day) on the length between Campbeltown and Tarbert and 4,400 vpd west of Tarbet, with the HGV percentage between 5% and 9%. At the Rest and Be Thankful, A83 Trunk Road traffic volumes were in the order of 4,500 vpd in 2019, with the HGV percentage around 9%, suggesting that, on average, around 400 HGVs pass through Glen Croe, on a daily basis. Additionally, around 17% of average daily traffic in 2019, on the A83 within Glen Croe (approximately 800 vehicles) was a light goods vehicle. Approximately 100 buses and coaches per day passed through Glen Croe via the A83 Trunk Road, in 2019. Travel routes to/from, and within, Argyll & Bute are highly seasonal, with greater volumes of people movements within the region during the summer months (predominantly as a result of increased visitor levels). Due to the geography and topography of the region, seasonal fluctuations in traffic volumes and the presence of slow-moving vehicles, travel times via the A83 Trunk Road between the key main towns/cities can be long relative to the distances involved and unreliable.

Implementability		
Engineering	Topography and Alignment Considerations	Between the start of the route corridor and the Rest and Be Thankful car park the corridor centreline follows the existing A83 Trunk Road which is currently compliant for vertical alignment geometry (which forms part of road design standards), although issues with maintenance have been raised. Generally, the horizontal alignment geometry (which forms part of road design standards) is to standard; however, a bend just east of the carpark is identified as non-compliant. To improve this would require considerable engineering input such as widening into the glen using a structure, or alternatively a cutting/tunnel through to Loch Restil.

		Along the valley floor compliance with road design standards is achievable. However, the rapid ascent at the northern end proves to be challenging without a significant engineered solution such as a direct tunnel through to the opposite side of the saddle on the north or a viaduct to provide the required elevation. It would be possible to achieve the rise in levels through switchbacks , although this is considered a less desirable alignment, and to minimise the footprint and impact on the slopes, the horizontal alignment geometry would likely need to be sub-standard. Watercourses also need to be considered along the valley floor. On the western side, the topography is particularly steep. While it is likely that a compliant vertical alignment geometry can be achieved over the full length, the horizontal alignment geometry may be sub-standard if the profile of the hill is hugged by the route due to the undulating surface. To improve on this, engineering solutions such as steep cuttings, retaining walls and structures are likely required. North of the saddle, the topography continues to constrain the route corridor as well as the footprint of Loch Restil taking up much of the flat land in the valley floor. A route would likely follow the existing A83 Trunk Road due to limited opportunities for improvement due to the topography.
	Geology / Geomorphology Considerations	The history of landslide events within Glen Croe and particularly on the approach to the Rest and Be Thankful has been well publicised, and it is evident that the frequency of these events has increased in recent years. There have been many instances of landslides impacting on the existing A83 Trunk Road alignment as well as the Old Military Road, and any route alignment within this route corridor must carefully consider the landslide hazard and incorporate robust measures to protect the route. This should be considered as part of detailed assessment should this route corridor be retained. The National Landslide Database records landslides to have occurred within the route corridor. It should be noted that additional landslides may have occurred which are not recorded within the database, particularly on the northeast-facing slopes of Glen Croe. The database records landslides to have occurred at the following locations: • At High Glencroe (south of the Rest and Be Thankful) where twenty-one landslides have been recorded with sources upslope of the A83 Trunk Road on the southwest-facing slopes of Beinn Luibhean. Those with recorded dates span from 2008-2020. No British Geological Survey (BGS) mass movement deposits are mapped in association with these records. • Elsewhere within Glen Croe between the Rest and Be Thankful and Ardgartan. One landslide was recorded

		within the corridor in 2020, originating in an area of forestry approximately 40 m east of the A83 Trunk Road on the lower slopes of the Cobbler. Two further landslides are recorded within Lower Glen Croe towards Ardgartan in the vicinity of Creagdhu (dated 1913) and Larachpark (dated 2014). • Two landslides close to the summit of Beinn an Lochain. One is recorded on the eastern flank, and one on the western flank with associated mass movement deposits mapped (any future landslide at the same location on the western side of the peak is considered unlikely to affect any road alignment within the route corridor due to the slope aspect and topography). • On the middle and upper parts of the northeast-facing slopes of Ben Donich. These locations are outside route the corridor but any future landslide at the same location could potentially affect the western part of the corridor due to the slope aspect and topography. The BGS has mapped associated mass movement deposits which encroach into the southwest of the corridor. An assessment of other potential issues including potentially difficult ground conditions is summarised below: • Potential for compressible ground associated with deposits of alluvium and river terrace deposits with possible implications for road alignment. These deposits may require excavation and replacement with fill or suitable improvement treatment. • Faults recorded in the vicinity of the Rest and Be Thankful car park with associated potential for highly fractured rock, resulting in potential rock face instability in cuttings, potential groundwater problems and potential issues for tunnelling. • Shallow rockhead and variability in rock strength which may cause difficulties for shallow excavations and any tunnelled sections.
	Hydrology and Drainage Considerations	This is covered under 'Water Environment' in the 'Environment' part of this table.
	Structures Considerations	A range of structural solutions are likely to be required for options within the route corridor and would vary depending on the location of a route within the corridor. Constructability, operation and maintenance in relation to structures is discussed elsewhere within the document. • An online debris flow shelter would be necessary to protect the road from landslides for a route along the existing A83 Trunk Road alignment.

		• An elevated multi-span viaduct parallel and downslope of the existing A83 Trunk Road as part of a realignment of the A83 Trunk Road. • An elevated multi-span viaduct rising from a realignment of the A83 Trunk Road along the valley floor, rising to a tunnel passing under the valley head to a point on the A83 Trunk Road downslope from Loch Restil. • An elevated multi-span viaduct on the west side of the Glen as part of a realignment of the A83 Trunk Road. • A tunnel from the A83 Trunk Road north of the Croe Water passing under the valley hillside on the east connecting back into to the A83 Trunk Road north of Loch Restil. Key issues associated with the likely structures are: <u>Debris Flow Shelter</u> • DFS are heavily engineered structures that form canopies over a section of road prone to debris flows and are usually constructed from reinforced concrete allowing landslides to slide over the top of the structure without disrupting traffic flow. • The nature of the landslides in Glen Croe is such that the DFS must be able to deflect a mixture of large boulder rock falls, gravel and slurry and water flows. • The DFS option would generally maintain the horizontal and vertical alignment of the existing A83 Trunk Road. Opportunities to improve the existing alignment would therefore be limited. • A conceptual structural arrangement for a DFS capable of design development is conceivable, although the engineering challenge is considerable; one which enables online construction; which seeks to minimise the lengths of time during which the A83 Trunk Road is closed with a temporary diversion onto the OMR and allows for transit of traffic through the Works during construction. • The structural form of a DFS resembles a tunnel. The extent to which this form, particularly the ventilation and emergency access from the side openings would have to comply with design regulations applying to tunnels requires examination. • There is the opportunity though for an ‘open’ structure on the downslope side of the DFS to provide light, assist ventilation and a degree of landscape view for vehicle occupants. The ‘open’ side might also obviate the special requirements which would normally be required for a tunnel, i.e. ventilation, fire suppression systems, etc. and might allow a means of emergency escape in the event of fire or breakdown although it is not intended that vehicles will be permitted to stop in the shelter for other than emergency purposes. • It is envisaged that the arch form of a DFS would accommodate all watercourses and the slip planes for potential debris flows across the top of the structure with debris being deposited on the down slope by means of a cantilevered canopy. The normal flow of watercourses would be carried by pre-formed channels

		traversing the shell structure overhead and dropping to downslope cascades. • Excessive slurry type events have the potential to 'back up' on the downslope verge on the external surfaces adjacent to the columns of the DFS. A continuous slurry trap channel would be provided on the downslope (outer) side inside the shelter to prevent slurry accumulation backflowing onto the carriageway. A solid barrier in the shelter would be set back from the carriageway to both provide this channel and to provide vehicular collision protection and working protection to maintenance operatives or pedestrians/cyclists in the shelter. • In time, land erosion and landslips would tend to govern the overall appearance of the landform on the up and downslopes next to the DFS. The formed backfilled volume on the upslope side would however tend to reduce the relief of the existing slopes within the vicinity which may result locally at the watercourse channels in an unnatural topography. Normally this might be masked by judicious placing of vegetation, but this might in time be negated by landslips. <u>Viaducts</u> • The viaduct structure would be set at a sufficient level to permit debris flow events to pass below the A83 Trunk Road. There is no specific guidance on clearances to permit potential landslide, debris flow or rock-fall events to pass beneath structures; however, design development of any viaduct structure would have to consider factors such as, but not necessarily limited to, the magnitude of any event, source locations and pathways, relative position and spacing of piers and any deflector structures. • It would generally follow a similar profile to the existing road with an average climbing gradient of 5%. • Existing road culverts may be removed, and natural gullies opened up. Whist the existing road construction might be broken up, advantage could be taken of the excavated 'terrace' to deploy arrestor or deflector structures to protect the piers of the viaduct. • Single leaf piers will be preferable for a sidelong viaduct to maximise the space below the deck. The leaf piers would be positioned as remotely as possible from known debris channels bearing in mind the requirement for an acceptable aesthetic. Nevertheless, their robust form will be designed to resist what debris bears against them. In addition to the piers' structural resilience, upslope deflectors will also be required. • The deck level would be set to match the level of the existing carriageway to limit the visual broadening of the linear feature against the hillside. • The deck would maintain the appearance of a linear feature by having a constant deck thickness and, commensurate with the spacing necessary to avoid existing debris runoff channels, spans of between 40 and 70 metres are likely to be required.

		<u>Tunnels</u> • A number of different tunnel options could facilitate a practical road alignment through the route corridor. In the first instance, two options have been considered similar to the purple option from the previous 2012 study. • Both options enter a tunnel on the lower slopes of the west side of Beinn Luibhean below the existing A83 Trunk Road. In each case the tunnel would then curve to the right around the flanks of Beinn Luibhean, in rock, passing under the eastern shore of Loch Restil. • The first option, so called 4% option, is approximately 2.25km in length and rises at 4% gradient to a high point then descends at 7% to emerge about 1km north of Loch Restil, while the second option, just 1km in length ascends at a gradient of 5.7% and emerges near the north end of Loch Restil. It is considered that an intermediate option approximately 1.5km long at a constant 4% gradient or a longer tunnel from near the Croe Water through to Butterbridge in Glen Kinglas might represent more suitable options. • A third tunnel option within the route corridor is a direct tunnel connecting the A83 Trunk Road under the eastern slope of the valley. This option is approximately 3.3km in length and enters a tunnel next to the A83 Trunk Road north of the Croe Water crossing, rising at a 4% grade before emerging and connecting back into the A83 Trunk Road north of Loch Restil. • It is initially considered that the tunnel would be constructed by a single bore providing a single carriageway with bi-directional traffic through the tunnel; however, there are important fire life safety, and associated ventilation and escape provisions, backed up by European and National highways standards that will govern the tunnel configuration. • For a single carriageway, bi-directional tunnel, these provisions are quite complex. The ventilation system must be in permanent operation and in the event of a fire, smoke and heat has have to be removed from the tunnel using semi-transverse ventilation, which draws the smoke and heat into an overhead duct. In a long tunnel such as this, exhausts are likely to be required through intermediate shafts. Escape from the fire is also more problematic in that an escape duct has to be provided within the tunnel section. People trapped in the tunnel cannot be expected to be able to walk far through such a narrow duct, and so intermediate shafts or a parallel escape bore must be provided to facilitate escape to free air. Given the depth of intermediate shafts of up to 150m deep or more, lifts and a recovery suite at the shaft head would have to be provided. Alternatively, a parallel rescue bore could be constructed parallel to the main bore with enough space for rescue vehicles. However while the longer tunnel is considered to need a single intermediate ventilation/escape shaft, the 1km long option could probably forego the need for this provision. • Accordingly, a twin bore, dual carriageway tunnel may be more appropriate. In such tunnels, in the event of a severe vehicle fire, longitudinal jet fan ventilation is ramped up to full strength to blow the smoke and heat

		in the direction of flow of traffic, away from vehicles queued behind the incident, while those ahead of the incident escape by continuing as normal. For those trapped in the tunnel, they can escape into the other non-incident bore through cross-passages, at say 100-300m intervals, and can be evacuated by rescue vehicles. Intermediate shafts would not typically be required other than to vent pollution.
	Constructability Considerations	<u>Debris Flow Shelter</u> • The construction of an online debris flow shelter (DFS) is problematic. The length of the shelter would occupy a considerable portion of the length of the A83 Trunk Road in Glen Croe. Its construction would predominantly have to take place alongside and above live traffic with frequent overnight closures for extended periods for construction activities that could not physically or safely be undertaken with live traffic running. Construction itself would be vulnerable to pre-existing and ongoing landslide hazard, and it may prove challenging to mitigate this to an acceptable level. • A reinforced concrete structure is not practically feasible. The DFS would comprise precast construction. The form of design hinges predominantly on the practicalities of construction. • Along this section of the A83 Trunk Road it is anticipated that rock could be up to 15m below ground level, depending on the alignment, and is likely to necessitate piling onto rock. This would require access to all pier locations to form the working areas necessary to construct the individual foundations. Reinforced concrete piers would then be constructed from the pile caps by either precast segmental construction or in situ construction with a climbing formwork system. • Uphill topography varies with a number of channels eroded by existing watercourses and past material slips and the downslope from the existing road is itself prone to some instability. The width available for the construction of such a structure is severely limited and includes just the width of the existing highway and some limited space created by the existing catchpits alongside the road. These exist only on a limited length and in places, the available width is further constrained. • Construction access to the site is severely limited and it is assumed that materials delivery will be by road almost exclusively from the south via the A82. The limitations of the delivery route and the very constrained space for craneage and construction vehicles on site favour assembly of relatively small-scale components. Small scale precast components could be manufactured elsewhere and transported to site or could be cast in a yard at the foot of the valley. • Whether the full length of the DFS is provided in a single operation or the option is taken to provide prioritised part-lengths on the basis of landslip vulnerability or construction programme, the modular nature of the structural form assists the aim of minimising traffic disruption during construction.

		• An outline construction sequence is preferred that seeks to minimise traffic disruption. However, it is recognised that during construction, two-way traffic flow on the A83 Trunk Road will not be possible. • Throughout the construction period, there would be potential for landslide events to occur. It may be that significant events during construction would necessitate the use of the Old Military Road whilst the debris is cleared. The Contractor's Temporary Works arrangement would have to ensure, as far as is practical, that the works did not unduly exacerbate the landslide hazard potential. It is recognised that this would be an onerous contractual and design/physical requirement. • Throughout the construction, watercourses would have to be temporarily diverted. Upon completion of the shells, the watercourse channels, droppers and cascades would be constructed. Consideration would be given to their precasting to enable rapid installation. • In addition to the DFS, some construction work would be required on the lower slopes remote from the structure to provide erosion protection from the runoff tails of any debris directed across the shelter into this area, including on the remaining section of the existing A83 Trunk Road. This may include the use of gabion mattresses or other revetment works. <u>Viaducts</u> • There are various methods by which to construct the deck. These include by post-tensioned segmental construction by balanced cantilever, incremental segmental span launching by gantry system or segmental or insitu launching from one end. For smaller structures, other methods such as use of precast deck sections of insitu concrete pours may be appropriate. • For the A83 Trunk Road to remain open during construction of an extended viaduct, access from the A83 Trunk Road to the pier locations is precluded. The more likely option is for pier access to be taken from the Old Military Road or a temporary additional 'haul road' formed alongside; the Old Military Road will have to remain serviceable during the Works in case of a landslide diversion. • Personnel access to the superstructure construction would be via these temporary roads. Material delivery and the progression of the superstructure construction would occur on the piers by one of the span-by-span or launched methods outlined above. • As an off-line option with access from the valley floor and a span-by-span or launched deck construction, the viaduct's construction is likely to have only limited disruption to the A83 Trunk Road. This disruption would be limited to the locations where the proposed alignment would tie-into the existing A83 Trunk Road at the north and south ends of the route corridor. It would also be dependent on the construction methodology used for the sections of viaduct, with the use of temporary carriageways creating local diversions to allow

		sufficient working areas for construction a possibility. There would, however, be considerable disruption to the Old Military Road, at least until a temporary haul road is constructed alongside. • At the southern abutments the alignment has a potentially significant impact to the A83, so it would be recommended to divert the road offline at grade before commencing construction of the approach embankment. It may also be advisable to utilise a reinforced earth wall or similar system to prevent the earthworks encroaching onto the existing A83. • Abutment works at the northern end of the structure have the potential to impact the A83 and the Rest and Be Thankful viewpoint, as well as the OMR, due to the constrained working area on a steep slope. Final positioning and design of the abutment would need to take cognisance of working space requirements. • Construction of piers on steep slopes presents a potential challenge for creating working access and supply of materials in some areas, which may require significant temporary works solutions. <u>Tunnels</u> • A tunnel could be advanced by drill and blast techniques or by using a large Tunnel Boring Machine (TBM). • Whichever method is used, short sections of cut and cover tunnel would be required at each portal location to form a vertical face in reasonably competent rock from which the tunnel can be advanced. At this location the construction of portals would be a significant challenge, given the potential for landslide events near the south portal in particular. The construction requirements for the viaduct interface points will also need to be considered where a viaduct and tunnel occur together. • At each drill-and-blast advance the flat-bottomed “horseshoe”-shaped excavation of newly cut rock would be evaluated by a geologist and strengthened using a combination of rock bolts and sprayed concrete (SCL), to form a stable primary lining before the next advance is drilled and charged with explosive. Although this may seem a slow and laborious process it can be an economic method to construct tunnels in rock. The tunnel can be completed more quickly if the drill-and-blast sequence can be repeated at the opposite portal, or even from intermediate shafts. Once the tunnel is completed an in-situ cast secondary lining can be installed to form a durable final structure. • Alternatively, the tunnel can be bored using a large Tunnel Boring Machine (TBM), starting at one end and boring the length of tunnel consecutively. Although this involves a large capital investment in a TBM and large site set-up at the portal locations, when compared with drill-and-blast, the final circular structural lining of pre-cast segments can be formed as the tunnel advances. • Given the difficulties associated with the landslides near the south portal and the shortage of useable space, it is likely that the main tunnel driving site would be at the northern portal. It is also unlikely that a TBM-mined tunnel would be economic and practical at this location.

		• The construction of the tunnel portals would also likely result in disruption to the A83 Trunk Road. However, this would be limited to locations of the A83 Trunk Road adjacent to the tunnel portals. The use of temporary carriageways at these locations to create local diversions could be used to allow sufficient working areas for construction of the tunnel portals. The viability of diversions will depend greatly on the other works around the portal, particularly at the southern end where diversion options are limited by the valley slope on one side and the progression of the new road works on the other. As a result, wherever possible it would be advisable to locate the portals away from the A83 and OMR to minimise impacts to these roads and avoid the need for temporary diversions. • In areas where the tunnel portal is to be constructed on slopes with loose or potentially unstable ground, there is likely to be a requirement for relatively substantial temporary and permanent works solution to stabilise the portal. <u>Further Considerations</u> • Many of the options in this route corridor are constructed within the existing debris flow zone which presents a potential hazard for the workforce during construction over a potentially extended period. As a result, and subject to risk assessment, there may be a requirement to provide additional protection to mitigate the hazard and protect the workforce during the construction period. • The valley floor at the southern end offers areas that could be used for main construction compounds and laydown areas to support construction, particularly at the junction with the Old Military Road. • Where the new route is constructed on the west side of the valley there will be a significant impact to the Rest and Be Thankful car park, requiring closure to the public. This could present an opportunity to use the area as a compound for construction at the northern end. <u>Summary</u> This route corridor allows for numerous potential options for construction within it, with some more readily achievable than others. The valley floor offers areas that could be utilised for site accommodation and laydown areas with deliveries and earthworks vehicles able to utilise the Old Military Road entrance point at Glen Croe to enter site. As the route corridor is in a relatively small area the effects of disruption from traffic management would likely be contained and minimised compared with many of the other extensive corridor options. Construction in the route corridor would require notable amounts of construction traffic on the public roads for earthworks import and removal as well as delivery of materials including major precast bridge elements. There is also a challenge for access

		when constructing on the steep slopes of the valley in some areas, particularly for the major structures.
Environment Considerations	Biodiversity, Fauna and Flora	209.4ha of Beinn an Lochain SSSI falls within the route corridor. There could be temporary and permanent habitat loss within the SSSI, including the loss of designated features tall herb ledge and upland assemblage, which would be a major negative environmental effect. Moderate negative environmental effects could also occur as a result of nitrogen deposition. Glen Etive and Glen Fyne SPA is directly adjacent to the route corridor There could be temporary and permanent habitat loss within the SPA, which would be a major negative environmental effect. Disturbance to breeding golden eagle, a designated feature, could occur during construction and operation. This would be a major negative environmental effect. No parcels of woodland listed on the AWI fall within the route corridor. There is potential for impacts on terrestrial and aquatic species from construction activities, as follows: • Disturbance from noise and vibration and light pollution. • Injury or mortality from vegetation removal, vehicle movements, or becoming trapped in uncovered holes and pipes during construction. • Fragmentation and loss of habitat suitable for shelter, foraging and commuting. • Changes in water flow conditions from runoff, or alterations to watercourses and groundwater. During operation, there is potential for habitat loss and fragmentation for protected species as a result of tree and vegetation clearance and loss of irreplaceable AWI.
	Population and Human Health	There is potential for localised minor noise and vibration effects on receptors within the route corridor during the construction phase. For example, noise nuisance and vibration caused by traffic and activities associated with construction works could result in general annoyance and/or sleep disturbance for local residents. During the operation phase, there is potential for receptors close to the route corridor to experience minor noise and vibration effects from increased vehicle traffic. While there are relatively few residential receptors within the route corridor.

		There is potential for other minor effects on population receptors resulting from construction traffic. Increased traffic volumes and construction activities could result in diversions and affect journey lengths for both vehicle travellers and non-motorised users (NMUs). The route corridor would generally improve connectivity between the central belt and Argyll and Bute and it is expected it would provide greater accessibility to active travel routes, including the LLTNPA core path network in and around the area, and hill-walking routes such as The Cobbler. There is potential for land-take from properties to facilitate the operation of the route corridor.
	Water Environment	Construction within the route corridor and operational structures and discharges may affect the hydromorphology and surface water quality of approximately two Water Framework Directive classified river water body, one Water Framework Directive classified coastal waterbody and approximately 30-40 minor watercourses. One surface water Drinking Water Protected Area may also be affected. SEPA Flood Maps (SEPA, 2020) indicate that the route corridor may be at fluvial flood risk from Croe Water during a medium likelihood event (0.5% Annual Exceedance Probability (200-year) event). Construction and operation within the route corridor could result in a minor negative effect on the water environment.
	Soils	The route corridor generally follows the existing A83 Trunk Road and the surrounding area of Glen Croe, and a minor negative or uncertain effect is assessed. This recognises there would likely be an unavoidable effect on non-priority peatland habitat, potential for unavoidable loss of existing commercial forestry of LCF Class F4 adjacent to the existing A83 Trunk Road, and also LCF Class F5 and F6.
	Air Quality	There is potential for localised air quality impacts on receptors within the corridor during the construction phase: for example, dust generated from site activities and emissions from vehicular movements, which could result in annoyance for local residents. There is potential for receptors within the route corridor to be affected by pollutant emissions (e.g. carbon monoxide, sulphur dioxide, particulate matter) from vehicle traffic during operation. However, there are very few residential receptors within the route corridor and the existing air quality in the region is good, and with mitigation measures in place it is expected that any negative effects which do arise are likely to be minor.

		Potential air quality impacts on ecological receptors are assessed under Biodiversity, flora and fauna.
	Climatic Factors	The route corridor generally follows the existing A83 Trunk Road and the Old Military Road through Glen Croe and Restil. The existing corridor faces regular precautionary and enforced closures during periods of extended rainfall, causing slope instability and landslides. As indicated in the 'Water Environment' section, there are areas of the route corridor at risk of flooding. The anticipated increase in severity and frequency of rainfall events caused by climate change could pose greater risk from flash-flooding of watercourses. As indicated in the 'Soils' section, there are sections of peatland that would be affected by the route corridor, leading to its degradation and release of carbon. Any felling required would also reduce the carbon sink value of forests within the route corridor. As stated in the 'Materials' section, engineering solutions would be required to accommodate aspects of the various options being considered for the route corridor construction. Manufacture of materials and construction activities would have a minor effect on climate from the release of carbon emissions. Considerable volumes of imported fill material for earthworks is required for some options, resulting in negative environmental effects on climate.
	Material Assets	With regard to natural material assets, as set out in the Soils section, construction would be unavoidable on peat soils. This is assessed as resulting in a major negative environmental effect on natural material assets. Due to the steep topography of the route corridor, significant engineering solutions would be necessary to mitigate potential disruption due to landslides. These solutions would require large-scale works and use of materials, resulting in minor negative environmental effects
	Cultural Heritage	There is potential for minor negative or uncertain effects on the cultural heritage resources identified within the route corridor from the range of possible route options being considered. Construction access to foundations and piers is required from the Old Military Road. There is potential for negative effects on undesignated cultural heritage resources, including unknown archaeological resources if offline options are constructed, including significant earthworks and drill and blast tunnelling.
	Landscape and Visual Amenity	The corridor has the potential to cause significant negative effects on the Special Landscape Qualities of the LLTNP, the local landscape character and elements as well as views from the nearby viewpoints and visual receptors within

		the route corridor due to the construction and operation of the carriageway and supporting infrastructure including extensive earthworks, viaducts, tunnels or debris flow shelters.
Traffic	Traffic Flows	The route corridor will enhance resilience through the existing Glen, operating similarly to the existing A83 Trunk Road under normal conditions, therefore is not expected to significantly impact on traffic levels.
	Accidents	Reductions in transport related casualties could, potentially, be realised as a result of reductions in vehicle kilometres associated with fewer landslide induced road closures and the associated long diversion routes for strategic traffic travelling to and from Argyll & Bute.
Operational Considerations		From a Trunk Roads operation perspective, the main operational considerations within the route corridor are the risk of flooding and/or landslides, based on the steep topography. The centreline of the route corridor has a maximum elevation of approximately 265m above ordnance datum, with significant peaks to the south-west and north-east providing shelter. This means it is likely that snow accumulates within the route corridor during the winter months, with potential winter resilience operational issues. Routes along the Existing A83 Trunk Road Depending on the exact structural measures identified to protect the road from debris flow, inspections and maintenance would be required for any ground anchors and 'bowstring' ties. These would be accessible from access hatches flush with the internal footway and the external downslope verge. The debris flow shelter is unreinforced so long term durability in a relatively wet environment should be superior to reinforced concrete. The external canopy and columns would require to be able to resist harsh weather and freeze/thaw conditions. The factory controlled conditions of their pre-casting will ensure a high concrete quality and consistency of reinforcement cover. Routine maintenance and inspection would be required as for any structure, with specific requirements relating to carriageway drainage, lighting and road surfaces. Occasional maintenance will be required to remove large debris from the roof of the shelter and accumulated debris on the downslopes. Inspection and maintenance access ramps onto the DFS would be provided at the ends or at intervals along the length to allow access for small plant to remove debris.

	Routes Between the A83 Trunk Road and the Old Military Road Appropriate access would need to remain available during operation in order to maintain all structural elements of any viaduct that may form part of the option. Whilst many areas of the structure might be accessible from land adjacent to the viaduct or through a gantry suspended on gantry rails running the length of the viaduct, there exists the possibility that some maintenance activities may need to be accessed from the Trunk Road thereby creating the potential for lane closures and traffic management. Routes on the Western Side of the Glen Should a structure be required on a new route up the western side of the Glen, the operational considerations noted above would also apply. Routes along the Valley Floor and Through Tunnels • There is a need for regular inspection and maintenance of such tunnels. A tunnel manager, tunnel safety officer and a tunnel design & safety consultative group (TDSCG) must be set up early in the design process and continue through operation. The location and type of tunnel operations centre would need to be reviewed and investigated further, depending on the final location and length of tunnel provided. • A sufficient power supply will be required to allow operation of the tunnel ventilation system and any other systems, particularly those required in the event of an emergency incident. • The use of the tunnel by vehicles carrying potentially hazardous materials or dangerous goods (such as fuel tankers) is largely dependent on fire safety and ventilation, and may require a tunnel ventilation system that allows for a larger design fire size. The risk profile associated with the gradient may mean that dangerous goods vehicles need to be escorted through the tunnel in a convoy. It should be noted that a twin bore dual carriageway tunnel configuration is considered likely to result in fewer road traffic accidents (due to no bi-directional traffic flow), theoretically attracting a lower risk of emergency incidents. • For a twin bore dual carriageway configuration, vehicle cross-overs and possibly lay-bys may need to be provided at intervals if practicable, as per recommendation from the European Directive EUD 2004/54 EC. However, the shorter 1km long tunnel is unlikely to require such provision. • The development of any tunnel design should be informed by consultation with emergency services and other relevant stakeholders to ensure that appropriately robust measures in the event of an emergency incident are put in place.

Financial Considerations	The estimated cost range of a scheme within this route corridor is approximately £268M - £860M.
Estimated Time to Completion	It is estimated it would take approximately 7-10 years before a scheme becomes operational depending on the option selected within the route corridor.
Public Acceptability	Consideration of the feedback received during the public consultation held during September / October 2020 shows that for this route corridor there are a considerably higher number of comments supporting than those opposing.

STAG Criteria		
Criteria		Assessment Summary
Environment		Refer to Implementability Assessment – Environment
Safety		Refer to Implementability Assessment – Accidents
Economy	Transport Economic Efficiency	This route corridor is located within the existing Glen and therefore is unlikely to provide any significant benefits associated with journey time savings, when compared to the current A83 Trunk Road, operating under normal conditions. A high-level cost-benefit analysis undertaken for the different route corridor options proposed suggests that, assuming normal operation of the existing A83 Trunk Road, the benefit to cost ratio for the proposed route corridor is expected to be very low. Quantification of the economic benefits of the scheme will require further analysis of the cost of closures to the economy.
	Wider Economic Impacts	As a result of the enhanced resilience provided through mitigating landslide induced closures and, subsequently, increased business confidence and associated inward investment, this intervention has the potential to provide a positive contribution towards wider economic impacts within the wider Argyll & Bute region. While this route corridor address issues with resilience, poor reliability and long journey times come about, not only because of issues with resilience at the Rest And Be Thankful. Even under normal operating conditions i.e. when the A83 Trunk Road is fully open to traffic, journey times for both strategic and local traffic using the A83 Trunk Road can be variable, due to slow moving vehicles and tourist/visitor traffic.

STAG Criteria		
Criteria		Assessment Summary
		The current road network and lack of suitable alternative routes inevitably mean that many areas would remain remote even if resilience issues at the Rest and be Thankful were overcome. This suggests that wider economic impacts, simply from removing the risks of landslides or A83 Trunk Road route closures, at the Rest and Be Thankful, may potentially be modest. It is also worth noting that, while rural depopulation (a significant issue within Argyll & Bute) is linked to wider economic outcomes, indications are that headline economic conditions are not the main driver of this. Transport interventions could likely play a part in arresting population decline, but only if considered alongside an integrated package of economic, cultural and social regeneration measures. A package of measures of this type, coupled with upgraded access to Kintyre, Bute and Cowal, has the potential to arrest population decline and reinvigorate local communities within Argyll & Bute.
Integration	Transport Integration	An integrated transport system aids accessibility by connecting people to opportunities and goods to markets. This route corridor may provide multi-modal opportunities to enhance transport integration. The intervention provides the opportunity to enhance linkages to walking and cycling routes and core paths. As part of the design process, it will be ensured that NMU facilities provided as part of the intervention address the needs of recreational walkers, cyclists and equestrians, as well as, to a more limited extent in this route corridor, commuters. The intervention will provide enhanced resilience and potential journey time reliability benefits for buses and coaches travelling via the A83 Trunk Road. In the context of providing reliable journey times, the length of improvement in the A83 corridor, compared to the overall corridor length, is small. Therefore, although corridor improvements at the Rest and be Thankful will make the route available more often, it will not necessarily provide a step change in overall journey time reliability. The resilience provided may provide bus and coach operators with an opportunity to review timetables, translating to more efficient operations and, potentially, a change in service frequency and the number of communities served.

STAG Criteria		
Criteria		Assessment Summary
		Landslide induced incidents on the A83 Trunk Road at the Rest & Be Thankful can lead to road closures and diversions. Should the Old Military Road also be closed, the diversionary route for A83 traffic between Tarbet and Inveraray is approximately 25 miles longer in length than if using the A83. Depending on journey origin and destination, the longest diversion length experienced by travellers would be over 60 miles. The improved resilience may contribute towards a reduction in the variability of bus journey times and the likelihood of full closures, leading to service cancelations. This may also provide a health and welfare benefit to bus drivers, due to the reduction in instances where bus services are force to travel via longer diversion routes. This route corridor is not expected to have any material impact on the perception of a seamless public transport journey, as interchange and ticketing will not be affected to any great extent. However interchange with bus services travelling on the A83 Trunk Road, due to the reduction in cancelled or delayed services discussed above, may be more reliable. The intervention, through the enhanced resilience provided, will enable more efficient opportunities for freight transport, facilitating more efficient and effective transportation of goods of significant value to the regional and national economies, including high value aquaculture produce and whisky.
	Transport and Land Use Integration	The main aspect of appraisal within the transport and land-use integration criteria is identifying and mitigating any conflicts between the intervention and land-use planning policy and environmental designations. If selected as the preferred route corridor, a strategic assessment of the impact of the route corridor on the environment would be carried out in the Strategic Environmental Assessment (SEA). More detailed Environmental Impact Assessment would be carried out as part of the DMRB Assessment Process. The route corridor is expected to support enhanced accessibility to and from developments in the wider region, and may support investment decisions in Argyll & Bute, more generally.

STAG Criteria		
Criteria		Assessment Summary
	Policy Integration	The route corridor contributes to strategic policy objectives set by the Scottish Government and Transport Scotland. A wide range of national and regional level policies from various plans, programmes and strategies have been reviewed, including Argyll and Bute's Local Development Plan, its' Strategic Environmental Assessment and the LLTNP Local Development Plan. The various relevant policies contained within these documents have been taken into account in the TPOs, the existing corridor conditions and the implementability assessment. No over-riding conflicts have been identified and, in specific instances, the route corridor may contribute towards the delivery of specific policies. The A83 Trunk Road was identified in Transport Scotland's STPR as a route requiring network optimisation through route management and targeted investment. Transport Scotland's emerging STPR2 continues to appraise the need for investment in improved access to Argyll & Bute. It is likely that this route corridor will contribute positively to the NTS2 vision and several of the underpinning priorities and outcomes, including 'takes climate action' and 'helps deliver inclusive economic growth'. Achieving positive outcomes against several of the priorities and outcomes, however, will be dependent on the quality and nature of the infrastructure provided, particularly related with the facilitation and promotion of travel via active modes. This route corridor is likely to contribute positively towards the NPF3 vision, in terms of delivering 'a successful, sustainable place', 'a low carbon place' 'a natural resilient place' and 'a connected place'. NPF3 recognises that Scotland's varied coast and islands have an exceptional, internationally recognised environment and notes the opportunity to secure growth from renewable energy generation as well as other key economic sectors including tourism and food and drink (of key importance to the regional economy). It is recognised that infrastructure investment, including improved transport links are required to bring employment, reverse population decline and stimulate demand for development and services in rural areas. This route corridor is likely to contribute positively towards key objectives as set out within Argyll & Bute's Local Development Plan. An intervention within this route corridor will likely assist in the improvement of:

STAG Criteria		
Criteria		Assessment Summary
		- Argyll and Bute's connectivity, transport infrastructure, integration between land use, transportation and associated networks. - Argyll and Bute's main towns and key settlements, as increasingly attractive places where people want to live, work and invest. - the economic and social regeneration of smaller rural communities. - the continued diversification and sustainable growth of Argyll and Bute's economy, with a particular focus on sustainable assets in terms of renewables, tourism, forestry, food and drink, including agriculture, fishing, aquaculture and whisky production. - addressing climate change impacts and reducing the region's carbon footprint. This route corridor is likely to contribute positively towards the strategic principles set out within the LLTNP Local Development Plan. An intervention within this route corridor will contribute to the National Park by aiding the delivery of 'a successful, sustainable place', 'a low carbon place', 'a natural, resilient place' and 'a more connected place'. While the route corridor is likely to largely fit with policies related with transport based emissions, the nature of the construction and engineering activities required to deliver this route corridor are likely to result in significant emissions, on the basis of existing technologies. It is anticipated, however, that efficiencies in construction practices and the materials used, could be identified e.g. sustainably sourced materials, with a lower embodied carbon content. This would aid in ensuring that any emissions associated with construction activities are minimised, as far as practicably possible, making best use of advances in emerging decarbonisation technology. It is expected that the route corridor would be delivered in-line with measures, as set out within the Scottish Government's 'Update to the Climate Change Plan' (2018 – 2032), and associated documents, including the emerging findings from the 'Deep Decarbonisation Pathways for Scottish Industries: Research Report' relating with the decarbonisation of industry, including the construction sector. A further assessment of carbon, and opportunities for carbon reduction in design, would be considered in later stages of the project assessment process.

STAG Criteria		
Criteria		Assessment Summary
Accessibility and Social Inclusion	Community Accessibility	It is considered unlikely that this route corridor would have any significant impact on public transport usage, reducing transport poverty or reducing reliance on private cars. This is primarily due to the nature of the route corridor and the areas within which it is located. There exists an opportunity, through the infrastructure provided, to positively impact on the level of active travel undertaken within the route corridor. While there is the potential for local trips to be made via active modes, and for additional trips to be generated resulting from increased use of the infrastructure provided by visitors and tourists, it is unlikely, however, that the future level of active travel trips within the corridor would be significant. This route corridor provides a potential opportunity for the provision of enhanced parking facilities, improving access to the scenic area within which the route corridor sits. This could provide enhanced access to the natural environment for those wishing to park and proceed via active modes. Potential enhancements in resilience provided as a result of mitigating landslide induced closures could aid community accessibility, through better, more reliable access to services, both locally and further afield.
	Comparative Accessibility	Due to the rural nature of the Argyll & Bute region, the distances between key towns and a lack of suitable public transport services (in some areas) car ownership levels are greater than the national average. Due to the current high dependency for travel by car, the scale of accessibility benefits that would be delivered to this main user group through delivery of an intervention within this route corridor include more reliable journeys to employment opportunities, recreation, education and health services located both within and outwith the region. Visitors and leisure users would also likely benefit from NMU infrastructure provided, linking to core paths, existing cycle networks, outdoor activities and viewpoints. The design of such infrastructure should ensure that local communities benefit fully from such facilities and are not adversely impacted by them. Freight users may see health and wellbeing benefits from the enhanced resilience provided by this route corridor, with fewer closures resulting in the need for lengthy diversion routes, which can add a significant

STAG Criteria		
Criteria		Assessment Summary
		duration to journeys, contributing towards driver fatigue and stress. Given the rural nature of the region, journeys made using the A83 Trunk Road, may already be several hours in length. Positive impacts can be expected, in terms of mitigating impacts on socially excluded groups - Argyll & Bute has a higher proportion of older residents than the national average. Enhanced resilience may provide more reliable access to key services, including healthcare. This route corridor could contribute to reducing economic and geographic deprivation for currently socially disadvantaged groups (Argyll & Bute has several areas within the 10% most deprived communities in Scotland) through the improvement of accessibility and the enhancement of business confidence driving an associated increase in inward investment and jobs.

Assessment Summary

Transport Planning Objectives		Assessment						
Objective		Major Negative	Moderate Negative	Minor Negative	Neutral	Minor Positive	Moderate Positive	Major Positive
TPO1	Resilience – reduce the impact of disruption for travel to, from and between key towns within Argyll & Bute, and for communities accessed via the strategic road network.						✓	
TPO2	Safety – positively contribute towards the Scottish Government's Vision Zero road safety target by reducing accidents on the road network and their severity.					✓		
TPO3	Economy – reduce geographic and economic inequalities within Argyll & Bute through improved connectivity and resilience.					✓		
TPO4	Sustainable travel – encourage sustainable travel to, from and within Argyll & Bute through facilitating bus, active travel and sustainable travel choices.				✓			
TPO5	Environment – Protect the environment, including the benefits local communities and visitors obtain from the natural environment, by enhancing natural capital assets and ecosystem service provision through delivery of sustainable transport infrastructure.			✓				

Route Corridor 1 – Glen Croe

Implementability		RAG Rating		
		RED	AMBER	GREEN
Engineering	Topography and Alignment Considerations			
	Geology / Geomorphology Considerations			
	Structures Considerations	Part length and full-length tunnel options only.		
	Constructability Considerations	Part length and full-length tunnel options only.		
Environment	Biodiversity, Fauna and Flora			
	Population and Human Health			
	Water Environment			
	Soils			
	Air Quality			
	Climatic Factors			
	Material Assets			
	Cultural Heritage			
	Landscape and Visual Amenity			
Traffic	Traffic Flows			
	Accidents			
Operational Considerations				
Financial Considerations				

Access to Argyll & Bute (A83) Strategic Environmental Assessment & Preliminary Engineering Services
Route Corridor Preliminary Assessment
Route Corridor 1 – Glen Croe

STAG Criteria		Assessment						
Criteria		Major Negative	Moderate Negative	Minor Negative	Neutral	Minor Positive	Moderate Positive	Major Positive
Environment		Refer to Implementability Assessment – Environment						
Safety		Refer to Implementability Assessment – Accidents						
Economy	Transport Economic Efficiency	✓						
	Wider Economic Impacts					✓		
Integration	Transport Integration				✓			
	Transport and Land Use Integration				✓			
	Policy Integration				✓			
Accessibility and Social Inclusion	Community Accessibility					✓		
	Comparative Accessibility					✓		