

Access to Argyll & Bute (A83) Strategic Environmental Assessment & Preliminary Engineering Services  
Route Corridor Preliminary Assessment  
Route Corridor 7 – Inverclyde – Cowal - Lochgilphead

Route Corridor Details	
Route Corridor Option	Route Corridor 7 – Inverclyde – Cowal – Lochgilphead
Route Corridor Description	This route corridor includes a connection from the A78 Trunk Road to Cowal via an approximate 3.9km fixed link crossing of the Firth of Clyde and upgrades along the A815 corridor between Dunoon and Dalinlongart. The route corridor then generally follows the existing B836, A886, C11 and B8000 roads to Otter Ferry, on the eastern shore of Loch Fyne where an approximate 3.0km fixed link crossing of Loch Fyne ties into the A83 Trunk Road at Port Ann. The approximate overall length of the full route corridor is 44km in length. The fixed link crossing over the Firth of Clyde will present considerable challenges. This area is used by large marine vessels as well as Ministry of Defence (MOD) submarines which are based at Faslane and Coulport. The structure will require to span a deep section of the Firth of Clyde as well as have adequate clearance for large marine vessels.
Rationale for Route Corridor	The Inverclyde – Cowal – Lochgilphead route corridor was initially identified by the Cowal Fixed Link working group and was subsequently considered as a potential route corridor by Transport Scotland's Strategic Transport Projects Review team. This route corridor is considered to offer a potential alternative access route into Argyll and Bute bypassing the main landslide risk area on the A83 at the Rest and be Thankful to provide access to the central belt via Inverclyde and the A78 Trunk Road and M8 motorway.
Geographic Context	The route corridor lies predominantly within the Argyll & Bute region, which comprises solely of the entirety of the Argyll & Bute local authority area. The southernmost part of the route corridor lies within the Inverclyde local authority area. The route corridor end points are located a straight line distance of approximately 25-45 miles from the city of Glasgow. The southern extent of the route corridor is situated on the eastern shore of the Firth of Clyde and the A78 Trunk Road. On the west coast of the Firth of Clyde the town of Dunoon falls within the route corridor extents, the second largest settlement in Argyll and Bute, and connected to the wider area and A83 Trunk Road by the A815. From the head of the Holy Loch to the head of Loch Ruel the route corridor heads due west on the B836 serving the small settlements of Clachaig, Ardtaraig and Auchenbreck. The route corridor crosses the A886 which provides a road connection from the Isle of Bute, via a ferry crossing at Colintraive, through Glendaruel to the A83. Continuing west the C11 passes through unsettled areas to Otter Ferry. The western extents of the route corridor is situated between Lochgilphead and Port Ann on the A83 Trunk Road. The route corridor is located partially within the Loch Lomond and The Trossachs National Park (LLTNP) and there are environmentally designated sites both within and in proximity of

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	<p>the route corridor. With respect to transport links, the route corridor joins the two aforementioned trunk roads and it also crosses the Firth of Clyde in proximity to existing ferry routes between Gourock and Dunoon.</p>
<p>Social Context</p>	<p>Given the geographically remote nature of large areas of Argyll &amp; 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.</p> <p>The Scottish Index of Multiple Deprivation (SIMD) identifies concentrations of deprived areas across Scotland. Argyll &amp; 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.</p> <p>The region's population has been in decline for over a decade, against a backdrop of a population increase at the national level.</p> <p>Data from NHS Highland estimates that there are 26,000 referrals for Argyll &amp; 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.</p> <p>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.</p>
<p>Economic Context</p>	<p>The A83 Trunk Road is one of only two east-west strategic trunk road network connections between Argyll &amp; Bute and the central belt. The lack of a reliable strategic route linking Argyll &amp; 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.</p>

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	<p>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.</p> <p>The route corridor follows for part of its length, the route of the A815 road which is the main road link between Toward at the very south of the Cowal peninsula, the town of Dunoon, many smaller communities along its length including Sandbank and Strachur, and the A83 Trunk Road near Cairndow. This road provides an important link for businesses, residents and visitors in the Cowal peninsula with the wider strategic trunk road network.</p> <p>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 &amp; Bute region could contribute towards increasing inward investment and job opportunities for local communities. Reliable access for Bute and Cowal and Mid-Argyll, Kintyre and Islay has the potential to have a transformational effect on local/regional economies.</p>
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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 significantly enhanced resilience, through the provision of a number of alternative routes, 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 and other incidents leading to road closure, such as climate change induced flooding events, accidents and road maintenance activities on the existing A83 Trunk Road, between Lochgilphead and Tarbet, is largely mitigated for a proportion of strategic A83 trunk road traffic, as a result of this route corridor. The main landslide risk area on the A83 Trunk Road, at the Rest and be Thankful, is effectively bypassed by this route corridor.

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		<p>While this route corridor potentially includes fixed link crossings, which can be impacted by severe weather (particularly during the winter period) risks of disruption to traffic would be minimised through the design of any structures required. It should also be recognised, however, that the provision of fixed link crossings may remove the need for ferries to be used to complete certain trips. Ferry services can be impacted by severe weather and mechanical issues with vessels. This route corridor may, therefore, offer a more resilient means of travel for trips to and from areas of Cowal and Mid-Argyll, Kintyre and the Island, including the key towns Dunoon and Lochgilphead. Travel from Cowal, in particular, can be subject to disruption as, due to the peninsular nature of the area, a single road connection (the A815) links the area to the wider road network.</p> <p>In providing an additional route to the existing A83 Trunk Road (assuming it remains operational) enhanced resilience will be provided for large parts of Argyll &amp; Bute, offering a more reliable connection between the region, the central belt and beyond.</p>
TPO2	Safety – positively contribute towards the Scottish Government’s Vision Zero road safety target by reducing accidents on the road network and their severity.	This route corridor is likely to result in significant reductions in vehicle kilometres for strategic traffic currently using the A83 Trunk Road. As such, it is judged that a corresponding reduction in traffic related casualties could be realised from this route corridor.
TPO3	Economy – reduce geographic and economic inequalities within Argyll & Bute through improved connectivity and resilience.	<p>Through reducing the potential impact of landslides on the trunk road, this route corridor would improve resilience of access to key domestic and international markets.</p> <p>Additionally, as a result of the more direct connections to the central belt provided, enhanced competitive access between Argyll &amp; Bute and key markets could be realised. Through providing enhanced connectivity to both Cowal and Kintyre the route corridor is likely to provide enhanced access to a larger geographical area.</p> <p>This route corridor offers the potential to reduce economic and geographic deprivation, particularly within the Bute &amp; Cowal (Dunoon and Rothesay both have data zones within the</p>

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		most deprived 10%) and, to a lesser extent, Mid-Argyll, Kintyre and Islay regions of Argyll & Bute (Campbeltown has data zones within the most deprived 20%).
TPO4	Sustainable travel – encourage sustainable travel to, from and within Argyll & Bute through facilitating bus, active travel and sustainable travel choices.	<p>Through the provision of fixed links to Cowal and Kintyre, improvements in mobility &amp; inclusion and reductions in transport poverty could be facilitated through the enhanced connectivity provided by this route corridor.</p> <p>However, it should be recognised that the infrastructure provided by this route corridor on its own merely facilitate improvements in these areas. Further interventions (such as enhanced public transport services) would be required to score positively against these sub-objectives.</p> <p>It is judged that, as a result of the provision of trunk roads in currently largely rural areas (particularly in Cowal) potential negative impacts on active travel could be experienced by communities within these areas. This includes, but is not limited to, potential reductions in actual or perceived road safety and potential severance issues, which could adversely impact active travel. Investment in a new route corridor within the region would however provide an opportunity to include enhanced active travel provision as part of the design.</p>
TPO5	<p>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.</p> <p>An example of ecosystem service provision is improving water quality regulation.</p>	The range and scale of potential environmental effects identified for this route corridor is such that it is likely that extensive environmental mitigation will be needed and there is the potential for a range of significant environmental impacts that could affect ecosystem service provision.

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Existing Route Corridor Conditions		
Engineering	Route Corridor Length	The route corridor is approximately 44km long.
	Existing Roads	<p>The route corridor intersects the A78 Trunk Road at its southern extents and the A83 Trunk Road at its western extents.</p> <p>The route corridor generally follows the Local Authority operated / maintained 'A' / 'B' / 'C' roads listed below: A770, A815, B836, A886, C11 and B8000.</p> <p>The route corridor intersects the following Local Authority operated / maintained 'A' / 'B' / 'C' roads. A770, A885, C60, C08, A815, A886, A8003, C11 and B8000.</p>
	Existing Accesses	<p>A class road: 4  B class road: 3  C class road: 6  Unclassified road/direct access: 239</p> <p>Relative to the other route corridors, the high number of accesses noted above is attributed to the route corridor passing through the town of Dunoon and other settlements.</p> <p>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.</p>
	Topography and Land Use	<p>Ground levels along the centre of the route corridor generally rise from the roundabout on the A78 Trunk Road near Inverkip, at a height of approximately 20m above ordnance datum, to approximately 50m above ordnance datum near Low Lunderston. Across the route corridor width in this area the land generally falls towards the Firth of Clyde from an area of high ground elevated at approximately 140m to 160m above ordnance datum. The route corridor then crosses the Firth of Clyde towards the Cowal peninsula landing generally to the south of Dunoon. Ground levels beyond the western shores of the Firth of Clyde rise very steeply to higher ground that extends round the west side of Dunoon. Ground levels to the west of Dunoon within the route corridor extend up to approximately 250m above ordnance datum and this is situated in expansive forests. The town of Dunoon itself is elevated between sea level and approximately 50m above ordnance datum. As the route corridor heads north from Dunoon towards</p>

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		<p>Land use within this section of the route corridor is primarily coniferous plantation woodland. There are several residential/commercial properties throughout the corridor. Agricultural land is present through Glen Lean, at Ardtaraig, Balliemore and adjacent to the River Ruel. In terms of utilities and infrastructure there are several features associated with the Striven Power Station between Loch Tarsan and Loch Striven including <b>extensive overland and underground infrastructure, most notably two pipes crossing the existing road.</b></p> <p>The route corridor centre then generally follows the A886 heading north west. Ground levels along the corridor centre are typically between 10m and 30m above ordnance datum as the road follows the valley floor and the Cuil Uinseann watercourse. The route corridor then turns west and generally follows the single track C11 road, through a large area of forest with ground levels rising steeply along the route corridor centre up to approximately 320m above ordnance datum. As the route corridor continues west generally towards Otter Ferry, ground levels fall again and the route corridor continues to pass through expansive areas of forest.</p> <p>Land use within this section of the route corridor is primarily coniferous plantation woodland. There are a pair of low voltage electricity transmission lines which follow the corridor from east to west.</p> <p>Otter Ferry, which is located at sea level on the eastern shore of Loch Fyne, generally marks the point where the route corridor starts to cross Loch Fyne. On the western shore of Loch Fyne the route corridor ends at the A83 Trunk Road, which generally follows Loch Fyne as it runs down the Kintyre Peninsula. Trunk road levels vary between approximately 10m and 40m above ordnance datum at the end of the route corridor.</p> <p>Land use within this section of the route corridor is primarily coniferous plantation woodland. There are a small number of residential properties located at Achnaba and Port Ann. In terms of utilities and infrastructure, there is an electrical substation and associated power lines to the east of Port Ann.</p>
	<p>Geology / Geomorphology</p>	<p>The route corridor crosses the Firth of Clyde and then follows the shoreline north towards Holy Loch across low-lying, slightly undulating ground and then across steeper slopes north of Sandbank along the toe of Finbracken Hill and Dalinlongart Hills. The route corridor follows the Little Eachaig River west away from Holy Loch. The river flows from Loch Tarsan and sits within a steep sided U-shaped valley with Cruach Neuran to the south and Sgorach Mor to the north. The heads of Loch Striven and Loch Riddon which lie to the south of the route corridor show similar topography, with wide U-shaped valleys flanked by steep slopes. Between the two lochs the route corridor follows a wide shallow sided valley. From Loch Riddon to Otter Ferry the route corridor initially follows a narrow valley before reaching wide fairly gentle sloping moorlands.</p>



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		<p>The existing route of the A815 from Dunoon, north through Hunter's Quay to the western end of Holy Loch, follows a strip of Raised Marine Deposits – sands and gravels. Inland, to the west of Kirn, glacial Till and large isolated areas of Peat are mapped. To the immediate north and east, Marine Beach Deposits are mapped along the shoreline of the Firth of Clyde and Holy Loch.</p> <p>Significant deposits of Marine Beach Deposits, Raised Marine Deposits and Alluvium are mapped where the Little Eachaig River and the River Eachaig flow into Holy Loch and within their respective valleys, with localised deposits of glacial Till on the margins of the Little Eachaig valley to the west. Alluvium is mapped along almost the full length of the valley between Clachaig and Loch Tarsan, with remnants of River Terrace Deposits recorded on the margins of the valley floor. A large area of peat is mapped in association with tributaries to Tamhnich Burn. Glacial Till is occasionally mapped on the lower slopes. Generally, the upper slopes show no superficial cover. Extensive areas of Marine Deposits and Alluvium are mapped at the mouth of Balliemore Burn at Loch Striven, and at the lower reaches of the River Ruel where it flows into Loch Riddon. One notable area of peat is mapped within the route corridor in the upland areas between Loch Striven and Loch Riddon.</p> <p>Superficial cover is largely absent within the route corridor to the west of the River Ruel until the route corridor descends into Otter Ferry, where Raised Marine Deposits and extensive Marine Beach Deposits are mapped along the shoreline of Loch Fyne. The A83 tie in on the western side of the loch has only localised Raised Marine Deposits mapped. Otter Ferry is mapped as predominantly Raised Marine Deposits, with Marine Beach Deposits recorded extending along the spit into Loch Fyne. The A83 tie in on the western side of the loch has only localised Raised Marine Deposits mapped.</p> <p>Made ground is recorded along the shoreline to the south of Dunoon in association with the ferry terminal. Additional smaller areas of made ground deposits are mapped in the wider area of Dunoon and to the north of Sandbank. Made ground is anticipated within the wider route corridor as a result of existing development. At the head of Holy Loch made ground is mapped along the alignment of the existing A815 where the road crosses alluvial deposits, as well as further north to the south of Uig. An area of 'Worked ground (Void)', likely to represent a sand and gravel pit or similar, is mapped southeast of the A815, close to Orchard farm. A further area of made ground is recorded to the south of Dalinlongart in association with a development. The dams to the east and west of Loch Tarsan are recorded as artificial ground. Further made ground is anticipated across the route corridor in association with existing development and infrastructure.</p>
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		<p>The bedrock in the east of the route corridor comprises faulted strata of the Strathgryfe Lava Member and the Clyde Sandstone to the east of the Firth of Clyde fixed link crossing. Pelite of the Dunoon Phyllite Formation and psammite of the Loch Katrine Volcaniclastic Formation underlie the Dunoon area. The majority of the route is underlain by the Beinn Bheula Schist Formation, comprised of psammites, pelites and metaconglomerates. The route corridor crosses into the Southern Highland Group in the west of the route corridor towards Otter Ferry. The Southern Highland Group is mapped as metavolcaniclastic sedimentary rock; thereafter the route corridor passes over metabasalt of the Dalradian Supergroup, and metalimestone of the Loch Tay Limestone Formation, and semipelite of the Ben Lui Schist Formation. The western landfall of the Loch Fyne crossing is underlain by the Crinan Grit Formation.</p> <p>Numerous dykes are mapped within the route corridor, generally trending north-south to north east-south west, and north west-south east.</p> <p>Minor faults are mapped within the route corridor, generally trending northeast or east-northeast. Two regional scale faults cross the route corridor, one between Loch Striven and Loch Tarsan trending northeast, the second where the route corridor crosses the River Ruel near Glendaruel, again the fault trends northeast.</p> <p>Firth of Clyde Fixed Link Crossing</p> <p>On the east bank, superficial cover is generally patchy. In the vicinity of Underheugh Farm, glacial Till – diamicton is mapped extending inland. Raised Marine Deposits (clay, silt, sand and gravel) are mapped, with beach and tidal flat deposits (clay, silt, sand and gravel) along the shoreline at the southern and northern margins of the route corridor. Tidal flat deposits are more extensive to the south of the route corridor, and pockets of peat are mapped on higher ground to the east.</p> <p>On the west bank, Marine Beach and Raised Marine Beach Deposits (sand and gravel) are mapped, with a small area of no superficial deposits mapped in the central area of the route corridor.</p> <p>No mapping is available within the firth, however geophysical reflection surveys have been undertaken. One borehole is available within the route corridor on the west bank, recording 'sand and gravel' to 16.8m. Schist and strong thinly laminated phyllite is recorded from 16.8m to 20m. A dip of 35° is recorded.</p>
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		<p>The bedrock geology underlying the eastern side of the crossing is mapped as belonging to the Strathgryfe Lava Member comprising basalts in the north of the route corridor. Sandstone belonging to the Clyde Sandstone Formation is mapped in the central area of the route corridor with the Clyde Plateau Volcanic Formation comprising tuff and agglomerate mapped in the south of the route corridor.</p> <p>The strata on along the eastern shoreline are heavily faulted in the area. Faults trend northwest-southeast within the fault block and project into the loch. A thrust fault transects the route corridor approximately 600m offshore, trending northeast-southwest. The bedrock geology and faulting in the vicinity of this landfall is complex and should be assessed in more detail in conjunction with the identification of the crossing location should this route corridor be retained.</p> <p>The bedrock geology underlying the western bank side of the crossing is mapped as belonging to the Dunoon Phyllite Formation comprising pelite. Two igneous intrusions, one trending north-south and the other east-west are also mapped.</p> <p>Loch Fyne Fixed Link Crossing</p> <p>Raised Marine Deposits are mapped across Otter Ferry at the eastern end of the fixed link crossing, with Marine Beach Deposits mapped along the shoreline and extending into the loch. Small areas of Alluvium are mapped in association with water courses to the north of the route corridor. Isolated deposits of glacial Till are mapped to the east of Otter Ferry. At the western end of the fixed link crossing, isolated areas of Raised Marine Deposits are mapped, with Marine Deposits mapped along the shoreline to the north in the Port Ann area.</p> <p>No GI information is available for review within or near the route corridor of the fixed link crossing. A review of the offshore geoindex indicates that seismic reflection surveys have been undertaken to the south of the route corridor.</p> <p>Bedrock geology at the crossing is mapped as semipelite of the Ben Lui Formation on the eastern shore of the loch, and quartzite and pebbly psammite of the Crinan Grit Formation to the west of the crossing. Large metabasalt intrusions are mapped within the psammities as part of the Dalradian Supergroup. At Otter Ferry the route corridor initially follows a narrow valley before reaching wide fairly gentle sloping moorlands.</p>
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		<p>References:</p> <ul style="list-style-type: none"> <li>British Geological Survey, Geological Survey of Scotland, 1:63,360/1:50,000 geological map series. Accessed via BGS maps portal <a href="https://www.bgs.ac.uk/information-hub/bgs-maps-portal/">https://www.bgs.ac.uk/information-hub/bgs-maps-portal/</a>, October to December 2020.</li> <li>British Geological Survey, Onshore GeoIndex, <a href="https://mapapps2.bgs.ac.uk/geoindex/home.html">https://mapapps2.bgs.ac.uk/geoindex/home.html</a>, 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.</li> <li>British Geological Survey, The BGS Lexicon of Named Rock Units, <a href="https://webapps.bgs.ac.uk/lexicon/home.cfm">https://webapps.bgs.ac.uk/lexicon/home.cfm</a>. Accessed October to December 2020.</li> </ul>
	Hydrology and Drainage	This is covered under 'Water Environment' in the 'Environment' part of this table.
	Structures	<p>The following structures are noted within this route corridor.</p> <ul style="list-style-type: none"> <li>13 existing piped culverts</li> </ul>
Environment Considerations	Biodiversity, Fauna and Flora	<p>Route corridor crosses Upper Loch Fyne and Loch Goil MPA for approx. 2.8km.</p> <p>131.7ha of Ruel Estuary SSSI falls within the route corridor.</p> <p>62 parcels of woodland listed on the AWI fall within the route corridor, adjacent to Otter Hill Road, the A886, B836 and A815.</p>
	Population and Human Health	The noise environment in the vicinity of the route corridor is characterised by the road traffic on existing A and B roads as well as rural land. The route corridor passes through a predominantly rural environment and there are a number of settlements within the route corridor including Dunoon, Sandbank, Clachaig, Balliemore, Otter Ferry and Achnaba.

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		<p>The following core paths are within the route corridor:</p> <ul style="list-style-type: none"> <li>• C207a, b, c and d (Sandbank to Toward);</li> <li>• C226 (Bird Garden to Ardnadam);</li> <li>• C227a, b, c and d (Alexander Street (rear) path network, Dunoon);</li> <li>• C223a, b and c (Dunans loop to Inverreck and LLTNP boundary);</li> <li>• C212b (Port Lamont to Ardtariag, Loch Strivan);</li> <li>• C214h, i, k, l and m (Cowal Way Glenbranter to Portvadie);</li> <li>• C215 (Glendaruel to Otter Ferry);</li> <li>• C217a (Otter Ferry to Blairs Ferry, Kames); and</li> <li>• C406 (Otter Ferry Circular, Loch Fyne).</li> </ul> <p>Cowal Way, a long distance walking path, passes through the route corridor to the west of Loch Riddon and the River Ruel, travelling north past Glendaruel.</p> <p>National Cycle Network (NCN) Route 753 also passes through the route corridor, following the A770 from Faulds Park, Gourock towards Inverkip. The Dunoon to Portvadie Sustrans route (an on-road route which is not on the National Cycle Network) intercepts the route corridor at Dunoon and travels in a north-westerly direction along the routes of the existing A815, B836 and A886 (and route corridor) until it reaches Glendaruel.</p>
	Water Environment	<p>The route corridor crosses or is in the vicinity of multiple water bodies classified under the Water Framework Directive, including:</p> <ul style="list-style-type: none"> <li>• Seven river water bodies, Kilfinan Burn/Allt Lean Achaidh, River Ruel, Tamhnic Burn, Balliemore Burn/Allt Gleann Laorigh, Glentarsan Burn, Little Eachaig River/Cruach Neuran Burn and the River Eachaig; and</li> <li>• Five coastal water bodies, Firth of Clyde Inner – Dunoon and Wemyss Bay, Loch Fyne – Middle Basin, Loch Striven, Holy Loch and Loch Riddon.</li> </ul> <p>The route corridor also crosses approximately 110-120 minor watercourses.</p> <p>SEPA Flood Maps (SEPA, 2020) indicates that the route corridor may be at existing fluvial flood risk from Milton Burn in Dunoon, River Eachaig, Little Eachaig, Glenkin Burn, Glentarsan Burn, Balliemore Burn, Tamhnic Burn, River Ruel, Bealachandrain Burn and Kilail Burn during a medium likelihood event (0.5% Annual Exceedance Probability (200-</p>

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		<p>year) event). The route corridor may be at existing coastal flood risk from Firth of Clyde at Dunoon, Holy Loch at Tom nan Ragh, Loch Striven, Loch Riddon, and Loch Fyne during a medium likelihood event (0.5% Annual Exceedance Probability (200-year) event).</p> <p>The Ruel Estuary SSSI and the Upper Loch Fyne and Loch Goil Marine Protected Area are within the vicinity of the route corridor.</p> <p>Loch Fyne Shellfish Water Protected Area and Loch Striven and Kyles of Bute Shellfish Water Protected Areas are within the route corridor.</p> <p>There are Active Aquaculture Sites, CAR licenced fish farms and Classified Shellfish Harvesting Areas within the vicinity of the route corridor.</p> <p>The route corridor passes through two surface water Drinking Water Protected Areas.</p> <p>Lunderston Bay bathing water is out with the route corridor but within the vicinity of the route corridor.</p>
	Soils	<p>Soil type within the route corridor is mixed with peaty podzols, peaty gleys, mineral podzols, brown soils and alluvial soils all present. Peaty Gleys are predominant in the western section of the route corridor. The route corridor where peat is present predominantly transects peat identified as Class 5 (no peatland habitat recorded, soils are carbon rich and deep peat) and Class 3 (not priority peatland habitat with carbon rich soils and some areas of deep peat) in the Carbon and Peatland 2016 Map. However, the route corridor also transects pockets of peat identified as Class 2 (nationally important carbon-rich soils, deep peat and priority peatland habitat, areas of potentially high conservation value and restoration potential) east of Otter Ferry. A small pocket of Class 1 peatland (nationally important carbon rich soils, deep peat and priority peatland habitat, areas likely to be of high conservation value) is present adjacent to the B836 in Glen Lean. Given the combination of soils, climactic conditions and topography the Land Capability for Agriculture (LCA) Class within the route corridor is predominantly Class 5 (Class 5.1, 5.2 and 5.3) with Class 4 (Class 4.1 and 4.2) on the more productive mineral soils and Class 6 (Class 6.1, 6.2 and 6.3) on the steeper and higher slopes.</p> <p>There are no Geological Conservation Review (GCR) sites in the route corridor.</p>

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		<p>The Land Capability for Forestry (LCF) class is mixed ranging from Class F2 the Holy Loch in the east and at Otter Ferry in the west to Class F6 on the higher steeper slopes in between. There are existing stands of commercial forestry throughout the route corridor. The route corridor includes land identified in the Argyll &amp; Bute Council Woodland Forestry Strategy as Preferred (land that offers the greatest scope to accommodate future expansion of a range of woodland types, and hence, to deliver on a very wide range of objectives, Sensitivities are limited) at Glen Lean and Otter Ferry. Other areas identified include existing woodland, Sensitive (areas where the nature or combination of sensitivities restricts the scope to accommodate further woodland expansion or removal) and Potential (considerable potential to accommodate future expansion of a range of woodland types, but where at least one 'sensitivity' exists).</p>
	Air Quality	<p>The route corridor passes through a predominantly rural environment and there are a number of settlements within the route corridor including Dunoon, Sandbank, Clachaig, Balliemore, Otter Ferry and Achnaba.</p> <p>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 &amp; Bute Air Quality Annual Progress Report, 2020).</p> <p>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.</p>
	Climatic Factors	<p>The baseline for climatic factors is not considered to differ greatly between the 11 route corridors.</p> <p>As outlined in the 'Water Environment' section, the route corridor may be at existing fluvial flood risk from Milton Burn in Dunoon, River Eachaig, Little Eachaig, Glenkin Burn, Glentarsan Burn, Balliemore Burn, Tamhnich Burn, River Ruel, Bealachandrain Burn and Kilail Burn during a medium likelihood event. The route corridor may be at existing coastal flood risk from Firth of Clyde at Dunoon, Holy Loch at Tom nan Ragh, Loch Striven, Loch Riddon, and Loch Fyne during a medium likelihood event.</p> <p>As described in the 'Soils' section, there are several areas of peat soils in the route corridor with high carbon sequestration and sink value.</p>

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		As described in the Biodiversity, Flora and Fauna section, there are areas of forested land in the route corridor, including Argyll and Bute Forestry Strategy areas. Forested areas also have a carbon sequestration and sink value.
	Material Assets	<p>The route corridor contains a variety of natural material assets. As outlined in the Climatic Factors section, there are areas of forestry within the route corridor and as listed in the Soils section, there are sections of peat soils and a mixture of LCF classes.</p> <p>There are also a variety of built material assets in the corridor. The route corridor generally follows existing road infrastructure including a mixture of 'A' 'B' and 'C' roads. There is a pedestrian ferry service linking Dunoon and Gourock across the Firth of Clyde. The route corridor requires a structural crossing of the Firth of Clyde downstream of HMNB Clyde and Clydeport Container Terminal. Consideration for clearance and maritime navigation must be given to facilitate continued passage for naval, commercial shipping, fishing and leisure traffic on the Firth of Clyde.</p> <p>There are several minor renewable energy developments along the route corridor, mostly comprised of micro hydro schemes. Dalinlongart waste disposal site is within the corridor to the north of Dunoon.</p>
	Cultural Heritage	There are eight Scheduled Monuments, 47 Listed Buildings, a Garden and Designed Landscape (GDL) and two Conservation Areas within the route corridor. There is a high concentration of Listed Buildings at Dunoon. The extent of the route corridor occupied by the Ballimore GDL on the eastern shore of Loch Fyne is relatively large.
	Landscape and Visual Amenity	<p>The route corridor is approximately 44km long. Starting with the new crossing between Port Ann on the western and Otter Ferry on the eastern shore of Loch Fyne, this route corridor runs through Ballimore Garden and Designed Landscape (GDL) and then passes through the Kyles of Bute National Scenic Area (NSA) for approximately 3km, past the northern tip of Loch Riddon and Loch Striven, and then runs along the southern edge of Holy Loch until it reaches Dunoon where the large-scale crossing at the Firth of Clyde is proposed. This route corridor runs along existing roads except for the two crossings. Small sections of the route corridor around Holy Loch are located within the LLTNP (at a distance of approximately 800m from the route corridor centreline. Approximately half of this route corridor is located within the West Loch Fyne (Coast), East Loch Fyne (Coast) and Bute &amp; South Cowal Areas of Panoramic Quality (APQs). There are several Open Space Protection Areas and two Conservation Areas (in Dunoon and Clachaig).</p> <p>The Landscape Character Types (LCTs) from the Loch Fyne crossing to the Firth of Clyde crossing are Rocky Coastland – Argyll LCT, Plateau Moor and Forest – Argyll LCT, Steep Ridges and Mountains LCT, Craggy Upland – Argyll LCT, Straths and Glens LCT, Rugged Moorland Hills LCT and Raised Beach - Glasgow &amp; Clyde Valley LCT.</p>



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		<p>There is a large number of Seascape Character Areas (SCAs) within the route corridor, namely Loch Fyne - Lachlan Bay to South Ballimore SCA, Loch Fyne - Loch Gilp to Brainport Bay SCA, Loch Striven - Head of Loch Striven SCA, Loch Striven - Head of Loch Striven to The Craig SCA, Loch Striven - Ardbeg Point to Head of Loch Striven SCA, Upper Firth of Clyde - Toward to Dunoon and Dunoon SCAs and Inner Firth of Clyde - Holy Loch and Gourock to Cloch Point SCAs.</p> <p>Land cover within the route corridor comprises small and scattered settlements, sea and freshwater lochs and coasts, open grassland and moorland, native woodland, coniferous forestry and numerous watercourses as well as the main town on the Cowal peninsula, Dunoon. This route corridor would cross and likely be visible from the Loch Lomond and Cowal Way (Strachur to Lochgoilhead section) and the Argyll Paddle Trail. Parts of the route corridor would also be visible from of Loch Fyne and Firth of Clyde coastline as well as numerous residential and recreational receptor locations.</p>
Traffic		<p>Annual average daily traffic (AADT) flow levels on the A83 Trunk Road in 2019 were 2,300 vpd (vehicles per day) on the stretch 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 Trunk Road 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.</p> <p>Travel routes to/from, and within, Argyll &amp; 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 between the key main towns/cities can be long relative to the distances involved and unreliable.</p>

Implementability		
Engineering	Topography and Alignment Considerations	Within the route corridor extents on the east side of the Firth of Clyde, topography varies. Steep hills of approximately 100m fall towards the coastline with some flatter areas towards the junction between the A770 and A78 Trunk Road. The carriageway alignment will be dictated by the crossing type, which if this is a bridge structure,

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		<p>will require a minimum marine navigation clearance of 75m. If a route is positioned closer to the A78 Trunk Road, topography should allow for compliant geometry; however, if positioned further north, the terrain levels will likely cause issues.</p> <p>On the west side of the Firth of Clyde, the centreline of the route corridor follows the A815 through Dunoon. If a route is taken through Dunoon, it is expected that the existing road will be utilised. Vertical alignment should be compliant; however, it will likely be sub-standard for horizontal alignment geometry in places with little space for improvement due to the route being heavily constrained on the east by the sea and buildings, properties, etc. on the west. However, this will be an urban trunk road and both context and an appropriate design speed should be considered.</p> <p>The topography to the west of Dunoon is steep hillsides, falling towards the town. Alternatively, a bypass of Dunoon may be possible; however, lifting and falling an alignment to an appropriate elevation would be challenging both due to the topography itself as well as the built up/occupied areas on the periphery of Dunoon which limits the available space for a straightforward solution. Furthermore, Bishop's Glen Reservoir to the west of Dunoon, and Loch Loskin to the north will need to be considered.</p> <p>Between Dunoon and Sandbank the centreline of the route corridor continues to follow the A815. Using this route, the vertical alignment is expected to be compliant, although some sub-standard sections of horizontal alignment geometry have been identified. Similar to above, the built up area on the west, and Firth of Clyde/Holy Loch on the east significantly limit the available space to provide improvements; however, an appropriate design speed and the context of the road through an urban environment should be considered. From the centreline west, there is more open area for an alternative route and while undulating in level could likely accommodate a compliant alignment with standard embankment and cutting; however, this area is currently the Cowal Golf Course which would be significantly impacted by a route in this location.</p> <p>From Sandbank to Dalinlongart, the centreline is constrained on the north-east by Holy Loch and steep hills on the south-west, effectively making the existing A815 route the only real possible option. This is bordered by properties along the length; however, it is generally flat and straight, and should allow for compliant vertical and horizontal alignment geometry.</p> <p>The centreline of the route corridor follows the B836 west to Glenlean/Loch Tarsan. The valley floor is relatively flat and should allow for compliant vertical alignment to be achieved. Steep side slopes, Little Eachaig River and tributary</p>
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		<p>watercourses do constrain the route and will influence the horizontal alignment geometry; however, alignments should generally comply with standards .</p> <p>Heading west between Glenlean and Ardtaraig, the route corridor is constrained by Loch Tarsan, supplying the Striven Hydro Scheme, on the north and steep slopes on the south. A route will likely follow the contours and should allow for compliant vertical and horizontal alignment geometry to a point at west of the loch; however, levels rapidly fall from 100m to sea level at Loch Striven. The centreline of the corridor follows the B836 round the head of Loch Striven. The topography does not lend itself well to achieving compliant vertical geometry in order to descend to sea level and then ascend to 150m. It will also require doubling back around the head of the loch. In order to achieve this, it will likely require a sub-standard radius to roughly follow the extents of the loch around this section. It is unlikely that a practical solution could be implemented to allow a compliant radius. Furthermore, there is potential for this area to flood due to its low lying, flat nature and proximity to the loch with a substantial river. This could be avoided through the use of a structure over Loch Striven; however, a climb of around 50m on the west side of the loch over a short distance would still be required making it difficult to provide a suitable alignment for an open road and may require a tunnel to pass the saddle in the topography.</p> <p>Continuing west to the top of Loch Ruel, the route corridor opens up and is less constrained which should allow for a compliant horizontal alignment geometry. The ground does descend in level; however, vertical alignments to standard should be achievable with little difficulty, although cuttings will likely be required.</p> <p>Between the top of Loch Ruel and Otter Hill Road/C11, the topography steepens on the north side, but following the contours should allow for a compliant vertical alignment. On the southern/western side is an open valley floor which should provide sufficient land to achieve a horizontal alignment geometry to road design standards. A number of settlements as well as the River Ruel and its tributaries are spread across the area which will need to be considered, particularly from the perspective of potential flooding.</p> <p>The centreline of the route corridor follows the C11 west to Otter Ferry. From the start of the C11, the topography steeply rises up a gully from 50m up to 300m over a distance of 2km. The increase in level combined with the steep slopes make this a very challenging area to achieve a compliant alignment. Several switchbacks would be required in order to reasonably elevate the road; however, these would likely need to be sub-standard to minimise the impact on the hillside, otherwise significant retaining walls may be required. If the road could successfully be raised to follow the C11, the topography begins to flatten but then undulates. Continuing west, It is likely that compliant vertical and horizontal alignment geometry could be achieved through the use of fairly standard embankments and cuttings. The</p>
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		<p>only real alternative to circumvent the steep rise would be to use a tunnel, emerging at an appropriate level near Otter Ferry.</p> <p>On approach to Loch Fyne the topography begins to fall. The steepness varies and it will be possible to optimise the route to minimise gradients; however, it is unlikely that a straightforward alignment to standard will be achievable. Again, switchbacks will likely be necessary to provide the change in elevation, although at this location the topography is less severe than detailed before. The level of descent and alignment will most likely be dictated by the location of the crossing for Loch Fyne.</p> <p>The A83 Trunk Road on the western side of Loch Fyne is situated close to the shoreline at points and relatively low lying, 10 to 40m. Topography is unlikely to cause significant issues for tying into the trunk road assuming a structure is used for the crossing as this will allow for the new carriageway coming from the west to be of a similar elevation. Consideration for an appropriate junction will be required. Alternatively, a tunnel could be considered for this location; however, this will come with its own challenges for connecting back into the existing A83 due to the depth of the loch and the vertical gradients required.</p>
	<p>Geology /  Geomorphology  Considerations</p>	<p>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. Potential landslide hazards may require measures to protect any route alignment and this should be considered as part of detailed assessment should this route corridor be retained. The database records landslides to have occurred at the following locations:</p> <ul style="list-style-type: none"> <li>• To the northeast of Clachaig, between Dalinlongart and Loch Tarsan. The British Geological Survey (BGS) also has mapped mass movement deposits in association with this record.</li> <li>• Above the route corridor to the northwest of Dalinlongart at Holy Loch. The BGS also has mapped mass movement deposits in association with this record.</li> <li>• The BGS records mass movement deposits to the west of Ballimore at the north end of Lock Striven. There is no NLD record associated with this deposit.</li> </ul> <p>An assessment of other potential issues including potentially difficult ground conditions is summarised below:</p> <ul style="list-style-type: none"> <li>• Potential presence of peat deposits at eastern end of the fixed link crossing with associated potential for peat slides or resulting in excessive settlement for earthworks and foundations.</li> </ul>

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		<ul style="list-style-type: none"> <li>• Potential presence of soft or loose deposits (alluvium and raised marine deposits) primarily in association with the river mouths of the lochs. At least 13km of route corridor between Holy Loch and Loch Striven are mapped as alluvium, likely to be highly compressible. These deposits may require excavation and replacement with fill or suitable improvement treatment.</li> <li>• Potentially highly compressible deposits at the eastern end of the fixed link crossing in association with tidal flat deposits. This may pose a risk for excavations and result in excessive settlement for earthworks and foundations.</li> <li>• Variable strength of rock due to the presence of igneous intrusions within the route corridor, likely to cause difficulties for excavations.</li> <li>• Faulting can create zones of weak and/or highly fractured rock which is a significant hazard when tunnelling or excavating cuttings. Conversely faulting can create zones of extremely strong 'welded' fault rock, which again would create difficulties for tunnelling or areas of cutting in relation to excavatability.</li> <li>• The presence of faults may provide a preferential pathway for groundwater flow, and groundwater may pose significant issues for excavation in cuttings and for tunnelling if the groundwater table is high.</li> <li>• Faulting in the area of the fixed link crossings, creating zones of highly fractured rock with reduced bearing capacity.</li> </ul>
	Hydrology and Drainage Considerations	This is covered under 'Water Environment' in the 'Environment' part of this table.
	Structures Considerations	<p>The following structures are likely to be needed for a new road within this route corridor.</p> <ul style="list-style-type: none"> <li>• A cable stayed or suspension bridge over the Firth of Clyde approximately 3,900m long (2 x 900m main spans).</li> <li>• A cable stayed bridge approximately 820m long (500m main span) long across Loch Striven.</li> <li>• A tunnel approximately 1,450m under high ground west of Loch Striven.</li> <li>• A tunnel approximately 4,400m under high ground west of Ballochandrain.</li> <li>• A bridge or tunnel approximately 3,000m long across / under Loch Fyne.</li> <li>• Approximately 79 no. new culverts.</li> <li>• Approximately 12 no. new bridges.</li> <li>• Approximately 1 no. new multi-span bridge (River Ruel).</li> <li>• Approximately 13 existing piped culverts possibly requiring upgrading.</li> </ul>

		<p>Constructability, operation and maintenance in relation to structures is discussed elsewhere within the document.</p> <p>Key issues associated with the likely structures are:</p> <p><u>Firth of Clyde Cable Stayed or Suspension Bridge</u></p> <ul style="list-style-type: none"><li>• The 3,900m long (2 x 900m main spans) bridge crossing length is comparable with the world's longest.</li><li>• An approximate comparison for the crossing is made with the Queensferry Crossing (QC) although the proposed crossing is considerably longer and in deeper water. The three tower Queensferry Crossing takes advantage of the mid channel island Beamer Rock. The three tower configuration allows for the two 650m cable stayed spans. Whilst there is no central island at the Firth of Clyde crossing such was the case for QC at Beamer Rock upon which the central tower can be located, there is a possibility that the relatively shallower mid-channel Warden Bank could, dependent on geology, support a central tower. Nevertheless, the depth at this bank is still 11m deep and therefore a central tower foundation would require a significant caisson for construction.</li><li>• Flanking towers similarly would be founded in water deeper than the flanking towers at Queensferry Crossing.</li><li>• The three-tower cable stayed form would be preferable to the suspension form for all of the reasons that Queensferry Crossing was the preferred form in its location – principal among them, durability, the ability of the cable stays to be completely replaced if required. However, for the proposed bridge, it is anticipated that the main spans on a three tower structure would be approximately 900m and would put such a bridge in the top 6 longest cable stayed bridges in the world.</li><li>• Such a cable stayed bridge would approach the limits of technology and therefore costs are anticipated to be higher than an extrapolation from smaller bridges of similar form.</li><li>• The deck height and, depending on road cross section, suggest that aerodynamic design would be a critical parameter in the design. The bridge would require wind resilience measures similar to the barriers installed on the Queensferry Crossing. The bridge configuration, especially with regard to torsional rigidity would require specific wind analysis and testing which may prolong scheme development and final design duration.</li><li>• High tower construction on the Firth of Clyde, estimated 250m to 300m (note: the deck carriageway level is at +85m above water level).</li><li>• Consideration should be given to winter resilience of the bridge, principally deck surface and cable/tower de-icing.</li></ul>
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- The three main towers and possibly some approach viaduct foundations would be designed for ship collision, most likely with the mass of the underwater foundations providing sufficient energy absorption.

#### Loch Striven Bridge

- The Loch Striven Bridge crosses the comparatively shallow head of the loch at approximately 20m depth. The bridge's main span would be approximately 500m between two A -frame towers with a total length of approximately 820m.
- Deck level is at a relatively high level of 95m to suit the east and west land profiles, particularly where, on the west side, a tunnel is required. To reduce the level of the deck would increase the length of the tunnel significantly.
- The bridge would be a cable stayed single carriageway with pedestrian/cyclist provision.
- The cable stayed form obviates cable ground anchors as would be the case for a suspension form and greatly improves durability – the ability for cable maintenance and replacement.
- The two towers would be reinforced concrete founded on spread footings onto rock. Sands overlie rock so a mass concrete filled caisson would transfer load below the water line
- The bridge must remain straight thereby dictating the approach alignments.
- With the relatively high deck level, the towers would be correspondingly high estimated at 200 – 250m.
- The bridge deck must be wind resilient and will require wind barriers similar in form to those provided on the Queensferry Crossing. However, a slender single carriageway long span cable stayed bridge presents a design challenge to ensure the adequacy of the deck's aerodynamic response.
- Consideration should be given to winter resilience of the bridge, principally deck surface and cable/tower de-icing.

#### Loch Fyne Bridge

- The Loch Fyne Bridge is an alternative to a tunnel at this crossing location and crosses the loch at the sand spit at Otter Ferry.
- The overall length of the crossing is approximately 3,000m comprising a shallow area to the east at Otter Ferry with deeper channel of up to 20 – 30m in the narrows at the west side of the loch.
- A mixed bridge form would be appropriate comprising an eastern reinforced concrete spine box form or composite steel box girder approach viaduct over the shallower area to the east and a cable stayed bridge section over the deeper narrows to the west.

		<ul style="list-style-type: none"> <li>• The cable supported length is 1,600m of the overall length of 3,000m and would comprise a steel composite box girder and reinforced concrete slab. The bridge's main span would be approximately 1,100m between two A -frame towers.</li> <li>• Unlike the other crossings which must cater for the passage of large commercial and military vessels, the navigation clearance to the Loch Fyne Bridge need be only the minimum clearance required for commercial navigation, +45m.</li> <li>• The bridge would be single carriageway with pedestrian/cyclist provision.</li> <li>• The cable stayed form obviates cable ground anchors as would be the case for a suspension form and greatly improves durability – the ability for cable maintenance and replacement.</li> <li>• The two towers would be reinforced concrete founded on spread footings onto rock. Sands overlie rock so a mass concrete filled caisson would transfer load below the water line</li> <li>• The cable stayed length of the bridge must remain straight although the eastern approach viaduct could be curved to suit the approach road alignment and if advantageous in terms of geology.</li> <li>• The towers would be approximately 200m high.</li> <li>• The bridge deck must be wind resilient and will require wind barriers similar in form to those provided on the Queensferry Crossing. However, the cable supported length is significant and a slender single carriageway long span cable stayed bridge presents a design challenge to ensure the adequacy of the deck's aerodynamic response.</li> <li>• Consideration should be given to winter resilience of the bridge, principally deck surface and cable/tower de-icing.</li> </ul> <p><u>Tunnels within Route Corridor 7</u></p> <ul style="list-style-type: none"> <li>• Loch Striven West Tunnel – A tunnel is considered to be required to satisfy a practical road alignment through the corridor. The proposed tunnel would be approximately 1.45km in length and would be routed around the side of the hill following a similar route to the B836 at a slight downwards grade of 0.5%.</li> <li>• Ballochandrain Tunnel – A tunnel is considered to be required to satisfy a practical road alignment through the corridor. The proposed tunnel would be approximately 4.4km in length and on a generally straight alignment east to west. From Ballochandrain the tunnel would climb at a gradient of approximately 4%. After reaching a high point of 170m the road heads downwards at approximately 3% to the west portal approaching Otter Ferry.</li> <li>• Loch Fyne Tunnel – A tunnel is considered to be required to satisfy a practical road alignment under Loch Fyne at Otter Ferry, where the Loch is thought to be 50m at its deepest on the route considered. The tunnel, which is an alternative to the bridge at this crossing location would be approximately 3-4km in length</li> </ul>
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		<p>depending on alignment and would run on a curve from an eastern portal at Otter Ferry to the western side of the Loch south of Carrick. From Otter Ferry the road would descend at 4-5% to a low point of approximately -65m AOD and then would climb at a similar gradient to emerge on the west.</p> <p>It is initially considered that tunnels 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 tunnel configuration.</p> <p>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 have to be removed from the tunnel using semi-transverse ventilation, which draws the smoke and heat into an overhead duct and exhausts are likely to be required at intermediate shafts or via shafts near the tunnel portals for the shorter Loch Striven West Tunnel. Escape to free air from fire is facilitated by either an escape duct provided within the tunnel section or for longer tunnels via intermediate shafts with lifts and recovery suites given significant depth below ground surface and remote locations.</p> <p>Accordingly, twin bore, dual carriageway tunnels 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.</p>
	<p>Constructability Considerations</p>	<p><u>Major Structures Constructability Considerations – Bridges</u></p> <p>Firth of Clyde Cable Stayed or Suspension Bridge</p> <p>The following key considerations apply to the construction of the bridge over the Firth of Clyde at Dunoon:</p> <ul style="list-style-type: none"> <li>• A significant approach viaduct would be required on the east shore between the A770 and the east span of the bridge. For navigation clearance, a deck carriageway minimum height of approximately +75m must be attained to ensure a deck navigation clearance is obtained of +75m (+85m deck carriageway level allowing for 5m deck construction depth and 5m deflection)</li> <li>• Similarly, on the west shore an approach viaduct would extend out from the higher land west of Dunoon from which an approach road alignment would run west to form a by-pass of Dunoon.</li> </ul>

		<ul style="list-style-type: none"><li>• Preliminary assessment suggests a central tower could be placed on Warden bank at some 11m depth. This would entail prefabricating and sinking a caisson onto the bank and lowering to rock level. Once sealed, underwater concreting would form the spread footing possibly of the order of 30 – 40m deep upon which the base for the central tower could be formed.</li><li>• Similarly, caissons would be fabricated and placed for the flanking towers whose foundations would also be formed in underwater concreting.</li><li>• Concrete batching would be from the marine facility (e.g. Greenock) and transported to the tower and pier locations by barge. Concrete to the towers would be pumped from the barges to pumps on the tower bases and thereby to the incremental jumps in the towers.</li><li>• Approach marine piers would be founded pilecaps on driven piles all enclosed in cofferdams.</li><li>• Access to the east side of the bridge is relatively straightforward with good access to the Central Belt road network. Access to the west shore is more limited so it is anticipated that primary works offices and staging will be on the eastern shore.</li><li>• The construction of the western abutment will cause significant disruption on the A815 in Dunoon and would require a long-term temporary diversion to maintain connectivity along the coastline, which would potentially be difficult to locate. It would be worth considering moving the abutment out into the water to maintain the existing A815 to avoid needing to construct a new permanent route around the coast for traffic not using the viaduct in the long term as well , although the depth of water would not make this a simple piece of construction.</li><li>• Similarly, the eastern abutment construction will sever the connection along the A770 coast road. Although this area is somewhat less inhabited the route provides a connection between Inverkip and Castle Levan so the loss of connectivity could present a notable issue for residents and businesses. This abutment would therefore warrant a similar consideration to the western abutment.</li><li>• A single carriageway bridge deck will require high twin legged 'A-frame' towers. The deck would be enclosed between the tower legs with torsional restraint provided by bearings. The central tower would provide longitudinal fixity with expansion joints at the east and west deck ends. The reinforced concrete towers would be constructed incrementally by jump forming with concrete being pumped up the towers as their height incrementally increases.</li><li>• The torsional span lengths are important as the long slender deck combined with wind barriers will be aerodynamically sensitive. The flexibility of the slender deck will also present a deflection challenge.</li><li>• Steel box deck segments would be fabricated nationally and/or internationally and delivered to a staging area at a nearby facility. It is likely that marine facilities at Greenock would be suitable for the staging area for precasting of the composite deck slab. Weather and tide important factors in segment erection. Given the</li></ul>
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		<p>military, commercial and private/leisure marine navigation demand in this area of the Firth of Clyde, marine management and control is a construction programme risk.</p> <ul style="list-style-type: none"> <li>• Segments would be transported by barge to below their location in the span.</li> <li>• Main span segments would be progressively lifted onto the tower and extend incrementally from the towers in an alternating balanced cantilever sequence on each of the three towers until closure at the approach viaducts and then at the midspans of the two main spans.</li> <li>• Lifting would require GPS placement of barges and their station protected by an exclusion zone on the main navigation channels. This will clearly affect marine vessel navigation. The duration of barges on station for the lift is expected to be comparatively lengthy at approximately 8 – 10 hours. This allows for anchoring (2 - 3 hours) and strand jack lifting which, owing to the deck height, could take up to 7 hours to achieve. For the relatively prolonged operation, wave height and wind conditions may limit the number of available weather windows for lifting unexpected or variable conditions 'on the day' impede the lifting operations.</li> <li>• Climbing tower cranes fixed to the main towers will lift materials and equipment to deck level.</li> <li>• DIO consultation will be required for a number of specific security and operating restrictions such as; <ul style="list-style-type: none"> <li>○ potential restriction to deck access during the passage of military or large oil transportation vessels.</li> <li>○ Construction activities effect on secure channel communications between RNAD Coulport, Faslane, Holy Loch etc.</li> <li>○ The possible effect of a large-scale bridge structure on radar and sonar.</li> <li>○ Security exclusion zones.</li> </ul> </li> <li>• The suspension bridge construction could have a potential impact on commercial and fishing activities.</li> </ul> <p>Loch Striven Bridge</p> <p>The following key considerations apply to the construction of the Loch Striven bridge:</p> <ul style="list-style-type: none"> <li>• There is access to both east and west ends of the bridge although the existing carriageway is single lane with passing places so construction access would require improvement prior to bridge construction. Marine access also appears relatively straightforward with access from the south of the loch.</li> <li>• The single carriageway bridge deck will require high twin legged 'A-frame' towers founded on rock. The tower foundations will be in water. However, there appears to be little if any navigation demand at this location at the head of Loch Striven so construction could progress from causeways constructed out from the shores. However, these would impede later segment erection from marine barge so would most likely need removal. Access to tower construction from land would eliminate the need for marine concrete transport.</li> </ul>
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- The foundation installation would be designed for underwater construction. The reinforced concrete towers would be constructed incrementally by jump forming with concrete being pumped up the towers as their height incrementally increases. Concrete volumes, especially given the nearby tunnel construction would warrant batching plants on site.
- Steel box deck segments would be fabricated nationally and/or internationally and delivered to a staging area at a nearby facility constructed onshore in the south of the loch.
- Segments would be transported by barge to below their location in the span. Main span segments would be progressively lifted onto the towers by alternating balanced cantilever progression out from the towers until closure at the bridge abutments and then at midspan.
- Lifting would require GPS placement of barges and their stations would be protected by an exclusion zone although there is very little marine traffic in this locale. Given the height of the deck, the duration of barges on station for the lift is expected to be comparatively lengthy at approximately 8 – 10 hours. This allows for anchoring (2- 3 hours) and strand jack lifting which, owing to the deck height, could take up to 7 hours to achieve. For the relatively prolonged operation, wave height and wind conditions may limit the number of available weather windows for lifting unexpected or variable conditions 'on the day' impede the lifting operations.
- Climbing tower cranes fixed to the main towers will lift materials and equipment to deck level.
- The bridge construction on Loch Striven could have a potential impact on commercial and fishing activities

#### Loch Fyne Bridge

The following key considerations apply to the construction of the Loch Fyne bridge alternative:

- There is access to both east and west ends of the bridge although the existing carriageway on the east shore at and to Otter Ferry is single lane with passing places so construction access would require improvement prior to bridge construction. Marine access also appears relatively straightforward with access from the south.
- The eastern approach viaduct would be constructed by the temporary formation of an access causeway or jetty extending from the shore at Otter Ferry and placement of a series of cofferdams at the pier locations onto the Otter spit.
- The piers for the approach viaduct would be founded on steel piles driven to rock or into sand/gravel dependent on the geotechnical design. Pile caps would be formed in reinforced concrete in the cofferdams with leaf or discrete piers erected to deck level.

		<ul style="list-style-type: none"> <li>• The viaduct would be a post-tensioned concrete spine box girder or composite steel box section launched from the eastern shore. This would require a construction bay formed at Otter Ferry with delivery of concrete and/or fabricated steel components. Box assembly would take place in the assembly bay.</li> <li>• The cable supported length of the single carriageway bridge deck will require high twin legged 'A-frame' towers founded on rock. The tower foundations will be in water. There appears to be limited navigation demand at this location so construction could progress from causeways/jetties constructed out from the shores. However, these would impede later segment erection from marine barge so would most likely need removal. Access to tower construction from land would eliminate the need for marine concrete transport. Access to the east tower would most likely require an extended causeway across the Otter spit.</li> <li>• The foundation installation would be designed for underwater construction. The reinforced concrete towers would be constructed incrementally by jump forming with concrete being pumped up the towers as their height incrementally increases. Concrete volumes, especially given the nearby tunnel construction would warrant batching plants on site.</li> <li>• Steel box deck segments would be fabricated nationally and/or internationally and delivered to a staging area at a nearby facility constructed onshore in a location within approx. 3km of the bridge.</li> <li>• Segments would be transported by barge to below their location in the span. Main span segments would be progressively lifted onto the towers by alternating balanced cantilever progression out from the towers until closure at the bridge abutment on the west, the approach viaduct end on the east and then at midspan.</li> <li>• Lifting would require GPS placement of barges and their stations would be protected by an exclusion zone although there is very little marine traffic in this locale. Given the moderate height of the deck, the duration of barges on station for the lift is expected to approximately 5 hours. This allows for anchoring (1 hours) and strand jack lifting which could take up to 4 hours to achieve. Wave height and wind conditions may limit the number of available weather windows for lifting unexpected or variable conditions 'on the day' impede the lifting operations.</li> <li>• Climbing tower cranes fixed to the main towers will lift materials and equipment to deck level.</li> <li>• The bridge construction on Loch Fyne could have a potential impact on commercial and fishing activities.</li> </ul> <p><u>Major Structures Constructability Considerations – Tunnels within Route Corridor 7</u></p> <ul style="list-style-type: none"> <li>• Tunnels could be advanced by drill and blast techniques or by using a large Tunnel Boring Machine (TBM).</li> <li>• Whichever technique is used, short sections of cut and cover tunnel would be required at each portal location to form a vertical portal face in reasonably competent rock from which the tunnel can be advanced. 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</li> </ul>
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		<p>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. Once the tunnel is completed an in-situ cast secondary lining can be installed to form a durable final structure.</p> <ul style="list-style-type: none"> <li>• Alternatively, tunnels can be bored using a large Tunnel Boring Machine (TBM), starting at one end and boring 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.</li> </ul> <p>Issues specific to various tunnel options are as follows:</p> <ul style="list-style-type: none"> <li>• Loch Striven West Tunnel – The construction of a portal at the north-east end of the tunnel adjacent to Loch Striven is likely to be problematic due to the elevation and slope. Access may be preferred from the south-west end of the tunnel, via Loch Riddon, the A886 and B836. Due to the length of this tunnel, drill-and-blast is considered to be more suitable.</li> <li>• Ballochandrain Tunnel – A TBM drive site from the western end of the proposed tunnel seems the optimum solution as the TBM could be delivered via Loch Fyne, and spoil and other materials could be transported via the Loch, rather than on sub-standard local roads. However, this would mean that the road from Otter Ferry to the western portal location would need to be constructed first as the existing track would not be suitable. Access via Loch Riddon and the A886 to the eastern portal would be possible too with an improvement of the existing track, and there may be better land availability at this site.</li> <li>• Loch Fyne Tunnel – The tunnel could be advanced using a large Tunnel Boring Machine (TBM), or possibly an immersed tube tunnel, which is floated into place and sunk into a dredged trench on the loch bed. Regardless of technique, short sections of cut and cover tunnel would be required at each portal location. Both techniques present a considerable tunnelling challenge as the Loch bed is variable, and consists of both soft ground deposits and rock, the extents of which are unknown at this stage.</li> </ul> <p><u>Other Constructability Considerations – Road and Small Structures</u></p> <p>Dunoon to Rashfield</p> <p>Road improvement on this section of the A815 are currently assumed to require widening at existing road level</p>
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		<p>only, so significant earthworks and other heavy civil engineering activities are not anticipated for this part of the scheme. The widening works would require the traffic to be restricted to a single lane on the opposite side of the road from where the work is being carried out with work progressing linearly along the road in small construction sections for each work front. The number of sections under progress may be restricted according to traffic modelling requirements. Works along this stretch of road are through a densely populated area so improvement works may have a notable impact on access to properties and connection routes, particularly where minor bridges require replacement.</p> <p>As an alternative to upgrading the A815 through the town, an option exists within the route corridor to bypass the town of Dunoon. Whilst this may remove some of the issues noted above with respect to construction within an urban area there is expected to be constructability challenges with a bypass option similar to other lengths of the route corridor that require new lengths of road to be constructed.</p> <p>Rashfield to Ballochandrain</p> <p>This alignment is a new offline road approximately 7.5km long that crosses the existing alignment of the B836 at numerous locations before moving fully to an online widening of the existing road south of Loch Tarsan and back offline to a new multi-span cable stay bridge crossing at Loch Striven. The Loch Striven Bridge is set at 95m above loch water level necessitating high towers of up to 250- 300m. The road then moves into a 1.45km tunnel and new surface road to finish at Ballochandrain. The following are key construction considerations for the route:</p> <ul style="list-style-type: none"><li>• The area where the route is passing through is relatively isolated from any roads of notable size which presents a challenge for logistics</li><li>• The existing B836 is a bi-directional single carriageway with intermittent passing places, so would therefore be impacted notably by the construction of a new road criss-crossing the alignment making traffic management difficult without closing the road. A closure could have significant impacts for connectivity between local communities so would require careful planning.</li><li>• If possible, it would be advantageous to move as much of the alignment offline as possible to mitigate impacts to the existing road and also provide for a haul route for earthworks vehicles.</li><li>• Where the new alignment crosses over the existing road levels should be kept close to existing if possible and the existing pavement construction reused to alleviate TM issues.</li><li>• Earthworks quantities are potentially relatively significant in the eastern section of the works but are a mix of cut and fill areas. If possible, the alignment should be designed to achieve a cut and fill balance to reduce the amount of material arriving at or leaving from site. Given the minor roads in this area this would be a particular advantage.</li></ul>
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		<ul style="list-style-type: none"><li>• Construction of the new link road across the top of Loch Striven presents challenges due to likely depth of water and the height of the piers, requiring extensive marine plant to support the work in the loch.</li><li>• Given the access issues in this area it would be advisable to primarily support construction of the bridge from the loch to bring in materials. If a marine facility or temporary jetty could be established here it could also support earthworks activities and tunnel construction to reduce spoil being removed from site on the local road network.</li><li>• To the west end of the new tunnel, construction of the new surface road and an adjacent haul road would be advised to enable work to begin on the tunnel from the western portal whilst the bridge is constructed over the loch. Construction from the east end if the tunnel would be challenging without the bridge in place due to the steep slope and height of the portal above the existing road.</li><li>• During tunnelling a significant challenge will be removal of the excavated spoil using the local road network. Opportunities to reuse the material on site or possibly transport to a marine loading area at Loch Striven may be explored that would alleviate the amount of traffic on the road.</li></ul> <p>Ballochandrain to Port Ann</p> <p>This section of road connects between the A886 in Ballochandrain in the east and the A83 on the west side of Loch Fyne at Port Ann , incorporating a short section of new surface road at the eastern end before entering a 4.4km tunnel through the mountain which exits approximately 2km from the eastern shore of Loch Fyne requiring a new surface road to reach the crossing. The link road crossing Loch Fyne would either need to be a bridge structure or tunnel formed using TBM or possibly an immersed tube. The route has the following key construction considerations:</p> <ul style="list-style-type: none"><li>• Access roads on the east side via the A886 are single carriageway A class roads providing limited access to site via road. Resulting from the tunnel excavation and the construction of the new surface roads it may be more feasible to establish a site compound and adjacent marine facility on the eastern loch shore to provide deliveries and remove spoil from site rather than using the surface roads. The capacity of the existing road network could also be additionally strained through ongoing online improvements to other nearby roads as part of the scheme.</li><li>• On the west side of the mountain current surface access is very poor with only narrow access tracks to the area. This means that logistics routes via the loch or road network would need to be created to allow the works to commence.</li></ul>
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Environment Considerations	Biodiversity, Fauna and Flora	<p>The route corridor crosses Upper Loch Fyne and Loch Goil MPA for approximately 2.8km. Pollution during construction and operation of crossing could impact the MPA, which could cause a major negative environmental effect.</p> <p>131.7ha of Ruel Estuary SSSI falls within the route corridor. This could result in the temporary and permanent loss of SSSI habitat, including the loss of designated features fen meadow, flood-plain fen, saltmarsh and upland oak woodland, which could be a major negative environmental effect. Moderate negative environmental effects could also occur as a result of nitrogen deposition.</p> <p>62 parcels of woodland listed on the AWI fall within the route corridor. This could result in the loss of nationally important and irreplaceable habitat, which could require compensation, and would be a major negative environmental effect. Moderate negative environmental effects could also occur as a result of nitrogen deposition.</p> <p>There is potential for negative environmental effects on terrestrial and aquatic species from construction activities, as follows:</p> <ul style="list-style-type: none"> <li>• Disturbance from noise and vibration and light pollution</li> <li>• Injury or mortality from vegetation removal, vehicle movements, or becoming trapped in uncovered holes and pipes during construction</li> <li>• Fragmentation and loss of habitat suitable for shelter, foraging and commuting; and</li> </ul> <p>Changes in water flow conditions from runoff, or alterations to watercourses and groundwater.</p> <p>During operation, there is potential for unavoidable habitat loss and fragmentation for protected species as a result of tree and vegetation clearance and loss of irreplaceable AWI.</p>
	Population and Human Health	<p>There is potential for localised 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 receptors. Construction of watercourse crossings in particular could result in a longer construction period and could involve activities such as piling with high levels of noise and vibration.</p> <p>During the operation phase, there is potential for receptors close to the route to experience new or increased noise and vibration effects from increased vehicle traffic.</p>

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		<p>As there are a number of settlements within the route corridor, in addition to noise and vibration there is potential for other minor negative 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).</p> <p>During operation, the watercourse crossings would provide significant journey savings around Loch Fyne and the Firth of Clyde and the route corridor would improve connectivity between the central belt and Argyll and Bute. The route corridor would provide greater accessibility to active travel routes such as Cowal Way, NCN Route 753 and the core path network in and around the route corridor. There is also potential for paths to be severed as a result of the route corridor.</p> <p>Land-take from properties would be required to facilitate the operation of the route corridor and the tunnelling options would require additional land take and potentially demolitions.</p> <p>There is also potential for localised effects from air quality on human health; these are discussed further under Air Quality.</p>
	Water Environment	<p>Construction within the route corridor and operational structures and discharges may affect the hydromorphology and surface water quality of approximately seven Water Framework Directive (WFD) classified river water bodies, five WFD coastal water body and approximately 110-120 minor watercourses.</p> <p>SEPA Flood Maps (SEPA, 2020) indicates that the route corridor may be at fluvial flood risk from Milton Burn in Dunoon, River Eachaig, Little Eachaig, Glenkin Burn, Glentarsan Burn, Balliemore Burn, Tamhnich Burn, River Ruel, Bealachandrain Burn and Kilail Burn during a medium likelihood event (0.5% Annual Exceedance Probability (200-year) event). The route corridor may be at coastal flood risk from Firth of Clyde at Dunoon, Holy Loch at Tom nan Ragh, Loch Striven, Loch Riddon, and Loch Fyne during a medium likelihood event (0.5% Annual Exceedance Probability (200-year) event). Potential for coastal flooding from new crossings on Firth of Clyde and Loch Fyne, which could impact flooding on associated road infrastructure.</p> <p>May impact the Ruel Estuary SSSI. Upper Loch Fyne and Loch Goil Marine Protected Area may also be affected by crossing structures.</p> <p>Loch Fyne Shellfish Water Protected Area is directly crossed and may be impacted. Loch Striven and Kyles of Bute Shellfish Water Protected Areas are within the route corridor and may be impacted by the route corridor.</p>

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	<p>There are Active Aquaculture Sites, CAR licenced fish farms and Classified Shellfish Harvesting Areas within the vicinity of the route corridor which may be affected.</p> <p>Two surface water Drinking Water Protected Areas may also be affected.</p> <p>Lunderston Bay bathing water is out with the route corridor but within the vicinity of the route corridor and may be affected.</p> <p>Construction and operation within the route corridor could result in major negative environmental effects on the water environment.</p>
Soils	<p>The route corridor is assessed as having a minor negative or uncertain environmental effect. This recognises the route corridor is likely to avoid potential impacts on Class 2 and Class 1 peatland habitat (nationally important and of potentially high conservation value and restoration potential). Loss of existing commercial forestry and land identified as Preferred and Potential within the Argyll &amp; Bute Woodland Strategy is likely to be unavoidable within the route corridor.</p>
Air Quality	<p>There is potential for localised air quality effects on receptors close to the route corridor during the construction phase: for example, dust generated from site activities including construction of large structures over the Firth of Clyde and at Loch Fyne, and pollutant emissions from vehicular movements, which could result in annoyance for local residents.</p> <p>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.</p> <p>Although the existing air quality in the region is good, there are a number of settlements within the route corridor which could potentially experience air quality negative effects; however it is expected that these would be reduced through mitigation measures.</p> <p>Potential air quality effects on ecological receptors are assessed under Biodiversity, flora and fauna.</p>
Climatic Factors	<p>Construction of the route corridor would have major negative effects on climate due to the release of carbon emissions associated with the construction materials and construction activities as outlined in the Material Assets section</p>

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		<p>Once operational, forecast traffic levels are considered to be relatively moderate to high, for this route corridor, assuming the continued operation of the A83 through the Rest and Be Thankful. With the predicted shift towards electric vehicles this would reduce in the future. Additionally, the route corridor would reduce the driving distance for some journeys due to the introduction of the Loch Long and Firth of Clyde crossing, which over time would likely result in carbon savings.</p> <p>Effects on the route corridor as a result of predicted changes to the climate and weather should also be considered. As indicated in the 'Water Environment' section, the route corridor is situated within or in close proximity to zones deemed to be at risk of coastal or fluvial flooding at several locations. The anticipated increase in severity and frequency of rainfall events caused by climate change could pose greater risk from flash-flooding.</p> <p>As indicated in the 'Soils' section, the route corridor is located on areas identified as peatland, which, if constructed on, would lead to the release of sequestered carbon and a loss of high value carbon sink land. Any felling required would also reduce the carbon sink value of forested areas within the route corridor. Woodland and Forestry Strategy areas, including existing planted woodland, potential, preferred and sensitive sites, need to be considered in the route corridor selection process.</p>
	Material Assets	<p>As outlined in the Climatic Factors section, there are several natural material assets including woodland, peat soils and farmland that could be affected by the route corridor.</p> <p>Loss of natural material assets would result in minor negative or uncertain environmental effects for soils and major negative effects on woodland.</p> <p>As outlined in the 'Climatic Factors' section, there is likely to be major negative environmental effects from the construction of built material assets in the route from manufacture of materials and construction activities including:</p> <ul style="list-style-type: none"> <li>• 12 no. new bridges.</li> <li>• 1 no. new 3,900m long (2 x 900m main spans) long cable stayed or suspension bridge.</li> <li>• 1 no. new 8,20m long (500m main span) cable stayed bridge (Loch Striven).</li> <li>• Construction of up to three tunnels, one tunnel would be over 3,000m long.</li> <li>• 1 no. new multi-span bridge (River Ruel).</li> <li>• 1 no. bridge or tunnel (Loch Fyne).</li> </ul> <p>The Firth of Clyde is a busy shipping route for naval vessels accessing HMNB Clyde and cargo vessels accessing Clydeport Container Terminal at Greenock as well as ferry services, leisure and fishing vessels. There is potential for</p>

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		effects on shipping during construction of the structural crossing. Appropriate clearance for shipping would be required to avoid effects on navigation during operation.
	Cultural Heritage	<p>Due to the relatively high numbers of cultural heritage resources within the route corridor (compared to route corridors 1 to 3) and the locations of these, it is considered unlikely that a route within this route corridor could be developed that would avoid major negative effects on these.</p> <p>The most cultural heritage constraints are where there is a high concentration of Listed Buildings at Dunoon and the extent of the route corridor occupied by the Ballimore GDL.</p>
	Landscape and Visual Amenity	There is potential for major negative effects on the special qualities of the Kyles of Bute NSAs, the West Loch Fyne (Coast), East Loch Fyne (Coast) and Bute & South Cowal APQs, one GDLs, and the local landscape and seascape character due to the construction and operation of the carriageway. There is also potential for negative visual effects for residential receptors in proximity to the route corridor, as well as vehicle travellers using the existing roads and other outdoor receptors. The construction of the significant new structural crossings at Loch Fyne and the Firth of Clyde would affect the landscape character and visual amenity of these areas.
Traffic	Traffic Flows	<p>Due to the improved road links to Cowal and Kintyre, associated with this route corridor, within the context of typical traffic levels on the existing A83 Trunk Road, traffic using this corridor is forecast to be moderate to high, with a corresponding reduction in traffic on the A83 Trunk Road through the Rest and Be Thankful (potentially between 25 and 75%) in 2027. This assumes that the Rest and Be Thankful is operating under normal conditions.</p> <p>Traffic reductions are also forecast on the A82 Trunk Road by Loch Lomond to the south of its junction with the A83, as well as on the wider A83 Trunk Road between its junctions with the A82 Trunk Road and the new scheme, and on the A815, along its length.</p>
	Accidents	This route corridor is one of the options resulting in significant reductions in vehicle kilometres for strategic traffic currently using the A83 Trunk Road. As a result, it is judged that a corresponding reduction in traffic related casualties could be realised.
Operational Considerations		From a Trunk Road operation perspective, the main operational considerations within the route corridor are the risk of flooding and/or landslides where it passes through valleys or adjacent to waterbodies, based on the steep topography in these areas. In some areas, the centreline of the route corridor has a maximum elevation of approximately 320m above ordinance datum, with significant adjacent peaks providing shelter. This means it is likely

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	<p>that in these areas, snow accumulates within the route corridor during the winter months, with potential winter resilience operational issues.</p> <p><u>Bridges within Route Corridor 7</u></p> <p>Long span bridges will require the Trunk Road Operating Company to maintain an on-site bridge management and control facility with bridge traffic management and control, communications with Traffic Scotland, marine navigation and MOD liaison along with inspection, maintenance and repair capabilities. Additionally, facilities will be required for maintaining equipment and collecting telemetry from a Structural Health Monitoring System.</p> <p><u>Tunnels within Route Corridor 7</u></p> <ul style="list-style-type: none"> <li>• There is a need for regular inspection and maintenance of such tunnels. A tunnel manager, tunnel safety officer and a tunnel design &amp; 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.</li> <li>• 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. Dependent on the evaluation of risks, dangerous goods vehicles may 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.</li> <li>• For a twin bore dual carriageway configuration, vehicle cross-overs may need to be provided at intervals if practicable, as per recommendation from the European Directive EUD 2004/54 EC. In addition, lay-bys should be provided at intervals.</li> <li>• The development of any tunnel design should be informed by consultation with emergency services and other relevant stakeholders and guided by European and National Standards to ensure that appropriately robust measures in the event of an emergency incident are put in place.</li> </ul>
Financial Considerations	The estimate cost range of a scheme within this route corridor is approximately £8.73Bn - £11.49Bn.

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Estimated Time to Completion	It is estimated it would take approximately 16-17 years to achieve a fully operational road in this route corridor assuming constructed as a single contract. If construction was phased with contracts in sequence, the time for completion would be greater.
Public Acceptability	Consideration of the feedback received during the public consultation held during September / October 2020 shows that the balance of positive and negative sentiment for this route corridor is more evenly balanced, or at least less clearly positive or negative overall.

STAG Criteria		Assessment Summary
Criteria		Assessment Summary
Environment		Refer to Implementability Assessment – Environment
Safety		Refer to Implementability Assessment – Accidents
Economy	Transport Economic Efficiency	<p>This route corridor is likely to result in significant journey time savings for strategic traffic currently using the A83 Trunk Road between Kintyre and the central belt.</p> <p>Based on traffic forecasting for 2027 using Transport Model for Scotland (TMFS14), journey time savings between Tarbert and Glasgow are forecast to be large (&gt;15 minutes) in 2027, compared with other options. Journey time savings between Dunoon and Glasgow are also expected to be large (&gt;45 minutes) compared with existing road only options, following the construction of this route corridor.</p> <p>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.</p>
	Wider Economic Impacts	This route corridor offers substantial changes in connectivity and, therefore, is best not solely characterised as a solution to unreliability at the Rest and Be Thankful. Rather, it provides the opportunity to radically improve connectivity to some of the remote communities of Argyll and Bute.

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		<p>The route corridor offers more direct connections from Cowal, Kintyre and the islands (including Islay and Gigha) to the more populous areas of Inverclyde, providing substantial improvements in onward journeys to the central belt.</p> <p>The route corridor, therefore, has the potential to provide a significant positive contribution towards wider economic benefits for Argyll &amp; Bute. Significant benefits would likely be provided for key sector businesses, such as whisky, aquaculture and tourism, through enhanced access to both national and global markets.</p> <p>It is also worth noting that, while rural depopulation (a significant issue within Argyll &amp; 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 &amp; Bute.</p>
Integration	Transport Integration	<p>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.</p> <p>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 commuters, who may be given the opportunity to travel via active modes to transport interchanges. The intervention may help to reduce issues regarding actual and perceived severance, due to the provision of fixed links, with active travel infrastructure benefiting communities in Kintyre and Cowal, with improved linkages across the route corridor to Dunoon, Lochgilphead and beyond.</p> <p>The intervention will provide enhanced resilience and potential journey time and journey time reliability benefits for strategic and local bus and coach services. The resilience and enhanced connectivity provided may provide bus and coach operators with an opportunity to review timetables, translating to more</p>



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	<p>efficient operations and, potentially, a change in service frequency, scope for interchange between services and the number of communities served.</p> <p>Landslide induced incidents on the A83 Trunk Road at the Rest &amp; 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.</p> <p>This route corridor is not expected to have a major impact on the perception of a seamless public transport journey, as ticketing will not be affected to any great extent. However, there is potential for enhanced interchange between bus services, due to the enhanced connectivity provided.</p> <p>The intervention will improve journey time reliability and resilience, providing 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.</p>
Transport and Land Use Integration	<p>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.</p> <p>If selected as the preferred 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.</p>

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	<p>The route corridor is expected to support enhanced accessibility to and from developments in the wider region, and may support investment decisions in Argyll &amp; Bute, more generally.</p> <p>This route corridor is, however, judged to deliver negative impacts in terms of promoting sustainability and reducing the need to travel. The enhanced connectivity for Cowal and Kintyre provided by this corridor could result in higher levels of traffic as a result of the improved access provided for currently geographically remote communities. While this could result in a short-term negative impact, in terms of delivery against the climate action goals, cognisance of the likely timescales for the delivery of an intervention of this scale should be made, given that it is likely that the regional / national vehicle fleet may be largely decarbonised, by this stage. The overall impact on Land Use Transport Integration is considered to be Moderate Negative.</p>
Policy Integration	<p>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.</p> <p>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 &amp; Bute.</p> <p>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.</p>

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	<p>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.</p> <p>This route corridor is likely to contribute positively towards key objectives as set out within Argyll &amp; Bute's Local Development Plan. An intervention within this route corridor will likely assist in the improvement of:</p> <ul style="list-style-type: none"> <li>- Argyll and Bute's connectivity, transport infrastructure, integration between land use, transportation and associated networks.</li> <li>- Argyll and Bute's main towns and key settlements, as increasingly attractive places where people want to live, work and invest.</li> <li>- the economic and social regeneration of smaller rural communities.</li> <li>- 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.</li> <li>- addressing climate change impacts and reducing the region's carbon footprint.</li> </ul> <p>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'.</p> <p>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</p>

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STAG Criteria		
Criteria		Assessment Summary
		<p>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.</p> <p>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.</p> <p>A further assessment of carbon, and opportunities for carbon reduction in design, would be considered in later stages of the project assessment process.</p>
Accessibility and Social Inclusion	Community Accessibility	<p>It is considered that this route corridor offers the potential for positive impacts on accessibility, in terms of public transport usage, with enhanced access provided for Cowal and Kintyre. It is considered unlikely, however, that this route corridor would have any significant impact on 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.</p> <p>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.</p> <p>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, and to the fixed links which, in and of themselves, may be an attractor for visitors and tourists, wishing to park and proceed via active modes.</p>

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	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	<p>Due to the rural nature of the Argyll &amp; 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.</p> <p>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.</p> <p>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 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.</p> <p>Positive impacts can be expected, in terms of mitigating impacts on socially excluded groups (Argyll &amp; Bute has a higher proportion of older residents than the national average, for example).</p> <p>This route corridor offers the potential to reduce economic and geographic deprivation, particularly within the Bute &amp; Cowal (Dunoon and Rothesay both have data zones within the most deprived 10%) and, to a lesser extent, Mid-Argyll, Kintyre and Islay regions of Argyll &amp; Bute (Campbeltown has data zones within the most deprived 20%).</p>

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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.	✓						

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

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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						✓	