A83 Rest and Be Thankful

A83 REST AND BE THANKFUL - MTS SCHEME ASSESSMENT REPORT VOLUME 1

Transport Scotland

06/12/24

A83AAB-AWJ-GEN-MTS_GEN-RP-ZZ-000001

Notice

This document and its contents have been prepared and are intended solely as information for Transport Scotland and use in relation to the Access to Argyll and Bute (A83) scheme.

AtkinsRéalis WSP Joint Venture assumes no responsibility to any other party in respect of or arising out of or in connection with this document and/or its contents.

This document has 122 pages including the cover.

[This page is intentionally left blank]

Contents

Tables

Figures

1. Project Background

1.1. Introduction

1.1.1. The A83 Trunk Road is one of two east-west strategic trunk roads that connects Argyll and Bute to the central belt of Scotland, making it a vital link in the region's transportation infrastructure. The A83 is a 98 mile (158km) predominantly single carriageway road originating in Tarbet, where the A82 and A83 meets at the junction on the western side of Loch Lomond. It then terminates in Campbeltown, near the southern tip of the Kintyre Peninsula.

1.1.2. The section of the A83 through Glen Croe, between Ardgartan and the Rest and Be Thankful viewpoint at the A83/B828 junction, includes the highest point along the A83 at approximately 265m above ordnance datum, and the adjacent hillsides have a history of instability leading to frequent road closures and resultant diversion. A83AAB-AWJ-GEN-MTS_GEN-DR-ZZ-000001 in Volume 2, Appendix A.1 shows the position of Glen Croe relative to Glasgow and the central belt of Scotland.

1.1.3. When the A83 is not available for use as a result of, or at risk to landslides and debris flow events, the Old Military Road (OMR), which runs in parallel through the base of Glen Croe, is used as a diversion route. The OMR diversion operates as a combination of two-way free flow traffic over the first 1.1km and convoy working, managed by the Trunk Road Operating Company, for the remaining 2.7km where it is single track, see Figure 1-1. The alternative to the OMR is a diversion via A82, A85 and A819 which adds 41km to the journey between Tarbet and Inveraray. This could be longer depending on a traveller’s final destination.

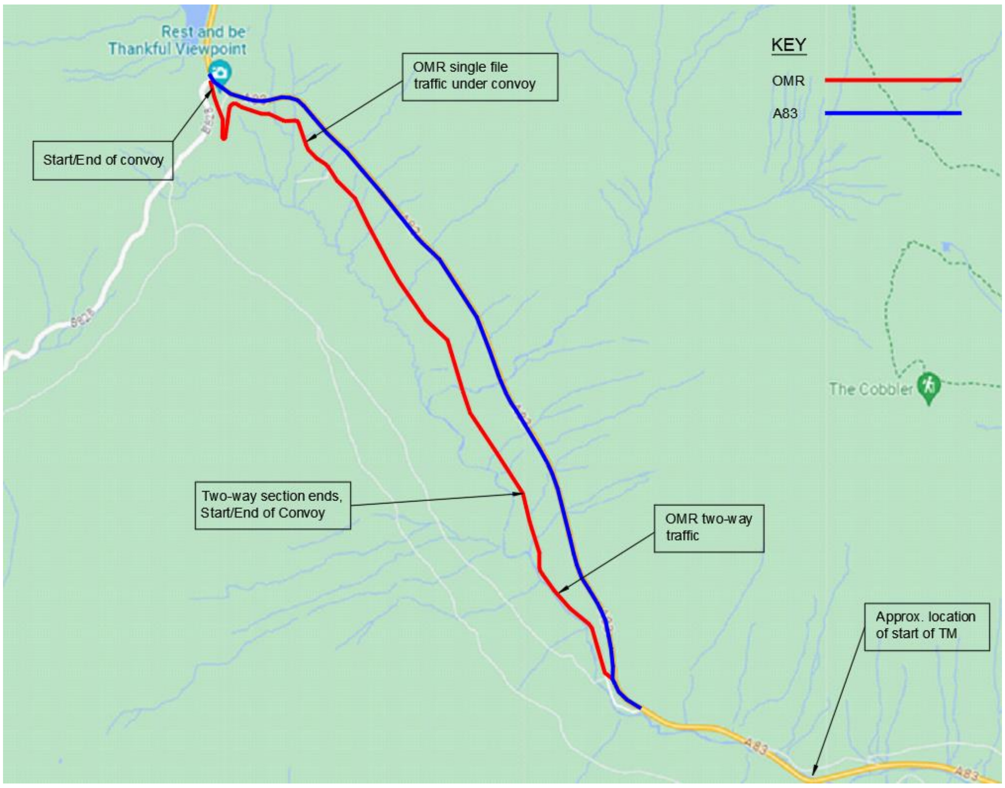

Figure 1-1 – Location Map and Existing Operational Arrangement

1.1.4. Following recommendations of Strategic Transport Projects Review 2 (STPR2) and major landslides in August and September 2020, the largest recorded in the area, a long-term, resilient, and sustainable solution was required to address the impacts these events have on Argyll and Bute. The then Cabinet Secretary instructed Transport Scotland to investigate a solution to address the landslide issues affecting the A83 Trunk Road at the Rest and Be Thankful. A Design Manual for Roads and Bridges (DMRB) Stage 1 Route Corridor Assessment was completed in 2021, identifying Glen Croe as the preferred route corridor. Further work also undertaken at this time explored possible options for a Long-Term Solution (LTS) resulting in five potential route options which were conceptually based on various iterations of tunnels, viaducts and debris flow shelters.

1.1.5. The then Cabinet Secretary also announced that Transport Scotland would develop a Medium Term Solution (MTS), whilst the LTS is being developed. Its purpose is to deliver a safe, proportionate and more resilient diversion route for use when the A83 Trunk Road is closed, until the permanent LTS is constructed.

1.1.6. The DMRB Stage 2 process was completed and the preferred route option for the LTS announced on 2 June 2023. The preferred route option, previously known as the Brown Option, is generally located along the existing A83. It starts at the Croe Water and ends north of the junction with the B828. The preferred LTS route option comprises a debris flow shelter, debris flow protection wall and continuous catchpit to protect the road users from debris flows, landslides and boulder falls on the southwest slopes of Ben Luibhean. An amended junction with the B828 is also proposed, which currently includes a significant rock cut to the east of the junction to improve sightlines. Minor works to improve the bus turning area and the Rest and Be Thankful car park are also being considered.

1.1.7. The MTS improvement scheme is being prepared to improve resilience and operation of the OMR until the LTS is constructed. It is also expected that constructing the MTS improvements will hasten progress and streamline delivery in advance of an LTS. This Scheme Assessment Report focuses solely on the MTS Proposed Scheme.

1.2. Scheme Objectives

1.2.1. The scheme objectives that have been identified for the MTS are:

- Increase resilience of a temporary diversion route by reducing the likelihood of closure due to landslides, flooding, or other incidents.
- Maximise the operational benefits of a temporary diversion route, for all vehicles, by providing a route that achieves a proportionate balance of time to implement, cost and impact. And,
- Reduce the likelihood of accidents on a temporary diversion route.

1.3. Scheme Background and Context

1.3.1. At present, the privately owned OMR is used as a diversion route when the A83 Trunk Road is or has the potential to be impacted by a landslide or debris flow event as identified through regular monitoring.

1.3.2. The OMR diversion provides a shorter route than the alternative diversion via the A82, A85 and A819. For the longer diversion, travelling from Tarbet to Inveraray, this adds approximately 26 miles onto a 23-mile journey and can take 60 to 70 minutes, which is approximately 25 to 35 minutes longer than when the A83 is fully open to traffic. For journeys between Cairndow and Tarbet it adds 46 miles onto a 13-mile journey and can take approximately 80 minutes, which is approximately 60 minutes longer than when the A83 is fully open to traffic.

1.3.3. The frequency and severity of landslip events affecting the A83 has increased markedly since 2012. As a result, there has been a significant increase in the number of days traffic has been diverted onto the OMR. Between 2012 and 2017, diversion via the OMR was required on 13.5 days and 13 nights, however between 2018 and 2023, traffic was diverted via the OMR on 169 days and 228.5 nights.

1.3.4. The increased frequency and severity of landslip events has also given rise to an increased risk of damage to the OMR. In recent years, various works and measures to protect it have been carried out.

1.3.5. There is now an immediate need to improve the resilience and operation of the OMR, and for Transport Scotland to have full control of, and responsibility for the OMR with access to all necessary statutory powers.

1.3.6. Following option development and assessment, a preferred route for the MTS was announced in December 2022 by the then Cabinet Secretary for Transport, where it was proposed to take forward improvements to the existing OMR. Details of the option development and assessment are contained in the Access to Argyll and Bute (A83) Medium Term Strategy – Options Assessment Report published in January 2023.

1.3.7. The MTS interventions include:

- debris catch fences
- a HESCO Barrier and earth bunds
- widening of the existing single-track OMR to provide an increased length of two-way carriageway
- targeted widening at sharp bends to ease movement for larger vehicles
- new structure and widening of an existing structure.
- in-channel watercourse reprofiling, and
- improved drainage and culverts.

1.3.8. Figure 1-2 shows the MTS intervention scheme in context to the A83 Trunk Road.

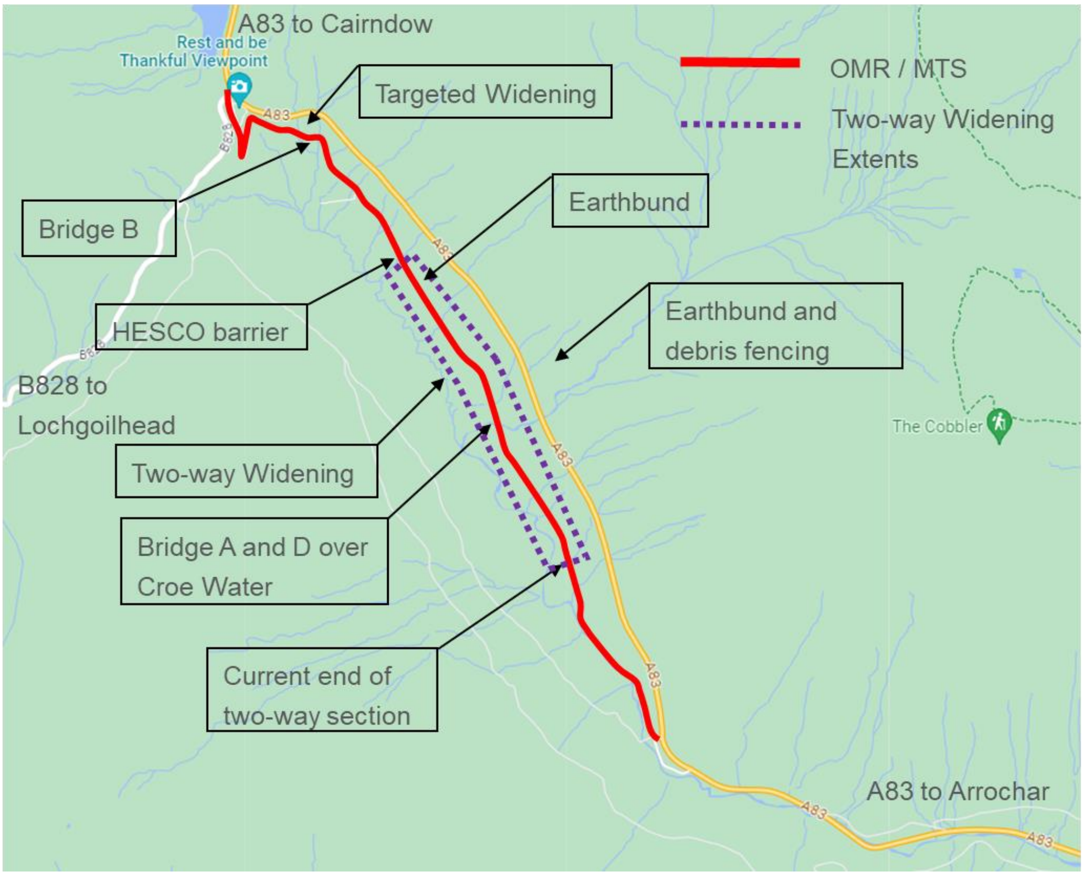

Figure 1-2 - Access to Argyll and Bute (A83) – MTS route through Glen Croe

1.4. Scheme Assessment Engineering Report

1.4.1. The DMRB sets out guidance on the development of motorway and all-purpose trunk road schemes and is applicable to the Proposed Scheme which acts as a diversion route to the trunk road network during times of closure of the A83 Trunk Road. DMRB provides guidance on environmental assessment, including the level of assessment at key stages of development and the reporting of environmental effects.

1.4.2. DMRB Volume 5, Section 1, Part 2, TD37/93 'Scheme Assessment Reporting' sets out the general requirements for the reporting of scheme assessments at the various stages of scheme development. The document provides guidance on the assessment objectives of each stage, the topic areas that are to be assessed and how the information should be presented. TD37 outlines three stages of assessment, comprising Stage 1, Stage 2 and Stage 3.

1.4.3. It is noted that DMRB TD37 has been withdrawn from the suite of DMRB standards, however it is still applicable to trunk road projects in Scotland.

1.4.4. Recognising that the MTS scheme is being progressed as a proportionate response to the A83 trunk road resilience issues, a proportionate approach has been taken to the scheme assessment and reporting process. This is based upon the broad principles set out within DMRB TD37 and is summarised in Table 1-1.

Table 1-1: Proportionate MTS Assessment and Reporting Approach

DMRB Stage	TD37 Requirement	MTS Assessment and Reporting Approach
Stage 1	Identify the environmental, engineering, economic and traffic advantages, disadvantages and constraints associated with broadly defined improvement strategies.	Given the constrained nature of the geographical area within which interventions constituting a medium-term solution is located, a Stage 1 assessment was not undertaken as broad improvement strategies would be required to consider land out with Glen Croe, and this would be considered to amount to a Long-term Solution (LTS) which is covered within the LTS Reporting. A

DMRB Stage	TD37 Requirement	MTS Assessment and Reporting Approach
		proportionate approach was therefore taken, and the assessment commenced with the identification and assessment of potential alignment options within Glen Croe, including options on land currently owned by Scottish Ministers.
Stage 2	Identify the factors to be taken into account in choosing alternative routes or improvement schemes and to identify the environmental, engineering, economic and traffic advantages, disadvantages and constraints associated with those routes or schemes.	The Medium term strategy - Options assessment report sets out a proportionate assessment of alignment options within Glen Croe. This determined which options were deemed to meet the requirements of a proportionate solution which could be delivered within the timescales for the medium term, and identified those which are not, sifting them out from further consideration. This process considered the Proposed Scheme objectives and the engineering, environmental, traffic and economic advantages, disadvantages and constraints associated with each option. The 'Medium term strategy – Options assessment report' should be considered as a proportionate combined DMRB Stage 1 / Stage 2 report, generally aligned to the assessment topics in TD37.
Stage 3	identify clearly the advantages and disadvantages, in environmental, engineering, economic and traffic terms, of the Overseeing Department's preferred route or scheme option. A particular requirement at this stage is an assessment of the significant environmental effects of the project, in	The EIA process and associated EIA Report has been undertaken based upon the outcomes of the EIA Scoping process (as detailed in Volume 4, Appendix 6.1 Summary of EIA Scoping). An MTS Scheme Assessment Report **(this report)** has been prepared to supplement the EIA Report. The MTS Scheme Assessment Report should be considered as a proportionate equivalent of a DMRB

DMRB Stage	TD37 Requirement	MTS Assessment and Reporting Approach
	accordance with the requirements of section 105A of the Highways Act 1980 (England and Wales), Section 20A and 55A of the Roads (Scotland) Act 1984, or Article 39B of the Roads (Northern Ireland) Order 1980, implementing EC Directive 85/337.	Stage 3 report, based on the key principles outlined in TD37.

1.5. References

- Strategic Transport Projects Review 2 (STPR2)
- Preliminary Engineering Services (PES) (Design Manual for Roads and Bridges Stage 1)
- Access to Argyll and Bute (A83) DMRB Stage 1 Assessment Report (Strategic Environmental Assessment (SEA))
- Scottish Road Network Landslide Study: Implementation, Transport Scotland, 2008
- A83 Trunk Road Route Study, Jacobs, 2013
- A83 Glen Kinglas Options Report – 2019 Update, Jacobs, 2019
- Access to Argyll and Bute (A83) DMRB Stage 2 Assessment Report, AtkinsRéalis WSP Joint Venture, 2022, and
- Medium term strategy - Options assessment report, Jacobs AECOM, 2023

2. Existing Conditions

2.1. Introduction

2.1.1. This section of the report describes the engineering conditions of, and adjacent to, the existing OMR within the extents of the MTS proposed through Glen Croe.

2.1.2. The existing conditions relate to the scheme location, topography, watercourses, climate and land use as described in Section 2.2.

2.1.3. The engineering factors relating to the existing OMR have been considered and are described in Section 2.3 and include the following:

- Existing Road Network
- Existing Drainage
- Existing Ground Conditions
- Existing Structures (including culverts and retaining walls)
- Existing Road Pavement
- Existing Utilities
- Traffic Flows

2.1.4. A83AAB-AWJ-GEN-MTS_GEN-DR-CX-000001 to A83AABAWJ-GEN-MTS_GEN-DR-CX-000005 contained in Volume 2, Appendix A.2 present the information discussed in this section.

2.2. Scheme Location and Environment

Location

2.2.1. The Proposed Scheme is located in Argyll and Bute, see A83AAB-AWJ-GEN-MTS_GEN-DR-ZZ-000001 in Volume 2, Appendix A.1, and extends approximately 4km from the intersection of the A83 Trunk Road and the OMR at the southern end of the valley to the Rest and Be Thankful car park, connecting back into the trunk road at the A83/B828 junction.

Topography

2.2.2. Within the extents of the proposed Scheme, the OMR traverses through Glen Croe, which is flanked on both sides by various mountains, namely The Cobbler, Cruach Fhiarach, The Brack, Ben Donich, Beinn Luibhean, and Beinn an Lochain. The existing ground levels along the proposed Scheme rise from circa 85m above ordnance datum (AOD) at the south-east extent of the corridor to a height of circa 265m AOD at the north-eastern extent of the proposed Scheme, adjacent to the Rest and Be Thankful viewpoint car park.

2.2.3. Ground levels on the eastern side of Glen Croe rise steeply to the summits of The Cobbler, at approximately 884 metres AOD, and Beinn Luibhean, at approximately 858 metres AOD. On the western side of Glen Croe, ground levels again rise steeply to the summit of Ben Donich at approximately 847 metres AOD.

2.2.4. The existing conditions drawings show existing contours at 5 metres intervals.

Watercourses

2.2.5. The main watercourses/waterbodies which run through, or lie adjacent to, the proposed Scheme are Croe Water and Loch Restil.

2.2.6. Croe Water is one of the main tributaries of Loch Long within the A83 corridor and has a catchment of approximately 18km^2 and is approximately 7.7km in length. The catchment is rural and includes an extensive network of minor watercourses. Croe Water itself runs adjacent to the OMR, however its catchment and associated minor watercourses extend across the OMR.

2.2.7. Loch Restil is a freshwater water body covering an area of approximately 0.1km^2. The water body is unclassified by SEPA (Scottish Environment Protection Agency) and lies within the Kinglas Water catchment.

2.2.8. The Existing Condition drawings indicate the extents of the flood plains around these bodies of water.

Climate

2.2.9. The location of the Proposed Scheme, and its surrounding area, is noted for its cold and wet climate. Met Office (2021) reported an annual average maximum temperature of 11.65°C in the West of Scotland for the period between 1991 and 2020. The Centre for Ecology and Hydrology (2021) reported an annual average rainfall of roughly 3,145mm in Glen Falloch (located around 11km northeast of the Proposed Scheme), approximately double the recorded national average. Met Office 2021 data for the period between 1991 and 2020 indicates that Scotland receives an average annual rainfall of 1,573.32mm.

Land Use

2.2.10. The land use within the locality of the Proposed Scheme is mostly agricultural and commercial forestry in the form of coniferous plantation woodland on the adjacent slopes, including portions of The Brack and Ben Donich on the south-western side, and The Cobbler on the north-eastern side.

2.2.11. There are five outbuildings/sheds, and a cottage located within Glen Croe Farm which are all accessed via the OMR. These are used primarily for non-commercial agricultural farming except the cottage to the north which is not permanently occupied and has a generator for electricity and private water supply.

2.2.12. A desk study indicates there are no planning applications within the extents of the proposed scheme.

2.3. Existing Road

Old Military Road

2.3.1. The OMR was original constructed in the 18th century linking Dumbarton with Inveraray and was in operation until the late 1930s when it was replaced with a new road to the east, upslope of existing. This subsequently became the present day A83 Trunk Road.

2.3.2. The OMR is approximately 4km long in total, all within the Proposed Scheme extents, of which approximately 2.6km is situated within privately owned land and the remaining 1.4km within land owned by Scottish Ministers and managed by Forestry and Land Scotland (FLS).

2.3.3. The section within private ownership stays true to the original geometry where it is a single-track road with a varying carriageway width between 3m to 3.5m. Given its age, the OMR does not comply with modern design standards. Localised widening has been undertaken as part of improvements by Transport Scotland over the years since it became a diversion route for the A83 Trunk Road, starting in 2013. The road is un-kerbed and has no road markings.

2.3.4. As this section is privately owned, there is no posted speed limit.

2.3.5. The section in Scottish Ministers' ownership is a two-way single carriageway road with an average width of 6.5m. The widening was introduced through an improvement scheme to reduce journey times. It is un-kerbed with the edges delineated by continuous longitudinal road markings. No hard strips are provided. To help manage speed, seven sets of speed cushions are placed along the length at varying intervals. While completed in more recent years, the alignment generally follows the route of the original OMR and is therefore not compliant with current design standards.

2.3.6. Although owned by Scottish Ministers, this section does not operate as a public road, with only private local traffic or FLS vehicles using it for access. As such, there is no posted speed limit; however, an advisory 15mph speed limit is adopted for the two-way section. When operating as an emergency diversion for the A83 Trunk Road, the 15mph speed limit is retained and 10mph convoy working used on the single-track section.

Existing Junctions and Direct Accesses

2.3.7. Technically, there are no junctions as defined in the DMRB on the OMR or junction operations as part of the wider Proposed Scheme.

2.3.8. While simple priority junctions, albeit non-compliant, are present between the B828 local road and A83 Trunk Road, and B828 local road and Rest and Be Thankful car park at the northern end of the Proposed Scheme, they operate under temporary traffic management when the OMR is used as a diversion, therefore, do not act as junctions in their truest sense as it is effectively free flow traffic. When not in use as an emergency diversion, public vehicle access to the OMR is prevented by a locked gate located at the Rest and Be Thankful car park.

2.3.9. At the southern end of the Proposed Scheme, vehicles access the OMR from the A83 via a ‘link’ which operates under free flow conditions when the diversion comes into operation. This was constructed in early 2024 as Phase 1 of the MTS, which was delivered to improve resilience of the route by moving the link out of the 1 in 50-year flood zone. Access to the OMR and the ‘link’ is closed off to trunk road traffic through the use of bollards and a locked gate when the diversion is not in use. The previous ‘link’, which was located within the 1 in 2-year flood zone, has been stopped up as part of the Phase 1 works and is no longer accessible from the A83 Trunk Road.

2.3.10. There is one direct access within the Proposed Scheme which is located at the very southern end of the OMR. This provides access from the A83 Trunk Road to the OMR for FLS and the private landowner, and is secured by a locked gate.

2.3.11. While there are a number of dedicated points which provide access to different areas of land plots along the length of the OMR, due to its status as a private road, these would not be defined as direct accesses according to the DMRB. Typically, these provide access to fields, private tracks or agricultural buildings, as well as one residential property, High Glen Croe cottage, and the Rest and Be Thankful car park.

2.3.12. During operation of the diversion route, it is understood that that access is still permitted for private landowners in order to operate their farm; however, there is a general understanding of limiting their activities so as not to interfere with the operation of the emergency diversion for the A83 Trunk Road.

Existing Active Travel Provision

2.3.13. No formal pedestrian, cycle or equestrian routes exist within the scheme extents. However, the OMR is used as an alternative route to the A83 Trunk Road for cyclists to navigate the significant elevation change through the glen. Furthermore, it is known to be used by pedestrians as a recreational route from the forest tracks on the western side of the glen or Rest and Be Thankful car park.

2.4.1. Existing drainage along the OMR consists of ditches and filter drains adjacent to the road, which discharge into a number of minor watercourses and channels which are tributaries of the Croe Water. Runoff is collected from both the existing carriageway and the natural catchment which drains from the upslope between the OMR and A83 Trunk Road.

2.4.2. Where ditches or filter drains are not present, it is assumed that runoff drains over the edge and generally disperses into the natural channels directly or infiltrates into the ground.

2.4.3. A number of culverts cross the OMR conveying watercourses and channels from the upslope on the eastern side of the OMR to the western downslope side, where they typically feed into Croe Water. These are discussed further in Section 2.7.

2.4.4. Across the existing bridges there is no formal drainage system. It is understood that the runoff from the carriageway drains against existing parapets and disperses into downstream drainage features or surrounding land.

2.5. Existing Ground Conditions

2.5.1. An overview of the anticipated ground conditions and geotechnical hazards is provided in Section 4.7.

Existing geotechnical assets

2.5.2. The are various areas of ground stabilisation measures related to the OMR and downslope of the A83 Trunk Road. These include two areas of soils nailing and an area of coarse granular rock fill:

- At Chainage 3,200m, soil nails with a flexible mesh facing were installed to facilitate the widening of the bend on the approach / exit to an existing masonry arch bridge on the OMR, see Figure 2-1. The works were undertaken as part of improvement work to the OMR when it was upgraded to become the temporary diversion route in winter of 2012/2013.

- Above approximate Chainage 2,900m, soil nails were installed with a sprayed concrete facing immediately downslope of the A83 culvert outfall. The works were undertaken in 2015, to remediate an area prone to scour. In addition, an in-channel boulder fence was installed to retain rock fill.
- Coarse granular rockfill has been installed above Retaining Wall 2, see Figure 2-9 on Page 33.

Figure 2-1 - Existing soil nailed slope on the OMR, looking east

2.6. Existing Road Pavement

2.6.1. The original OMR carriageway was constructed prior to the development of modern pavement materials and is assumed to have been replaced in a piecemeal approach, as and when required, in the years prior to its use as an emergency diversion route for the A83 Trunk Road.

2.6.2. In more recent years, the Trunk Road Operating Company have improved notable lengths as part of maintenance and upgrade schemes. Road core information is not currently available to determine the foundation, but as-built records show that the upper layers consist of flexible asphalt.

2.7. Existing Structures

Bridges

2.7.1. Three bridges are present along the length of the OMR within the Proposed Scheme extents, as detailed in Table 2-1. This includes Bridge A over the Croe Water in the lower area of Glen Croe and Bridge B and Bridge C which provide two crossings of unnamed watercourses in the northern and steeper extents of Glen Croe.

Table 2-1- Existing Structures

Reference	Chainage (m)	Watercourse Crossed	Structure No.	Deck Width (m)	Bridge Span (m)	Structure Type
Bridge A	1,740	Croe Water	N/A	5.7	5.5	Reinforced concrete
Bridge B	3,215	Unnamed	N/A	7.0	4.2	Masonry Arch
Bridge C	3,305	Unnamed	N/A	7.0	4.2	Masonry Arch

2.7.2. Bridge A, also known as OMR_13, a photograph of which is shown in Figure 2-2, carries the OMR over the Croe Water. It has a single main span with two flood spans on either side of the structure. The main span and flood spans consist of precast reinforced concrete culvert units for the full length and width of the deck. There is a reinforced concrete “spreader slab” on top of the culvert units. There is a stone masonry parapet over the bridge, and stone masonry training walls either side of the bridge. A general arrangement of the existing structure is shown in document A83AAB-AWJ-SBR-MTS_BRA-DR-CB-000002 contained in Volume 2, Appendix A.7.

Figure 2-2 – OMR Bridge A, looking west down the Croe Water

2.7.3. Bridge B, also known as OMR_30, a photograph of which is shown in Figure 2-3, carries the OMR over an unnamed watercourse and is a single span masonry arch structure. The bridge has stone masonry parapets and spandrels, and part of the parapet to the southwest of the structure has been struck and subsequently removed. A general arrangement of the existing structure is shown in document A83AAB-AWJ-SBR-MTS_BRB-DR-CB-000003 contained in Volume 2, Appendix A.7.

Figure 2-3 – OMR Bridge B, South-Western Elevation

2.7.4. Bridge C, also known as OMR_31, a photograph of which is shown in Figure 2-4, carries the OMR over an unnamed watercourse and is a single span masonry arch structure, with a solid spandrel. The eastern elevation of the bridge consists of a masonry headwall and drainage pipe. This pipe is approximately 1.5m in length and transitions into the structure near the bridge edge. A general arrangement of the existing structure is shown in document A83AAB-AWJ-SBR-MTS_BRC-DR-CB-000003 contained in Volume 2, Appendix A.7.

Figure 2-4 – OMR Bridge C, Western Elevation

HESCO barrier

2.7.5. There is a HESCO barrier adjacent to the OMR at approximately Chainage 2,350 to Chainage 2,525m. The barrier was constructed between December 2020 and January 2021 as part of emergency mitigation works to protect the OMR from debris flows, following the largest recorded events at the site in August and September 2020. The barrier also mitigates the risks from boulder falls that could impact the OMR at this location.

2.7.6. The HESCO barrier takes the form of a gravity retaining wall formed of welded mesh concertina baskets lined with a heavy-duty geotextile on the vertical sides. The baskets are filled with free draining granular fill. It is approximately 6.6m in height, 6.1m wide at the base and 175m in length, offset up to 2m from the edge of the OMR, see Figure 2-5.

2.7.7. 300mm twin wall pipes have been placed through the barrier at the top of the first and second HESCO unit layers at 5m to 10m spacings. The pipes will provide drainage should water become impounded behind the structure, if the underlying culvert becomes blocked.

2.7.8. To provide appropriate tie-ins to the hillside, the barrier has been constructed to form a return to the uphill slope at its eastern and western ends. The shape of the barrier has been developed to generate capacity (volume) for the retention of landslide debris and to reduce the ability for material to spill around its ends onto the OMR beyond.

Figure 2-5 – Existing HESCO Barrier looking north-east along the OMR

Culverts

2.7.9. Over the length of the OMR there are 36 locations that can convey a watercourse / overland flow, these are annotated on the General Arrangement drawings A83AAB-AWJ-HGN-MTS_MB0-DR-CH-000045 to A83AAB-AWJ-HGN-MTS_MB0-

DR-CH-000049 in Volume 2, Appendix A.3. Of these, three are bridges (OMR_13 – Bridge A, OMR_30 – Bridge B and OMR_31 – Bridge C, which are discussed above) and one, OMR_36, is a small 0.15m diameter structure that was not assessed as its dimension excluded it from being classified as a culvert. The remaining 32 no. culverts all convey flow from the upslope of the OMR to the Croe valley on the downslope side. These culverts are a mix of concrete or UPVC plastic construction and have varying headwalls arrangements. A selection of culverts and headwalls can be seen in the photographs in Figure 2-6 and Figure 2-7. The existing culverts and their diameters are summarised in the Table 2-2 below.

Figure 2-6 – OMR_14 (left) and OMR_21 (right)

Figure 2-7 – OMR_28 (left) and OMR_25 (right)

Table 2-2- Existing OMR Culverts

Culvert Reference	Chainage (m)	Diameter (m)
OMR_01 (New - Phase 1)	320	0.6
OMR_02	510	0.6
OMR_03	705	0.6
OMR_04	785	0.6
OMR_05	805	0.6
OMR_06	915	0.45
OMR_07	985	0.6
OMR_08	1,195	0.375
OMR_09	1,315	0.9
OMR_10	1,410	0.9
OMR_11	1,455	0.45
OMR_12	1,610	0.375
OMR_14	1,840	0.9
OMR_15	1,985	0.6
OMR_16	2,065	0.75
OMR_17	2,165	0.45
OMR_18	2,255	0.75
OMR_19	2,375	1.05 / 0.9
OMR_20	2,485	0.375
OMR_21	2,580	1.05
OMR_22	2,640	0.375
OMR_23	2,720	1.05

OMR_24	2,755	0.375
OMR_25	2,830	0.6
OMR_26	2,890	0.375
OMR_27	2,940	0.6
OMR_28	2,995	0.6
OMR_29	3,115	0.45
OMR_32	3,335	0.6
OMR_33	3,480	0.6
OMR_34	3,500	0.375
OMR_35	3,520	0.3
OMR_36*	3,580	0.15

* OMR_36 Was not assessed as it is 0.15m and not considered a culvert.

Retaining Walls

2.7.10. There are four existing retaining walls within the extent of the proposed MTS intervention scheme.

2.7.11. The location of Retaining Wall 1, which is approximately 50m in length and 2m in height and is of dry stone construction, is indicated in Figure 2-8. It is obscured by dense vegetation along the western verge of the OMR. The exact length of the wall is not clear due to the presence of vegetation, lack of historical data and weathered boulders which may have been the top of the retaining wall, or debris from the hillside.

Figure 2-8 – OMR Retaining Wall 1, looking south

2.7.12. Retaining Wall 2 is located at the northern end of the OMR on the western verge. Its approximately 17m long and 1.65m in height constructed of masonry brick. The wall is located behind a post and wire fence and has a drainage culvert through the wall, approximately halfway along its length, see Figure 2-9.

Figure 2-9 – OMR Retaining Wall 2, looking east

2.7.13. Retaining Wall 3 as shown in Figure 2-10 is located at the northern extents of the OMR near the and Rest and Be Thankful car park and viewpoint. The structure is located on the eastern verge of the road, retaining the OMR. It is approximately 29m long with a max height of 2.3m and constructed of random rubble masonry. There are areas of vegetation growth along the wall and a rectangular opening of approximately 550mm x 700mm at the base of the wall at approximately halfway along the length of the wall.

Figure 2-10 – OMR Retaining Wall 3, looking north

2.7.14. Retaining Wall 4 as shown in Figure 2-11 is located upslope of approximate Chainage 2,760m and appears to be related to the original construction of the A83 Trunk Road. The wall is approximately 2m in height and stands on a concrete footing.

Figure 2-11 - Retaining Wall 4, looking north

2.8. Existing Public Utilities

2.8.1. A C2 notification was issued to Statutory Undertakers in line with the New Roads and Street Works Act (NRSWA) 1991. Responses were received from all Statutory Undertakers contacted with only BT Openreach confirming the presence of apparatus within the scheme extents.

2.8.2. The BT Openreach apparatus is located to the west of the OMR and runs in parallel for much of its length between the access from the A83 Trunk Road to the southeast of the Proposed Scheme and the Rest and Be Thankful car park to the north. Two spurs offshoot the main line towards the two residential properties within the scheme extent. This is in the form of underground cables and chambers.

2.8.3. At the Rest and Be Thankful car park, overhead telecoms lines commence running southwest along the B828 where it leaves the scheme extent.

2.9. Existing Traffic Flows

2.9.1. As the OMR is privately owned, Annual Average Daily Traffic (AADT) is negligible in normal circumstances.

2.9.2. When the OMR is used as an emergency diversion route for the A83 Trunk Road, traffic flows are conservatively assumed to be similar to the A83, which is 4,500 AADT with approximately 4.5% Heavy Goods Vehicles (HGV). However, it is recognised that depending on destination, some drivers may choose to use alternative routes such as via the A82, A85 and A819 or the Gourock to Dunoon ferry.

2.9.3. Further information is provided in Section 5 Traffic and Economic Assessment.

2.10. Existing Environmental Aspects

2.10.1. Full details on environmental aspects are contained within the MTS Environmental Impact Assessment Report.

2.10.2. The Proposed Scheme has included consideration of the environmental constraints present within the scheme extents and has sought to avoid or mitigate, where possible, the potential for adverse environmental impact.

3. Description of Scheme

3.1. Engineering Description

3.1.1. The MTS improvements proposed introduce a number of engineered measures to help achieve the scheme objectives set out in Section 1.2. While the scheme extents include the OMR in its entirety, the interventions themselves are discretely targeted along its length to provide a proportionate response to improve the resilience of the local diversion route and achieve a balance of time to implement, cost and impact.

3.1.2. General arrangements of the scheme presenting the proposed MTS improvements are shown in documents A83AAB-AWJ-HGN-MTS_MB0-DR-CH-000045 to A83AAB-AWJ-HGN-MTS_MB0-DR-CH-000049 in Volume 2, Appendix A.3. Typical Cross Sections are also shown in documents A83AAB-AWJ-HGN-MTS_MB0-DR-CH-010080 to A83AAB-AWJ-HGN-MTS_MB0-DR-CH-010082 in Volume 2, Appendix A.4.

3.2. Mainline

3.2.1. The Proposed Scheme introduces widening of the OMR over a length of approximately 1.4km from the boundary of FLS / Glen Croe Farm to increase the provision for two-way traffic. This length extends from where the existing two-way carriageway ends at Chainage 1,085m to the location of the existing HESCO barrier at approximately Chainage 2,450m. At this point, the road tapers back to existing single file traffic.

3.2.2. Beyond Chainage 2,450m, localised widening is proposed at three existing sharp bends to assist HGVs in navigating the narrow carriageway when using the diversion route.

3.2.3. There is no change to the overall length of the OMR.

3.3. Proposed Junctions and Direct Accesses

3.3.1. There are no proposals to introduce new junctions or make changes to existing junctions within the scheme.

3.3.2. New direct accesses will be created to the adjacent land plots following Compulsory Purchase Order (CPO) of the OMR. It is estimated at this time that 40 no. accesses would be created.

3.4. Earthworks

3.4.1. The widening of the OMR will require various low height soil cuttings and embankments. The proposed cut slopes are generally 1V (vertical): 3H (horizontal), with a maximum height of approximately 7.5m at Chainage 1,228. The proposed widening on embankment has side slopes of 1V:2H, with a maximum height of 5m at Chainage 2,110m.

3.4.2. Two debris flow protection earthwork bunds are required to protect the A83 and the OMR during debris flow and rock fall events. The preliminary design for the bunds has slopes of 1V:1.5H and a crest width of 3m. It is anticipated that the bunds will be constructed using a high friction granular fill. Geogrid reinforcement may be incorporated in the design to provide additional stability.

3.4.3. The proposed earthwork bund adjacent to the OMR begins at Chainage 2,150 and continues parallel to the OMR until Chainage 2,300m where it ties into a rise in the existing topography. The bund has a height of approximately 6m from crest to toe on the OMR facing side and is offset 2m from the edge of the carriageway. The height from crest to toe of the rear face of the bund, which will define the retention capacity of the bund, has a maximum height of 4m at Chainage 2,270. The rear height varies throughout the bund as the toe ties in with the natural topography of the slope behind the bund and a drainage ditch is then cut in to the existing slope at the bund toe. Two existing culverts (ref: Culvert OMR_17 and Culvert OMR_18) will be extended below the bund to ensure continuity of the existing watercourses and enable adequate slope drainage.

3.4.4. A second earthwork bund is proposed at the entrance to the disused quarry above the A83. The bund has a height of approximately 3m from crest to toe on the A83 facing side and will tie-in to the steep quarry walls at both ends. A new culvert will be required below the bund to ensure that flows from the quarry reach the existing culvert intake at the A83. Minor earthworks will also be required to improve the existing open channel between the quarry and the A83.

3.5. Drainage

3.5.1. Generally, the proposed road drainage philosophy is to maintain the existing drainage scenario or where feasible, formalise drainage elements along the OMR. Existing drainage has been assessed to determine the suitability and the potential to retain. Where proposed works are expected to impact the existing drainage, new formal drainage has been included in the design.

3.5.2. Where new drainage is proposed, the design includes filter drains (acting as combined surface and sub-surface drains), carrier drains, gullies, cut-off ditches/filter drains, locations of outfalls, chambers and catchpits.

3.5.3. Surface water runoff from the OMR drainage system derives from the road cross-section, including the carriageway and verges, together with the associated earthworks. Additional surface flow from natural catchment runoff draining towards the Proposed Scheme outside the verge-to-verge cross-section will be kept separate from the carriageway drainage system where practicable by cut-off drainage.

3.5.4. The cut-off drainage will be used throughout the Proposed Scheme to capture surface water run-off from embankments, cuttings and where existing ground profiles require control of run-off. The proposed cut-off drainage will replace existing drainage, where required, and divert runoff to local watercourses and channels.

3.5.5. In relation to water quality treatment, the drainage proposals aim to provide betterment and formalisation of drainage when compared to the current arrangement.

3.5.6. With regard to flood risk, a zero-detriment approach in comparison to the existing scenario has been adopted for the Proposed Scheme as agreed in principle with SEPA. This aligns with the requirements set out for flood management by Argyll and Bute Council who are in a local plan district with Highland Council, with the latter being the Lead Local Authority. In line with section 6.13 of 'The Highland Council's Flood Risk and Drainage Impact – Supplementary Guidance', allowable discharge rates and volumes draining to a receiving watercourse/waterbody shall not exceed the existing runoff rates for Brownfield sites, or the Greenfield runoff rate for previously undeveloped sites. A climate change allowance of 46% has also been applied in line with Scottish Environment Protection Agency (SEPA) Document 'LUPS-CC1: Climate change allowances for flood risk assessment in land use planning'.

3.5.7. Where drainage networks are controlled to allowable discharge rates (based on a zero-detriment approach pre and post development assessment), the restriction of flow is achieved through the installation of flow controls such as vortex flow controls and orifice plates.

3.5.8. Attenuation of runoff is achieved through the use of oversized pipes, avoiding the need for attenuation features such as ponds and basins.

3.6. Structures

Bridges

3.6.1. As part of the MTS, a new bridge is proposed alongside improvements to existing bridges. There is a new proprietary structure, Bridge D, required over Croe Water at approximate Chainage 1,740m. This will be positioned alongside existing Bridge A which requires some minor parapet works. Bridge B, located at Chainage 3,215m is to be widened using a precast arch solution to accommodate carriageway widening at the curve.

HESCO barrier extension

3.6.2. The preliminary design for the proposed extension to the HESCO barrier is a continuation north from the existing barrier, for approximately 150m, terminating at

Chainage 2630m. The front face will be approximately 6m in height, allowing for embedment. The rear height will vary, as required, to provide deflection of debris flows to the low point behind the existing barrier. The alignment of the barrier is at a skew to the OMR to take advantage of the change in gradient and maximise the potential capacity of the barrier. The form of the barrier will be optimised to reduce the excavation into the hillside as far as possible.

3.6.3. A new culvert, (ref. OMR_20), will be provided below the HESCO barrier extension to enable continuity of the existing watercourse. The northern extent of the proposed barrier extension will taper to meet the existing landform.

Culverts

3.6.4. There are improvements proposed to a total of 19 No. culverts and 2 No. new culverts as part of the Proposed Scheme.

3.6.5. Typically, these are replacements or extensions of existing culverts beneath the OMR to convey watercourses. However, a new culvert upstream of OMR_21 and an extension of an existing culvert, OMR_20, is associated with the proposed HESCO barrier works. There is also an extension to culverts OMR_18 associated with the debris flow earthwork bund adjacent to the OMR and a new culvert associated with the debris flow earthwork bund at the old quarry upslope of the A83 Trunk Road.

3.6.6. A new culvert (A83_Quarry) will be required below the bund to ensure that flows from the quarry reach the existing culvert intake at the A83. Minor earthworks will also be required to improve the existing open channel between the quarry and the A83 Trunk Road.

3.6.7. Three of the culverts require more substantial drop structure style headwall inlets to accommodate differences in elevation.

3.7. Debris flow and rock fall fences

3.7.1. Debris flow and rock fall fences are proposed above the A83 Trunk Road to increase the resilience of both the A83 and the OMR. New fences are proposed where there are currently no geotechnical interventions in place above the A83

Trunk Road, this includes the slopes either side of the old quarry. The slope angles here are generally steep and often exceeding 30°.

3.7.2. The two proposed fences are 30m and 35m in length and require a minimum height of 3.5m. The fences typically include steel posts attached to concrete foundations. The posts are anchored upslope with upslope anchor ropes including integrated braking elements. A primary net is attached to upper and lower support ropes. Secondary meshes may be incorporated into the design for retaining the fine material.

3.8. Land Take

3.8.1. Land required to construct, operate and maintain the scheme will be acquired through the CPO process. Where Scottish Ministers already own areas of land required for the delivery of the Proposed Scheme on behalf of FLS , these will be appropriated.

3.8.2. It may be desirable for the Appointed Contractor to acquire additional areas of land for the construction site compound and storage areas. Such additional areas will not be included within the CPO, or defined Land Made Available (LMA) by the Employer for the Works and will require to be obtained by the Appointed Contractor through negotiation with the relevant Landowners, and subject to a separate planning process as required.

3.9. Cost Estimate

3.9.1. Throughout development of the Proposed Scheme, the cost estimate has been reviewed and refined. The current out-turn construction cost estimate is provided in Table 3-1. This includes risk and opportunities, optimism bias and Value Added Tax.

Table 3-1- Out-turn Estimate

	Scheme Assessment Probable Best Estimate (Q2, 2024)	Scheme Assessment Central Estimate (Q2, 2024)	Scheme Assessment Probable Worst Estimate (Q2, 2024)
Total Out-turn Estimate	£24,313,717	£29,353,146	£34,377,857

4. Engineering Assessment

4.1. Introduction

4.1.1. The Proposed Scheme, as described in Section 3, has been developed from the preferred MTS outlined in the Access to Argyll and Bute (A83) Medium Term Strategy – Options Assessment Report by Jacobs AECOM 2023.

4.1.2. This section is supported by a variety of drawings which are referenced in the relevant section and are summarised below:

- Volume 2, Appendix A.4 - Typical Cross Sections
- Volume 2, Appendix A.5 – Plan and Profile Drawings
- Volume 2, Appendix A.6 – Proposed Drainage Layouts
- Volume 2, Appendix A.7 – Structures General Arrangements
- Volume 2, Appendix A.8 – Proposed Culvert Layouts
- Volume 2, Appendix A.9 – Proposed Geotechnical Assets

4.2. Engineering Standards

4.2.1. The Proposed Scheme is intended to deliver a proportionate solution that will only be used in temporary situations at slow speeds and under traffic management, therefore a pragmatic approach to its development has been adopted to minimise environmental and economic impacts.

4.2.2. As a result of the above, the design does not provide full compliance with DMRB as this would lead to a solution which is disproportionate for the Proposed Scheme objectives. However, the design does seek to apply the principles of the DMRB Standards along with other relevant guidance and best industry practice where possible.

4.3. Departures and Relaxations

4.3.1. As the OMR will only be used under temporary traffic management, Departures from Standard and Relaxations are not applicable. Instead, the temporary traffic management layout should comply with Chapter 8 of the Traffic Signs Manual (Traffic Safety Measures and Signs for Road Works and Temporary Situations), and such layout will require liaison and approval with the relevant road authorities and stakeholders.

4.4. Geometry

4.4.1. The basis of the carriageway improvements is to maximise journey time savings where it is proposed to extend the two-way widening by 1.4km from approximately chainage 1,080m to chainage 2,480m. The remaining length of the OMR will remain as single track as widening would require significant earthworks, retaining features and Vehicle Restraint Systems which would not align to the Proposed Scheme objectives of a proportionate solution.

4.4.2. North of the two-way length, targeted widening at three existing low radius, sharp bends is proposed at approximate chainages 3,200m, 3,510m and 3,700m where the carriageway width will be increased by approximately 1.2m, 1.2m and 1m respectively. The primary aim of the widening is to assist HGVs in their safe navigation of the OMR.

4.4.3. Typical Cross Sections which provide context of the widening as outlined above and the proposed geotechnical assets and structure are shown in documents A83AAB-AWJ-HGN-MTS_MB0-DR-CH-010080 to A83AAB-AWJ-HGN-MTS_MB0-DR-CH-010082 in Volume 2, Appendix A.4.

4.4.4. Additionally, the proposed plan and profiles of the alignment are shown in documents A83AAB-AWJ-HGN-MTS_MB0-DR-CH-000050 to A83AAB-AWJ-HGN-MTS_MB0-DR-CH-000056 contained in Volume 2, Appendix A.5.

4.4.5. Unlike a conventional road design where a design speed is determined and the geometry is designed accordingly, the Proposed Scheme retains the existing horizontal and vertical alignment throughout with on-line widening provided for a length of 1.4km and at specific locations where the existing geometry is known to present a particular constraint to vehicle passage, which is in-keeping with the proportionate approach. The operational requirements have been assessed using vehicle tracking analysis for the design vehicles of Freight Transport Association (FTA) 16.5m Articulated HGV, and 10m Rigid HGV as they are known to regularly use the route, and the former typically being the largest standard vehicle on the road network.

4.4.6. While the OMR has been used as a diversion route for over 10 years successfully accommodating these vehicles, an analysis was carried out on the proposed improvement which confirmed that both vehicles can negotiate the route safely with the proposed improvements. The design intent is to provide a 0.45m clearance either side of the vehicle "in-lane" when negotiating a curve. This is not always the case depending on the severity of the curve; however, this is limited to the single-track section, where vehicles will be travelling under convoy at low speeds and does not present any operational or safety issues.

4.4.7. In order to determine a suitable speed limit for the MTS following Proposed Scheme delivery, a Manual for Streets 2 (MfS2) Stopping Sight Distance (SSD) assessment was undertaken on the two-way section accounting for vertical and horizontal curvature, and gradient of the carriageway. Whilst MfS2 is intended for the urban environment, it is more applicable for low-speed roads, such as the OMR, compared to the DMRB, and shares the same foundation as the TA43/00 Guidance on Road Link Design that underpins the DMRB CD109. It is also considered that MfS2's updated vehicle dynamics are more representative of modern traffic.

4.4.8. The analysis found that vehicles have sufficient forward visibility to stop at 30mph (48kph). Despite this, it is proposed that a lower speed limit of 25mph is more appropriate for the nature of the route. Checking SSD using a 25mph / 40kph design speed results in a forward visibility requirement of 30m whilst SSD using the 30mph / 48kph speed results in a forward visibility requirement of 43m. As such, there is a 13m allowance between actual SSD calculated at the proposed 25mph speed and the requirement calculated for 30mph at the most constrained section of the scheme.

4.4.9. It is recognised that a 25mph speed limit is uncommon on public roads compared to a speed which is a multiple of 10 e.g. 20mph or 30mph. However, given the unique context under which the OMR operates, and that drivers are likely to be more aware of their environment, it is viewed that an uncommon speed limit will have a greater impact which in turn should result in better compliance. It is worth noting that the current advisory speed limit is 15mph, so not a multiple of 10.

4.4.10. For the single-track section, it is proposed that this will remain under convoy arrangement whenever the OMR comes into operation, therefore this section will be subject to a 10mph speed limit.

4.5. Junctions and Direct Accesses

4.5.1. There are no proposals to introduce new junctions or make changes to existing junctions within the scheme.

4.5.2. 40 new direct accesses are expected to be created from the OMR to the adjacent land plots providing access to fields and buildings.

4.6. Active Travel

4.6.1. Given the nature of the proposal, no specific active travel or walking, wheeling, cycling or equestrian proposals form part of the Proposed Scheme. A Walking, Cycling and Horse-Riding Assessment was undertaken in line with DMRB GG142 which did not identify any immediate improvements to be considered as part of the MTS; however, this did identify broader strategic opportunities for consideration as part of the wider area.

4.6.2. Following its implementation, it is expected that the OMR will operate as it has done historically with non-motorised users sharing the carriageway with vehicular traffic. However, in the event that the A83 Trunk Road is closed and the emergency diversion route is brought into operation, it is anticipated that walking and cycling will be prohibited from travelling on the carriageway as per current operational practice, where these users are held at either end of the local diversion and transported along the route by the convoy vehicles.

4.7. Geology, Ground Conditions, and Earthworks

4.7.1. The ground conditions for the MTS scheme have been determined from detailed review of geological mapping and historical ground investigation data in conjunction with the findings of the Preliminary Ground Investigation for the wider scheme, undertaken by Raeburn Drilling and Geotechnical Ltd. Further ground investigations have recently been undertaken and factual reporting of this work will be available to support the next stage of design development, i.e. detailed design.

Superficial deposits

4.7.2. Made ground is present locally across the scheme area associated with the existing OMR, farm tracks and buildings. There is also made ground associated with existing ground stabilisation and landslide mitigation measures. Made ground encountered during ground investigations includes tarmac layers, engineered and non-engineered fill.

4.7.3. The natural superficial deposits underlying the site are reported to comprise:

- Peat: Surface deposits and buried peat have been identified across the scheme area with recorded thicknesses ranging from 0.2m to 1.5m. The peat is generally described as soft to firm dark brown slightly sandy slightly silty fibrous peat. Plastic pseudo-fibrous peat and plastic amorphous peat have also been recorded.
- Alluvium and River Terrace Deposits: Based on the published geology, alluvium, alluvial fan deposits and river terrace deposits are anticipated to be present within the Glen Croe valley floor and locally underlying the OMR. Descriptions of the deposits vary from loose orangish brown slightly gravelly silty fine to coarse sand to very loose to medium dense greyish brown very sandy silty fine to coarse subangular and subrounded gravel. Laminations of sandy clay and silt and lenses of peat are expected to occur locally within these deposits.
- Colluvium: Colluvial deposits are expected throughout the scheme area with thicknesses and extents highly dependent on the locations, types, and volumes of historical failure events. Available data indicates that colluvial deposits may be

encountered overlying or interbedded with topsoil, peat, alluvial and glacial deposits. Typical descriptions of these deposits include loose to medium dense silty or clayey sands and gravels with varying proportions of subrounded to angular cobbles and boulders of schist. For the purposes of this assessment, debris flow deposits have been considered within the overall category of colluvium.

- Glacial deposits: Published geological maps indicate both hummocky (moundy) glacial deposits and glacial till within the scheme area. Typical descriptions of the glacial deposits identify granular material comprising medium dense to very dense light brown to brown slightly silty or clayey fine to coarse sand and angular to subangular fine to coarse gravel with occasional angular to subangular cobbles and boulders of schist. Drillers record the presence of large boulders within the glacial deposits.
- Weathered bedrock: A layer of weathered bedrock overlying the competent bedrock has been interpreted in various exploratory holes. Descriptions of the material interpreted as weathered bedrock typically comprise extremely weak to moderately weak brown psammite and drillers' descriptions of broken schist and fractured schist.

4.7.4. Available data and site reconnaissance indicates that bedrock is at or near the surface across the higher ground and at the northern extent of Glen Croe. Within the lower parts of Glen Croe the depth to bedrock increases, with recorded thickness of superficial deposits up to approximately 18m.

Bedrock

4.7.5. The bedrock geology beneath the site is reported to comprise metamorphic strata of the Beinn Bheula Schist Formation and igneous intrusions of the South of Scotland Granitic Suite and North Britain Siluro-Devonian Calc-Alkaline Dyke Suite. The bedrock is recorded as consisting of:

- Psammite: generally described as "strong and very strong very narrowly and narrowly banded schistose grey psammite with very closely spaced very narrow and narrow white quartzite, dark grey semi-pelite and dark grey pelite bands".

- Pelites and semi-pelite: generally described as "strong and very strong very narrowly and narrowly banded schistose dark greenish grey pelite with extremely closely and very closely spaced very narrow to thin dark grey semi-pelite bands".
- Dolerite: Igneous strata encountered during the intrusive investigations have generally been identified as dolerite. The dolerite is typically described as "very strong dark grey dolerite with very narrow (0.5mm-2mm thick) closely spaced grey quartz veins; Slightly weathered evident as slight loss of strength and green staining on fracture surfaces".

4.7.6. A number of generally north-east/south-west trending faults are mapped within the northwest of the scheme area, intersecting at Ch 3,280 and Ch3,500. The type and displacement of these faults are not recorded, however there is a visible discontinuity within the bedrock outcrops at these locations aligned with the proposed fault location, as these discontinuities follow generally straight lines across the topography, they are likely close to vertical and steeply dipping.

4.7.7. Fault breccia has been recorded in two boreholes within the vicinity of the MTS scheme undertaken for the Preliminary Ground Investigation. The boreholes (AAB-BH1027A and AAB3-BH1032) are located close to the valley floor. At borehole AAB-BH1032, artesian groundwater conditions have been recorded associated with the fault zone.

Groundwater

4.7.8. The SEPA Water Environment Hub interactive map indicates that the scheme area is underlain by the Cowal and Lomond groundwater body, which is defined as having a 'good' overall condition and 'good' water quality.

4.7.9. The published British Geological Society (BGS) Hydrogeology map and BGS GeoIndex indicate that the Southern Highland Group (i.e. the parent unit of the Beinn Bheula Schist Formation which underlies the majority of the study area) and the unnamed igneous intrusions are both Class 2C low productivity aquifers. Small amounts of groundwater are expected to be present in the near surface weathered zones and in secondary fractures, with rare springs.

4.7.10. Available information indicates that groundwater levels vary across the scheme area. Monitoring readings record levels between 0.23m below ground level (bgl) and 5.79 m bgl, with levels typically <2m bgl. Groundwater strikes were encountered at depths between 0.2 m bgl and 6.7 m bgl. Most of the groundwater strikes were recorded in the interpreted colluvium.

Natural geo-hazards

4.7.11. The MTS scheme is located partially along slopes which are subject to potential geohazards, particularly debris flow and boulder fall events. The nature and degree of hazard varies depending on the location within the glen. Consideration of the geohazards in relation to both the construction and operation phases has been undertaken during the development of the MTS scheme to inform the design of appropriate earthworks, structural and protective elements.

4.7.12. A natural terrain hazards study has been undertaken, which assesses the principle geohazards of debris flows and boulder fall events and the likely consequences of these events on the existing mitigation measures, proposed HESCO barrier extension, earthwork bunds and proposed debris flow and rockfall fences.

4.7.13. Consideration has also been given to the long-term maintenance requirements of mitigation measures, including provision of access for inspection and to enable debris to be removed following an event. If the mitigation measures were to be damaged during a debris flow, landslide or other geohazard event, access may be required to effect repairs and/or replacement of elements of the system. Consequently, the protection afforded to the OMR may be temporarily reduced and temporary closures may be required.

Earthworks design issues

4.7.14. It is anticipated that some form of ground improvement will be required in areas of widening on embankment where soft and/or organic materials are encountered at the foundation level of the embankment. The required depth of ground improvement is expected to be relatively shallow. Given the anticipated shallow depth of improvement, excavation and replacement is likely be the preferred method of ground improvement for the sections of OMR widening on embankment.

High groundwater levels mean that temporary dewatering measures will likely be required during excavation below the earthwork's footprint.

4.7.15. For the debris flow protection bund adjacent Ch 2,150 to Ch 2,300, localised soft and/or organic materials may also be excavated and replaced within the footprint of the earthwork. The embankment foundation may include reinforcement using geogrids and separator layers to prevent migration of fines, similar to the foundation of the existing HESCO barrier, refer to document A83AAB-AWJ-HGT-MTS_GEN-DR-GE-000012 contained in Volume 2, Appendix A.9.

4.7.16. The debris flow protection bund at the old quarry above the A83 is expected to be founded on bedrock. Loose debris and accumulation of materials within the footprint of the proposed bund should be removed prior to the placement of fill materials.

4.7.17. Excavations for the channel reprofiling works should be undertaken from the top down to minimise the risk of instability during construction. The excavated channel slopes should be seeded/planted, as required, to promote vegetation growth as soon as practicable. The use of biodegradable liners should be considered to minimise the potential for erosion and scour.

4.7.18. Existing information suggests that the materials that will be excavated in areas of proposed cut as part of the MTS two-way widening works or the channel reprofiling works are generally relatively wet and can contain relict soil layers. Separating the topsoil layer will also be difficult due to the undulating, irregular topography and this may lead to further entrainment of organic materials. As such, as dug materials are unlikely to comply with the requirements of Class 1 or 2 General Fill for re-use in the sections of widening on embankment. The re-use of excavated material may be limited to Class 4 fill for landscaping areas with shallower slopes.

4.7.19. Available ground investigation data indicates that the topsoil encountered on site is generally very thin. In addition, the presence of boulders and irregular topography will cause significant difficulties in separating the topsoil from the underlying superficial deposits. Therefore, only a limited quantity of topsoil is expected to be available for re-use from areas of proposed excavation.

4.7.20. It is assumed that imported granular fill will be used for the sections of widening on embankment. Imported fill for embankments is expected to comply with Class 1 General Fill requirements. Embankment slopes of 1 (vertical) in 2 (horizontal) have been proposed to help minimise the volume of imported fill required for the scheme.

4.7.21. Typical details of the earthworks associated with the widening on embankment and cutting are shown in A83AAB-AWJ-HGT-MTS_GEN-DR-GE-000011 contained in Volume 2, Appendix A.9.

Earthworks volumes

4.7.22. A summary of the estimated quantities (based on the engineering assessment) is detailed in Table 4-1, Table 4-2 and Table 4-3.

Table 4-1- Summary of Estimated Excavation Quantities

Soil Class	Quantity (m^3)
Acceptable excavation	*0 (See 4.7.23)*
Unacceptable excavation	16,095
Topsoil	*0 (See 4.7.24)*
Total	16,095

4.7.23. From the information available, the quality of the material that will be excavated is considered unacceptable for re-use as general fill at this point; however, may be suitable as landscape fill.

4.7.24. Furthermore, this information also suggests that where topsoil is present, it is typically a thin layer. Therefore, it is expected that it will be excavated as part of the bulk earthworks rather than typical topsoil strip operation.

Table 4-2- Summary of Estimated Fill Quantities

Soil Class	Quantity (m^3)
Acceptable Fill	26,250
Topsoil	2,750
Total	29,000

Table 4-3- Summary of Estimated Earthworks Balance

Import/Export	Quantity (m^3)
Estimated Import	29,000
Estimated Export	16,095

4.7.25. For the purposes of the estimated earthworks balance, a worst-case scenario has been assumed where all excavated material will be unusable and require to be exported, and all fill material will require to be imported. Following receipt of further ground investigation information, opportunities for reuse and reducing the balances will be better understood.

4.8. Drainage, Hydrology and Hydrogeology

Road Drainage Hydrology

4.8.1. Surface water runoff from the OMR drainage system derives from the road cross-section, including the carriageway and verges, together with the associated earthworks. Additional surface flow from runoff draining towards the proposed Scheme from natural catchment outside the road corridor will be kept separate from the road drainage system where practicable by cut-off drainage (ditches and filter drains where space constraints require).

4.8.2. The runoff estimation method used for the engineered (road based) catchment is based on the Wallingford Procedure. The runoff contributing to each drainage network has been obtained by applying the following Percentage Runoff factors to the contributing areas:

- carriageway – 100% impermeable, and
- grassed verges, cut slopes, embankments, natural catchment – 53% impermeable

4.8.3. A value of 53% has been assumed for verges, cut slopes, embankments, and natural catchments according to the standard percentage runoff value associated with the soil using the FSR (Flood Studies Report) method.

4.8.4. Design storms are based on rainfall intensities appropriate to the area where the road is situated (Flood Studies Report data) with an additional 46% allowance for climate change. Climate change allowance value based on Synthetic design storms have been generated for storms of varying duration and return periods (RP) obtained from computer simulated rainfall profile data.

4.8.5. Due to site specific topography, it was determined that peak flow estimates for the overland flow intercepted by the cut off drains should be calculated based on 'Time of Concentration' calculations.

4.8.6. Groundwater has been assumed to be at a low enough level to not interact with the road drainage at the OMR. This will need to be verified following receipt of the factual reporting from the recently concluded Ground Investigation works.

Allowable Discharge

4.8.7. At present, the existing road runoff discharges unattenuated flows into the existing ditches and filter drains which drain to the watercourses/channels.

4.8.8. In the proposed scenario, a zero-detriment approach in comparison to the existing scenario has been followed for the new alignment proposals. Where drainage networks are controlled to allowable discharge rates (based on a zero-detriment approach pre and post development assessment), the restriction of flow is achieved through the installation of flow controls (vortex flow controls and orifice plates). With regards to Flood Management, Argyll & Bute Council are in a local plan district with Highland Council, with Highland Council being the Lead Local Authority. In line with section 6.13 of ‘The Highland Council’s Flood Risk and Drainage Impact – Supplementary Guidance’, allowable discharge rates and volumes draining to a receiving watercourse/waterbody shall not exceed the existing runoff rates for Brownfield sites, or the Greenfield runoff rate for previously undeveloped sites. This is why a zero-detriment approach pre and post development assessment is implemented.

Design Storms

4.8.9. The following design storms have been applied to the various elements of the drainage proposals:

- pipe networks:
  - 1-year plus 46% climate change in-bore
  - 5-year plus 46% climate change no surcharge of water levels in filter drains into the pavement formation (considered to be 600mm deep)
  - 30-year plus 46% climate change no flooding
- oversized pipes for attenuation:
  - 30-year plus 46% climate change no flooding
- cut-off drainage:
  - 50-year plus 46% climate change no flooding (on basis that the OMR culverts are designed for the 50-year event).
- the spacing of gullies has been designed in accordance with HA102/17 Spacing of Road Gullies. The following maximum channel flow widths have been adopted:
  - 0.75m (considered to be suitable on basis that carriageway doesn’t have a hard strip however also doesn’t have a pedestrian footpath adjacent to road).

Road Drainage Proposals

4.8.10. In order to best summarise the road drainage, the Proposed Scheme has been split into three sections:

- existing two-lane extents (Chainage 160m to Chainage 1090m)
- two-lane widening extents (Chainage 1090m to Chainage 2480m), and
- existing single track extents including sharp bend widening (Chainage 2480m to Chainage 3836m)

4.8.11. Between Existing Two-Lane Extents, Chainage 160m to Chainage 1,090m, it is proposed to retain the existing ditches. There are no significant carriageway widening works proposed along these extents therefore there is not a notable increase to flood risk. It is expected that any existing ditches will be remediated if required however general parameters will be the same to remain ‘like-for-like’.

4.8.12. Between Two-Lane Widening Extents, Chainage 1,090m to Chainage 2,480m, formalised drainage networks are proposed. There are a total of 19 no. networks throughout these extents. These contain filter drains, carrier drains, gullies and chambers (Type 8 inspection chambers and Type 7 catchpits as per Manual of Contract Documents for Highways Works (MCHW) Highways Construction Details F Series). These have been designed with oversized pipes for attenuation and flow controls to restrict the flow. These will outfall via stone mesh headwalls to the downstream end of culverts.

4.8.13. Between Existing Single-Track Extents including Sharp Bend Widening, Chainage 2,480m to Chainage 3,836m, it is proposed to retain the existing ditches, and filter drains along this extent where they are not impacted by the sharp bend widening proposals. It is expected that any existing ditches will be remediated if required however general parameters will be the same to remain ‘like-for-like’. At the sharp bend locations, localised drainage proposals have been specified where retaining the existing drainage is not feasible and is impacted by the carriageway widening.

4.8.14. Cut-Off Drainage has been proposed where required (due to existing cut-off drainage being impacted) to seek design compliance with CG 522 which stipulates that natural catchment drainage systems should be separated from the road drainage systems. Generally, where new road drainage is proposed, natural catchment has been separated out with independent cut-off drainage features however there is one location between Chainage 2,080m to Chainage 2,130m where cut-off drainage was found to be unfeasible and no existing feature in place, therefore the natural catchment was considered within the modelling of the road drainage of Network 14 and 15. Cut-Off Drainage design consists of ditches, filter drains, carrier drains, chambers (Type 8 inspection chambers and Type 7 catchpits as per MCHW F Series) and stone mesh headwalls for outfall.

4.8.15. Drainage layout plans of the carriageway networks along the two-way widened section and the sharp bend widening in the single-track section are shown in drawings A83AAB-AWJ-HDG-MTS_MB0-DR-CD-050151 to A83AAB-AWJ-HDG-MTS_MB0-DR-CD-050154, and A83AAB-AWJ-HDG-MTS_MB0-DR-CD-050170 and A83AAB-AWJ-HDG-MTS_MB0-DR-CD-050171, and the cut-off drainage is shown in documents A83AAB-AWJ-HDG-MTS_MB0-DR-CD-050161 to A83AAB-AWJ-HDG-MTS_MB0-DR-CD-050164, both contained in Volume 2, Appendix A.6.

Treatment Methodology

4.8.16. In relation to water quality treatment, the drainage strategy proposal aims to provide betterment and formalisation of drainage when compared to the current arrangement. The proposals of the drainage strategy have been agreed in principle with SEPA of the A83 Environmental Steering Group (ESG).

Attenuation

4.8.17. Where required, attenuation of runoff is achieved in the use of oversized pipes. This avoids the need for attenuation features such as ponds and basins to be specified.

4.9. Public Utilities

4.9.1. Following the process set out in the New Roads and Street Works Act 1991 (NRSWA), C3 notices have been issued to BT Openreach whose existing plant will be affected by the Proposed Scheme, and subsequently C4 notices issued.

4.9.2. It has been indicated that approximately 1,410m of diversion works will be required for the existing telecoms apparatus.

4.9.3. It is anticipated this will be located within the western verge of the two-way widening, between approximate Chainage 1,070m and Chainage 2,480m, and consist of sub-surface ducting and chambers.

4.10. Structures

4.10.1. Structures have been designed in accordance with the DMRB and Eurocodes. The structures require additions or modifications to facilitate traffic along the OMR in both directions. There is a new proprietary structure, Bridge D, required alongside the existing Bridge A, and Bridge B shall be widened using a precast arch solution.

4.10.2. There are improvements proposed to a total of 19 No. culverts and 2 No. new culverts as part of the Proposed Scheme.

4.10.3. Additionally, there is an extension to the existing HESCO barrier of approximately 150m.

Bridge D - Proprietary Bridge

4.10.4. There is a requirement to install a proprietary bridge structure adjacent to Bridge A, approximate Chainage 1,740m. This structure will carry the southbound traffic, whilst the existing Bridge A will carry the northbound traffic. The proprietary bridge will span a tributary of Croe Water.

4.10.5. The proprietary bridge will be provided by a specialist manufacturer and is anticipated to be constructed of structural steel with a proposed single span of 12 metres. It is assumed that the structure will be supported on reinforced concrete abutments upon spread foundations.

4.10.6. The structure will be simply supported, and is likely to be a modular, bailey bridge type structure. The structure will be aligned square with the abutments and therefore have no skew.

4.10.7. The carriageway width between kerbs will be 4.2 metres, and the bridge will have N2-W1 bridge parapet.

4.10.8. A general arrangement of Bridge D is shown in document A83AAB-AWJ-SBR-MTS_BRD-DR-CB-000002 contained in Volume 2, Appendix A.7.

Bridge B - Localised Widening

4.10.9. Planned realignment of the OMR requires localised widening of Bridge B, approximate Chainage 3,215m. The downstream parapet will be demolished to extend the width of the structure by 1.5m and facilitate traffic in both directions.

4.10.10. A proprietary arch will be provided by a specialist manufacturer and is anticipated to be an unreinforced concrete arch with a clear span of 4.4m. The arch will be supported on newly constructed reinforced concrete abutments and spread foundations. The arch will span square to the abutments and therefore have no skew.

4.10.11. Spandrel walls will be precast sections, clad with locally sourced masonry, in keeping with the aesthetics of the existing bridge. The wingwalls will be reinforced concrete L-shaped walls, also faced in locally sourced masonry.

4.10.12. The carriageway width between kerbs is approximately 4.7m. The new downstream parapet will be constructed of masonry and have a height of 1.15m, in line with CD 377 - Requirements for Road Restraint Systems. It will include a curve at the western end, where the parapet end protection cannot be provided. This is in line with Department for Transport Guidance on the Design, Assessment and Strengthening of Masonry Parapets on Highway Structures.

4.10.13. A general arrangement of Bridge B is shown in A83AAB-AWJ-SBR-MTS_BRB-DR-CB-000004 contained in Volume 2, Appendix A.7.

Culverts

4.10.14. To determine suitability of the existing culverts, it was necessary to calculate the existing hydraulic capacity. Results for the baseline culverts along the OMR (provided by Jacobs) were reviewed and updated using more recent topographical survey and spreadsheet calculations (following the approach outlined in the CIRIA culvert screen and outfall manual C781). All of the 32 culverts along the A83 were assessed to understand their existing capacity which ranged from less than the 50% annual exceedance probability (AEP) event to more than the 0.5% AEP event plus an allowance for climate change (CC).

4.10.15. All of these structures were re-surveyed as part of the initial survey requirements to verify the existing dimensions. Four culverts, OMR_12, OMR_22, OMR_26 and OMR_34 were found to have smaller diameters than originally recorded in the incoming topographical data. These structures were then included in the modelling as their original capacity was incorrect and so were reassessed to check if they could pass the Q50 (2% AEP) design criteria. These structures, as well as their original hydraulic capacity (based on the incorrect diameter), can be seen below. Details of all OMR structures as well as their baseline hydraulic capacity can be seen in Table 4-4.

Table 4-4- Hydraulic capacity of OMR Structures

Crossing Ref	Geometry	Full Flow culvert capacity (m3/s)	Return period capacity (years)
OMR_01	Pipe culvert, 0.6m diameter	0.36	<5-yr
OMR_02	Twin pipe culvert, 0.6m diameter	0.72	~5-yr
OMR_03	Pipe culvert, 0.6m diameter	0.36	>200-yr + CC
OMR_04	Pipe culvert, 0.6m diameter	0.36	>200-yr + CC
OMR_05	Pipe culvert, 0.6m diameter	0.36	~2-yr
OMR_06	Twin pipe culvert, 0.45m diameter	0.34	>200yr
OMR_07	Twin pipe culvert, 0.6m diameter	0.72	<2-yr
OMR_08	Pipe culvert, 0.375m diameter	0.18	>200-yr + CC
OMR_09	Pipe culvert, 0.9m diameter	1.01	<10-yr

OMR_10	Pipe culvert, 0.9m diameter	1.03	>200-yr
OMR_11	Pipe culvert, 0.45m diameter	0.17	<2-yr
OMR_12	Pipe culvert, 0.375m diameter	0.18	>200-yr
OMR_13	Bridge A (Cobbler Bridge)	-	-
OMR_14	Pipe culvert, 0.9m diameter	0.97	<20-yr
OMR_15	Pipe culvert, 0.6m diameter	0.37	>200-yr
OMR_16	Pipe culvert, 0.75m diameter	0.64	~25-yr
OMR_17	Pipe culvert, 0.45m diameter	0.39	~50-yr
OMR_18	Pipe culvert, 0.75m diameter	0.58	<5-yr
OMR_19	Pipe culvert, 0.9m diameter below HESCO Barrier, 1.05m below OMR	0.65	>200-yr
OMR_20	Pipe culvert, 0.375m diameter	0.11	<5-yr
OMR_21	Pipe culvert, 1.05m diameter	0.45	<2-yr
OMR_22	Pipe culvert, 0.375m diameter	0.15	>100-yr
OMR_23	Pipe culvert, 1.05m diameter	1.3	>200-yr

OMR_24	Pipe culvert, 0.375m diameter	0.15	>200-yr
OMR_25	Twin pipe culvert, 0.6m diameter	1.04	>200-yr CC
OMR_26	Pipe culvert, 0.375m diameter	0.2	>200-yr
OMR_27	Pipe culvert, 0.6m diameter	0.37	<2-yr
OMR_28	Pipe culvert, 0.6m diameter	0.36	<75-yr
OMR_29	Pipe culvert, 0.45m diameter	0.14	<2-yr
OMR_30	Bridge B	-	-
OMR_31	Pipe culvert, 0.75m diameter Bridge C	0.68	<10-yr
OMR_32	Pipe culvert, 0.6m diameter	0.35	>200-yr
OMR_33	Pipe culvert, 0.6m diameter	0.33	>200-yr
OMR_34	Pipe culvert, 0.375m diameter	0.37	>200-yr
OMR_35	Pipe culvert, 0.3m diameter	0.065	<2-yr

4.10.16. Using the updated topographical survey, the existing hydraulic capacity was verified. This confirmed that 15 crossings had to be upsized to meet the Q50 design standard plus an allowance for (d/4) where possible. A hydraulic model was constructed for each of these and used to size the proposed culvert. In some instances, multiple culverts were required to pass the Q50 flow and achieve the required freeboard. The required dimensions, number of barrels, and inverts for these can be found in Table 4-5. Layouts for the culverts can also be viewed in Volume 2, Appendix A.8.

Table 4-5- Proposed Culvert Works

Culvert Reference	Appendix A.3 Description	Chainage (m)	Engineering Description
OMR_08	Extension Proposed	1,198	Extension length 3.108m: 1no. 375mm dia. plastic pipe
OMR_09	Twinned and extension proposed	1,320	Length 15.30m: 2No. 900mm dia. plastic pipes
OMR_10	Extension Proposed	1,410	Extension length 6.114m: 1No. 900mm dia. plastic pipe
OMR_11	Twinned, upsizing and extension proposed	1,451	Length 13.50m: 2No. 600mm dia. plastic pipes
OMR_12	Extension and upsizing proposed	1,608	Length 15.05m: 1No. 600mm dia. plastic pipe
OMR_14	Twinned and extension proposed	1,840	Length 21.10m: 2No. 900mm dia. plastic pipes
OMR_15	Extension Proposed	1,992	Extension length 14.346m: 1No. 600mm dia. plastic pipe
OMR_16	Twinned, extension and upsizing proposed	2,066	Length 16.30m: 2No. 800mm dia. plastic pipes
A83_Quarry	New culvert proposed	2,120	Length 13.94m: 1No. 000mm dia. plastic pipes
OMR_17	Twinned, extension and upsizing	2,170	Length 12.9m: 2No. 700mm dia.

	proposed		plastic pipes
OMR_18	Twinned, extension and upsizing proposed	2,255	Length 13.51m: 2No. 900mm dia. plastic pipes
OMR_19	Extension proposed	2,370	Length 22.05m: 1No. 900mm dia. plastic pipes
OMR_20	Twinned and upsizing proposed	2,488	Length 11.92m: 2No. 600mm dia. plastic pipe
OMR_21	Twinned and upsizing proposed	2,581	Length 7.91m: 2No. 900mm dia. plastic pipes
OMR_22	Upsizing proposed	2630	Length 6.21m: 1No. 600mm dia. plastic pipe
OMR_26	Twinned and upsized	2,896	Length 9.92m: 2No. 500mm dia. plastic pipes
OMR_27	Twinned and upsized	2,940	Length 6.32m: 2No. 900mm dia. plastic pipes
OMR_29	Twinned and upsized	3,118	Length 6.26m: 2No. 600mm dia. plastic pipes
OMR_34	Upsizing proposed	3,507	Length 10.59m: 1No. 600mm dia. plastic pipe
OMR_35	Upsizing proposed	3,527	Length 8.9m: 1No. 600mm dia. plastic pipe

4.10.17. Three of the structures, OMR_17, OMR_18 and OMR_21- New, all have a slightly different design criterion from the other culverts.

4.10.18. OMR_21 - New is associated with the extension of the HESCO barrier over watercourse A83_ML_024_000. This crossing is approximately 25m upstream from the OMR and will likely be a portal frame culvert that will straddle the existing watercourse, whilst providing support for the HESCO barrier above it. This structure will be large enough to pass at least the 0.5% AEP plus an allowance for climate change (Q200+CC) flow and not cause a hydraulic restriction, which will mimic the existing hydraulic scenario.

4.10.19. The other two structures are required to sit under the proposed earth bund, adjacent to the HESCO bund. To reduce the possibility of flows backing up behind the bund during a large event, due to a blocked culvert or similar, standard of protection for this structure was increased from a Q50 event to a Q200+CC event. This resulted in culverts OMR_17 and OMR_18 being upsized to pass the Q200+CC flow. The proposed dimensions for OMR_17 and OMR_18 are (1. No x 700mm diameter) and (1.No x 800mm diameter) respectively.

4.10.20. Two drop structures are required at OMR_17 and OMR_18 as an alternative to channel realignment due to the significant elevation difference. Drop structures will keep earthworks extents to a minimum whilst ensuring appropriate cover to the road surface is met. Locations of OMR_17 and OMR_18 are shown in Figure 4-1 .

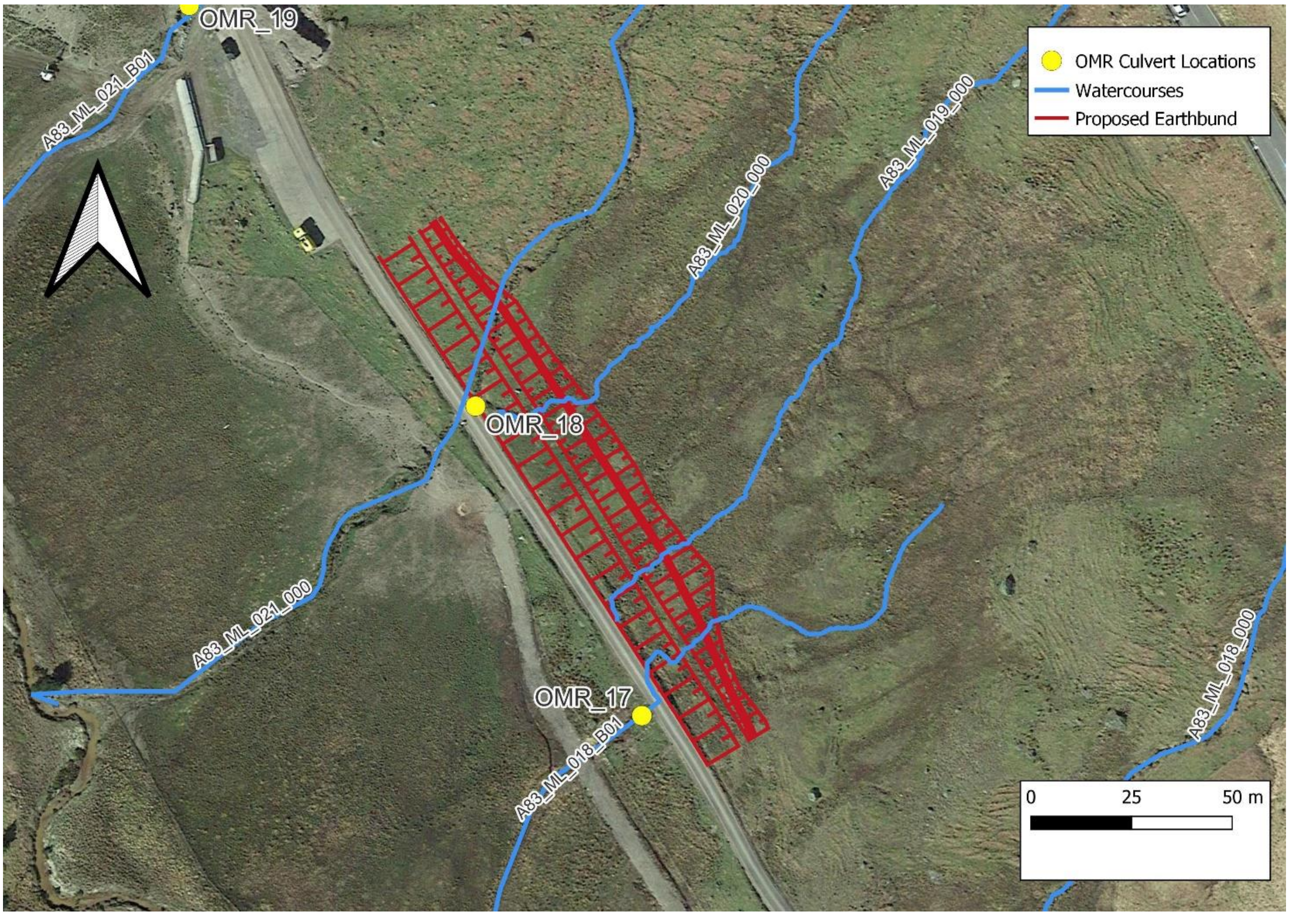

Figure 4-1 – Locations of OMR_17 and OMR_18 in context to the earth bund

Existing HESCO barrier and extension

4.10.21. The existing and proposed HESCO barrier will act as a debris resisting barrier, which are one of the commonly used defensive measures to mitigate natural terrain geo-hazards, namely debris flows. The barrier will also mitigate the risk of boulder falls impacting the OMR at this location. There are no UK standards for the design, construction and maintenance of such structures. However, there are several overseas guidance documents on the design of debris-resisting barriers. The AWJV have adopted the recommended guidance within GEO Report No.270 (2012) in the design of geotechnical loads on the HESCO barriers resulting from debris flow events and boulder fall impacts. The existing HESCO barrier was constructed as a temporary structure with a design working life considered to be 10 years. With regular inspections and maintenance, the structure should remain serviceable for an extended period.

4.10.22. At the northern end of the existing HESCO barrier, sections of the barrier will be removed to enable an extension to culvert OMR_20. The watercourse that has been diverted to culvert OMR_19 will be reinstated to redirect flows to the drop structure for culvert OMR_20. Following completion of the culvert extension, the barrier will be reinstated allowing the extension to the barrier to be fully integrated to the existing construction.

4.10.23. The existing open channel behind the HESCO barrier will be formalised and scour protection provided, as required to prevent undermining of the barrier.

4.10.24. The HESCO barrier extension is designed as a deflection structure, which will divert debris flows to the topographical low point behind the existing HESCO barrier. The design of the HESCO barrier extension has been influenced by various constructability considerations, including challenging access, steep side long ground and the management of the watercourses. The watercourses facilitate normal hillside drainage and potentially also the passage of debris flows.

4.10.25. At present, it is assumed that the HESCO barrier and extension will not be required following completion of the LTS construction and that the structure could be demolished.

4.10.26. Typical cross sections of the proposed and existing HESCO barriers are shown in drawing A83AAB-AWJ-HGT-MTS_GEN-DR-GE-000012 in Volume 2, Appendix A.9.

4.11. Debris flow and rock fall fences

4.11.1. The proposed fences are shallow landslide barriers that are designed as a hybrid system to offer protection against rockfall and debris flows. The barriers are designed to deform under impact through a series of anchors, brakes, and meshes, and retain either rockfall or debris flow material.

4.11.2. Details of the flexible debris flow fences are shown in drawing A83AAB-AWJ-HGT-MTS_GEN-DR-GE-000013 in Volume 2, Appendix A.9.

4.11.3. The design of these fences has been informed by consideration of:

- location above the existing A83 trunk road
- extent of potential excavation works required for the LTS catch pit
- topographic constraints identified from the recent drone surveys
- debris flow modelling to understand the likely flow paths, velocities and energies
- rock fall modelling for boulder/rock fall impacts
- on site walkovers to identify the most suitable location for construction, and
- early engagement with manufacturers and contractors

4.11.4. 3D debris flow and rockfall modelling has been undertaken to inform the positioning of the barriers. The largest suitable barrier has been designed for taking into account the site constraints, most notably the terrain. Modelling has then been undertaken to calculate the volume the barriers can retain. The maximum velocities the barriers can withstand is as per the manufacturer's rating for that system.

4.11.5. The preliminary design for these mitigation measures is limited to the identification of location and extents of the fences, energy values, corrosion protection and maintenance/servicing requirements. The specification for debris flow fences also identifies typical volumes they will be required to retain.

4.12. Fencing and Environmental Barriers

4.12.1. Permanent fencing along the boundary will generally be replaced similar to the existing situation through consultation and agreement with adjacent landowners where appropriate. Specific fencing requirements will be subject to agreement on accommodation works with affected adjoining landowners.

4.12.2. No ecological fencing or environmental barriers are required for the Proposed Scheme and have not been included.

4.13. Traffic Signs and Road Markings

4.13.1. As the Proposed Scheme will only be operated as a diversion and under temporary traffic management when the A83 Trunk Road is closed, permanent signage will be limited along the route to a small number of speed limit and warning signs. Signage will also be specified at either end of the OMR to communicate when it is closed as a diversion route and drivers are to use the A83 Trunk Road.

4.13.2. Reflective marker posts will be installed on the outside of low radius bends to enhance driver awareness of the road geometry. Furthermore, speed cushions will also be positioned at regular intervals, continuing on from those on existing two-way section, to help drivers maintain appropriate speeds for the OMR.

4.13.3. The use of road markings is also expected to be limited to continuous edge lining, helping delineate the edge of carriageway for drivers.

4.13.4. Subject to confirmation of the approach to the Traffic Regulation Orders, there will be opportunity during future design development to explore the benefits of installing any temporary signage and supporting infrastructure required for the operation of the diversion as a permanent measure that can be covered when not required with an aim to hasten implementation. This will be discussed with the Trunk Road Operating Company.

4.13.5. Traffic signs and road markings will be designed to the current signing standards The Traffic Signs Regulations and General Directions (TSRGD) 2016.

4.13.6. No signage will be illuminated as part of the Proposed Scheme.

4.13.7. Following completion of the Proposed Scheme, it is expected that the Trunk Road Operating Company will continue to set up and manage any temporary traffic management as per the current approach when a diversion is required.

4.14. Vehicle Restraint Systems

4.14.1. The conventional DMRB method of Vehicle Restraint System (VRS) assessment, Road Restraint Risk Assessment Process (RRRAP), is not applicable for roads less than 50mph and with less than 5,000 vehicles per day, both of which are the case for the OMR. As the Proposed Scheme does not meet either of these criteria, the need for VRS has been assessed using the UK Roads Liaison Group (UKRLG) risk assessment process as set out in the guidance document: *Design & Maintenance Guidance for Local Authority Roads - Provision of Road Restraint Systems on Local Authority Roads*. The above document provides guidance for a risk assessment scoring system based on the following criteria: -

- Location – *Road type A, B, C, U, etc.*
- Layout – *Bend severity, desirable minimum, 1-step reduction, etc. & junction proximity etc.*
- Collision – *Number of hazards & severity.*
- Consequential – *Secondary incidents, network disruption, cost of damage.*

4.14.2. When considering the most constrained and challenging area at the northern end of the OMR, which includes steep slopes, culverts and watercourses on bends, it was determined that a VRS is not considered necessary. This outcome is in line with how the OMR currently operates when used as a diversion route for the A83 Trunk Road.

4.14.3. Despite the above, parapets are provided on the two main watercourse crossings (Bridges A & B) and a high containment kerb is also proposed at Bridge B to protect the parapet as this has been subject to strikes by the trailers of articulated vehicles.

4.15. Road Pavement

4.15.1. Further design development will be undertaken as the project moves forward to determine an appropriate pavement design life and criteria considering input of the Trunk Road Operating Company. For ease of construction and future maintenance, it is expected that this will be a flexible asphalt pavement. The Appointed Contractor will ultimately be responsible for the detailed design of the pavement in line with the requirements set out in the Contract.

4.16. Scheme Procurement

4.16.1. The Proposed Scheme is expected to be procured by means of a Design & Build (D&B) type contract. For this form of contract, the Appointed Contractor will undertake both the detailed design and construction of the Proposed Scheme as well as a maintenance period for a set period of time. Following this, responsibility for operating and maintaining the trunk road is expected to become the responsibility of the Trunk Road Operating Company on behalf of the Scottish Government. Responsibility for operating and maintaining side roads would remain with Argyll and Bute Council on completion of the Proposed Scheme.

4.16.2. The scheme has been designed to sufficient detail on behalf of Transport Scotland to complete the necessary statutory procedures. Thereafter, detailed design shall be the responsibility of the successful Appointed Contractor. It is intended to allow the Contractor as much freedom as possible within the Contract to design and construct the works by the most efficient and safest means available, within the constraints and commitments imposed by the Environmental Impact Assessment (EIA) Report.

4.16.3. Optimisation of the Proposed Scheme design will still be deemed to comply with the EIA Report provided that any design changes have been subject to environmental review to ensure that the residual impacts would not be greater than those reported within the EIA Report, and subject to Transport Scotland's acceptance of the findings of any such review.

4.16.4. The Contract will describe the Employer’s Requirements for the works and the standards required for both construction and maintenance. The contract will include the Statutory Road Orders and the LMA by the Employer for the works. The Contractor will take responsibility for the Design, Construction and Maintenance of the Works over a defects period set out by Transport Scotland in the Contract Documents. Following the defined defects period, the Trunk Road Operating Company will be responsible for maintenance of the trunk road.

4.17. Maintenance Proposals

Road Maintenance

4.17.1. Despite the nature of the MTS in respect of use as an occasional diversion route, regular maintenance operations will still be required to ensure the effective operation of the route such as cut off ditch clearing; gully, pipe and chamber cleansing; sign face cleaning and winter maintenance.

4.17.2. The LMA for the MTS has been prepared such that it can accommodate both the initial construction and future maintenance requirements of the Proposed Scheme. Land acquisition has been kept to a minimum on the premise that where earthworks adjacent to the OMR are low or at grade, maintenance operations will be carried out from the carriageway. Where earthworks are more significant, a 3m maintenance strip is provided at the toe or crest of the earthworks to allow suitable access for a vehicle.

Structures Maintenance

4.17.3. It is expected that Bridges A, B and C will be maintained in a similar manner to present. The proposed Bridge D will be a proprietary structure which are typically designed to be easily maintainable and will include safe methods of access to allow inspection of the sides and beneath the bridge deck. For Bridge B, it is expected that the Trunk Road Operating Company will apply their standard approach for inspection and maintenance regimes on structures while taking cognisance of any advice and guidance provided by the proprietary bridge manufacturer.

4.17.4. All culverts will have access for operatives to carry out maintenance and inspection safely. Vehicular access for maintenance of structures will be provided from the OMR itself given the restriction of public traffic unless operating under a diversion.

Culverts with drop structures behind the HESCO barrier or earth bund will be accessible via a maintenance track.

4.17.5. The existing HESCO barrier is subject to periodic inspections in accordance with the Trunk Road Operating Company's inspection regime, to identify any damage or changes to the barrier. Special inspections are also required as outlined below:

- visual inspection after intense rainfall / channel flow due to the risk of erosion to the back of the barrier
- full inspection post landslide event to identify any damage

4.17.6. With regard to access, it is expected that inspections and maintenance will be carried out from the OMR or via a maintenance track to the rear.

Debris Clearance

4.17.7. In the instance that debris does reach the OMR following a landslide or debris flow event, material will need to be cleared by the Trunk Road Operating Company. The size of the event will predominantly dictate the approach to the operation; however, this may be undertaken from the OMR itself using long-reach plant or via the access at the rear of the HESCO barrier. Where debris accumulates behind the earth bund, a 3m maintenance track along the top has been provided which can be accessed from either end to carry out clearance operations.

4.17.8. Given the unpredictable nature of a landslide event, it is not possible to accurately determine the full extent to which access may be required for any future clearance or remedial works. In the event that clearance or remedial works are required out with the CPO boundary, they will be undertaken on third party land using the roads authority powers under the Roads (Scotland) Act 1984.

4.18. Construction

Introduction

4.18.1. A constructability review was undertaken as part of the Scheme Assessment to ensure a feasible means of constructing and delivering the Proposed Scheme.

Based on this, a possible construction programme and sequence has been set out in the following section.

4.18.2. At detailed design, the construction programme and methodology will be determined by the Appointed Contractor. They would be permitted to change the construction process, timescales and duration of each works element provided that environmental impacts are no greater than those described in the Environmental Impact Assessment (EIA), and that commitments given in the EIA are adhered to (or measures providing equivalent mitigation, subject to agreement with Transport Scotland and the A83 Environmental Steering Group, as required).

Construction Programme and Phasing

4.18.3. At present, it is assumed that construction period will extend over an estimated 12 months on a continuous basis following appointment of a Contractor. However, this may be subject to interruption and extension either due to:

- the OMR being required as a diversion route when A83 Trunk Road is or has the potential to be, as identified through regular monitoring, impacted by a landslide or debris flow event, or
- a landslide or debris flow event reaches the OMR itself, disrupting, and potentially suspending, construction activities to allow for clean-up operations

Construction Sequencing

4.18.4. The Appointed Contractor will be required to provide a detailed programme prior to commencement of the works. This will set out:

- the overall period of construction
- programming of the key elements and phases of construction, and
- the duration of each element and phase

4.18.5. The programme will be required to be regularly updated to reflect any changes in programmed activities and will provide the basis for notification to residents, local communities and road users where sensitive activities would be likely to involve temporary disturbance to access or non-routine events.

4.18.6. The construction programme is complicated by the fact that the OMR may need to be used by trunk road traffic with relatively short notice during times of elevated landslide risk which will be determined through continual monitoring. At present, monitoring includes weather forecasts, hillside conditions and level of water saturation.

4.18.7. Given the risk, it would be beneficial for the Appointed Contractor to identify those elements of work / durations that cannot be constructed whilst maintaining the potential for mobilisation of the OMR at short notice. For example, the widening of the Bridge B structure or the installation of twin culvert structures where road plates would not be suitable.

4.18.8. The construction programme will be prepared by the Appointed Contractor taking account of weather which can impact construction activities, including wet weather periods which may instigate the need for the diversion and cold periods, as well as any contractual requirements. The Appointed Contractor will be contractually required to have contingencies in place in order to reinstate the route as soon as practicable, this may include measures such as the use of quick drying concrete or the erection of a temporary concrete parapet.

Outline Construction Programme

4.18.9. Initial constructability reviews have indicated that construction could be sub-divided into three distinct works sections, with construction activity in each of these areas being programmed in separate phases:

- Section 1 – Immediately north of Phase 1 from Chainage 450 to the end of the proposed HESCO Barrier at Chainage 2,660. This section includes the majority of the works including the two-way and localised widening, associated road infrastructure, drainage, structures and culvert improvements, earthworks bund, HESCO barrier and channel reprofiling. The proposed BT Openreach diversion will need to be considered as part of Section 1 as its installation relies on the widened verge of the OMR.
- Section 2 – Immediately north of the proposed HESCO Barrier at Chainage 2,660 to where the OMR connects to the A83 at Chainage 3,960. This section includes

localised, targeted improvements at the three sharp bends. Notably, carriageway widening, drainage and structure and culvert improvements.

- Section 3 – Quarry adjacent to the A83 Trunk Road. This sits independent of the OMR and could potentially be completed in parallel with either Section 1 or Section 2. This section includes targeted geotechnical improvements. Notably, an earthworks bund and debris flow fencing.

4.18.10. Due to the narrow, linear nature of the Proposed Scheme with access from either end only, sub-dividing the works will help reduce construction challenges of the subsequent sections. Furthermore, it may help in the management of quickly implementing a diversion route should the A83 Trunk Road require to be closed at short notice.

Typical Construction Activities

4.18.11. Key construction activities associated with the Proposed Scheme are indicated in Table 4-6.

Table 4-6- Indicative Construction Activities

Section	Construction Activities
Possible Advance Works	• Environmental mitigation • Utility Apparatus / services diversions • Archaeological investigations and excavations
Roadworks	• Site establishment and plant compounds at strategic locations • Permanent fencing including accommodation works fencing • Site clearance and demolition • Temporary and permanent surface water outfalls • Utility Apparatus / services diversions • Temporary pre-earthworks drainage and permanent cut-off drainage • Earthworks (cuttings and embankments) • Earthworks Bunds • Landscaping • Drainage, service ducts and chambers • Topsoil spreading, seeding and turfing • Pavement construction

Section	Construction Activities
	• Roadwork finishes including signs, road markings and traffic calming measures • Accommodation works
Structures	• Installation of Bridge D • Widening of Bridge B • Extension of HESCO Barrier • Culvert improvements (extension and new construction) • Installation of debris flow fences
Environmental	• Landscape and ecological mitigation planting • Permanent diversion of watercourses
Temporary Works	• Temporary works to facilitate bridge D implementation • Temporary carriageway to maintain implementation of diversion route • Temporary Traffic Management • Temporary diversion of watercourses to facilitate culvert construction • Temporary diversion of watercourses to facilitate culvert construction • Temporary outfalls • Temporary fencing to facilitate construction
Maintenance	• Landscape maintenance • Remedial works as a result of landslides or debris flow events during construction • Other routine maintenance and defects repair works

Traffic Management

4.18.12. The Appointed Contractor will be required to develop and agree a Traffic Management Plan (TMP) with Transport Scotland and the Trunk Road Operating Company, Police Scotland, Argyll and Bute Council, and other directly affected stakeholders for the duration of the contract. The plan will identify proposals for the principal phases of the works and individual construction activities which will potentially involve disruption to existing vehicular and pedestrian access in specific locations along the construction corridor.

4.18.13. The majority of the works for the Proposed Scheme are offline either on the OMR or within the quarry. Therefore, it is anticipated that traffic management will be limited to the interfaces with the A83 Trunk Road and predominantly managing safe access and egress for construction or local traffic, such as landowners.

4.18.14. Notwithstanding the above, the TMP will need to account for a scenario where trunk road traffic is diverted on to the OMR as a result of a closure which may require public traffic running adjacent to the works. The Appointed Contractor should be prepared for progressing cessation of any live works and traffic management set up. It is likely that the TMP will require to be regularly reviewed and updated as the programme progresses.

4.18.15. In the event that works cannot be ceased or the site made fit for public traffic by the Appointed Contractor due to their nature, it may be necessary to use the long diversion route.

5. Traffic and Economic Assessment

5.1. Scheme background

5.1.1. As outlined in Section 1, when the A83 Trunk Road is required to close or has the potential to be, as identified through regular monitoring, impacted by a landslide or debris flow event, the OMR is used as a diversion route which is managed by the Trunk Road Operating Company using a mixture of controlled two-way free flowing traffic and convoy system.

5.1.2. When the OMR was first used as an emergency diversion route for A83 trunk road traffic in 2013, the tight turns and steep gradients, particularly at the north-west end, would occasionally cause issues for HGVs requiring recovery vehicles to be mobilised to ‘rescue’ them. This in turn led to delays for vehicles trapped behind the affected HGV, and for those waiting to use the diversion route. With an aim to mitigate these issues, measures such as carriageway widening at tight turns and installation of high friction surfacing have been implemented along the OMR diversion route since its initial use in 2013.

5.1.3. Overall, this has helped to reduce the additional journey time associated with travelling along the OMR when operating as a diversion, with most of the additional time associated with waiting at the convoy markers whilst the current convoy is moving. This can amount to average standing times of around 11 minutes; however, if the driver arrives just as the convoy leaves, the waiting time could increase to around 25 minutes. Travel time along the OMR is approximately 12 minutes, totalling 23 minutes. This amounts to an average additional journey time of 21 minutes compared to the A83 journey time.

5.1.4. In the event whereby traffic cannot be diverted onto the OMR, for example due to risk of a significant landslide, a longer diversion route via the A82, A85 and A819 is utilised, shown in Figure 5-1.

5.1.5. An alternative diversion, depending on the user’s origin and destination, is to use the ferry from Dunoon to Gourock. This offers an alternate route from the South of Argyll and Bute into Central Scotland to cities such as Glasgow and costs £22.75 per journey per car.

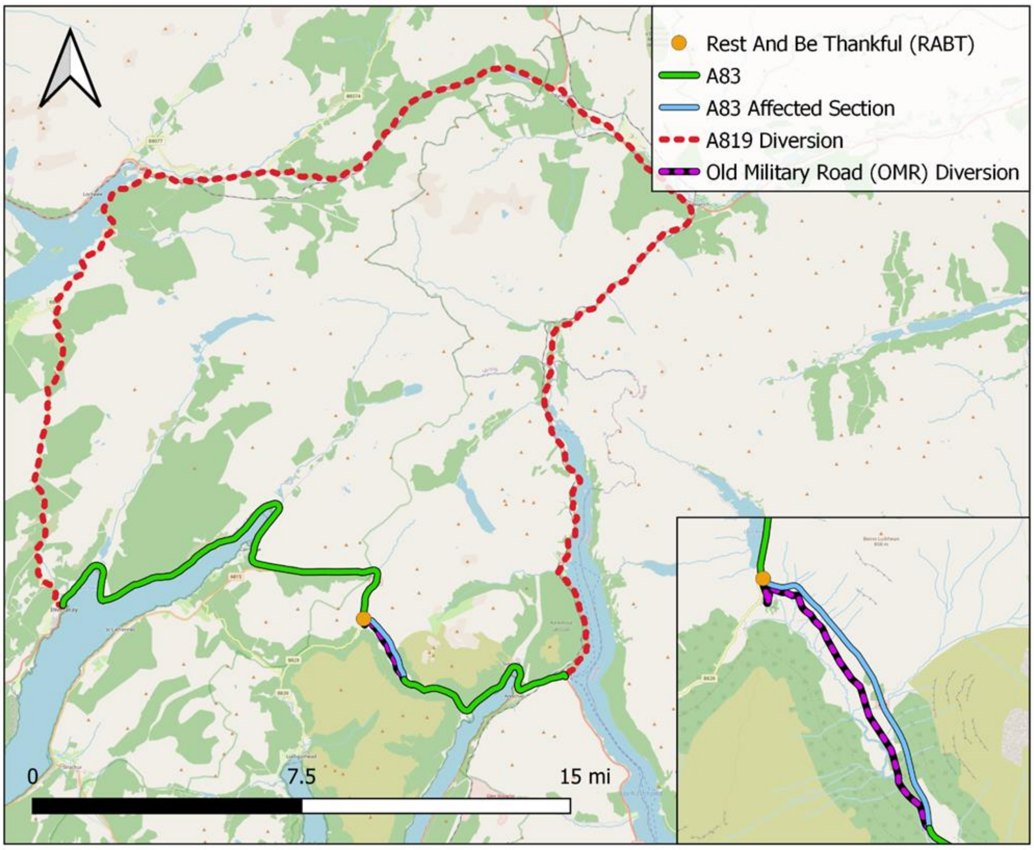

Figure 5-1 – Routes from Inverary to Tarbet

5.2. Data Collation

Traffic Surveys

5.2.1. AWJV commissioned three sets of traffic count surveys, at different locations around the Rest and Be Thankful Site, for a two-week period. The surveys were commissioned over the following dates:

- 30th October 2023 to 12th November 2023
- 27th February 2024 to 11th March 2024
- 1st April 2024 to 8th April 2024

5.2.2. The Automatic Traffic Count (ATC) locations for the October/November 2023 and February/March 2024 traffic surveys around the Rest and Be Thankful Site are provided below in Figure 5-2.

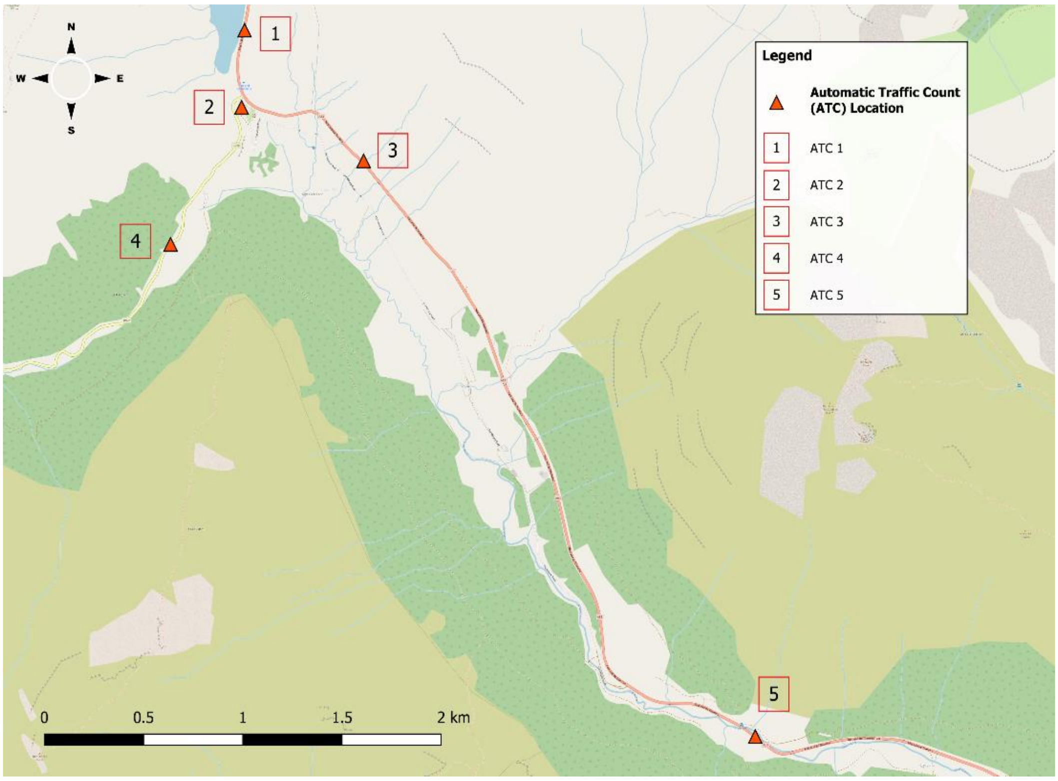

Figure 5-2 : Traffic Count Survey Locations

5.2.3. The data collected in April 2024 has not been used as the A83 Trunk Road was closed for a large portion of the surveyed period. The October / November 2023 and the March 2024 surveys have been used to calculate an Annual Average Daily Traffic (AADT) value for the surveyed periods. A seasonality factor, derived from a National Traffic Data System (NTDS) count site, was then applied to these values to get a yearly AADT value, to be used as the baseline existing situation. Following this methodology, the 2024 AADT value across the A83 near the Rest and Be Thankful site was calculated as approximately 4,200 vehicles. The calculated 2024 AADT along the A83 provided the baseline for forecasting future year traffic flows.

Transport Model for Scotland

5.2.4. The Transport Model for Scotland (TMfS) has been used to forecast the future flows along the A83 for two traffic forecast scenarios, the 'With Policy' and 'Without Policy' forecast traffic scenarios. These scenarios follow assumptions that would represent both low and high 'Motorised Traffic and Emissions' future scenarios. The assumptions used to produce these forecast traffic scenarios are described in Section 5.3. Forecast percentage change in AADT figures along the A83 Trunk Road at the Rest and Be Thankful were extracted from the TMfS for both forecast traffic scenarios. Annual AADT change factors derived from this data were then used to forecast AADT traffic flows along the A83 from the 2024 base year traffic flow. The processing and use of this data is described in greater detail in Section 5.3.

National Traffic Data System Traffic Counts

5.2.5. Access to the NTDS database has been provided to AWJV to aid in the traffic appraisal. There is only one active traffic counter located on the A83 Trunk Road in the immediate study area, which is to the south-east of the Proposed Scheme. The location of this counter is shown below in Figure 5-3.

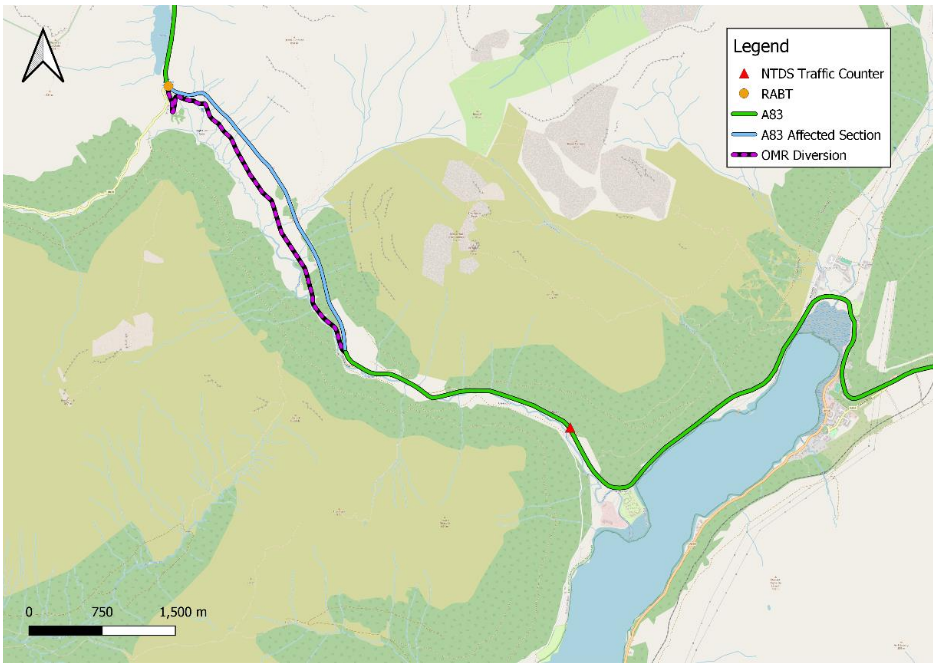

Figure 5-3 – NTDS count location

5.2.6. This counter is considered representative of traffic along the A83 corridor near the Rest and be Thankful site as there is few exit points between the scheme study area and the counter itself. The count data for this site from 2023 has been used to calculate seasonality factors corresponding to the survey periods. The seasonality factors were then applied to the corresponding survey period AADT to produce a yearly average AADT value for each survey.

5.2.7. The NTDS database indicates that, during 2020 the COVID-19 lockdowns had a pronounced effect on travel patterns, reducing the observed vehicle counts on the A83 Trunk Road by almost 66% from March to April. The number of vehicles increased as government travel restrictions were lifted, but then dropped greatly after the two landslides at the Rest and Be Thankful in August and September. This affected travel until the A83 Trunk Road re-opened in April 2021. Data for the remainder of 2021 and 2022 approximately followed the trend of the available data from 2019, indicating that the longer-term effects of COVID-19 have had little impact on travel patterns along this trunk road specifically. This further emphasises the importance of this road, as many local users of the A83 Trunk Road are required to use this corridor to access workplaces, education, and services.

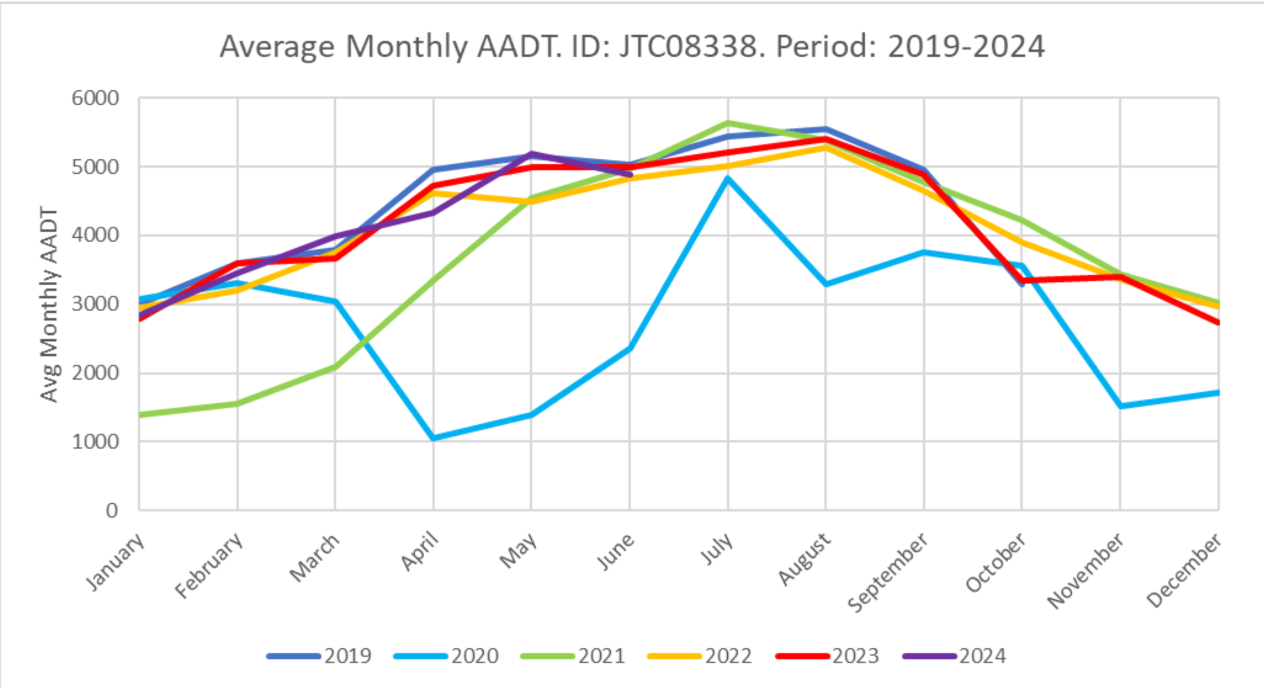

Figure 5-4 - NDTS average vehicle counts 2019-2024

INRIX Database

5.2.8. AWJV has also been given access to the INRIX database which allows for a select link analysis on certain parts of the Scottish road network. A select link analysis provides information on the origins and destinations of trips that are using the route. The main goal was to examine the journey time of vehicles using the OMR diversion during an A83 closure. The INRIX data was deemed to be unsuitable as it may not pick up the additional journey time that is spent queuing for the convoy. Furthermore, it was not possible to complete a select link analysis on the OMR itself as the feature is not available on this road.

Convoy Data

5.2.9. A register of operations from BEAR Scotland in the period August 2020 to January 2024 has been provided to AWJV for analysis and to inform the appraisal. This register contains dates and times in which the A83 Trunk Road traffic management, A83 Trunk Road convoy, OMR convoy and full A819/A82 diversion were deployed. This has been particularly useful to highlight the disruption caused by each of the traffic management measures and to use in calculating total operating costs per day of the traffic measures in the appraisal.

5.3. Traffic Model

Model Overview

5.3.1. A spreadsheet model to perform an economic appraisal of the transport costs has been developed in accordance with Scottish Transport Appraisal Guidance (STAG) reported in Section 9 and the HM Treasury Economic Parameter Data Book. Journey time costs and vehicle operating costs have been calculated to obtain a detailed picture of the economic impact that the road closures have on transport within the region.

5.3.2. The current year of 2024 was deemed to provide the most appropriate baseline from which to forecast traffic growth from. This approach utilises the traffic count surveys at the Rest and Be Thankful commissioned by AWJV in early 2024, which provides the most up to date traffic flow data along the A83 that is currently available. Therefore, 2024 has been chosen as the model base year.

5.3.3. The development of the model has been undertaken within a spreadsheet as this was deemed proportionate considering the location of the scheme and the levels of traffic that use the A83 Trunk Road. The model applies the changes in travel time to the number of trips predicted to use the A83 Trunk Road using the traffic flow data detailed in Section 5.2. The model represents an average day across the whole year. The changes in journey times from each scenario are then applied to the number of trips, forecasts trips are unchanged for all scenarios assed, to derive journey time benefits and vehicle operating costs for the economic appraisal. The changes in journey times were generated using a python simulation described in Section 5.3.

Convoy Simulation

5.3.4. A simple simulation of the convoy procedure has been developed in python, a general-purpose programming language, which has been used to inform the wait time at the A83 Trunk Road convoy. The simulation was used to derive an equation for the average wait time of a vehicles for a given number of vehicles per hour. This equation has then been used in the appraisal. The equation was derived by simulating a series of different vehicle per hour and interpolating the wait times from these outputs.

5.3.5. The wait time of the average user is approximately 11 minutes on the current OMR layout, but this is reduced to around 5 minutes on the upgraded OMR. This has been modelled over a 2-hour period over 30 iterations with a random number of vehicles arriving from the east and west with a range of vehicles per hour tested.

5.3.6. Several assumptions and parameters were used in the creation of the python script, which are given below:

Current OMR:

- One-way section length: 2700m
- One-way section vehicle speed: 10mph
- Vehicles per hour: Range from 25 to 1400
- Maximum convoy length: 35 vehicles (which includes the convoy vehicle)
- Vehicles have instantaneous speed
- No route choice has been incorporated into this simple model

Upgraded OMR:

- One-way section length: 1300m
- One-way section vehicle speed: 10mph
- Vehicles per hour: Range from 25 to 1400
- Maximum convoy length: 35 vehicles (which includes the convoy vehicle)
- Vehicles have instantaneous speed
- No route choice has been incorporated into this simple model

5.3.7. For both the current and upgraded MTS OMR respectively, each iteration of the simulation was averaged and used to produce a relationship between the vehicles per hour (vph) and the average time taken to cross the OMR one-way section. This is presented below in Figure 5-5.

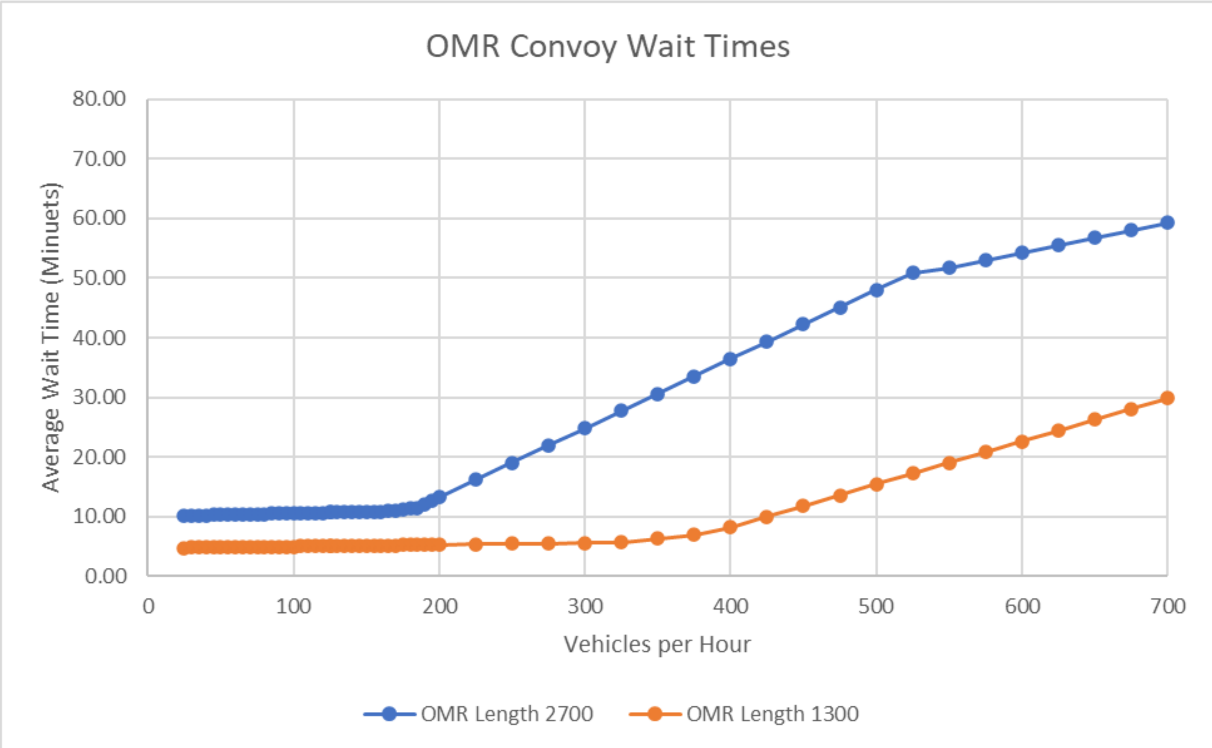

Figure 5-5 – Simulated convoy wait times

5.3.8. This MTS economic appraisal utilises a 24-hour average vph approach (AADT divided by 24) to calculate journey times along the OMR for forecasted traffic flows. The results produced were consistent with the average travel time along the current OMR diversion of 24 minutes including the wait time.

5.3.9. Journey times across the existing OMR and upgraded OMR as part of the MTS were also calculated from the convoy simulation data using an hourly daily profile extracted from local NTDS traffic counts. This was conducted to explore the potential effect of the MTS on the average journey time at peak hours during A83 Trunk Road closure periods. The results of this are presented below in Figure 5-6.

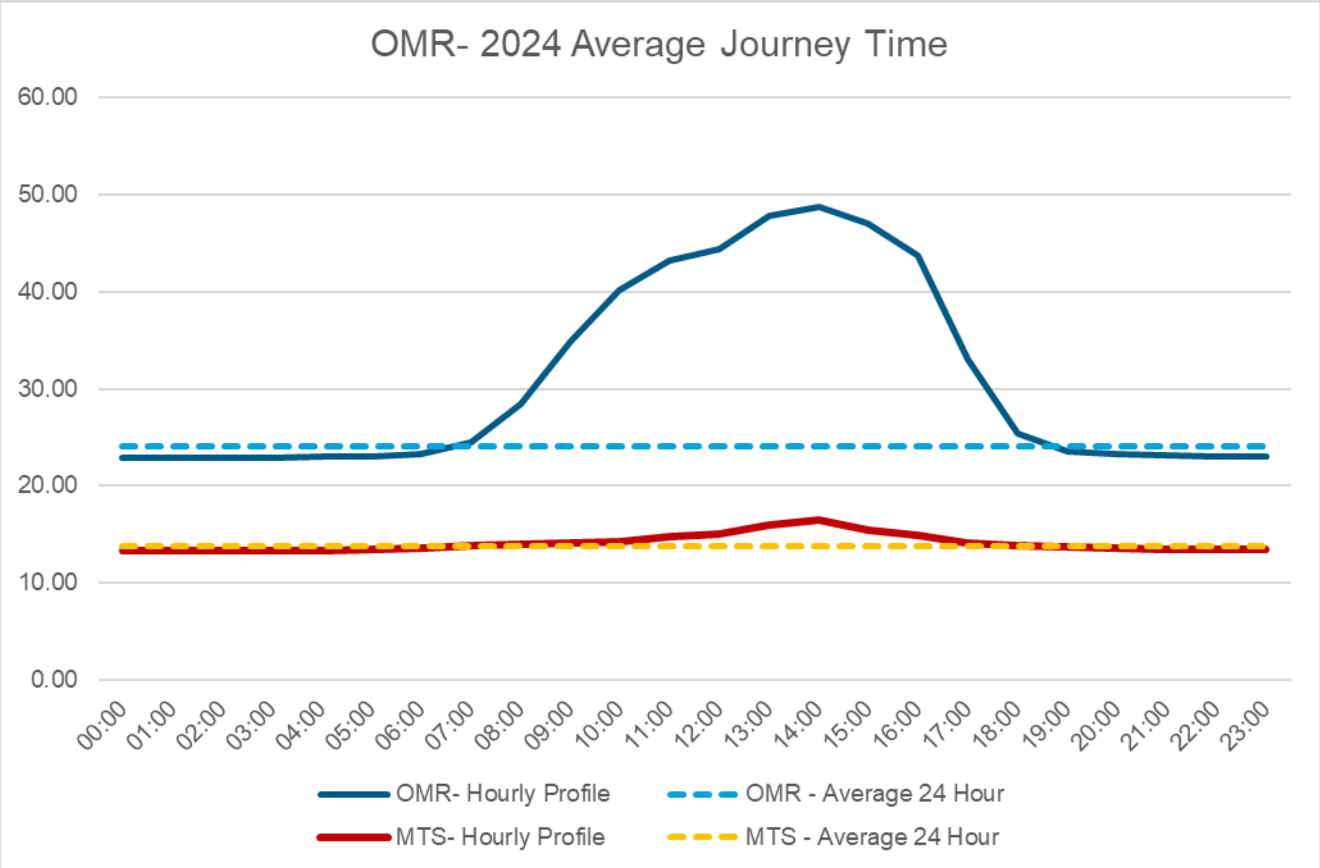

Figure 5-6- Daily profile OMR journey times

Traffic flow forecasts

5.3.10. Traffic flow forecast growth factors have been derived for this stage of the appraisal from the Transport Model for Scotland (TMfS). The traffic flow growth factors are based on a 2023 baseline from the model version TMfS18a. Included are two flow scenarios:

- Without Policy – High Traffic Scenario
- With Policy – Low Traffic Scenario

5.3.11. The 'Without Policy Ambition' traffic flow forecast, called 'High Motorised Traffic/Emissions Scenario', makes the following assumptions:

- Existing electric vehicle growth with no further interventions promoting uptake.
- Car ownership will only be constrained in city centres where there are existing parking constraints.
- Decline in trip rates: -15% commute, -33% business, all others – stable.
- A 40% update of connected and autonomous vehicles (CAV's) by 2050 with the first CAV's appearing in the mid 2020's.
- No change in fuel cost.

5.3.12. The 'With Policy Ambition' traffic flow forecast, called 'Low Motorised Traffic/Emissions Scenario' in the LTS DMRB Stage 1, makes the following assumptions:

- Phase out the sale of new petrol and diesel cars and vans by 2030.
- Car ownership constrained in all cities to number in 2020.
- Decline in trip rates: -25% commute, -66% business, all others – extrapolate decline.
- No connected and autonomous vehicles (CAV's) by 2050.
- Car generalised cost increase to achieve 20% reduction in car vehicle kms by 2030.

5.3.13. Both scenarios incorporate enhancements to explicitly represent the longer-term effects of the COVID-19 pandemic, such as increased home working and increased levels of digital substitution.

5.3.14. For both scenarios, five forecast years were considered:

- 2025
- 2030
- 2035
- 2040
- 2045

5.3.15. By using multiple forecast years, a future year profile can be derived up to 2045. The traffic flow forecasts use the 2024 AADT counts as a baseline and are then calculated up to 2045, after which it has assumed that there is no change in the traffic flow for each scenario as shown in Figure 5-7.

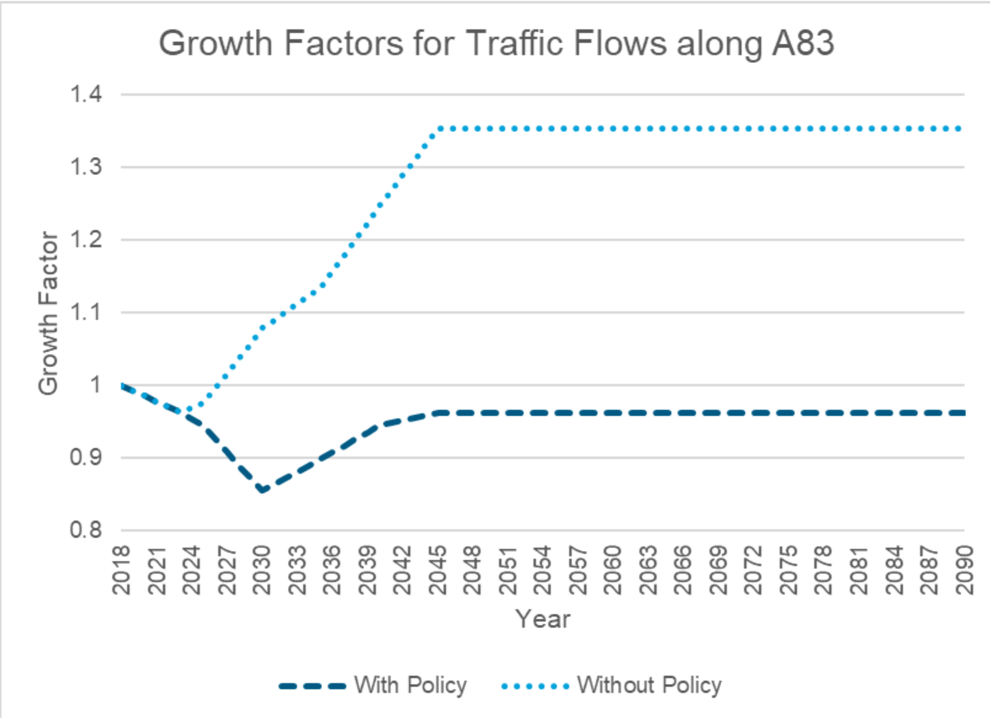

Figure 5-7 – AADT Forecasts

5.3.16. Journey purposes using the A83 Trunk Road were extracted from the LTS DMRB Stage 1 Wider Economic Impact Report (WEIR) and are shown in Table 5-1.

5.3.17. It should be noted that business users and Light Goods Vehicles (LGVs) are not separate below, therefore these have been treated as a single class for the modelling methodology.

5.3.18. It has been assumed that non-home-based equates to Working (purpose) Value of Times, which is reasonable for the study area.

5.3.19. The 'non-homebased' journeys have been split into two types using the assumption from the WEIR that there are around 200 HGVs using the A83 trunk road per day in each direction.

5.3.20. The proportions of each journey type have been used in combination with the projected traffic flow forecasts from Section 5.2. Weekdays, weekends and bank holiday flows have not been treated separately and the total number of vehicles per day in Table 5-1 represents an average of 365 days in 2019. The 2019 journey purpose splits along the A83 Trunk Road have been retained and applied to the 2024 baseline and all forecast years.

Table 5-1- Journey purposes

Journey purpose	Total occupants	Total vehicles	Proportion of travellers
Home based: Work	1,244	1,058	20%
Home based: Education	258	150	4%
Home based: Other	3,244	1,874	53%
Non home based: Business cars and LGVs	964	739	16%
Non home based: HGVs	400	400	7%
Total	6,110	4,221	100%

Model Scenarios

5.3.21. The appraisal will test three different core scenarios, variations of these scenarios will be undertaken through a series of sensitivity tests. The core scenarios are outlined below.

10-year appraisal – with LTS (Construction period)

5.3.22. This scenario has been considered as the 'primary' test and follows the current plan for the MTS and LTS closely. It will test the MTS while the LTS is under construction, so the OMR will be used more often for times when the A83 Trunk Road is closed during the construction period. It is assumed that the OMR convoy will be in operation for approximately 12 months of the year during the construction period. The Do Minimum scenario will include the LTS construction period but with the existing OMR convoy in operation for the same 4-year construction period. It is assumed the OMR/MTS usage outside of the LTS construction period will follow the assumed usage of the OMR existing traffic situation.

10-year appraisal – no LTS

5.3.23. This scenario will test the MTS over a 10-year period and assume the LTS is not under construction. The scenario will test the current situation on the A83 Trunk Road but with the MTS in place on the Old Military Road Diversion. The purpose of this scenario is to provide a comparative scenario against the primary option above.

60-year appraisal – no LTS

5.3.24. This scenario will test the MTS over a 60-year period and assume the LTS is not under construction. This is a more traditional appraisal scenario for a scheme. It should be noted that this scenario will be testing the MTS for a period longer than its planned lifetime. The number of days the convoy is in operation will use the standard assumption of 40 days per year.

5.3.25. These core scenarios will then be varied by undertaking a series of sensitivity tests which will test different assumptions.

Appraisal Assumptions

5.3.26. The appraisal period for the Proposed Scheme requires consideration of how the MTS is intended to be implemented alongside the LTS. The purpose of the Proposed Scheme is to provide a proportionate solution that offers greater resilience and improved safety for the A83 Trunk Road diversion route. Additionally, it will also help provide a diversion during the construction of the LTS. Therefore, it has been deemed appropriate to appraise the scheme for the initial construction period of the LTS. This would provide an economic appraisal over the years 2024 to 2034. An opening year of 2034 is currently being assumed for the LTS.

5.3.27. A more standard 60-year appraisal is not deemed appropriate or proportionate to assess the MTS because it has been designed and intended to be used for a limited period prior to the LTS opening. However, it is recognised that this is a shorter appraisal period as it reflects the intended usage period. Therefore, for completeness, and recognising that this approach does not conform to a standard appraisal timeline, a 60-year period sensitivity test has also been undertaken.

5.3.28. It has been assumed that during the appraisal period there is no construction period for the OMR upgrades. General traffic and current A83 Trunk Road traffic will be diverted onto the OMR when required during the entire appraisal period. Table 5-2 below details the assumptions used for the Construction Period Appraisal of the MTS.

Table 5-2 - Appraisal Period Assumption Comparison

OMR	10-year Appraisal – LTS Construction Appraisal Period	60-Year Appraisal Period (without LTS)	10-Year Appraisal Period (without LTS)
DM Scenario	Existing traffic situation at the OMR – assume LTS to be constructed over 4 years	Existing traffic situation at the OMR	Existing traffic situation at the OMR
DS Scenario	MTS upgrades along the OMR – assume LTS will be constructed over 4 years	MTS upgrades along the OMR	MTS upgrades along the OMR
Appraisal period	2026-2034* (10 Years)	2026-2085 (60 Years)	2026-2035* (10 Years)
MTS scheme cost included in appraisal?	Yes	No	No
LTS Construction period (2030 – 2034*)	Yes	No	No
LTS scheme cost included in appraisal?	No	No	No
2070 Landslide assumption?	No	Yes	No

5.3.29. All appraisal scenarios will share the assumption that all traffic diverted to the OMR in the Do-minimum (DM) scenario will be subject to the existing road lengths, speeds and convoy wait times. In the Do-Something (DS) scenario, any traffic diverted onto the OMR will be subject to the MTS upgraded road parameters. It is the difference of journey times in the DM and DS along the OMR which drives the economic benefit in this appraisal. Table 5-3 below presents the differences between the exiting OMR and the upgraded (with-MTS) OMR.

Table 5-3 - Breakdown of OMR route

OMR	Section type	Section length (km)	Section speed (mph)
Current road (DM)	One-way	2.7	10
Current road (DM)	Two-way	1.1	15
MTS upgrade (DS)	One-way	1.3	10
MTS upgrade (DS)	Two-way	2.5	25

5.3.30. To define the future scenario, several assumptions have been made to produce a projection of the number of closures of the A83 Trunk Road defined as the appraisal baseline. The closures have had different severities applied to them to define how road users will travel through the A83 Trunk Road.

5.3.31. Table 5-4 provides a summary of these base assumptions.

5.3.32. It is predicted that a similar event to the landslide in 2020 was a 1 in 50-year event. Therefore, it is assumed that a similar magnitude landslide would occur in 2070 and would cause a similar level of disruption to the A83 Trunk Road at the Rest and Be Thankful. During this time, it is conservatively assumed all traffic would be diverted via the OMR convoy and there would be no additional use of the A819/A82 northern diversion. This is only applicable to the 60-year appraisal.

Table 5-4 - Projected closures on A83

Travel scenario	Number of days per typical year	Number of days during a major event (2070)
OMR Convoy in operation	40	220
A819/A82 full diversion	0	30

5.3.33. A summary of the core assumptions for the 3 MTS appraisal periods is presented below in Table 5-5.

Table 5-5 – Core assumptions summary

Assumption	10-year Appraisal – LTS Construction Appraisal Period	60-Year Appraisal Period (without LTS)	10-Year Appraisal Period (without LTS)
Appraisal Length	10 Years	60 Years	10 Years
A82/A85 Diversion Usage %*	0%	0%	0%
Include LTS in DM	Yes	No	No
Include LTS in DS	Yes	No	No
A83 2-way Speed (km/hr)	73	73	73
A83 Length (km)	3.35	3.35	3.35
Original OMR Length (km)	3.8	3.8	3.8
Original OMR 2-way speed (km/hr)	24.1	24.1	24.1
Original OMR 1-way	2.7	2.7	2.7

Assumption	10-year Appraisal – LTS Construction Appraisal Period	60-Year Appraisal Period (without LTS)	10-Year Appraisal Period (without LTS)
section (km)			
Original OMR 1-way speed (km/hr)	16.1	16.1	16.1
MTS OMR Length (km)	3.8	3.8	3.8
MTS OMR 2-way Speed (km/hr)	40	40	40
MTS OMR 1-way Section (km)	1.3	1.3	1.3
MTS OMR 1-way Speed (km/hr)	16.1	16.1	16.1
Number of OMR Convoy days per year	40	40	40
Number of Diversion days per year	0	0	0
Number of OMR days during LTS construction	365	0	0
Construction Start Year	2030	N/A	N/A
Construction End Year	2033	N/A	N/A
Landslide Events	0	1	0
Landslide Years	N/A	2070	N/A
OMR days	N/A	220	N/A

Assumption	10-year Appraisal – LTS Construction Appraisal Period	60-Year Appraisal Period (without LTS)	10-Year Appraisal Period (without LTS)
A83 convoy usage	N/A	0	N/A
A819 /A82 Diversion Usage days	N/A	30	N/A
Mainline HGV's travel 15% slower	Yes	Yes	Yes
Convoy length (vehicles)	35	35	35
A819/A82 diversion speed (km/h)	60	60	60
A819/A82 diversion additional length (Inverary to Tarbet) (km)	40.68	40.68	40.68

* Note the percentage trips are separate from the number of diversion days, this assumes that a percentage of users would use the diversion instead of the OMR.

5.3.34. Table 5-6 below summarises the journey time changes for a typical journey from Inverary to Tarbet, relative to the existing A83 Trunk Road with no traffic management measures, for 2024 baseline traffic flows. Forecasted changes in traffic flows across the A83 Trunk Road corridor means the OMR and MTS will be subject to changes in journey times in future years due to changes in wait times during convoy operation described in Section 5.2. The journey times for the existing A83 Trunk Road and A819/A82 full diversion are assumed to be constant across all traffic forecast scenarios.

Table 5-6 - A83 relative journey time probability – Core Scenario Assumptions

Route	Variation to typical journey time (Inverary to Tarbet) for 2024 baseline traffic flows
Existing A83 with no traffic management measures	0
Existing OMR with convoy	+ 21 mins
MTS upgraded OMR with convoy	+ 11 mins
Full diversion via A819/A82 diversion	+ 38 mins

5.4. Traffic and Economic Appraisal

Appraisal Overview

5.4.1. This section details the Transport Economic Efficiency (TEE) analysis and Cost Benefit Analysis (CBA) of the Medium-Term Solution (MTS). This will capture the main impacts of the scheme in terms of economic welfare, predominantly represented by the main costs and benefits of users and operators of the transport system.

5.4.2. It has been assumed that the MTS will be constructed in early 2026 and the appraisal assumes benefits are accrued during this year.

5.4.3. The construction phase of the LTS for the purposes of the appraisal of the MTS scheme has been assumed to be 2030-2033. This is the ‘worst-case’ scenario for completion of the LTS and was selected to demonstrate the potential benefits of the MTS in this instance. It is noted that the construction period differs from the appraisal period for LTS, which assumes the current planned construction programme. The schedule for the construction phase will likely have a negligible impact on the benefits of the LTS scheme.

5.4.4. Three pairs of Do-Minimum (DM) and Do Something (DS) Scenarios were tested to appraise the MTS:

- **10-year appraisal with LTS** – LTS construction period included in both the DM and the DS. Reflects the intended programme for progression and deliver of the LTS.
- **10-year appraisal without LTS**- No LTS construction in the DM or DS scenario. This demonstrates the benefits of the MTS irrespective of progression of the LTS.
- **60-year period without LTS** – No LTS construction in the DM or the DS. This is a more traditional appraisal scenario but does not best reflect the design purpose and the intended length of time it is used for.

Exclusions

5.4.5. This appraisal has not included any impact on public transport and active modes. There is evidence of low usage of public transport and active modes in the study area and so this will have a negligible impact within the economic appraisal.

5.4.6. Indirect tax revenues have not been included in the appraisal due to the expected negligible impact on the overall user benefits.

5.4.7. No accident benefit analysis has been undertaken at this stage. The scheme does not significantly alter the standard of road from a traffic speed point of view and is unlikely to show a significant change in the number of accidents occurring on this section of the A83 Trunk Road.

5.4.8. For the purposes of the Scheme Assessment, the Environmental Impact has been qualitatively undertaken. The methodology for each impact is summarised within each relevant section of this report.

User benefits and vehicle operating costs

5.4.9. To calculate the forecast journey time benefits, the average journey time for each user was calculated using the spreadsheet model across the appraisal period. The number of vehicles projected for each year was then expanded into users by applying the occupancy factor. The value of time has been applied to the decreases/increases in travel time for each option to provide a total benefit/disbenefit. The model represents a single day and therefore to annualise a whole year representative period this was expanded by 365 days.

5.4.10. For each scenario, the forecast traffic flows were split by journey purpose. This allowed the application to place a cost on the time for each diversion relative to the journey time of an 'open as usual' A83. In accordance with STAG, this has been appropriately calculated with parameter values from the Traffic Analysis Guidance (TAG) economic data book (May 2024 v1.23) and discounted.

5.4.11. It is important to note here that the appraisal makes use of the assumption that HGVs travel 15% slower than light vehicles on the A83 Trunk Road and A819/A82 Diversion routes. This assumption is not used for the OMR routes, where it is assumed all traffic travel at the fixed, slower speed.

5.4.12. Vehicle operating costs were calculated in a similar way as journey time costs whilst making use of the relevant TAG data book information and AADT flows used throughout this report. Vehicle occupancies are not used in this calculation.

5.4.13. For the scenario that includes the LTS construction period, several assumptions have been applied on the program of works and the operation of the OMR during construction. For the purposes of this assessment, it is estimated that the A83 will be closed, and traffic diverted to the OMR for the entire construction period. Table 5-7 shows the closures assumed to take place during the construction period of the LTS.

Table 5-7 - Construction periods and diversions for LTS options

Option	Construction length (years)	Number of OMR diversion days
LTS	4	365

5.4.14. The final discounted totals per year are then collected and summed over the - appraisal period. The number of closure days and the number of days requiring each diversion are then incorporated to develop a detailed model of the economic impact of disruption to transport. The Present Value Benefits (PVB) for each appraisal period and forecast scenario are presented below in Table 5-8.

Table 5-8 - Present Value Benefits (2010 prices)

Appraisal Scenario	With Policy Ambition PVB	Without Policy Ambition PVB
10 Year with LTS	£9,116,880	£13,149,695
10 Year without LTS	£2,703,900	£3,570,578.89
60 Year without LTS	£11,790,402.21	£23,645,089.74

5.4.15. Table 5-9 presents Scheme Base Costs. These costs include risk and optimism bias and are shown in 2022 prices.

5.4.16. The operating costs for the MTS have assumed to be less due to the reduction in rental costs in the Do Something when compared to the Do Minimum.

Table 5-9 - Scheme base costs

Option	Description	Location to existing OMR	Construction period	Cost excluding maintenance (£k 2022 Prices)	Operating costs (whole life) (£k 2022 price)
MTS	Improvements to extend the OMR two-way section	Mainline	1 Year	£43,432	-£2,470*

*Assumption from 10-year appraisal

5.4.17. The treatment of costs for the Proposed Scheme has been applied in accordance with TAG Unit A1.2. Inflation has been applied from its sole construction period. The inflation rate applied is the Gross Domestic Product (GDP) deflator plus 2.1%. These costs have then been discounted from 2010 with discount rate of 3.5% per year and then rebased to 2010 prices using the GDP deflator to calculate the Present Value Costs (PVC) in 2010 prices as per 2.7.7 TAG Unit A1.1. Presently there is no assumed maintenance costs for the Proposed Scheme.

5.4.18. The cost of the projected A83 Trunk Road closures to bring the OMR into emergency operation, including temporary traffic management, within the Do Minimum scenario have been offset against the Proposed Scheme investment costs within the final PVC. The total cost derived which is included within the PVC calculation is solely reliant on the Proposed Scheme construction cost and is identical for each appraisal period and forecast period. The PVC for each appraisal period is presented in Table 5-10.

Table 5-10- Present Value Costs (2010 prices)

Option	Present Value Costs (£ 2010 Prices)
10 Year with LTS	£17,242,306
10 Year without LTS	£19,196,197
60 Year without LTS	£17,729,522

Benefit to Cost Ratios

5.4.19. The ratio between the PVB and PVC are presented as the Benefit to Cost Ratio (BCR). The BCR for each appraisal and forecast scenario are given below in Table 5-11.

Table 5-11 – MTS core BCRs

Option	With Policy Ambition BCR	Without Policy Ambition BCR
10 Year with LTS	0.45	0.66
10 Year without LTS	0.09	0.12
60 Year without LTS	0.5	1.01

5.4.20. Table 5-11 shows that the BCRs for the With Policy Ambition are lower than the Without Policy Ambition, this is because there are a lower number of trips in the With Policy Ambition forecasts due to lower car usage. Therefore, there are fewer trips on the A83 generating a lower benefit. The 10-Year with LTS BCR is larger than the BCR for the 10 Year Without LTS, due to the construction period of the LTS which causes the A83 Trunk Road to be closed for much of the four-year construction period. This shows that the MTS provides most benefit in a situation when the LTS is being constructed rather than a standalone scheme in the context of 10yr appraisal period.

5.4.21. The 60-year appraisal has induced the largest BCRs when compared to the 10-year appraisals. The ‘without Policy Ambition’ BCR has a BCR of 1.01 and shows that as a standalone scheme over 60 years, this scheme would provide a positive return on investment. This is as expected due to the length of the appraisal period with costs incurred initially but benefits accumulating as they are realised continuously throughout the operation relative to the do-nothing scenario. As stated previously, this scenario is for comparative purposes only and to demonstrate how the scheme performs under the assumptions that are typically applied to a proposed road scheme for a Stage 3 DMRB assessment.

5.4.22. The Appraisal Summary Table (AST) for each appraisal and forecast scenario of this MTS economic appraisal are presented in Annex A. An AST has been produced only for scenarios which follow the core assumptions presented in Table 5-5.

5.4.23. There is a high degree of uncertainty when attempting to predict the number of A83 closures. Therefore, additional scenarios have been included to cover a range of variables and the subsequent impact on the present value benefits.

A819/A85/A82 Diversion in Place

5.4.24. This sensitivity test tests each scenario using the core assumptions but with a change to the assumptions around the full A819/A85/A82 diversion usage. From analysing the traffic flows on the A85 and A83 on days the convoy was in operation, it was inconclusive as to the number of trips that were re-routeing via the full diversion (A85/A82) instead of travelling along the A83 through the convoy. Therefore, the following assumptions were applied to understand the level of benefits that would be realised in this instance. In this test it is assumed that the A819/A82 diversion would be used for the following:

- 5 days a year during the construction period
- 30 days in a landslide year
- 5% of trips would use the diversion when the OMR is in use

5.4.25. Table 5-12 below shows the BCR results for each scenario under these assumptions.

Table 5-12 – Diversion Sensitivity Test BCR Results

Option	With Policy Ambition BCR		Without Policy Ambition BCR	
	Core	Sensitivity Test	Core	Sensitivity Test
10 Year with LTS	0.45	0.5	0.66	0.7
10 Year without LTS	0.09	0.15	0.12	0.19
60 Year without LTS	0.5	0.75	1.01	1.31

5.4.26. The results above show the implementation of the Diversion Sensitivity Test leads to a small reduction in BCR values when compared with the core scenario results. This is expected because some traffic which in the core scenario utilises the OMR, in the sensitivity scenario instead utilises the A819 / A85 / A82 diversion route, reducing the benefit of the MTS because it is used by less vehicles than in the core scenario.

Landslide Occurrence

5.4.27. In this test the number of landslide events was increased, with a landslide in 2035 and 2070. This means that a single landslide event is captured in each 10-year appraisal by assuming this occurs in 2033 and two are captured in the 60-year appraisal. The other landslide assumptions are retained from the core scenario.

Table 5-13 - Landslide Occurrence Sensitivity test BCR results

Option	With Policy Ambition BCR		Without Policy Ambition BCR	
	Core	Sensitivity Test	Core	Sensitivity Test
10 Year with LTS	0.45	0.65	0.66	0.93
10 Year without LTS	0.09	0.14	0.12	0.19
60 Year without LTS	0.5	0.55	1.01	1.09

5.4.28. Table 5-13 shows higher BCR results for all appraisal options when compared to the core scenario. Increasing the number of landslide events increases the use of the OMR while the A83 is closed. This increases the benefits of the scheme as more users benefit from the MTS upgrade to the OMR.

Landslide Interventions

5.4.29. This scenario tests the impact of different landslide interventions. Three different tests are performed, using the 60 Year Appraisal as that is the only Core Scenario where a landslide takes place. In two of the tests the assumptions are applied to both the Do Minimum and the Do Something Scenarios, for the last scenario the assumption is only applied to the Do Something Scenario.

5.4.30. The first two scenarios test the effect of increasing and decreasing the duration of usage of different options after a landslide event. The third scenario tests the impact of the upgraded OMR having a faster cleanup time reducing the length of closure time. The assumptions are shown below in Table 5-14 and the BCR results are shown in Table 5-15.

Table 5-14 – Landslide Intervention Assumptions

Test	OMR Days		Diversion Days	
	DM	DS	DM	DS
Core	220	220	30	30
Landslide Interventions Upper	280	280	45	45
Landslide Interventions Lower	160	160	15	15
Landslide Faster Cleanup	220	110	30	30

Table 5-15 – Landslide Intervention Test BCR results

60 Year Appraisal Tests	With Policy Ambition BCR	Without Policy Ambition BCR
Core	0.5	1.01
Landslide Interventions Upper	0.51	1.03
Landslide Interventions Lower	0.49	0.98
Landslide Faster Cleanup	0.52	1.04

5.4.31. Table 5-15 shows that there is a small impact to the BCR by adjusting the assumptions around the Landslide interventions. The small impact is largely due to the landslide taking place in 2070, and so has a reduced impact on the benefits of the scheme.

5.5. Conclusions

5.5.1. Local traffic counts and surveys conducted by AWJV show traffic flows along the A83 Trunk Road at the Rest and Be Thankful are generally low across the year with fluctuations in the Winter and Summer periods. The economic benefit of this scheme is directly associated with the decrease in journey time along the OMR because of the reduction in length of the one-way section and associated convoy wait times. This, coupled with the generally low AADT, means that any scheme through this corridor will inherently derive a reduced transport economic benefit.

Three different appraisals scenarios were conducted, two 10-Year Appraisals scenarios and a traditional 60-Year Appraisal.

5.5.2. The economic benefit of the MTS scheme is fundamentally dependent on the number of traffic interventions to divert traffic from the A83 Trunk Road at the Rest and Be Thankful to the OMR in all scenarios. The nature of the MTS scheme suggests that any occurrence of landslide incidents or roads closures to the A83 mainline beyond the assumptions made in the appraisal would lead to an increased TEE benefit produced from the MTS. This is reaffirmed by the results of the sensitivity tests presented in Table 5-13.

5.5.3. Following the Department for Transports (DfTs) Value for Money (VfM) framework, the more traditional 60-year appraisal of the MTS appraisal produces a low VFM for the ‘With Policy’ and ‘Without Policy’ forecast traffic flow scenarios. However, this appraisal timeline is more arbitrary and does not represent the intended use of the scheme.

5.5.4. The 10-year appraisals of the MTS with and without the LTS construction period can be categorised as having poor VFM for both policy forecast scenarios. The MTS scheme is shown to produce over three times higher TEE benefits in the scenario where the LTS construction period is included in the appraisal assumptions due to the increased anticipated usage of the OMR during the LTS construction period. This scenario best represents the intended use of the Medium-Term solution scheme, where the occurrence of traffic interventions re-routing traffic from the A83 mainline to the OMR traffic intervention are more frequent.

5.6. Wider Economic Impacts

5.6.1. The Wider Economic Impacts (WEIs) have not been undertaken for the MTS due to impact of the scheme primarily being limited to the short to medium-term. The nature of the scheme will not improve journey times beyond completion of the LTS, with the aim to ensure connectivity during the construction phase of the LTS.

6. Summary

6.1. Scheme Description

6.1.1. The MTS aims to deliver a safe, proportionate and more resilient diversion route along the OMR when the A83 Trunk Road is closed due to landslide and debris flow risk.

1.5.1. The Proposed Scheme introduces a number of targeted and discrete improvements to help achieve the objectives set out in Section 1.2. The improvements which are discussed throughout this Scheme Assessment are outlined below:

- Introduction of debris catch fences above the A83 Trunk Road.
- Extension of the existing HESCO Barrier by approximately 150m.
- Construction of new two earth bunds, one adjacent to the OMR, and one within the quarry.
- Widening of the existing single-track OMR over a length of 1.4km to provide a total two-way carriageway length of 2.1km.
- Targeted widening at three sharp bends to ease movement for larger vehicles.
- Installation of a new proprietary structure at Croe Water to facilitate two-way operation and widening of Bridge B.
- Improved road and cut-off drainage throughout the widening works;
- Improvement of 19 existing culverts and installation of two new culverts. And,
- In-channel watercourse reprofiling.

Annex A - TEE and AST tables

Economic Efficiency of Transport System (TEE): MTS 10 Year Appraisal, with LTS, With Policy Ambition

Non-business: Commuting	**ALL MODES**		**ROAD**	
User benefits	**TOTAL**		**Private Cars and LGVs**	
Travel time	£ 1,753,330.95		£ 1,753,330.95	
Vehicle operating costs	£ 28,141.75		£ 28,141.75	
User charges	£ -		£ -	
During Construction & Maintenance	£ 52,891.37		£ 52,891.37	
NET NON-BUSINESS BENEFITS: COMMUTING	£ 1,834,364.07	*(1a)*	£ 1,834,364.07	
Non-business: Other	**ALL MODES**		**ROAD**	
User benefits	**TOTAL**		**Private Cars and LGVs**	
Travel time	£ 2,545,648.55		£ 2,545,648.55	
Vehicle operating costs	£ 53,781.55		£ 53,781.55	
User charges	£ -		£ -	
During Construction & Maintenance	£ 77,337.15		£ 77,337.15	
NET NON-BUSINESS BENEFITS: OTHER	£ 2,676,767.25	*(1b)*	£ 2,676,767.25	
Business				
User benefits			**Goods Vehicles**	**Business Cars & LGVs**
Travel time	£ 3,034,836.22		£ 1,131,637.04	£ 1,903,199.18
Vehicle operating costs	£ 184,363.90		£ 126,680.62	£ 57,683.28
User charges	£ -		£ -	£ -
During Construction & Maintenance	£ 95,568.87		£ 37,487.49	£ 58,081.38
Subtotal	£ 3,314,768.99	*(2)*	£ 1,295,805.15	£ 2,018,963.85
Private sector provider impacts				
Revenue	£ -			
Operating costs	£ -			
Investment costs	£ -			
Grant/subsidy	£ -			
Subtotal	£ -	*(3)*		
Other business impacts				

Developer contributions	£ -	*(4)*	£ -
NET BUSINESS IMPACT	£ 3,314,768.99	*(5) = (2) + (3) + (4)*	
TOTAL			
Present Value of Transport Economic Efficiency Benefits (TEE)	£ 7,825,900.31	*(6) = (1a) + (1b) + (5)*	

Notes: Benefits appear as positive numbers, while costs appear as negative numbers.

All entries are discounted present values, in 2010 prices and values

Economic Efficiency of Transport System (TEE): MTS 10 Year Appraisal, with LTS, Without Policy Ambition

Non-business: Commuting	**ALL MODES**		**ROAD**
User benefits	**TOTAL**		**Private Cars and LGVs**
Travel time	£ 2,582,585.64		£ 2,582,585.64
Vehicle operating costs	£ 34,461.29		£ 34,461.29
User charges	£ -		£ -
During Construction & Maintenance	£ 57,417.51		£ 57,417.51
NET NON-BUSINESS BENEFITS: COMMUTING	£ 2,674,464.44	*(1a)*	£ 2,674,464.44

Non-business: Other	**ALL MODES**		**ROAD**
User benefits	**TOTAL**		**Private Cars and LGVs**
Travel time	£ 3,749,637.46		£ 3,749,637.46
Vehicle operating costs	£ 65,858.80		£ 65,858.80
User charges	£ -		£ -
During Construction & Maintenance	£ 83,940.02		£ 83,940.02
NET NON-BUSINESS BENEFITS: OTHER	£ 3,899,436.27	*(1b)*	£ 3,899,436.27

Business				
User benefits			**Goods Vehicles**	**Business Cars & LGVs**
Travel time	£ 4,470,191.11		£ 1,666,855.63	£ 2,803,335.48
Vehicle operating costs	£ 226,369.52		£ 155,563.03	£ 70,806.48
User charges	£ -		£ -	£ -
During Construction & Maintenance	£ 103,634.95		£ 40,601.96	£ 63,032.98
Subtotal	£ 4,800,195.58	*(2)*	£ 1,863,020.63	£ 2,937,174.95
Private sector provider impacts				
Revenue	£ -			
Operating costs	£ -			
Investment costs	£ -			
Grant/subsidy	£ -			
Subtotal	£ -	*(3)*		
Other business impacts				
Developer contributions	£ -	*(4)*	£ -	
NET BUSINESS IMPACT	£ 4,800,195.58	*(5) = (2) + (3) + (4)*		

TOTAL

Present Value of Transport Economic Efficiency Benefits (TEE)	£ 11,374,096.29	*(6) = (1a) + (1b) + (5)*

Notes: Benefits appear as positive numbers, while costs appear as negative numbers.

All entries are discounted present values, in 2010 prices and values

Transport Appraisal Summary Table (TAST): MTS 10 Year Appraisal, with LTS

Sub-Criterion	Item	With policy ambition	Without policy ambition
Transport economic efficiency	Travel time	£ 7,333,815.72	£ 10,802,414.21
	User charges	£ -	£ -
	Vehicle operating costs	£ 266,287.20	£ 326,689.60
	Investment costs	£ -	£ -
	During Operating and maintenance	£ 225,797.39	£ 244,992.47
	Revenues	£ -	£ -
	Grant/Subsidy payments	£ -	£ -
	Monetised summary	£ 7,825,900.31	£ 11,374,096.29
	Monetary impact ratio	0.45	0.66
Cost to public sector	Public sector investment costs	£ 19,712,955.21	£ 19,712,955.21
	Public sector operating and maintenance costs	-£ 2,470,648.85	-£ 2,470,648.85
	Grant/Subsidy payments	£ -	£ -
	Revenues	£ -	£ -
	Taxation impacts	£ -	£ -
	Cost to funding agency	£ -	£ -
Monetised summary	Present value of transport benefits	£ 7,825,900.31	£ 11,374,096.29
	Present value of cost to government	£ 17,242,306.36	£ 17,242,306.36
	Net present value	-£ 9,416,406.04	£ 28,616,402.65
	BCR to government	0.45	0.66

Notes: Benefits appear as positive numbers, while costs appear as negative numbers.

All entries are discounted present values, in 2010 prices and values

Economic Efficiency of Transport System (TEE): MTS 10 Year Appraisal, No LTS, With Policy Ambition

Non-business: Commuting	**ALL MODES**		**ROAD**
User benefits	**TOTAL**		**Private Cars and LGVs**
Travel time	£ 540,381.79		£ 540,381.79
Vehicle operating costs	£ 20,251.94		£ 20,251.94
User charges	£ -		£ -
During Construction & Maintenance	£ -		£ -
NET NON-BUSINESS BENEFITS: COMMUTING	£ 560,633.73	*(1a)*	£ 560,633.73

Non-business: Other	**ALL MODES**		**ROAD**
User benefits	**TOTAL**		**Private Cars and LGVs**
Travel time	£ 1,128,367.53		£ 1,128,367.53
Vehicle operating costs	£ 38,703.37		£ 38,703.37
User charges	£ -		£ -
During Construction & Maintenance	£ -		£ -
NET NON-BUSINESS BENEFITS: OTHER	£ 1,167,070.90	*(1b)*	£ 1,167,070.90

Business				
User benefits			**Goods Vehicles**	**Business Cars & LGVs**
Travel time	£ 894,192.03		£ 296,785.43	£ 597,406.60
Vehicle operating costs	£ 82,003.51		£ 55,641.09	£ 26,362.42
User charges	£ -		£ -	£ -
During Construction & Maintenance	£ -		£ -	£ -
Subtotal	£ 976,195.55	*(2)*	£ 352,426.52	£ 623,769.03
Private sector provider impacts				
Revenue	£ -			
Operating costs	£ -			
Investment costs	£ -			
Grant/subsidy	£ -			
Subtotal	£ -	*(3)*		
Other business impacts				
Developer contributions	£ -	*(4)*	£ -	

NET BUSINESS IMPACT	£ 976,195.55	*(5) = (2) + (3) + (4)*
TOTAL Present Value of Transport Economic Efficiency Benefits (TEE)	£ 2,703,900	*(6) = (1a) + (1b) + (5)*

Notes: Benefits appear as positive numbers, while costs appear as negative numbers.

All entries are discounted present values, in 2010 prices and values

Economic Efficiency of Transport System (TEE): MTS 10 Year Appraisal, No LTS, Without Policy Ambition

Non-business: Commuting	ALL MODES		ROAD
User benefits	TOTAL		Private Cars and LGVs
Travel time	£ 718,529.59		£ 718,529.59
Vehicle operating costs	£ 23,257.76		£ 23,257.76
User charges	£ -		£ -
During Construction & Maintenance	£ -		£ -
NET NON-BUSINESS BENEFITS: COMMUTING	£ 741,787.34	(1a)	£ 741,787.34

Non-business: Other	ALL MODES		ROAD
User benefits	TOTAL		Private Cars and LGVs
Travel time	£ 1,500,356.73		£ 1,500,356.73
Vehicle operating costs	£ 44,447.78		£ 44,447.78
User charges	£ -		£ -
During Construction & Maintenance	£ -		£ -
NET NON-BUSINESS BENEFITS: OTHER	£ 1,544,804.51	(1b)	£ 1,544,804.51

Business				
User benefits			Goods Vehicles	Business Cars & LGVs
Travel time	£ 1,188,980.54		£ 394,626.76	£ 794,353.79
Vehicle operating costs	£ 95,006.49		£ 64,510.20	£ 30,496.30
User charges	£ -		£ -	£ -
During Construction & Maintenance	£ -		£ -	£ -
Subtotal	£ 1,283,987.04	(2)	£ 459,136.95	£ 824,850.09
Private sector provider impacts				
Revenue	£ -			
Operating costs	£ -			
Investment costs	£ -			
Grant/subsidy	£ -			
Subtotal	£ -	(3)		
Other business impacts				
Developer contributions	£ -	(4)	£ -	

NET BUSINESS IMPACT	£ 1,283,987.04	*(5) = (2) + (3) + (4)*
TOTAL Present Value of Transport Economic Efficiency Benefits (TEE)	£ 3,570,578.89	*(6) = (1a) + (1b) + (5)*

Notes: Benefits appear as positive numbers, while costs appear as negative numbers.

All entries are discounted present values, in 2010 prices and values

Transport Appraisal Summary Table (TAST): MTS 10 Year Appraisal, No LTS

Sub-Criterion	Item	With policy ambition	Without policy ambition
Transport economic efficiency	Travel time	£ 2,562,941.35	£ 3,407,866.86
	User charges	£ -	£ -
	Vehicle operating costs	£ 140,958.83	£ 162,712.03
	Investment costs	£ -	£ -
	During Operating and maintenance	£ -	£ -
	Revenues	£ -	£ -
	Grant/Subsidy payments	£ -	£ -
	Monetised summary	£ 2,703,900.18	£ 3,570,578.89
	Monetary impact ratio	0.17	0.22
Cost to public sector	Public sector investment costs	-£ 16,113,233.59	-£ 16,113,233.59
	Public sector operating and maintenance costs	£ -	£ -
	Grant/Subsidy payments	£ -	£ -
	Revenues	£ -	£ -
	Taxation impacts	£ -	£ -
	Cost to funding agency	£ -	£ -
Monetised summary	Present value of transport benefits	£ 2,703,900.18	£ 3,570,578.89
	Present value of cost to government	-£ 16,113,233.59	-£ 16,113,233.59
	Net present value	-£ 13,409,333.41	-£ 12,542,654.70
	BCR to government	0.17	0.22

Notes: Benefits appear as positive numbers, while costs appear as negative numbers.

All entries are discounted present values, in 2010 prices and values

Economic Efficiency of Transport System (TEE): MTS 60 Year appraisal, With Policy Ambition

Non-business: Commuting	ALL MODES		ROAD
User benefits	TOTAL		Private Cars and LGVs
Travel time	£ 2,406,429.26		£ 2,406,429.26
Vehicle operating costs	£ 46,187.46		£ 46,187.46
User charges	£ -		£ -
During Construction & Maintenance	£ -		£ -
NET NON-BUSINESS BENEFITS: COMMUTING	£ 2,452,616.72	*(1a)*	£ 2,452,616.72

Non-business: Other	ALL MODES		ROAD
User benefits	TOTAL		Private Cars and LGVs
Travel time	£ 5,024,848.50		£ 5,024,848.50
Vehicle operating costs	£ 88,268.62		£ 88,268.62
User charges	£ -		£ -
During Construction & Maintenance	£ -		£ -
NET NON-BUSINESS BENEFITS: OTHER	£ 5,113,117.12	*(1b)*	£ 5,113,117.12

Business				
User benefits			Goods Vehicles	Business Cars & LGVs
Travel time	£ 3,982,017.73		£ 1,321,645.46	£ 2,660,372.27
Vehicle operating costs	£ 242,650.63		£ 166,755.39	£ 75,895.24
User charges	£ -		£ -	£ -
During Construction & Maintenance	£ -		£ -	£ -
Subtotal	£ 4,224,668.37	*(2)*	£ 1,488,400.86	£ 2,736,267.51
Private sector provider impacts				
Revenue	£ -			
Operating costs	£ -			
Investment costs	£ -			
Grant/subsidy	£ -			
Subtotal	£ -	*(3)*		
Other business impacts				
Developer contributions	£ -	*(4)*	£ -	

NET BUSINESS IMPACT	£ 4,224,668.37	*(5) = (2) + (3) + (4)*
TOTAL Present Value of Transport Economic Efficiency Benefits (TEE)	£ 11,790,402.21	*(6) = (1a) + (1b) + (5)*

Notes: Benefits appear as positive numbers, while costs appear as negative numbers.

All entries are discounted present values, in 2010 prices and values

Economic Efficiency of Transport System (TEE): MTS 60 Year appraisal, Without Policy Ambition

Non-business: Commuting	**ALL MODES**		**ROAD**	
User benefits	**TOTAL**		**Private Cars and LGVs**	
Travel time	£ 4,883,707.55		£ 4,883,707.55	
Vehicle operating costs	£ 58,319.99		£ 58,319.99	
User charges	£ -		£ -	
During Construction & Maintenance	£ -		£ -	
NET NON-BUSINESS BENEFITS: COMMUTING	£ 4,942,027.54	*(1a)*	£ 4,942,027.54	
Non-business: Other	**ALL MODES**		**ROAD**	
User benefits	**TOTAL**		**Private Cars and LGVs**	
Travel time	£ 10,197,636.39		£ 10,197,636.39	
Vehicle operating costs	£ 111,455.03		£ 111,455.03	
User charges	£ -		£ -	
During Construction & Maintenance	£ -		£ -	
NET NON-BUSINESS BENEFITS: OTHER	£ 10,309,091.42	*(1b)*	£ 10,309,091.42	
Business				
User benefits			**Goods Vehicles**	**Business Cars & LGVs**
Travel time	£ 8,081,272.29		£ 2,682,202.23	£ 5,399,070.06
Vehicle operating costs	£ 312,698.49		£ 215,088.31	£ 97,610.17
User charges	£ -		£ -	£ -
During Construction & Maintenance	£ -		£ -	£ -
Subtotal	£ 8,393,970.77	*(2)*	£ 2,897,290.54	£ 5,496,680.23
Private sector provider impacts				
Revenue	£ -			
Operating costs	£ -			
Investment costs	£ -			
Grant/subsidy	£ -			
Subtotal	£ -	*(3)*		
Other business impacts				
Developer contributions	£ -	*(4)*	£ -	

NET BUSINESS IMPACT	£ 8,393,970.77	*(5) = (2) + (3) + (4)*
TOTAL Present Value of Transport Economic Efficiency Benefits (TEE)	£ 23,645,089.74	*(6) = (1a) + (1b) + (5)*

Notes: Benefits appear as positive numbers, while costs appear as negative numbers.

All entries are discounted present values, in 2010 prices and values

Transport Appraisal Summary Table (TAST): MTS 60 Year appraisal

Sub-Criterion	Item	With policy ambition	Without policy ambition
Transport economic efficiency	Travel time	£ 11,413,295.49	£ 23,162,616.23
	User charges	£ -	£ -
	Vehicle operating costs	£ 377,106.72	£ 482,473.51
	Investment costs	£ -	£ -
	During Operating and maintenance	£ -	£ -
	Revenues	£ -	£ -
	Grant/Subsidy payments	£ -	£ -
	Monetised summary	£ 11,790,402.21	£ 23,645,089.74
	Monetary impact ratio	0.73	1.47
Cost to public sector	Public sector investment costs	-£ 16,113,233.59	-£ 16,113,233.59
	Public sector operating and maintenance costs	£ -	£ -
	Grant/Subsidy payments	£ -	£ -
	Revenues	£ -	£ -
	Taxation impacts	£ -	£ -
	Cost to funding agency	£ -	£ -
Monetised summary	Present value of transport benefits	£ 11,790,402.21	£ 23,645,089.74
	Present value of cost to government	-£ 16,113,233.59	-£ 16,113,233.59
	Net present value	-£ 4,322,831.37	£ 7,531,856.15
	BCR to government	0.73	1.47

Notes: Benefits appear as positive numbers, while costs appear as negative numbers.

All entries are discounted present values, in 2010 prices and values