Appendix B Appraisal Summary Tables

Proposal Details			
Name and address of authority or organisation promoting the proposal: (Also provide name of any subsidiary organisations also involved in promoting the proposal)			Transport Scotland Buchanan House 58 Port Dundas Road Glasgow, G4 0HF
Proposal Name:	**A83 Ardgartan to Rest and Be Thankful Red Option**	Name of Planner:	Alasdair Graham
Proposal Description:	The Red Option involves substantial hazard reduction measures along the line of the existing road to reduce the occurrence of landslides and/or the frequency and duration that landslides cause road closures. These measures represent a significant step-change in the provision of landslide hazard reduction and include – • 440m of additional debris flow barriers • Improved hillside drainage adjacent to and under the road • Introduction of vegetation and planting on the slope	Estimated Total Public Sector Funding Requirement:	Capital costs/grant £9–10 million (2012 prices excluding VAT) Annual revenue support £0 Present Value of Cost to Govt. £9–10 million (2012 prices excluding VAT)
Funding Sought From: (if applicable)	N/A	Amount of Application:	**£9–10 million** (2012 prices excluding VAT)
Background Information			
Geographic Context:	The A83 trunk road runs from the A82 at Tarbet on Loch Lomond to the Kennacraig Ferry Terminal on West Loch Tarbert. It provides the main route for traffic from central Scotland to Argyll and Bute and therefore provides access to such towns as Inveraray, Lochgilphead, Tarbert and Campbeltown. Although the traffic volumes on the A83 are relatively low, there are no other landward means of transportation along this route and therefore much of Argyll is dependent on the A83. There are several geographical features and constraints which impact on the operation, for example several narrowings along its length and landslides at the Rest and Be Thankful. Ardgartan to Rest and be Thankful is a seven kilometre section of the A83 through Glen Croe. A 1km section from the crossing over the Coire Croe Burn to the bend immediately before the viewpoint car park has a history of hillside instability above and below the road. It has been closed due to landslides, or high risk of landslides, on 6 occasions in 5 years totalling 34 days.		

Social Context:	The area affected by closures of the A83 at Rest and Be Thankful includes Cowal, Mid Argyll, Kintyre, Islay Jura and Colonsay. This is referred to as the A83 study area. The population of the study area was 37,300 in 2011 which accounts for almost 42% of the total population of Argyll and Bute. However, the population of the A83 study area has declined by 2.5% between 2008 and 2011 compared to a decline of 1% across Argyll and Bute as a whole. Over the same period, the population of Scotland has grown by 1.7%. The study area is characterised by a lower proportion of people of working age and a higher proportion of people of pensionable age compared to Argyll and Bute as a whole and Scotland. The unemployment rate in the study area was 3.6% in August 2012 compared to the Scottish rate of 4.3%. The unemployment rate in the study area has been below the Scottish rate since 2009. Due to the seasonal nature of employment the area's employment statistics fluctuate throughout the year. In 2001 the average number of cars or vans per household in Argyll and Bute was 1.03 which was higher than the Scottish average of 0.93.
Economic Context:	Using evidence from this study, drawn from several key stakeholders, the additional annual costs to the A83 economy from previous landslide episodes at the Rest and Be Thankful are estimated to be £286,300 (in 2010 prices) for the road being closed for 5½ days over the year (the average duration of the past six events). Sensitivity analysis shows that the additional annual costs to the A83 economy from previous landslide episodes at the Rest and Be Thankful are in the range £130,200 (2½ day closure) to £676,800 (13 day closure).
Planning Objectives	
Objective:	Performance against planning objective:
Reduce the **impact on journey times** by reducing the frequency and duration of road closures caused by landslides.	The additional landslide mitigation measures would significantly reduce the frequency of occurrence of landslide debris reaching the A83 Trunk Road causing a full road closure.
Reduce the **economic impact to the A83 study area** by reducing the frequency and duration of road closures caused by landslides.	The additional landslide mitigation measures would significantly reduce the frequency of occurrence of landslide debris reaching the A83 Trunk Road causing a full road closure. As a result the subsequent economic impact to the communities and businesses served by the A83 would be reduced.

Rationale for Selection or Rejection of Proposal:	The Red Option represents a significant step-change in the provision of landslide hazard reduction adopted since 2008 following publication of the Scottish Road Network Landslides Study: Implementation Report. This option contributes towards the Transport Planning Objectives and demonstrates benefits against the criteria of Safety, Economy, Accessibility and Social Inclusion. The effects on the Environment and Integration are considered neutral compared to the Do Minimum scenario. This proposal is **selected** for further consideration as it is expected to significantly reduce the frequency of occurrence of landslide debris reaching the A83 Trunk Road at a much lower cost than the other options.
Implementability Appraisal	
Technical:	The range of landslide mitigation measures forming this intervention would be implemented using proven methods and technology. The works would require single lane traffic management during construction with only minimal impact to overall journey times.
Operational:	Operational costs for this option would increase slightly compared to the Do Minimum scenario. Following landslide events the debris would be removed from the barriers and debris fences re-tensioned.
Financial:	The implementation of this option requires significant capital investment and would be subject to funding availability and other competing priorities throughout Scotland. This option offers the potential for implementation in phases.
Public:	The debris flow barriers installed since 2010 protect a relatively short section of hillside. Recent landslides have occurred at other locations nearby. Public information about debris flow barriers is being prepared by Transport Scotland to explain how they would help mitigate the impact of landslides. Public opinion towards slope vegetation and planting seems generally positive. The extent to which this option addresses the public demand for a long-term solution to landslides at Rest and Be Thankful would be the subject of further consultation.

STAG Criteria		
Criterion	**Assessment Summary**	**Supporting Information**
Environment:	Neutral	The additional landslide protection measures are not anticipated to have any significant environmental effects. The Red Option represents the continuation of the landslide management strategy that has already commenced, therefore in comparison to the other corridors, this is considered to represent a Neutral effect.
Safety:	Minor Benefit	The road safety implication of this proposal due to the road layout and alignment would be comparable to the do minimum scenario, since the road alignment would be same. However, increased lengths of debris flow barriers would reduce the likelihood of landslide debris reaching the carriageway and causing vehicle accidents.
Economy:	Moderate Benefit	This option involves substantial hazard reduction measures along the line of the existing road to reduce the occurrence of landslides and/or the frequency and duration that landslides cause road closures. While there would still be a risk of closure of the road due to landslides, the risk would be significantly reduced at a much lower capital cost than the other options.
Integration:	Neutral	The proposal would not affect transport integration.
Accessibility and Social Inclusion:	Minor Benefit	The additional landslide mitigation measures would significantly reduce the frequency of occurrence of landslide debris reaching the A83 Trunk Road causing a full road closure. This would improve accessibility for the study area. This proposal would have no effect on social inclusion.

<table>
<tr><th colspan="4">Proposal Details</th></tr>
<tr><td colspan="3">Name and address of authority or organisation promoting the proposal:

(Also provide name of any subsidiary organisations also involved in promoting the proposal)</td><td>Transport Scotland
Buchanan House
58 Port Dundas Road
Glasgow, G4 0HF</td></tr>
<tr><td>Proposal Name:</td><td>A83 Ardgartan to Rest and Be Thankful Brown Option</td><td>Name of Planner:</td><td>Alasdair Graham</td></tr>
<tr><td rowspan="3">Proposal Description:</td><td rowspan="3">The Brown Option maintains the existing alignment of the A83 and involves the construction of debris flow shelters over a length of 1km.</td><td rowspan="3">Estimated Total Public Sector Funding Requirement:</td><td>Capital costs/grant
£105-120 million
(2012 prices excluding VAT)</td></tr>
<tr><td>Annual revenue support
£0</td></tr>
<tr><td>Present Value of Cost to Govt.
£105-120 million
(2012 prices excluding VAT)</td></tr>
<tr><td>Funding Sought From:
(if applicable)</td><td>N/A</td><td>Amount of Application:</td><td>£105-120 million
(2012 prices excluding VAT)</td></tr>
<tr><th colspan="4">Background Information</th></tr>
<tr><td>Geographic Context:</td><td colspan="3">The A83 trunk road runs from the A82 at Tarbet on Loch Lomond to the Kennacraig Ferry Terminal on West Loch Tarbert. It provides the main route for traffic from central Scotland to Argyll and Bute and therefore provides access to such towns as Inveraray, Lochgilphead, Tarbert and Campbeltown. Although the traffic volumes on the A83 are relatively low, there are no other landward means of transportation along this route and therefore much of Argyll is dependent on the A83. There are several geographical features and constraints which impact on the operation, for example several narrowings along its length and landslides at the Rest and Be Thankful.
Ardgartan to Rest and be Thankful is a seven kilometre section of the A83 through Glen Croe. A 1km section from the crossing over the Coire Croe Burn to the bend immediately before the viewpoint car park has a history of hillside instability above and below the road. It has been closed due to landslides, or high risk of landslides, on 6 occasions in 5 years totalling 34 days.</td></tr>
</table>

Social Context:	The area affected by closures of the A83 at Rest and Be Thankful includes Cowal, Mid Argyll, Kintyre, Islay Jura and Colonsay. This is referred to as the A83 study area. The population of the study area was 37,300 in 2011 which accounts for almost 42% of the total population of Argyll and Bute. However, the population of the A83 study area has declined by 2.5% between 2008 and 2011 compared to a decline of 1% across Argyll and Bute as a whole. Over the same period, the population of Scotland has grown by 1.7%. The study area is characterised by a lower proportion of people of working age and a higher proportion of people of pensionable age compared to Argyll and Bute as a whole and Scotland. The unemployment rate in the study area was 3.6% in August 2012 compared to the Scottish rate of 4.3%. The unemployment rate in the study area has been below the Scottish rate since 2009. Due to the seasonal nature of employment the area's employment statistics fluctuate throughout the year. In 2001 the average number of cars or vans per household in Argyll and Bute was 1.03 which was higher than the Scottish average of 0.93.
Economic Context:	Using evidence from this study, drawn from several key stakeholders, the additional annual costs to the A83 economy from previous landslide episodes at the Rest and Be Thankful are estimated to be £286,300 (in 2010 prices) for the road being closed for 5½ days over the year (the average duration of the past six events). Sensitivity analysis shows that the additional annual costs to the A83 economy from previous landslide episodes at the Rest and Be Thankful are in the range £130,200 (2½ day closure) to £676,800 (13 day closure).
Planning Objectives	
Objective:	Performance against planning objective:
Reduce the **impact on journey times** by reducing the frequency and duration of road closures caused by landslides.	Following construction of a debris flow shelter over the road the likelihood of landslide debris reaching the A83 Trunk Road causing a full road closure would be negligible for the length of road protected by the shelter. However, during construction of the debris flow shelters, construction traffic management would result in road closures and journey time delays for a significant period.
Reduce the **economic impact to the A83 study area** by reducing the frequency and duration of road closures caused by landslides.	Following construction of a debris flow shelter over the road the likelihood of landslide debris reaching the A83 Trunk Road causing a full road closure would be negligible for the length of road protected by the shelter. As a result the subsequent economic impact to the communities and businesses served by the A83 would be reduced, however there may be an impact during construction due to construction traffic management delays and road closures.

Rationale for Selection or Rejection of Proposal:	The Brown Option maintains the existing alignment of the A83 and involves the construction of debris flow shelters over a length of 1km. This option contributes towards the Transport Planning Objective and demonstrates benefits against the criteria of Safety, Economy, Accessibility and Social Inclusion for the completed scheme. Environmental Impact is noted due to the effect on local landscape and views. During construction there would be moderate economic impacts. This proposal is **rejected** for further consideration since the impacts during construction are considered to outweigh the longer term benefits and the estimated cost is greater than other proposals with similar long term benefits.
Implementability Appraisal	
Technical:	The design of a debris flow shelter would present technical challenges unique to this location due to the ground conditions and slope instability. While construction would be by proven methods and technology, the works would be within a narrow, linear construction site immediately adjacent to temporary traffic management.
Operational:	Operational costs for this proposal would increase due to the routine maintenance costs for such a major highway structure. Following debris flow events, remedial works would be required to clear excessive debris from culverts and the roof of the structure, though these works would not affect the operation of the road. The works would require a significant length and duration of single lane traffic management during construction and/or road closures with journey time delays for a period of at least 30 months.
Financial:	The implementation of this option requires significant capital investment and would be subject to funding availability and other competing priorities throughout Scotland.
Public:	Public opinion regarding debris flow shelters is mixed. Some have expressed strong support for this option while others express concern about the visual impact of such a significant civil engineering structure at this location. The journey time delays and potential wider economic impacts caused during a long period of construction would be of public concern.

STAG Criteria		
Criterion	**Assessment Summary**	**Supporting Information**
Environment:	Minor Impact	The introduction of the debris shelters into the valley could have effects on the local landscape and views, although the significance of these effects would depend on the appearance and extents of the landslide shelters, and how well they integrate into the landscape. No other potentially significant environmental effects are anticipated.
Safety:	Moderate Benefit	This proposal would improve road safety compared to the do minimum scenario. The construction of the debris shelters would include a minor realignment and widening of the existing carriageway. The construction of the debris shelters would eliminate the occurrence of landslide debris reaching the carriageway over the length protected by the shelter.
Economy:	Minor Benefit / Moderate Impact	It is assumed that following implementation of this proposal the risk of closure of the road due to landslide would be negligible. This option would enable vehicles to continue on the A83 trunk road without making any changes to their journey. Compared to the do minimum situation, the variability in journey time due to landslides would be significantly reduced. Construction traffic management would result in journey time delays for a significant period.
Integration:	Neutral	The proposal would not affect transport integration.
Accessibility and Social Inclusion:	Minor Benefit / Minor Impact	The construction of the debris shelters would eliminate the occurrence of landslide debris reaching the carriageway over the length protected by the shelter. This would improve accessibility for the study area. During construction accessibility would be adversely affected by construction traffic management. This proposal would not affect social inclusion.

Proposal Details			
Name and address of authority or organisation promoting the proposal: (Also provide name of any subsidiary organisations also involved in promoting the proposal)			Transport Scotland Buchanan House 58 Port Dundas Road Glasgow, G4 0HF
Proposal Name:	**A83 Ardgartan to Rest and Be Thankful Yellow Corridor Option**	Name of Planner:	Alasdair Graham
Proposal Description:	The yellow corridor option provides a new 1.2km long single carriageway on viaduct offset from the existing A83 following a similar profile with an average climbing gradient of 5%. It would be set at a sufficient level to permit debris flow events to pass below the viaduct.	Estimated Total Public Sector Funding Requirement:	Capital costs/grant £83-95 million (2012 prices excluding VAT)
			Annual revenue support £0
			Present Value of Cost to Govt. £83-95 million (2012 prices excluding VAT)
Funding Sought From: (if applicable)	N/A	Amount of Application:	**£83-95 million** (2012 prices excluding VAT)
Background Information			
Geographic Context:	The A83 trunk road runs from the A82 at Tarbet on Loch Lomond to the Kennacraig Ferry Terminal on West Loch Tarbert. It provides the main route for traffic from central Scotland to Argyll and Bute and therefore provides access to such towns as Inveraray, Lochgilphead, Tarbert and Campbeltown. Although the traffic volumes on the A83 are relatively low, there are no other landward means of transportation along this route and therefore much of Argyll is dependent on the A83. There are several geographical features and constraints which impact on the operation, for example several narrowings along its length and landslides at the Rest and Be Thankful. Ardgartan to Rest and be Thankful is a seven kilometre section of the A83 through Glen Croe. A 1km section from the crossing over the Coire Croe Burn to the bend immediately before the viewpoint car park has a history of hillside instability above and below the road. It has been closed due to landslides, or high risk of landslides, on 6 occasions in 5 years totalling 34 days.		

Social Context:	The area affected by closures of the A83 at Rest and Be Thankful includes Cowal, Mid Argyll, Kintyre, Islay Jura and Colonsay. This is referred to as the A83 study area. The population of the study area was 37,300 in 2011 which accounts for almost 42% of the total population of Argyll and Bute. However, the population of the A83 study area has declined by 2.5% between 2008 and 2011 compared to a decline of 1% across Argyll and Bute as a whole. Over the same period, the population of Scotland has grown by 1.7%. The study area is characterised by a lower proportion of people of working age and a higher proportion of people of pensionable age compared to Argyll and Bute as a whole and Scotland. The unemployment rate in the study area was 3.6% in August 2012 compared to the Scottish rate of 4.3%. The unemployment rate in the study area has been below the Scottish rate since 2009. Due to the seasonal nature of employment the area's employment statistics fluctuate throughout the year. In 2001 the average number of cars or vans per household in Argyll and Bute was 1.03 which was higher than the Scottish average of 0.93.
Economic Context:	Using evidence from this study, drawn from several key stakeholders, the additional annual costs to the A83 economy from previous landslide episodes at the Rest and Be Thankful are estimated to be £286,300 (in 2010 prices) for the road being closed for 5½ days over the year (the average duration of the past six events). Sensitivity analysis shows that the additional annual costs to the A83 economy from previous landslide episodes at the Rest and Be Thankful are in the range £130,200 (2½ day closure) to £676,800 (13 day closure).
Planning Objectives	
Objective:	Performance against planning objective:
Reduce the **impact on journey times** by reducing the frequency and duration of road closures caused by landslides.	Following construction of a viaduct the likelihood of landslide debris reaching the A83 Trunk Road would be negligible since it would instead pass below the road. This would significantly reduce the impact on journey times caused by landslides over this section of route.
Reduce the **economic impact to the A83 study area** by reducing the frequency and duration of road closures caused by landslides.	Following construction of a viaduct the likelihood of landslide debris reaching the A83 Trunk Road would be negligible since it would instead pass below the road. As a result, the subsequent economic impact to the communities and businesses served by the A83 would be reduced.

Rationale for Selection or Rejection of Proposal:	The yellow corridor option provides a new 1.2km long single carriageway on viaduct set at a sufficient level to permit debris flow events to pass below the viaduct. This option contributes towards the Transport Planning Objective and demonstrates benefits against the criteria of Safety, Economy, Accessibility and Social Inclusion. Environmental Impact is noted due to the potential effect on local landscape and views. This proposal is **selected** for further consideration since the likelihood of landslide debris reaching the A83 Trunk Road would be negligible since it would instead pass below the road.
Implementability Appraisal	
Technical:	The alignment of this proposal would provide an off-line section of carriageway between the bridge over Coire Croe Burn between the Cobbler and Beinn Luibhean. It bypasses the main areas of landslide risk on a viaduct parallel to the existing A83. The proposal would allow landslide debris to pass under the viaduct.
Operational:	Operational costs for this proposal would increase due to the routine maintenance costs for such a major highway structure.
Financial:	The implementation of this option requires significant capital investment and would be subject to funding availability and other competing priorities throughout Scotland.
Public:	This proposal is likely to receive good public support since it would provide a long term solution to road closures due to landslides. There may be concerns about the visual impact of such a significant civil engineering structure at this location.

STAG Criteria		
Criterion	**Assessment Summary**	**Supporting Information**
Environment:	Minor Impact	The introduction of a viaduct into the valley could have effects on the local landscape and views, although the significance of these effects would depend on the appearance of the viaduct, and how well it is visually integrated with its surroundings. No other potentially significant environmental effects are anticipated.
Safety:	Moderate Benefit	This proposal would improve road safety compared to the Do Minimum scenario. The road cross section and alignment would be constructed to current desirable minimum road design standards. The potential hazard of landslide debris on the road would be significantly reduced.
Economy:	Minor Benefit	Following implementation of this proposal the risk of closure of the road due to landslide would be negligible. This option would enable vehicles to continue on the A83 trunk road without making any changes to their journey. Compared to the do minimum situation, the variability in journey time due to landslides would be significantly reduced.
Integration:	Neutral	The proposal would not affect transport integration.
Accessibility and Social Inclusion:	Minor Benefit	Following implementation of this proposal the risk of closure of the road due to landslide would be negligible. This would improve accessibility for the study area. This proposal would not affect social inclusion.

Proposal Details			
Name and address of authority or organisation promoting the proposal: (Also provide name of any subsidiary organisations also involved in promoting the proposal)			Transport Scotland Buchanan House 58 Port Dundas Road Glasgow, G4 0HF
Proposal Name:	**A83 Ardgartan to Rest and Be Thankful Purple Corridor Option**	Name of Planner:	Alasdair Graham
Proposal Description:	The Purple Corridor Option follows the Glen Croe valley floor parallel to the line of the Old Military Road. It enters a tunnel at the head of Glen Croe and emerges from tunnel to rejoin the existing road in the vicinity of Loch Restil.	Estimated Total Public Sector Funding Requirement:	Capital costs/grant £460-520 million (2012 prices excluding VAT) Annual revenue support £0.5 million (2012 prices excluding VAT) Present Value of Cost to Govt. £
Funding Sought From: (if applicable)	N/A	Amount of Application:	**£**
Background Information			
Geographic Context:	The A83 trunk road runs from the A82 at Tarbet on Loch Lomond to the Kennacraig Ferry Terminal on West Loch Tarbert. It provides the main route for traffic from central Scotland to Argyll and Bute and therefore provides access to such towns as Inveraray, Lochgilphead, Tarbert and Campbeltown. Although the traffic volumes on the A83 are relatively low, there are no other landward means of transportation along this route and therefore much of Argyll is dependent on the A83. There are several geographical features and constraints which impact on the operation, for example several narrowings along its length and landslides at the Rest and Be Thankful. Ardgartan to Rest and be Thankful is a seven kilometre section of the A83 through Glen Croe. A 1km section from the crossing over the Coire Croe Burn to the bend immediately before the viewpoint car park has a history of hillside instability above and below the road. It has been closed due to landslides, or high risk of landslides, on 6 occasions in 5 years totalling 34 days.		

Social Context:	The area affected by closures of the A83 at Rest and Be Thankful includes Cowal, Mid Argyll, Kintyre, Islay Jura and Colonsay. This is referred to as the A83 study area. The population of the study area was 37,300 in 2011 which accounts for almost 42% of the total population of Argyll and Bute. However, the population of the A83 study area has declined by 2.5% between 2008 and 2011 compared to a decline of 1% across Argyll and Bute as a whole. Over the same period, the population of Scotland has grown by 1.7%. The study area is characterised by a lower proportion of people of working age and a higher proportion of people of pensionable age compared to Argyll and Bute as a whole and Scotland. The unemployment rate in the study area was 3.6% in August 2012 compared to the Scottish rate of 4.3%. The unemployment rate in the study area has been below the Scottish rate since 2009. Due to the seasonal nature of employment the area's employment statistics fluctuate throughout the year. In 2001 the average number of cars or vans per household in Argyll and Bute was 1.03 which was higher than the Scottish average of 0.93.
Economic Context:	Using evidence from this study, drawn from several key stakeholders, the additional annual costs to the A83 economy from previous landslide episodes at the Rest and Be Thankful are estimated to be £286,300 (in 2010 prices) for the road being closed for 5½ days over the year (the average duration of the past six events). Sensitivity analysis shows that the additional annual costs to the A83 economy from previous landslide episodes at the Rest and Be Thankful are in the range £130,200 (2½ day closure) to £676,800 (13 day closure).
Planning Objectives	
Objective:	Performance against planning objective:
Reduce the **impact on journey times** by reducing the frequency and duration of road closures caused by landslides.	This proposal provides a new alignment for the A83 along the valley floor and then in tunnel, rejoining the existing road in the vicinity of Loch Restil. It would be engineered in such a way to prevent landslide debris reaching the road. This would result in a negligible impact on journey times caused by landslides over this section of route.
Reduce the **economic impact to the A83 study area** by reducing the frequency and duration of road closures caused by landslides.	This proposal would be engineered in such a way to prevent landslide debris reaching the road. As a result the subsequent economic impact to the communities and businesses served by the A83 would be reduced.

Rationale for Selection or Rejection of Proposal:	The Purple Corridor Option follows the Glen Croe valley floor parallel to the line of the Old Military Road. It enters at the head of Glen Croe and emerges from tunnel to rejoin the existing road in the vicinity of Loch Restil. This option contributes towards the Transport Planning Objective and demonstrates benefits against the criteria of Safety, Economy, Accessibility and Social Inclusion for the completed scheme. Moderate environmental impact is noted due to the potential effect on landscape, ecology and noise. This proposal is **rejected** for further consideration since similar benefits can be achieved with the Yellow Corridor Option at lower cost and with a lower potential environmental impact.
Implementability Appraisal	
Technical:	The various elements of this proposal would be implemented using proven methods and technology.
Operational:	Operational costs for this proposal would increase due to the routine operation and maintenance costs for road tunnels.
Financial:	The implementation of this option requires significant capital investment and would be subject to funding availability and other competing priorities throughout Scotland. Additional revenue support would be needed to cover the additional operation and maintenance costs for the tunnel.
Public:	This proposal is likely to receive strong public support since it would provide a long term solution to road closures due to landslides. The high cost of this proposal would be of concern to some.

STAG Criteria		
Criterion	**Assessment Summary**	**Supporting Information**
Environment:	Moderate Impact	Potentially significant landscape effects are anticipated on the surrounding landscape and potentially significant visual effects are anticipated on the two properties as a result of the introduction of a new road corridor to the valley floor. Ecological effects such as habitat loss, fragmentation and disturbance may occur. However, these potential effects are not anticipated to be significant. This proposal could also potentially increase nitrogen deposition at Beinn an Lochain SSSI, for a narrow section along the road. Potential significant negative effects on the SSSI as a result of loss of mire vegetation could also occur, although field surveys should be undertaken to confirm this. Noise levels at sensitive receptors would be dependent on the alignment of the route within this corridor, but could potentially be significant at High Glencroe as a result of traffic passing closer to this property. No other potentially significant environmental effects are anticipated.
Safety:	Moderate Benefit	This proposal would improve road safety compared to the Do Minimum scenario. The road cross section and alignment would be constructed to current desirable minimum road design standards. The potential hazard of landslide debris on the road would be eliminated. The tunnel would be designed in accordance with the UK Road Tunnel Safety Regulations 2007.
Economy:	Minor Benefit	Following implementation of this proposal the risk of closure of the road due to landslide would be negligible. This option would enable vehicles to continue on the A83 trunk road without making any changes to their journey. Compared to the Do Minimum situation, the variability in journey time due to landslides would be significantly reduced.
Integration:	Neutral	The proposal would not affect transport integration.
Accessibility and Social Inclusion:	Minor Impact/Minor Benefit	B828 road users would be impacted by slightly increased journey times as a longer route to the north of the tunnel may be required to provide an adequate tie-in location. Accessibility to the Rest and Be Thankful car park would be impacted due to the proposal. Following construction of a new road alignment, including a tunnel, the likelihood of landslide debris reaching the carriageway would be negligible, improving accessibility for the study area. This proposal would not affect social inclusion.

<table>
<tr><th colspan="4">Proposal Details</th></tr>
<tr><td colspan="3">Name and address of authority or organisation promoting the proposal:

(Also provide name of any subsidiary organisations also involved in promoting the proposal)</td><td>Transport Scotland
Buchanan House
58 Port Dundas Road
Glasgow, G4 0HF</td></tr>
<tr><td>Proposal Name:</td><td>A83 Ardgartan to Rest and Be Thankful Blue Corridor Option</td><td>Name of Planner:</td><td>Alasdair Graham</td></tr>
<tr><td rowspan="3">Proposal Description:</td><td rowspan="3">The Blue Corridor Option follows the Glen Croe valley floor parallel to the line of the Old Military Road. In order to climb from an elevation of around 150m above ordnance datum to 250m at the car park at Rest and Be Thankful the route sweeps through two long bends at the top of Glen Croe.</td><td rowspan="3">Estimated Total Public Sector Funding Requirement:</td><td>Capital costs/grant
£66-75 million
(2012 prices excluding VAT)</td></tr>
<tr><td>Annual revenue support
£0</td></tr>
<tr><td>Present Value of Cost to Govt.
£66-75 million
(2012 prices excluding VAT)</td></tr>
<tr><td>Funding Sought From:
(if applicable)</td><td>N/A</td><td>Amount of Application:</td><td>£66-75 million
(2012 prices excluding VAT)</td></tr>
<tr><th colspan="4">Background Information</th></tr>
<tr><td>Geographic Context:</td><td colspan="3">The A83 trunk road runs from the A82 at Tarbet on Loch Lomond to the Kennacraig Ferry Terminal on West Loch Tarbert. It provides the main route for traffic from central Scotland to Argyll and Bute and therefore provides access to such towns as Inveraray, Lochgilphead, Tarbert and Campbeltown. Although the traffic volumes on the A83 are relatively low, there are no other landward means of transportation along this route and therefore much of Argyll is dependent on the A83. There are several geographical features and constraints which impact on the operation, for example several narrowings along its length and landslides at the Rest and Be Thankful.

Ardgartan to Rest and be Thankful is a seven kilometre section of the A83 through Glen Croe. A 1km section from the crossing over the Coire Croe Burn to the bend immediately before the viewpoint car park has a history of hillside instability above and below the road. It has been closed due to landslides, or high risk of landslides, on 6 occasions in 5 years totalling 34 days.</td></tr>
</table>

Social Context:	The area affected by closures of the A83 at Rest and Be Thankful includes Cowal, Mid Argyll, Kintyre, Islay Jura and Colonsay. This is referred to as the A83 study area. The population of the study area was 37,300 in 2011 which accounts for almost 42% of the total population of Argyll and Bute. However, the population of the A83 study area has declined by 2.5% between 2008 and 2011 compared to a decline of 1% across Argyll and Bute as a whole. Over the same period, the population of Scotland has grown by 1.7%. The study area is characterised by a lower proportion of people of working age and a higher proportion of people of pensionable age compared to Argyll and Bute as a whole and Scotland. The unemployment rate in the study area was 3.6% in August 2012 compared to the Scottish rate of 4.3%. The unemployment rate in the study area has been below the Scottish rate since 2009. Due to the seasonal nature of employment the area's employment statistics fluctuate throughout the year. In 2001 the average number of cars or vans per household in Argyll and Bute was 1.03 which was higher than the Scottish average of 0.93.
Economic Context:	Using evidence from this study, drawn from several key stakeholders, the additional annual costs to the A83 economy from previous landslide episodes at the Rest and Be Thankful are estimated to be £286,300 (in 2010 prices) for the road being closed for 5½ days over the year (the average duration of the past six events). Sensitivity analysis shows that the additional annual costs to the A83 economy from previous landslide episodes at the Rest and Be Thankful are in the range £130,200 (2½ day closure) to £676,800 (13 day closure).
Planning Objectives	
Objective:	Performance against planning objective:
Reduce the **impact on journey times** by reducing the frequency and duration of road closures caused by landslides.	This proposal provides a new alignment for the A83 along the valley floor and then climbing through two hairpins on the south-western side of the valley, rejoining the existing road to the south of Loch Restil. It would be engineered in such a way to significantly reduce the likelihood of landslide debris reaching the road. This would significantly reduce the impact on journey times caused by landslides over this section of route.
Reduce the **economic impact to the A83 study area** by reducing the frequency and duration of road closures caused by landslides.	This proposal would be engineered in such a way to significantly reduce the likelihood of landslide debris reaching the road. As a result the subsequent economic impact to the communities and businesses served by the A83 would be reduced.

Rationale for Selection or Rejection of Proposal:	The Blue Corridor Option follows the Glen Croe valley floor parallel to the line of the Old Military Road and the route sweeps through two long bends at the top of Glen Croe. This option contributes towards the Transport Planning Objective and demonstrates benefits against the criteria of Safety, Economy, Accessibility and Social Inclusion for the completed scheme. Moderate environmental impact is noted due to the potential effect on landscape, ecology and noise. The route alignment is the poorest of all the options and is longer than the Do Minimum scenario and all the other options. It would have sections of alignment with the steepest gradient of 8%. This proposal is **rejected** for further consideration since similar benefits can be achieved with the Yellow Corridor Option with a better overall route alignment and with a lower potential environmental impact.
Implementability Appraisal	
Technical:	The design and construction of this new route alignment would be implemented using proven methods and technology. The road alignment in this corridor does not fit well with the existing topography resulting in low radius bends and significant highway structures. It is longest route under consideration with steep sections with a gradient of 8%. The landslide hazard risk of the section of this corridor that crosses to the south side of the valley is considered to be only slightly less than the landslide hazard risk of the existing slopes above the A83, and therefore offers only a slight reduction in landslide hazard compared to the existing road corridor. Engineering measures would need to be incorporated into the design to minimise future landslide risks.
Operational:	Operational costs for this proposal would remain comparable to the existing route.
Financial:	The implementation of this option requires significant capital investment and would be subject to funding availability and other competing priorities throughout Scotland.
Public:	This proposal may receive public support if it can be demonstrated to provide a long term solution to road closures due to landslides. However the poorer road alignment is unlikely to be favoured compared to other options.

STAG Criteria		
Criterion	**Assessment Summary**	**Supporting Information**
Environment:	Moderate Impact	Potentially significant landscape effects are anticipated on the surrounding landscape and potentially significant visual effects are anticipated on the two properties as a result of the introduction of a new road corridor to the valley floor. Ecological effects such as habitat loss, fragmentation and disturbance may occur. However, these potential effects are not anticipated to be significant. This proposal could also potentially increase nitrogen deposition at Beinn an Lochain SSSI, for a narrow section along the road. Potential significant negative effects on the SSSI as a result of loss of mire vegetation could also occur, although field surveys should be undertaken to confirm this. Noise levels at sensitive receptors be dependent on the alignment of the route within this corridor, but could potentially be significant at High Glencroe as a result of traffic passing closer to this property. No other potentially significant environmental effects are anticipated.
Safety:	Minor Benefit	Road safety would be slightly improved compared to the Do Minimum scenario. The road cross section and stopping sight distance would be improved to current desirable minimum road design standards. However the tight horizontal radii and steep gradients offer no benefit over the Do Minimum scenario. The potential hazard of landslide debris on the road would be significantly reduced through engineering measures.
Economy:	Minor Benefit	Following implementation of this proposal the risk of closure of the road due to landslide would be negligible. This option would enable vehicles to continue on the A83 trunk road without making any changes to their journey. Compared to the Do Minimum situation, the variability in journey time due to landslides would be significantly reduced. However, this option is slightly longer than the existing route with slightly higher road user costs.
Integration:	Neutral	The proposal would not affect transport integration.
Accessibility and Social Inclusion:	Minor Benefit	The construction of a new road alignment would significantly reduce the occurrence of landslide debris reaching the carriageway. This would improve accessibility for the study area. This proposal would not affect social inclusion.

<table>
<tr><th colspan="4">Proposal Details</th></tr>
<tr><td colspan="3">Name and address of authority or organisation promoting the proposal:

(Also provide name of any subsidiary organisations also involved in promoting the proposal)</td><td>Transport Scotland
Buchanan House
58 Port Dundas Road
Glasgow, G4 0HF</td></tr>
<tr><td>Proposal Name:</td><td>A83 Ardgartan to Rest and Be Thankful Green Corridor Option</td><td>Name of Planner:</td><td>Alasdair Graham</td></tr>
<tr><td rowspan="3">Proposal Description:</td><td rowspan="3">The Green Corridor Option follows the south-west side of the Glen Croe valley in a corridor generally following the route of existing forestry tracks. This route provides a new 4.0km single carriageway from the Old Military Road junction to the to the B828 junction.</td><td rowspan="3">Estimated Total Public Sector Funding Requirement:</td><td>Capital costs/grant
£67-76 million
(2012 prices excluding VAT)</td></tr>
<tr><td>Annual revenue support
£</td></tr>
<tr><td>Present Value of Cost to Govt.
£67-76 million
(2012 prices excluding VAT)</td></tr>
<tr><td>Funding Sought From:
(if applicable)</td><td>N/A</td><td>Amount of Application:</td><td>£27-91 million
(2012 prices excluding VAT)</td></tr>
<tr><td colspan="4">Background Information</td></tr>
<tr><td>Geographic Context:</td><td colspan="3">The A83 trunk road runs from the A82 at Tarbet on Loch Lomond to the Kennacraig Ferry Terminal on West Loch Tarbert. It provides the main route for traffic from central Scotland to Argyll and Bute and therefore provides access to such towns as Inveraray, Lochgilphead, Tarbert and Campbeltown. Although the traffic volumes on the A83 are relatively low, there are no other landward means of transportation along this route and therefore much of Argyll is dependent on the A83. There are several geographical features and constraints which impact on the operation, for example several narrowings along its length and landslides at the Rest and Be Thankful.

Ardgartan to Rest and be Thankful is a seven kilometre section of the A83 through Glen Croe. A 1km section from the crossing over the Coire Croe Burn to the bend immediately before the viewpoint car park has a history of hillside instability above and below the road. It has been closed due to landslides, or high risk of landslides, on 6 occasions in 5 years totalling 34 days.</td></tr>
</table>

Social Context:	The area affected by closures of the A83 at Rest and Be Thankful includes Cowal, Mid Argyll, Kintyre, Islay Jura and Colonsay. This is referred to as the A83 study area. The population of the study area was 37,300 in 2011 which accounts for almost 42% of the total population of Argyll and Bute. However, the population of the A83 study area has declined by 2.5% between 2008 and 2011 compared to a decline of 1% across Argyll and Bute as a whole. Over the same period, the population of Scotland has grown by 1.7%. The study area is characterised by a lower proportion of people of working age and a higher proportion of people of pensionable age compared to Argyll and Bute as a whole and Scotland. The unemployment rate in the study area was 3.6% in August 2012 compared to the Scottish rate of 4.3%. The unemployment rate in the study area has been below the Scottish rate since 2009. Due to the seasonal nature of employment the area's employment statistics fluctuate throughout the year. In 2001 the average number of cars or vans per household in Argyll and Bute was 1.03 which was higher than the Scottish average of 0.93.
Economic Context:	Using evidence from this study, drawn from several key stakeholders, the additional annual costs to the A83 economy from previous landslide episodes at the Rest and Be Thankful are estimated to be £286,300 (in 2010 prices) for the road being closed for 5½ days over the year (the average duration of the past six events). Sensitivity analysis shows that the additional annual costs to the A83 economy from previous landslide episodes at the Rest and Be Thankful are in the range £130,200 (2½ day closure) to £676,800 (13 day closure).
Planning Objectives	
Objective:	Performance against planning objective:
Reduce the **impact on journey times** by reducing the frequency and duration of road closures caused by landslides.	This proposal provides a new alignment for the A83 on the south-west side of Glen Croe rejoining the existing road at the junction with the B828. It would be engineered in such a way to significantly reduce the likelihood of landslide debris reaching the road. This would significantly reduce the impact on journey times caused by landslides over this section of route.
Reduce the **economic impact to the A83 study area** by reducing the frequency and duration of road closures caused by landslides.	This proposal would be engineered in such a way to significantly reduce the likelihood of landslide debris reaching the road. As a result the subsequent economic impact to the communities and businesses served by the A83 would be reduced.

Rationale for Selection or Rejection of Proposal:	The Green Corridor Option follows the south-west side of the Glen Croe valley in a corridor generally following the route of existing forestry tracks. This route provides a new 4.0km single carriageway from the Old Military Road junction to the to the B828 junction. This option contributes towards the Transport Planning Objective and demonstrates benefits against the criteria of Safety, Economy, Accessibility and Social Inclusion for the completed scheme. Moderate environmental impact is noted due to the potential effect on landscape and ecology. This proposal is **selected** for further consideration along with the Red and Yellow options. This option would significantly reduce the likelihood of landslide debris reaching the road with a better route alignment than the Blue option and a lower capital cost than the Yellow Option.
Implementability Appraisal	
Technical:	Significant cut and fill would be required to provide acceptable horizontal and vertical alignments for the Green option. Considerable slope reinforcement works or retention measures would be required on the uphill side whilst a significant amount of filling or structural support would be required on the downhill side due to the steep topography. The landslide risk in the Green option is considered to be slightly lower than the existing A83 alignment, however the landslide risk in this option is still considered to be significant. Engineering measures would need to be incorporated into the design to minimise these localised risks.
Operational:	Operational costs for this proposal would remain comparable to the existing route.
Financial:	The implementation of this option requires significant capital investment and would be subject to funding availability and other competing priorities throughout Scotland.
Public:	Public opinion regarding a new route along the south-west side of Glen Croe is generally good with current local opinion perhaps favouring a solution within this corridor. However, the residual landslide risk may not fully address the public demand for a long-term solution to landslides at Rest and Be Thankful.

STAG Criteria		
Criterion	**Assessment Summary**	**Supporting Information**
Environment:	Moderate Impact	The new road may result in effects on landscape and visual receptors. However, it is anticipated that these could be mitigated through retention of existing vegetation which would screen the road from visual receptors and no significant landscape or visual effects are therefore predicted. Ecological effects (as a result of woodland loss) such as habitat loss, fragmentation and disturbance may occur. However, these potential effects are not anticipated to be significant. This proposal could also potentially increase nitrogen deposition at Beinn an Lochain SSSI, for a narrow section along the road. Potential significant negative effects on the SSSI as a result of loss of mire vegetation could also occur, although field surveys should be undertaken to confirm this. No other potentially significant environmental effects are anticipated.
Safety:	Minor Benefit	Road safety would be slightly improved compared to the Do Minimum scenario. The road cross section and stopping sight distance would be improved to current desirable minimum road design standards. However the route offers a poorer vertical alignment than the Do Minimum scenario with sections of steeper gradient. The potential hazard of landslide debris on the road would be significantly reduced through engineering measures, but a residual risk would remain.
Economy:	Minor Benefit	Following implementation of this proposal the risk of closure of the road due to landslide would be negligible. This option would enable vehicles to continue on the A83 trunk road without making any changes to their journey. Compared to the do minimum situation, the variability in journey time due to landslides would be significantly reduced. However, this option is slightly longer than the existing route with slightly higher road user costs.
Integration:	Neutral	This proposal would have no effect on transport integration.
Accessibility and Social Inclusion:	Minor Benefit	The construction of a new road alignment would significantly reduce the occurrence of landslide debris reaching the carriageway. This would improve accessibility for the study area. This proposal would not affect social inclusion.

Option Summary Table

A83 Trunk Road Route Study | Red Corridor Option

Option description:
The Red Option involves substantial landslide hazard reduction measures along the line of the existing road representing a significant step-change in the provision of landslide hazard reduction and include –

- 440m of additional debris flow barriers
- Improved hillside drainage adjacent to and under the road
- Introduction of vegetation and planting on the slope

Capital Costs/grant (2010 Prices)	£
Annual Revenue Support (2010 Prices)	£
Present Value (PV) of Cost to Government	£5.86m

Summary of impact on the five STAG criteria

Impacts (Monetary and Non-Monetary)	- - -	- -	-	0	+	++	+++	Monetary only (£m)	Monetary impact ratio (if relevant)
Accessibility and Social Inclusion					+				
Environment				0					
Integration				0					
Safety					+				
Economy						++		-3.32	0.43
							NPV:	-3.32	BCR: 0.43
Including Wider Economic Benefits							NPV(WEB):		BCR(WEB):

Assessment against Transport Planning Objectives

	- - -	- -	-	0	+	++	+++
TPO Target 1:					+		
TPO Target 2:					+		

Contribution toward the Government Purpose:

This option would contribute positively towards the Government Purpose by removing a potential barrier to sustainable economic growth for the businesses and communities served by the A83.

STAG Criteria		Implementability Appraisal	
Criterion:	**Supporting Information**	**Criterion:**	**Supporting Information**
Accessibility & Social Inclusion	The additional landslide hazard reduction measures would significantly reduce the frequency of occurrence of landslide debris reaching the A83 Trunk Road causing a full road closure. This would improve accessibility for the study area. This proposal would have no effect on social inclusion.	**Technical**	The additional landslide hazard reduction measures forming this intervention would be implemented using proven methods and technology. The works would require single lane traffic management during construction with only minimal impact to overall journey times.
Safety	The road safety of this proposal due to the road layout and alignment would be comparable to the do minimum scenario, since the road alignment would be same. However, increased lengths of debris flow barriers would reduce the likelihood of landslide debris reaching the carriageway and causing vehicle accidents.	**Operational**	Operational costs for this option would increase slightly compared to the Do Minimum scenario. Following landslide events the debris would be removed from the barriers and debris fences re-tensioned.
Economy	This option involves substantial hazard reduction measures along the line of the existing road to reduce the occurrence of landslides and/or the frequency and duration that landslides cause road closures. While there would still be a risk of closure of the road due to landslides, that the risk would be significantly reduced at a much lower capital cost than the other options.	**Financial**	The implementation of this option requires significant capital investment and would be subject to funding availability and other competing priorities throughout Scotland.
Integration	The proposal would not affect transport integration.	**Public Acceptability**	The extent to which this option addresses the public demand for a long-term solution to landslides at Rest and Be Thankful would be the subject of further consultation.
Environment	***This section identifies key impacts and tensions across the sub-criteria***		
	The additional landslide hazard reduction measures are not anticipated to have any significant environmental effects. In comparison to the other corridors, this is considered to represent a Neutral effect.		

Transport Planning Objectives			
Objective:	**Description of Objective**	**Objective:**	**Description of Objective**
TPO 1:	Reduce the impact on journey times by reducing the frequency and duration of road closures caused by landslides.	**TPO 2:**	Reduce the economic impact to the A83 study area by reducing the frequency and duration of road closures caused by landslides.

Option Summary Table

A83 Trunk Road Route Study — Yellow Corridor Option

Option description:
The yellow corridor option provides a new 1.5km long single carriageway with 1.2km on viaduct offset from the existing A83 following a similar profile with an average climbing gradient of 5%. It would be set at a sufficient level to permit debris flow events to pass below the viaduct.

Capital Costs/grant (2010 Prices)	£
Annual Revenue Support (2010 Prices)	£
Present Value (PV) of Cost to Government	£69.67m

Summary of impact on the five STAG criteria

Impacts (Monetary and Non-Monetary)

	- - -	- -	-	0	+	++	+++	Monetary only (£m)	Monetary impact ratio
									(if relevant)
Accessibility and Social Inclusion					+				
Environment		- -							
Integration				0					
Safety						++			
Economy					+			-67.0	0.04
							NPV:	-67.0	**BCR:** 0.04
Including Wider Economic Benefits							**NPV(WEB):**		**BCR(WEB):**

Assessment against Transport Planning Objectives

	- - -	- -	-	0	+	++	+++
TPO Target 1:					+		
TPO Target 2:					+		

Contribution toward the Government Purpose:

This option would contribute positively towards the Government Purpose by removing a potential barrier to sustainable economic growth for the businesses and communities served by the A83.

STAG Criteria		Implementability Appraisal	
Criterion:	**Supporting Information**	**Criterion:**	**Supporting Information**
Accessibility & Social Inclusion	Following implementation of this proposal the risk of closure of the road due to landslide would be negligible. This would improve accessibility for the study area. This proposal would not affect social inclusion.	**Technical**	The alignment of this proposal would provide an off-line section of carriageway between the bridge over Coire Croe Burn between the Cobbler and Beinn Luibhean. It bypasses the main areas of landslide risk on a viaduct parallel to the existing A83. The proposal would allow landslide debris to pass under the viaduct.
Safety	The safety of this proposal would be improved compared to the Do Minimum scenario. The road cross section and alignment would be constructed to current desirable minimum road design standards. The potential hazard of landslide debris on the road would be significantly reduced.	**Operational**	Operational costs for this proposal would increase due to the routine maintenance costs for such a major highway structure.
Economy	Following implementation of this proposal the risk of closure of the road due to landslide would be negligible. Compared to the do minimum situation, the variability in journey time due to landslides would be significantly reduced.	**Financial**	The implementation of this option requires significant capital investment and would be subject to funding availability and other competing priorities throughout Scotland.
Integration	The proposal would not affect transport integration.	**Public Acceptability**	This proposal is likely to receive good public support since it would provide a long term solution to road closures due to landslides. There may be concerns about the visual impact of such a significant civil engineering structure at this location.
Environment	***This section identifies key impacts and tensions across the sub-criteria***		
	The introduction of a viaduct into the valley could have effects on the local landscape and views, although the significance of these effects would depend on the appearance of the viaduct, and how well it is visually integrated with its surroundings. No other potentially significant environmental effects are anticipated.		

Transport Planning Objectives			
Objective:	**Description of Objective**	**Objective:**	**Description of Objective**
TPO 1:	Reduce the impact on journey times by reducing the frequency and duration of road closures caused by landslides.	**TPO 2:**	Reduce the economic impact to the A83 study area by reducing the frequency and duration of road closures caused by landslides.

Option Summary Table

A83 Trunk Road Route Study | Green Corridor Optior

Option description:
The Green Corridor Option follows the south-west side of the Glen Croe valley in a corridor generally following the route of existing forestry tracks. This route provides a new 4.0km single carriageway from the Old Military Road junction to the to the B828 junction.

Capital Costs/grant (2010 Prices)	£
Annual Revenue Support (2010 Prices)	£
Present Value (PV) of Cost to Government	£21.37m

Summary of impact on the five STAG criteria

Impacts (Monetary and Non-Monetary)	- - -	- -	-	0	+	++	+++	Monetary only (£m)	Monetary impact ratio (if relevant)
Accessibility and Social Inclusion					+				
Environment		- -							
Integration				0					
Safety					+				
Economy					+			-18.9	0.12
							NPV:	-18.9	BCR: 0.12
Including Wider Economic Benefits							NPV(WEB):		BCR(WEB):

Assessment against Transport Planning Objectives

	- - -	- -	-	0	+	++	+++
TPO Target 1:					+		
TPO Target 2:					+		

Contribution toward the Government Purpose:

This option would contribute positively towards the Government Purpose by removing a potential barrier to sustainable economic growth for the businesses and communities served by the A83.

STAG Criteria		Implementability Appraisal	
Criterion:	**Supporting Information**	**Criterion:**	**Supporting Information**
Accessibility & Social Inclusion	The construction of a new road alignment would significantly reduce the occurrence of landslide debris reaching the carriageway. This would improve accessibility for the study area. This proposal would not affect social inclusion.	**Technical**	Considerable slope reinforcement works or retention measures would be required on the uphill side whilst a significant amount of filling or structural support would be required on the downhill side due to the steep topography.
Safety	The safety of this proposal would be slightly improved compared to the Do Minimum scenario through improvements to the road cross section and alignment. The potential hazard of landslide debris on the road would be significantly reduced through engineering measures, but a residual risk would remain.	**Operational**	Operational costs for this proposal would remain comparable to the existing route.
Economy	Following implementation of this proposal the risk of closure of the road due to landslide would be negligible. Compared to the do minimum situation, the variability in journey time due to landslides would be significantly reduced.	**Financial**	The implementation of this option requires significant capital investment and would be subject to funding availability and other competing priorities throughout Scotland.
Integration	This proposal would have no effect on transport integration	**Public Acceptability**	Public opinion regarding a new route along the south-west side of Glen Croe is generally good with current local opinion perhaps favouring a solution within this corridor. However, the residual landslide risk may not fully address the public demand for a long-term solution to landslides at Rest and Be Thankful.
Environment	***This section identifies key impacts and tensions across the sub-criteria***		
	The new road may result in effects on landscape and visual receptors. However, it is anticipated that these could be mitigated through retention of existing vegetation which would screen the road from visual receptors and no significant landscape or visual effects are therefore predicted. Ecological effects (as a result of woodland loss) such as habitat loss, fragmentation and disturbance may occur. However, these potential effects are not anticipated to be significant. This proposal could also potentially increase nitrogen deposition at Beinn an Lochain SSSI, for a narrow section along the road. Potential significant negative effects on the SSSI as a result of loss of mire vegetation could also occur, although field surveys should be undertaken to confirm this. No other potentially significant environmental effects are anticipated.		

Transport Planning Objectives			
Objective:	**Description of Objective**	**Objective:**	**Description of Objective**
TPO 1:	Reduce the impact on journey times by reducing the frequency and duration of road closures caused by landslides.	**TPO 2:**	Reduce the economic impact to the A83 study area by reducing the frequency and duration of road closures caused by landslides.

Appendix C Stakeholder Consultation Workshop Report

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TRANSPORT SCOTLAND

A83 Trunk Road Route Study

Stakeholder Consultation Workshop: Summary of Discussion

Inveraray 22 August 2012

30 August 2012

Contents

1 Introduction

1.1 Purpose of the Workshop

What	A83 Trunk Road Route Study Stakeholder Workshop
When	Wednesday 22 August 2012 (10:00 – 15:30)
Where	Loch Fyne Hotel, Inveraray
Who	Jacobs, Transport Scotland and Stakeholders

The objective of this workshop was to provide stakeholders with an opportunity to discuss the issues along the A83 Trunk Road and allow them to contribute their views on any ideas or possible solutions that might help remedy those issues. A set of draft objectives for the study was also presented and discussed and suggestions for changes or additions invited.

1.2 Format of the Workshop

Before the workshop: Stakeholders who had confirmed their attendance at the event were provided with a copy of a briefing note prior to the workshop. This briefing note detailed the objective of the workshop, the agenda, the structure of the workshop, draft study objectives and further engagement. A copy of the briefing note is included in **Appendix A.**

At the workshop: Following a welcome and introductions, Graham Edmond, Head of Network Maintenance for Transport Scotland, provided an update on the current work that is ongoing at the Rest and be Thankful. This update included discussions on the installation of netting at the landslip sites and the proposed use of the Old Military Road as a temporary emergency diversion route during closure periods.

A variety of questions were introduced from the attendees and responses provided by Transport Scotland representatives.

Transport Scotland (Gordon Ramsay) provided a general overview of the A83 Trunk Road Study, advising that the study would appraise a series of potential options to address the landslide problem at the Rest and be Thankful and for the wider route and these options would be further discussed with the Taskforce.

Following the introductory presentations, 'Session One' was undertaken whereby participants split into four break out groups. Each group was led by a representative from Jacobs and a representative from Transport Scotland. A list of all attendees and groups is included in Section 2 of this paper.

Stakeholders were asked to discuss their views in relation to the following:

- *What are the issues related to the landslide closures on the A83 Rest and be Thankful that affect you?*
- *What are the consequences related to the issues identified above?*
- *Are there any potential solutions to address the issues identified above? and*
- *What problems would these potential solutions mitigate?*

Stakeholders were also asked for their views on the draft objectives that had been developed.


Break out groups in discussion

Following the 'Session One' break out groups, feedback was provided to the full stakeholder group by Jacobs staff or a nominated representative of the group and questions/comments were invited from stakeholders.

The participants returned to the same groups to participate in 'Session Two'. In this session, stakeholders were asked to consider the whole A83 Trunk Road between Kennacraig and Tarbet and again discuss their views in relation to issues, consequences, potential solutions and what problems the potential solutions would mitigate. Stakeholders were also asked to rank the issues in order of priority.

Break out groups in discussion

Feedback was again provided to the full stakeholder group following completion of the break out sessions followed by a question and answer session.

A summary of the output from each workshop session is included in Section 3.

After the workshop: Comment forms were made available at the end of the day for stakeholders to provide any additional information following the event. These forms should be submitted to us no later than Friday 14 September. A copy of the feedback form is included in Appendix B.

2 Workshop Attendees

John Buchanan (Friends of the Rest) Garret Corner (Inveraray Community Council) Mike Dean (Citylink Coaches) David Eaglesham (Road Haulage Association) Mary Haggarty (Arrochar & Tarbet CommunityCouncil) Andrew Mclure (Strathclyde Fire & Rescue) Alan Reid MP Gordon Ross (Western Ferries) Cllr John Semple Andrew Wilson (Mid-Argyll Chamber of Commerce) Robbie Brown (Caledonian Macbrayne) Kathleen Cameron (Tourist Guide) Cllr George Freeman Danny Halliday (West Coast Motors) Tony Jarvis (Highlands & Islands Enterprise) Iain MacInnes (Lochgoil Community Council) Peter McKerral (Forestry Contractors) Mike Masters (Furnace Community Council) Robert Pollock (Argyll & Bute Council) Roland Stiven (Timber Transport Forum) Graeme Herd (Jacobs) Veronica Allan (Transport Scotland) Helen Bradley (Jacobs) Keith Murray (Transport Scotland)	Bob Chicken (Tarbert & Skipness Community Council) Gavin Dick (Argyll & the Islands Tourism) Gordon Donaldson (Forestry Commission) Alastair Henderson (Caledonian Macbrayne) Cllr Donald Kelly Peter MacDonald (Strathclyde Police) Mary MacGugan (West Loch Fyne Jane MacLeod (Mid-Argyll Chamber of Commerce) Community Council) Paul Robertson (Strathclyde Police) John Semple (National Farmers Union) Jim Smith (Argyll & Bute Council) John Wrigley (Scotland Transerv) Cllr Roddy McCuish Ian Liddell (Lochgilphead Community Council) Leonard McNeill (West Loch Fyne Community Council) Alan Bell (Loch Lomond and the Trossachs National Park) David Duthie (HI-TRANS) Edward Laughton (Ardrishaig Community Council) Kirsty Robb (Argyll Timber Transport Group) Callum Robertson (Argyll & Bute) Mike Story (Argyll & the Islands Tourism) Rebecca McClenaghan (Jacobs) Gordon Ramsay (Transport Scotland) Graeme McQuaker (Jacobs) Andy Anderson (Transport Scotland)

3 Summary of Workshop Outputs

3.1 Introduction

Representatives from Jacobs recorded the various comments made by the stakeholders, within the break out groups. All comments were then collated, and grouped into a series of common themes. The sections below present the key issues relating to the Rest and be Thankful and the remainder of the Trunk Road

3.2 Draft Study Objectives

A set of draft study objectives were presented and discussed at the various break out groups. The draft objectives are listed below:

- Provide a long term (permanent) solution to address landslide impacts at the Rest and be Thankful;
- Improve journey time reliability by reducing the frequency and impact of road closures;
- Improve operating conditions on the A83;
- Reduce accident rates and severity on the A83;
- Improve pedestrian and cycling amenities in the settlements on the A83; and
- Deliver environmental benefits where possible, and minimise necessary environmental impacts to an acceptable level.

The above draft objectives will be refined over the next few weeks to reflect the specific problems identified and discussed as part of the stakeholder engagement session.

3.3 Summary of Discussion Groups

Appendix C provides a summary of the output from the discussions during the first break out session at the stakeholder workshop, and Appendix D contains details from the second session. This output is presented in terms of the problems, causes, constraints and comments relating to particular issues and potential solutions, as raised by the workshop participants. The individual comments made have been collated and grouped by Jacobs to aid presentation and understanding.

The information within the tables in Appendices C and D reflects the discussion across the four break out groups and is presented as a record of the discussion. This information will be used to inform the study and is not meant to represent a complete list of options that will be considered as the study progresses.

4 Next Steps

Moving forward, the next steps in the project are to:

- consolidate outputs from this workshop with previous work and any other written submissions;
- progress the Stage 1 Appraisal;
- continue to report to the monthly A83 Taskforce meetings;
- conclude study by end of October 2012; and
- publish a final report by the end of the year.

Appendix A Briefing Note

A83 Trunk Road Route Study
Stakeholder Workshop: 22 August 2012

Information to aid participants

Please find below a general outline of the workshop and the agenda for the day. This information has been prepared to give you an understanding of the workshop structure and to outline what you can expect on the day in terms of your participation.

The project team look forward to meeting you and working with you in an open and collaborative forum.

1. Objective of the Workshop

Jacobs has been appointed by Transport Scotland to carry out an appraisal of the A83 Trunk Road. In this appraisal we have been asked to consider measures to manage the effects of landslips at the Rest and be Thankful and also to consider wider measures which would seek to remove traffic pinch points and improve pedestrian and cyclist safety in villages along the A83.

Stakeholder and community participation and consultation are key elements of this process and we really encourage you to provide your thoughts, insights and ideas to help inform this study.

The objective of the workshop is to look more closely at the issues along the route and identify any ideas or solutions that could help remedy those issues. We are also keen to agree a set of objectives with you which will help the appraisal process.

We have invited a wide range of organisations and individuals to the meeting in order to hear from as many different people as possible in order that we may learn and understand more about the issues on the route and to think about the possible solutions.

You will note that this is a workshop rather than a public meeting. This means we would really like you to participate in the discussions. There will be further opportunities to talk to the team after the workshop should you have any further questions or concerns.

Lunch will be provided on the day, and we ask that you inform us of any special dietary requirements that you may have.

2. Agenda

An indicative Agenda is set out below. Please note this is for guidance and may be subject to change in terms of detailed timings and structure as we finalise our plans in the lead up to the workshop.

9:50 to 10:00 Registration

10.00 to 10.45 Introduction, Overview & Briefing

10.45 to 12.00 Session 1 – A83 Rest and Be Thankful

Discussion of the issues and identification of problems, followed by thoughts on the draft study objectives and identification of possible options and solutions.

12.00 to 12.30 Feedback

12.30 to 13.15 Lunch

13.15 to 12.30 Introduction to Session 2

13.30 to 14.45 Session 2 – A83 Tarbet-Lochgilpead-Kennacraig

Discussion of the issues and identification of problems, followed by thoughts on the draft study objectives and identification of possible options and solutions.

14.45 to 15.15 Feedback

15.15 to 15.30 Overview of Next Steps

3. Structure of Workshop

An indicative structure for the workshop is set out below. Please note this is for guidance and may be subject to change as we finalise our plans in the lead up to the workshop. Also on the day of the workshop we may adjust some of the details so that we can accommodate the evolving discussion.

The workshop will be hosted by representatives of Transport Scotland and Jacobs.
A Transport Scotland representative will provide a brief introduction, following which the programme for the day will be set out.

The first part of the morning session will consist of a short presentation by Jacobs staff on the appraisal process, highlighting the different aspects of the study; covering the Rest and be Thankful issues and also issues affecting areas along the remainder of the A83 Trunk Road.

Break out groups will then be used to facilitate discussion from the participants in each session. In addition to discussing the problems and opportunities, there will be a clear focus in each session on the discussion of well defined and robust objectives and potential solutions.

The first break out session will focus on the issues relating to the Rest and be Thankful section. Workshop participants will be encouraged to communicate the problems that are encountered as a result of the landslip closures and identify potential opportunities to improve the situation, both in the short term and longer term.

The afternoon session will concentrate on the issues relating to the whole of the A83 Trunk Road between Tarbet and Kennacraig. This will follow a similar structure to the morning session and participants will be encouraged to identify the causes and consequences of problems and other issues that are encountered along the length of the route, and again potential solutions.

4. Draft Study Objectives

The following draft study objectives have been identified and we would like to hear your thoughts on these on the day.

- Provide a long term solution to address landslide impacts at the Rest and be Thankful;
- Improve journey time reliability by reducing the frequency and impact of road closures;
- Improve operating conditions on the A83;
- Reduce accident rates and severity on the A83; and
- Improve pedestrian and cycling amenities in the towns on the A83.

The above objectives will be refined over the next few weeks to reflect the specific problems identified and discussed as part of the stakeholder engagement session.

5. Further Engagement

Whilst the workshop is a key component of the study, there will be further opportunities for stakeholders and interested parties to contribute to the study. All workshop participants will be issued with a form to provide additional comments, which can be submitted after the workshop. In addition, any further comments on the study can be submitted, after the workshop and for a reasonable period of time, via e-mail to A83trunkroadstudy@jacobs.com, or in writing to:

Evonne Baird
Jacobs UK Ltd
95 Bothwell Street
GLASGOW, G2 7HX

Appendix B Feedback Form

A83 Trunk Road Route Study

The A83 Trunk Road Route Study is being undertaken to identify existing issues on the A83 between Tarbet and Kennacraig and consider a range of improvement opportunities. The project team welcomes comments from stakeholders to help inform this study. Comments can be made in the space below, by email or in writing to the address given. Comments received by Friday 14 September 2012 will be considered as part of this study. However, please note it will not be possible for the project team to respond individually to comments received.

Comments:

Return to:
A83trunkroadstudy@jacobs.com (email address will become live on Friday 24 August 2012)
or
Evonne Baird, Jacobs UK Ltd, 95 Bothwell Street, Glasgow G2 7HX

Appendix C Summary of First Break-Out Session Discussions (Rest and be Thankful)

These tables summarise the issues and opportunities identified by participants during the first break-out session at the stakeholder event in Inveraray on 22 August 2012.

Problems	Causes	Constraints	Opportunities/Interventions
Closure of A83 at Rest and be Thankful	Landslide incidents or closure due to high risk of landslides.	Challenging topography. Geotechnical issues. Land ownership. Maintaining adequate diversion routes during construction. Landscape considerations. Affordability	Use of the Old Military Road for diversions. Utilise forestry road. Construction of a new route. Tunnelling. Provision of avalanche type rock/debris shelters. Removal of part of the hillside in a controlled manner. Re-introduction of livestock to the hillside to reduce the vegetation. Plant trees on the affected hillside. Improved ferry links to Cowal and Argyll.

Consequences of the Closure	Comments made by participants
Access to Glasgow and the central belt for shopping, hospital appointments and social requirements is reduced.	
Ageing population resulting from difficulty maintaining the population and reducing migration.	
Disruption to business. This includes hotels and other tourist facilities in Argyll and sawmills outwith Argyll that utilise forestry products from	

Consequences of the Closure	Comments made by participants
Argyll	
Economic costs to businesses in Argyll from additional fuel costs, drivers wages and other running costs.	
Closure of the Rest and be Thankful results in increased attendance times for the emergency services from alternative locations.	
External perception of Argyll as disconnected, peripheral and remote resulting from poor information giving negative messages.	Improve information promoting alternative routes.
Ferry connections missed resulting in a knock on effect to businesses on the islands.	
The hazard warning system flashes when there is an increased risk of landslide but drivers are unsure how to react when the warning is activated.	Review use of warning signs.
HGV/Bus may have insufficient driving hours to complete their journey.	Temporary relaxation of driving hours.
Closures and risk of closure due to landslides discouraging visitors from using the A83. High risk message being portrayed. Intense monitoring is making the situation worse.	Improve communication including promoting alternative routes into Argyll including use of the ferry service to Cowal. Toning down the high risk message.
Increased journey time due to road closure diversion. This increased journey time results in additional costs and can result in drivers not having sufficient driving hours to complete the journey.	
Increased risk of accidents due to the use of an unfamiliar diversion route with significantly longer driving times resulting in time pressures.	
Length of time to re-open the road following closure appears to be excessive as material needs to be removed and the slope made safe.	

Consequences of the Closure	Comments made by participants
Reduced passenger numbers on Campbeltown to Glasgow bus service during closures, reducing viability on non-subsidised service.	
Risk of material on lower slopes, below current road level, on the Rest and be Thankful slipping.	
Traffic queuing back onto road from ferry terminals at McInroes' Point and Hunter's Quay at times of increased traffic using ferry to Cowal to avoid A83 closure due to limited storage space at terminals.	
Traffic Scotland information slow to load on mobile devices and not specific to area.	Provide area specific information. Seek to improve suitability of web page for mobile devices.
Some school pupils travel to school through the landslip area and this is not viable when the route is closed.	
Uncertainty over future closures.	Improve information provision.
Viability of exporting timber from Argyll is reduced as the uncertainty over length of route is factored into pricing for the movement of timber resulting in reduced viability compared to other areas.	

Appendix D Summary of Second Break-Out Session Discussions (Tarbet to Kennacraig)

These tables summarise the issues and opportunities identified by participants during the first break-out session at the stakeholder event in Inveraray on 22 August 2012.

Problems	Causes	Constraints	Comments made by participants
Poor visibility, obscured road signs and damage to vehicles.	Uncut vegetation and overhanging trees.	Trees are not all owned by the roads authority.	Ongoing maintenance of roadside vegetation.
Lengthy or no diversion routes available.	Road closures due to accidents or other incidents.	Topography limits opportunities for suitable diversion routes.	Improve information provision.
Excessive duration of road closures	Serious/fatal road accidents. Requirement for accident investigation with specialist support from outwith the immediate area.	Limited specialist support within immediate area. Requirement to fully investigate road accidents.	Improve information provision.
Lack of overtaking opportunities on route	Road alignment. High level of HGV traffic. Driver frustration. Platooning traffic behind slow moving vehicles.	Physical constraints from rockfaces and the lochside. Cost.	Improve road layouts.
Lay-bys are infrequent and full of potholes	Poor maintenance		Improve existing laybys and provide additional laybys where required.
Pinch points between Tarbet and Arrochar.	Width of road through railway bridge	Road width/pedestrian provision through bridge.	
Sharp bend at Tarbet Hotel.	Poor road alignment	Land ownership/landscape	Improve road layout.

Problems	Causes	Constraints	Comments made by participants
Risk of accidents at Ardgarten	Poor alignment		Improve road layout. Provision of additional signage and surface treatment.
Bus passengers having to alight at Ardgarten visitors centre as there are no facilities for buses to turn at the Rest and be Thankful.	Lack of space for bus to turn.	Land issues	Argyll & Bute Council are progressing a scheme for a bus turning facility at this location.
Narrow road and potholes along the edge of road between Dunderave and Inveraray.	Road alignment.		Improve road layout.
Delays on River Aray Bridge	Tourists stopping to take photographs and pedestrians on bridge.	Width of bridge	Provide pedestrian viewpoint with a path from Inveraray Green. Provide additional pedestrian crossing of the river.
Poor signage for Dalmally Road in Inveraray.			Improve signage.
Pedestrian vehicle conflicts within Inveraray, particularly in the tourist season.	Trunk road passes directly through the main street in Inveraray, tourists and other pedestrians cross this road between shops, hotels, restaurants etc.	No clear single pedestrian desire line.	Investigate the requirement for formalised crossing facilities.
Vibration of buildings within Inveraray.	Heavy vehicles passing through the middle of the town.	Trunk road passes through the main street.	Consider bypass of Inveraray Additional Traffic Management measures

Problems	Causes	Constraints	Comments made by participants
Abnormal loads require whole width of road when passing through Inveraray.	Width of load vs width of road.	Tight corners through town.	Effective management of abnormal loads to minimise disruption.
Road layout at church through Inveraray.	Driver confusion/hesitation.	Narrow road width around church.	Improve signing.
Accident risk at Strone Point north of Inveraray.	Sharp bend in road.	Land ownership/landscape	Improve road layout/safety features.
Dangerous right turn from Furnace (northern end of village), especially for buses.	Poor visibility while turning out of village.	Available land	Improve road layout/safety features.
Speeding through 40mph at Minard	Straight section of road with 40mph limit past village.		Provide additional road markings/warning signs.
Standing start up hill from Minard for HGVs when stopped at lights.	Traffic lights at pinch point at red.		Re-configure traffic signals to give priority to traffic heading south.
Speeding on 40mph limit through Lochgair	Excessive speed		Improve signage Improve enforcement Introduce additional warning signs.
30mph limit leaving Lochgilphead is not suitable for location.	30mph limit implemented when school was built. Design altered resulting in no requirement for pupils to walk on this stretch.		Speed limit review has been carried out.

Problems	Causes	Constraints	Comments made by participants
Crossing the road safely in Ardrishaig.	Lack of crossing facilities		Consider providing some form of pedestrian crossing facilities.
Approach to Adrishaig is a 40mph and cars enter going too fast.			Reduce speed limit, incorporate traffic calming measures.
Vehicles unable to pass at pinch point at Erines.	Narrow road width.	Rockface on west side, loch side on east side of road.	Partial or complete widening. Improved signage and control of traffic through pinch point.
Problems safely crossing the road to the Co-Op in Tarbert	Lack of crossing facilities		Consider providing some form of pedestrian crossing facilities.
Lack of space for two vehicles to pass on the approach to Tarbert from the north.	Narrow road width.	Adjacent house boundaries next to roadway.	Improve road layout; Additional control of traffic.
Strategic timber route that allows forestry HGVs to avoid the centre of Tarbert not being used to full potential.	Adverse camber in road at junction with A83		Improve road layout.

Appendix D Environmental Assessment Ecology

Appendix D1 Legislation

(a) Conservation of Natural Habitats and Wild Flora and Fauna (the Habitats Directive, 1992) (92/43/3EEC) (as amended).

The EU Directive (92/43/EEC) on the Conservation of Natural Habitats and of Wild Fauna and Flora (the Habitats Directive, 1992) is the means by which Member States meet obligations made as a signatory of the Convention on the Conservation of European Wildlife and Natural Habitats (the Bern Convention). The Directive introduces a range of measures including the protection and surveillance of habitats and species. The main aim of the Directive is to promote the maintenance of biodiversity by requiring Member States to take measures to maintain or restore natural habitats and wild species at a favourable conservation status, introducing robust protection for those habitats and species of European importance.

The 189 habitats listed in Annex I of the Directive (76 of which occur in the UK; 23 of these are afforded 'priority' status as they are judged to be in particular danger of loss (Article 1)) and the 788 species listed in Annex II, are protected by means of a network of sites. Each Member State is required to prepare and propose a national list of sites for evaluation in order to form a European network of Sites of Community Importance (SCIs). Once adopted, these are designated by Member States as Special Areas of Conservation (SACs), and along with Special Protection Areas (SPAs) classified under the EC Birds Directive, form a network of protected areas known as Natura 2000.

(b) Conservation of Wild Birds (the Birds Directive, 1979) (79/409/EEC)

The European Union (EU) Directive on the Conservation of Wild Birds (79/409/EEC) was adopted in 1979. The Birds Directive is a primary tool for delivering EU obligations under the Convention of Biological Diversity, the Ramsar and Bonn Conventions. The Birds and Habitats Directives require Member States to take a number of measures/actions in order to protect all bird species, their sites and their habitats, and these include: measures to conserve and maintain all naturally occurring bird species across the EU through the designation of Special Protection Areas (SPAs) for species listed on Annex I of the Directive and migratory species.

(c) Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) (Habitats Regulations)

The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) transpose Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (EC Habitats Directive) into UK domestic law. The Regulations came into force on 30 October 1994 which, were subsequently amended in 1997. The Regulations provide for the designation and protection of 'European sites', the protection of 'European protected species', and the adaptation of planning and other controls for the protection of European sites.

In Scotland the Regulations were amended in 2004 (SSI/475/2004), 2007 (SSI/80/2007, SSI/349/2007) and 2008 (SSI/2008/17, SSI/2008/425).

(d) Water Framework Directive (WFD) (2000/60/EC)

The Water Framework Directive (WFD) recognises that ecosystem health is the most effective way to assess the environmental quality status of a watercourse. The WFD came into force in December 2000 and has moved the focus away from chemical water quality targets. It requires that all inland and coastal watercourses in Europe do not deteriorate from their current condition and reach at least 'good' ecological status by 2015 (not including heavily modified or artificial waterways, which must reach 'good' ecological potential). Under the WFD, the ecological status of watercourses is therefore now the focus of river management and impact assessment.

(e) Wildlife and Countryside Act 1981 (as amended) (WCA)

The WCA (1981) (as amended) is the principal mechanism for wildlife protection in the UK, originally aimed at consolidating and amending previous legislation to implement the requirements of the Bern Convention and the Birds Directive. Of particular relevance is Schedule 1, which lists birds that are afforded special protection, Schedules 4-6, which protect various wild animal species from injury, killing or disturbance, and Schedule 8, which confers protection to certain plant species. The statutory designation of Sites of Special Scientific Interest (SSSI) is the main site protection measure in the UK established under the WCA.

(f) Nature Conservation (Scotland) Act 2004 (NCSA)

This Act requires Scottish Ministers to publish a list of habitats and species considered to be of principal importance for biodiversity. This list, the Scottish Biodiversity List, was subsequently published in 2005 and is intended to be a tool for public bodies and others doing their Biodiversity Duty and as an important source of information and guidance for all.

The Act has three parts, Part 1 promotes the conservation of biodiversity whereby all Scottish public bodies and office holders will be obliged to 'further the conservation of biodiversity' in the course of exercising their functions. Part 2 revises the designation of the SSSI system for protecting Scotland's most precious natural places. Part 3 enhances the existing species protection provisions of the WCA (1981), as amended by adding the word 'recklessly' to legislation regarding killing, injury or disturbance of protected species so that 'intent' no longer needs to be proven.

(g) Wildlife and Natural Environment (Scotland) Act 2011 (WANE)

The Wildlife and Natural Environment (Scotland) Act 2011 amended a number of other pieces of legislation including the Wildlife and Countryside Act 1981 and the Deer (Scotland) Act 1996. The Act introduces new wildlife related offences, including 'vicarious liability'. It abolishes the designation of 'areas of special protection' under the Wildlife and Countryside Act 1981, adds further regulation of snaring practice, further regulates invasive and non-native species, ensures that badger licensing is consistent with that of other protected species, amends current arrangements for deer management and deer stalking, strengthens protection of badgers, changes how muirburn can be practised and makes operational changes to the management of Sites of Special Scientific Interest.

(h) Protection of Badgers Act (PBA) 1992

Badgers are legally protected from intentional cruelty (such as badger-baiting) and from the results of lawful human activities (such as housing, road or other developments), under the Protection of Badgers Act (PBA). The PBA consolidates all previous legislation including the Badgers Act 1973 (as amended) and the Badgers (Further Protection) Act 1991.

Badgers are also given protection from killing or taking by certain means under Schedule 6 of the WCA 1981 (as amended) (Reid, 2002). Under the legislation, badgers are afforded protection from wilful or attempted killing, injuring and interference with the badgers' sett. The PBA defines a badger sett as 'any structure or place which displays signs indicating current use by a badger'.

(i) Salmon and Freshwater Fisheries (Consolidation) (Scotland) Act 2003

This Act affords protection through a number of orders to which planning authorities must adhere. Under Order 23 (Part 1: Protection of young salmon) any person who knowingly takes, injures or destroys; places any device or engine for the purpose of obstructing the passage of, any smolt, parr, salmon fry or alevin shall be guilty of an offence. In addition, any person who knowingly injures or disturbs any salmon spawn; or disturbs any spawning bed or any bank or shallow in which the spawn of salmon may be, shall be guilty of an offence.

(j) Environmental Protection Act 1990

This Act aims to provide protection and conservation of the natural environment. A number of provisions are set out within the Act, one pertinent to this scheme being to make provision for the improved control of pollution arising from certain industrial and other processes.

(k) The UK Biodiversity Action Plan (UK BAP) and Local Biodiversity Action Plans (LBAPs)

The UK Biodiversity Action Plan (BAP) (1994) was established in response to the Global Convention on Biological Diversity (1992). Individual Action Plans define actions and measures to meet the objectives defined in the strategy, and specify measurable targets. They determine the broad habitats and species that are of value to the natural environment of the UK, and to identify actions and projects that could be undertaken to help protect or enhance the national biodiversity.

Local Biodiversity Action Plans (LBAPs) are implemented through planning policy, identifying habitats and species of particular value or endangerment at the local or regional level. BAPs in the UK have no statutory status, but provide a framework for implementing conservation requirements.

In the case of the current proposed scheme, the study area falls within the Loch Lomond and The Trossachs National Park and the park authority has responsibility for the BAP. For the park area a National Park BAP (NPBAP) has been produced.

Appendix D2 NVC Types in Beinn an Lochain SSSI

NVC types mapped and assessed by W A Fairhurst & Partners (1999).

(l) Calcareous Grasslands

CG10 *Festuca ovina – Agrostis capillaris – Thymus praecox* grassland
CG11 *Festuca ovina – Agrostis capillaris – Alchemilla alpina* grass-heath

(m) Calcifugous Grasslands and Montane Communities

U10 *Carex bigelowii – Racomitrium lanuginosum* moss-heath
U16 *Luzula sylvatica – Vaccinium myrtillus* tall-herb community
U17 *Luzula sylvatica – Geum rivale* tall-herb community
U19 *Thelypteris limbosperma – Blechnum spicant* community

(n) Mires

M6 *Carex echinata – Sphagnum recurvum/auriculatum* mire
M7 *Carex curta – Sphagnum russowii* mire
M11 *Carex demissa – Saxifraga aizoides* mire
M23 *Juncus effusus/acutiflorus – Galium palustre* rush-pasture

Appendix D3 Shortlisted Habitats and Species in the NPBAP

Table B1 – Habitats Short-listed for the NPBAP

Shortlisted Habitat	UK BAP Priority Habitat	Work Programme
Upland oakwood	✓	Woodlands & Forests
Upland mixed ash woods	✓	Woodlands & Forests
Upland birch woods	✓	Woodlands & Forests
Lowland mixed deciduous woodlands	✓	Woodlands & Forests
Wet woodlands	✓	Woodlands & Forests
Wood pastures and parkland	✓	Woodlands & Forests, Built Environment
Native pine woodlands	✓	Woodlands & Forests
Juniper woodlands		Woodlands & Forests
Hedgerows	✓	Farmland
Field boundaries and treelines		Farmland
Lowland meadows	✓	Farmland
Lowland dry acid grassland	✓	Farmland
Upland hay meadows	✓	Farmland
Lowland & upland calcareous grasslands	✓	Farmland
Upland heathland	✓	Moorland & Mountains
Blanket bog	✓	Moorland & Mountains
Montane heaths and willow scrub	✓	Moorland & Mountains
Upland flushes, fens and swamp	✓	Moorland & Mountains
Inland rock outcrops and scree	✓	Moorland & Mountains
Farmland		Farmland
Wet grassland		Farmland
Rivers	✓	Loch, Rivers and Ponds
Oligotrophic and dystrophic lakes	✓	Loch, Rivers and Ponds
Mesotrophic lakes	✓	Loch, Rivers and Ponds
Standing open waters		Loch, Rivers and Ponds
Built and developed environment		Built Environment
Greenspace		Built Environment
Transport corridors		Built Environment

Table B2 – Species Short-listed for the NPAP

Shortlisted Species	UK BAP Priority Species	Main Location in NPBAP (work programme)
Mammals		
Brown long-eared bat, *Plecotus auritus*	✓	Farmland, Woodlands & Forests, Built Environment
Brown hare, *Lepus europaeus*	✓	Farmland
Mountain hare, *Lepus timidus*	✓	Moorland & Mountains
Otter, *Lutra lutra*	✓	Loch, Rivers & Ponds, Coastal & Marine, Built Environment
Red squirrel, *Sciurus vulgaris*	✓	Red Squirrel
Soprano pipistrelle bat, *Pipistrellus pygmaeus*	✓	Farmland, Woodlands & Forests, Built Environment
Water vole, *Arvicola terrestris*	✓	Water Vole
Wildcat, *Felis silvestris*	✓	SNH National Survey
Birds		
Barn owl, *Tyto alba*		Woodlands & Forests, Farmland, Built Environment
Black grouse, *Tetrao tetrix*	✓	Black Grouse
Bullfinch, *Pyrrhula pyrrhula*	✓	Woodlands & Forests
Capercaillie, *Tetrao urogallus*	✓	Capercaillie
Curlew, *Numenius arquata*	✓	Farmland
Golden eagle, *Aquila chrysaetos*		Moorland & Mountains
Grey partridge, *Perdix perdix*	✓	Farmland
Lapwing, *Vanellus vanellus*	✓	Farmland
Linnet, *Carduelis cannabina*	✓	Farmland
Nightjar, *Caprimulgus europaeus*	✓	Woodlands & Forests
Reed bunting, *Emberiza schoeniclus*		Farmland
Skylark, *Alauda arvensis*		Farmland
Song thrush, *Turdus philomelus*	✓	Woodlands & Forests, Built Environment
Swift, *Apus apus*		Built Environment
Tree sparrow, *Passer montanus*	✓	Farmland
Yellowhammer, *Emberiza citrinella*	✓	Farmland
Amphibians		
Great crested newt, *Triturus cristatus*	✓	Loch, Rivers & Ponds

Shortlisted Species	UK BAP Priority Species	Main Location in NPBAP (work programme)
Fish		
Atlantic salmon, *Salmo salar*	✓	Loch, Rivers & Ponds
Arctic charr, *Salvelinus alpinus*	✓	Loch, Rivers & Ponds
Brown/Sea trout, *Salmo trutta*	✓	Loch, Rivers & Ponds
Powan, *Coregonus lavaretus*	✓	Powan & Lamprey
River lamprey and Lomond sub-species of river lamprey, *Lampetra fluviatilis*	✓	Loch, Rivers & Ponds, Powan & Lamprey
Sea lamprey, *Petromyzon marinus*	✓	Loch, Rivers & Ponds
Butterflies		
Pearl-bordered fritillary, *Boloria euphrosyne*	✓	Woodlands & Forests
Mountain ringlet butterfly, *Erebia epiphron*	✓	Moorland & Mountains
Molluscs		
Freshwater pearl mussel, *Margaritifera margaritifera*	✓	Freshwater pearl mussel
Plants		
Juniper, *Juniperus communis*	✓	Woodlands & Forests
Lesser butterfly orchid, *Platanthera bifolia*	✓	Biodiversity Audit
Scottish dock, *Rumex aquaticus*	✓	Biodiversity Audit
Marsh club moss, *Lycopodiella inundata*	✓	Biodiversity Audit

Appendix E Environmental Assessment Schedule of Policies and Assessment of Compliance

Appendix E Schedule of Policies and Assessment of Compliance

The table below provides a schedule of relevant national, regional and local policies and summarises the conclusions of a broad assessment of compliance of each corridor. Areas of potential non-compliance are highlighted in bold. The policies are categorised by topic, and the following acronyms are used to identify the source of each policy:

- *Scottish Planning Policy (SPP)*
- *Structure Plan (SP)*
- *National Park Plan (NPP)*
- *Local Plan (LP)*

Policy	Red	Brown	Yellow	Blue	Green	Purple
Transport						
SPP Paragraphs 165-181	Refer to assessments below.					
SP Proposal PROP TRANS1: Development Control, Transport and Access (Criterion D Continuity and safeguarding access to public rights of way and public access to countryside)	Section 7.11 Pedestrians, Cyclists, Equestrians and Community Effects notes there are no public rights of way, core paths or other paths affected by this corridor. Temporary disruption to cyclists using the A83 is anticipated during construction. This corridor is considered to comply with this policy.	Section 7.11 Pedestrians, Cyclists, Equestrians and Community Effects notes there are no public rights of way, core paths or other paths affected by this corridor. Temporary disruption to cyclists using the A83 is anticipated during construction. This corridor is considered to comply with this policy.	Section 7.11 Pedestrians, Cyclists, Equestrians and Community Effects notes there are no public rights of way or core paths. Potential effects on the amenity of users of the Old Military Road path are identified, however no access restrictions are predicted and therefore this corridor is considered to comply with this policy.	Section 7.11 Pedestrians, Cyclists, Equestrians and Community Effects notes there are no public rights of way affected by this corridor, however there is a core path (Gleann Mor to Glencroe). There may be adverse amenity effects on this core path although there will be no increase in journey length. It is also possible that two undesignated paths will be disrupted by severance. **This corridor is potentially non-compliant with this policy**.	Section 7.11 Pedestrians, Cyclists, Equestrians and Community Effects notes there are no public rights of way affected by this corridor, however there is a core path (Gleann Mor to Glencroe) which may experience adverse effects due to severance of the path and adverse amenity effects (noise, air quality, visual). One undesignated path may be similarly disrupted. **This corridor is potentially non-compliant with this policy**.	Section 7.11 Pedestrians, Cyclists, Equestrians and Community Effects notes there are no public rights of way affected by this corridor, however there is a core path (Gleann Mor to Glencroe). There may be adverse amenity effects although there will be no increase in journey length. It is also possible that two undesignated paths will be disrupted by severance. **This corridor is potentially non-compliant with this policy**.

Policy	Red	Brown	Yellow	Blue	Green	Purple
NPP Policy TR1: Reducing the Environmental Effects of Travel	The scheme will not promote reducing the need to travel or promote the use of public transport per se, however this policy is not directly relevant to the scheme which will provide essential improvement works to this existing important strategic route.					
NPP Policy INF1: Addressing Infrastructure Constraints and Improvements	This policy which promotes public investment in the Park's infrastructure at key locations to meet the social and economic needs of the Park's communities, including ensuring a high standard of road network. The scheme complies with the principle of this policy, however further assessment at a more detailed stage will be required to consider whether the options are sympathetic to the area's special qualities and utilise sensitive road engineering principles as set out in criterion (c) of the policy.					
LP Policy TRAN2: Promoting Sustainable Travel and Improved Travel Options	This policy supports proposals that positively contribute to safe, sustainable travel in particular promoting the hierarchy of walking, cycling, public transport and motorised transport. The hierarchy of sustainable travel is not directly relevant to this scheme which is for essential improvement works which will help maintain and improve safety on this important strategic route which is used both by motor users and cyclists. All options accord with this policy.					
LP Policy TRAN4: Provision of New Transport Infrastructure	This policy is relevant to road upgrading, and requires application of road engineering principles that are sensitive to the Park's special qualities. As noted in the detailed assessments in this table, there are few significant environmental impacts predicted as a result of these corridors (perhaps effects on protected species, however this may be managed with effective mitigation), and therefore it is not anticipated that these corridor will harm the special qualities of the National Park.		These corridors require more intensive works as they are off-line which would involve works in existing undeveloped land. Potentially significant environmental impacts are predicted including landscape effects, harmful effects to ecology and nature conservation, and built heritage. The widest range of potentially adverse effects is predicted as a result of the Blue and Purple corridors; and the green and yellow corridors are also predicted to potentially have adverse effects which could harm the special qualities of this area within the National Park. **These corridors are potentially non-compliant with this policy**.			
National Park						
SPP Paragraph 138	Refer to assessments below.					
NPP Policy SQ1: Conserving and Enhancing the Special Qualities	As noted in the detailed assessments in this table, there are few significant environmental impacts predicted as a result of these corridors (perhaps effects on protected species however this may be managed with effective mitigation), and therefore it is not anticipated that these corridor options will harm the special qualities of the National Park.		These corridor options require more intensive works as they are off-line which would involve works in existing undeveloped land. Potentially significant environmental impacts are predicted including landscape effects, harmful effects to ecology and nature conservation, and built heritage. The widest range of potentially adverse effects are predicted as a result of the Blue and Purple corridors; and the green and yellow corridors are also predicted to potentially have adverse effects which could harm the special qualities of this area within the National Park. The National Park (Scotland) Act 2000 requires that where there is potential conflict between the objectives of the National Park, conservation of natural and built heritage should take precedence. **These corridors are potentially non-compliant with this policy**.			
LP Policy NP1: Development in the National Park	As above.		As above. **These corridors are potentially non-compliant with this policy**.			

Policy	Red	Brown	Yellow	Blue	Green	Purple
Sustainable Economic Development						
SPP Paragraphs92-97 (Rural Development)	None of the corridors will require development on prime agricultural land. All are proposed with the purpose of improving access on the A82 which is a key strategic route to the rural communities in the West Highlands of Scotland. The corridors generally comply with the provisions of SPP on rural development.					
SP Policy STRAT S1: Sustainable Development	This policy seeks to maximise use of existing infrastructure, avoid development of prime agricultural land, conserve natural and built environment, respect landscape character, and avoid flooding and adverse effects on land, water, and air quality. No prime agricultural land will be affected. For assessments in relation to the other criteria please refer to other detailed policies in this table which address these types of effects. **Based on assessments against other detailed policies, there is potential non-compliance of the Yellow, Blue, Green and Purple corridors due to potential impacts on the natural environment (including a SSSI), built heritage features, and landscape character.**					
NPP Policy SE1: Strategy for a Sustainable Park Economy	All corridors comply with this policy, in particular part (f) which promotes improving the standards of roads maintenance and strategic routes.					
LP Policy SUSDEV1: Sustainable Development	Refer to assessment under policy STRAT S1 above.					
Historic Environment						
SPP Paragraphs 110-124	Refer to assessments under policies ENV20-ENV27 below.					
SP Policy STRAT DC9: Historic Environment and Development Control	Refer to assessments under policies ENV20-ENV27 below.					
NPP Policy BH1: Caring for Our Built Heritage	Refer to assessments under policies ENV20-ENV27 below.					
LP Policy ENV20: Conservation Areas	None of the corridors affect conservation areas.					
LP Policy ENV21: Listed Buildings	No direct or indirect effects on listed buildings are predicted as a result of these corridors in Section 7.8 Cultural Heritage.			Section 7.8 Cultural Heritage identifies that there is a potential direct effect on the Rest and Be Thankful Stone, a Category C(s) listed building. **This corridor is potentially non-compliant with this policy.**	No direct or indirect effects on listed buildings are predicted as a result of these corridors in Section 7.8 Cultural Heritage.	

Policy	Red	Brown	Yellow	Blue	Green	Purple
LP Policy ENV22: Demolition of Listed Buildings	See assessment under Policy ENV21 above. It is unknown whether the Rest and Be Thankful Stone will require to be removed as a result of development within the Blue corridor at this stage of the assessment process.					
LP Policy ENV23: The Wider Built Environment and Cultural Heritage of the Park	This policy seeks to protect and conserve features of architectural/historical merit or cultural significance, and retain features which contribute positively to the cultural heritage of the National Park. As noted in the other built environment policies in this section, no potential adverse effects on known or unknown archaeological or historical features are identified.		Section 7.8 Cultural Heritage has identified potential adverse effects on archaeological features (both known and unknown) for each of these corridors. In addition the Blue corridor may also have a direct effect on the Rest and Be Thankful Stone, which is C(s) listed and is also a key component of the visitor area for views of the Rest and Be Thankful and Glen Croe. **Each of these corridors have potential for non-compliance with this policy.**			
LP Policy 24: Historic Gardens and Designed Landscapes	There are no Historic Gardens or Designed Landscapes within the study area.					
LP Policy 25: Scheduled Ancient Monuments and Candidate Scheduled Ancient Monuments	There are no Scheduled Monuments or Candidate Scheduled Monuments within the study area.					
LP Policy ENV26: Other Unscheduled Sites of Archaeological Importance	No direct effects on any known archaeological assets are predicted for these corridors, as explained in Section 7.8 Cultural Heritage. These corridors are considered to comply with this policy.		Each of these corridors has the potential for direct effects on known archaeological remains. **These corridors are potentially non-compliant with this policy, with the Blue and Purple corridors identified in Section 7.8 Cultural Heritage having effects on higher numbers of archaeological remains.** The assessment should be reviewed at a later DMRB stage when more detailed information on likely effects and mitigation is available.			
LP Policy ENV27: Sites with Unknown Archaeological Potential	Section 7.8 Cultural Heritage states that these corridors are not located in areas of with archaeological potential and therefore unknown remains are unlikely.		Each of these corridors has the potential for direct effects on unknown archaeological remains. **These corridors are potentially non-compliant with this policy, with the Blue and Purple corridors identified in Section 7.8 Cultural Heritage as potentially having more significant effects as there is higher potential for unknown remains.** The assessment should be reviewed at a later DMRB stage when more detailed information on likely effects and mitigation is available.			
Landscape						
SPP Landscape and Natural Heritage Para 128-145	Refer to assessments against detailed policies below.					

Policy	Red	Brown	Yellow	Blue	Green	Purple
SP Policy STRAT DC8: Landscape and Development Control	This policy protects against development which would undermine or damage key environmental features of a visually contained or wider landscape. Section 7.7 Landscape and Visual predicts minor effects on the landscape from this corridor which would involve improvements to the existing road including further slope stabilisation measures. This option would not be discernibly different to the existing road and is likely to accord with this policy.	Section 7.7 Landscape and Visual predicts that effects on the landscape and visual character from this corridor would not be significant, as the landslide shelters would be viewed within the context of the existing road. It is likely that this corridor could comply with this policy.	Section 7.7 Landscape and Visual predicts significant effects on the landscape character as a result of the proposed viaduct structure within the relatively undeveloped valley area. The structure would be a prominent feature in the landscape which would also have adverse visual effects from the Rest and Be Thankful viewpoint. **This corridor is potentially non-compliant with this policy**.	Section 7.7 Landscape and Visual predicts significant effects on the landscape character of Glen Croe and the surrounding hills due to the introduction of a busy new road corridor along the valley floor which would alter the rural, tranquil nature of the glen. Significant adverse effects from the Rest and Be Thankful viewpoint are also predicted. **This corridor is potentially non-compliant with this policy**.	Section 7.7 Landscape and Visual explains that effects on the landscape and visual character of the glen will be dependent on the road design, but if sensitive to the existing landscape and if existing woodland is retained around the road corridor effects may not be significant. The compliance of this corridor in relation to the policy should be considered once more detail is available, but it is possible that this corridor can comply with this policy.	Section 7.7 Landscape and Visual predicts significant effects on the landscape character of Glen Croe and the surrounding hills due to the introduction of a busy new road corridor along the valley floor which would alter the rural, tranquil nature of the glen, although effects would be reduced compared to the Blue corridor by the tunnel option. Significant adverse effects from the Rest and Be Thankful viewpoint are also predicted. **This corridor is potentially non-compliant with this policy**.
SP Policy STRAT FW2: Development Impact on Woodland	No effects on woodland are predicted from these corridors as stated in Section 7.6 Ecology and Nature Conservation.			Section 7.6 Ecology and Nature Conservation notes that the western area of Glen Croe is dominated by coniferous planting woodland. Each of these corridors has the potential for loss of areas of woodland. **These corridors are potentially non-compliant with this policy, but this assessment should be updated once further details are available including the potential for replacement planting as mitigation.**		
NPP Policy LS1: Conserving and Enhancing the Diversity and Quality of the Park's Landscapes	As per assessment against SP Policy STRAT DC8 above.	As per assessment against SP Policy STRAT DC8 above.	As per assessment against SP Policy STRAT DC8 above. **This corridor is potentially non-compliant with this policy**.	As per assessment against SP Policy STRAT DC8 above. **This corridor is potentially non-compliant with this policy**.	As per assessment against SP Policy STRAT DC8 above.	As per assessment against SP Policy STRAT DC8 above. **This corridor is potentially non-compliant with this policy**.

Policy	Red	Brown	Yellow	Blue	Green	Purple
NPP Policy LS2: Landscape Character	As per assessment against SP Policy STRAT DC8 above.	As per assessment against SP Policy STRAT DC8 above.	As per assessment against SP Policy STRAT DC8 above. **This corridor is potentially non-compliant with this policy**.	As per assessment against SP Policy STRAT DC8 above. **This corridor is potentially non-compliant with this policy**.	As per assessment against SP Policy STRAT DC8 above.	As per assessment against SP Policy STRAT DC8 above. **This corridor is potentially non-compliant with this policy**.
NPP Policy LS3 Landscape Experience	As per assessment against SP Policy STRAT DC8 above.	As per assessment against SP Policy STRAT DC8 above.	As per assessment against SP Policy STRAT DC8 above. **This corridor is potentially non-compliant with this policy**.	As per assessment against SP Policy STRAT DC8 above. **This corridor is potentially non-compliant with this policy**.	As per assessment against SP Policy STRAT DC8 above.	As per assessment against SP Policy STRAT DC8 above. **This corridor is potentially non-compliant with this policy**.
LP Policy L1: Conserving and Enhancing the Diversity and Quality of the Park's Landscapes	As per assessment against SP Policy STRAT DC8 above.	As per assessment against SP Policy STRAT DC8 above.	As per assessment against SP Policy STRAT DC8 above. **This corridor is potentially non-compliant with this policy**.	As per assessment against SP Policy STRAT DC8 above. **This corridor is potentially non-compliant with this policy**.	As per assessment against SP Policy STRAT DC8 above.	As per assessment against SP Policy STRAT DC8 above. **This corridor is potentially non-compliant with this policy**.
LP Policy D1: Design Quality	This policy should be assessed once more detail is available for each of the corridors. It requires that development proposals should demonstrate an understanding of landscape setting and historical context, and reinforce distinctive character of local areas. **At this stage, it is considered that there may be issues of compliance for the Yellow, Blue, Green and Purple corridors given the potential impacts on landscape character and visual amenity, and also built heritage.**					
LP Policy ENV8: Ancient, Long-Established and Semi-Natural Woodlands	No woodlands listed on the Ancient Woodland Inventory are located within the study area, as noted in Section 7.6 Ecology and Nature Conservation.					
LP Policy ENV9: Development Impacts on Trees and Woodlands	No trees protected by Tree Preservation Order have been identified within the study area. The importance of the areas of coniferous planting woodland which may be removed for the Blue, Green and Purple corridors should be assessed in more detail to determine whether there are any issues of potential non-compliance with this policy.					
Ecology and Nature Conservation and Geodiversity						
SPP Landscape and Natural Heritage Para 128-145	Refer to assessments under LP Policies ENV1 – ENV7 below.					

Policy	Red	Brown	Yellow	Blue	Green	Purple
SP Policy STRAT DC7: Nature Conservation and Development Control	Refer to assessments under LP Policies ENV1 – ENV7 below.					
NPP Policy BD1: Biodiversity Enhancement	This policy seeks to safeguard biodiversity from potential damaging impacts from developments and other activities. Section 7.6 Ecology and Nature Conservation provides an assessment of potential effects on habitats and species which contribute to biodiversity. **All corridors have the potential to affect biodiversity. More potentially significant effects are predicted as a result of the habitat loss potentially resulting from development within the Yellow, Brown, Green and Purple corridors. Further assessment in relation to this policy should be undertaken at a later DMRB stage when ecology survey work has been completed.**					
NPP Policy BD2: Integrated Approach to Biodiversity	Refer to assessment under Policy BD1 above.					
NPP Policy G1: Conserving Geodiversity	A designated Geological Conservation Review Site is located approximately 2km to the east of the A83, centred on Ben Arthur (The Cobbler). Section 7.4 Geology, Land Contamination and Groundwater assesses the potential effects on geology however no effects on this designated area are predicted. No long terms effects are predicted on geology or groundwater. These corridors are considered to comply with this policy.				Section 7.4 Geology, Land Contamination identifies a potential long term effect on local groundwater if cuttings are required within this corridor. **This corridor is potentially non-compliant with this policy**.	Section 7.4 Geology, Land Contamination identifies a potential long term effect on local groundwater as a result of the tunnel construction option in this corridor. **This corridor is potentially non-compliant with this policy**.
LP Policy ENV1: European Sites (SACs and SPAs)	There are no European designated sites within the study area for any of the corridor options. Section 7.6 Ecology and Nature Conservation identifies that the Glen Etive and Glen Fyne SPA is situated approximately 970m north of the study area. At this stage, no potential effects are predicted on the SPA, however this should be considered as the scheme options are developed and more information is available. No likely issues of non-compliance with the policy are identified at this stage.					
LP Policy ENV2: SSSIs, National Nature Reserves and RAMSAR Sites	There are no National Nature Reserves or RAMSAR sites within the study area. The Beinn an Lochain SSSI is located at the northern end of Glen Croe. No potential adverse effects on the SSSI are predicted in Section 7.6 Ecology and Nature Conservation as a result of these corridors.			There are no National Nature Reserves or RAMSAR sites within the study area. The Beinn an Lochain SSSI is located at the northern end of Glen Croe. Section 7.6 Ecology and Nature Conservation predicts that there may be a loss of habitat within the SSSI which would have an adverse effect on the designation. Construction effects may include sedimentation and run-off into Loch Restil which is part of the SSSI. For the purple corridor potential construction effects from tunnelling are also possible. Section 7.9 Air Quality also notes that the SSSI contains habitats which are vulnerable to nutrient nitrogen deposition. It is not known whether these habitats are present adjacent to any of the corridors, however it is possible there may be a significant effect due to worsened nitrogen deposition within this corridor. **These corridors are potentially non-compliant with this policy.**		

Policy	Red	Brown	Yellow	Blue	Green	Purple
LP Policy ENV3: Local Nature Conservation Sites	There are no local nature conservation sites within the study area for any of the corridors, therefore, no potential non-compliance issues with this policy are predicted.					
LP Policy ENV4: Legally Protected Species	Desk based study has identified the potential for various protected species within the study area, including badger, bat, otter, pine marten, red squirrel, and bird and fish species. Potential effects on protected species are assessed in Section 7.6 Ecology and Nature Conservation in the absence of mitigation. In particular, there may be effects during construction, including night time working which will create disturbance to badgers, bats and otters. Increased sedimentation and run off may adversely affect aquatic species. **There corridors are potentially non-compliant with this policy, however this assessment should be updated once specific and generic mitigation is further advanced.**			Desk based study has identified the potential for various protected species within the study area, including badger, bat, otter, pine martin, red squirrel, and bird and fish species. Potential effects on protected species are assessed in Section 7.6 Ecology and Nature Conservation in the absence of mitigation. In particular, there may be effects during construction, including night time working which will create disturbance to badgers, bats and otters. Increased sedimentation and run off may adversely affect aquatic species. For these corridors the assessment also identifies potentially significant effects on protected species including bat, otter, pine marten, red squirrels and fish. **There corridors are potentially non- compliant with this policy, with wider significant effects compared to the other corridors, however this assessment should be updated once specific and generic mitigation is further advanced.**		
LP Policy ENV5: Species and Habitats Identified in National Action Plans	A broad assessment of potential effects on habitats and species, including those identified as priority habitats and species in the UK Biodiversity Action Plan is provided in Section 7.6 Ecology and Nature Conservation. Further information is provided under policies ENV3 and ENV 4 above. **All corridors have the potential to affect priority habitats and species such as upland habitats and the Croe Water. More potentially significant effects are predicted as a result of the potential habitat loss associated with development in the Yellow, Brown, Green and Purple corridors. Further assessment in relation to this policy should be undertaken at a later DMRB stage when ecology survey work has been completed.**					
LP Policy ENV7: protecting Geological Conservation Review Sites	A designated Geological Conservation Review Site is located approximately 2km to the east of the A83, centred on Ben Arthur (The Cobbler). Section 7.4 Geology, Land Contamination and Groundwater assesses the potential effects on geology however no effects on this designated area are predicted. All corridors are considered to comply with this policy.					
Water Environment						
SPP Water Environment, Paras 196-211	Refer to assessments against detailed water environment policies below.					
SP Policy STRAT DC10: Flooding and Land Erosion	No significant flood risk issues have been identified in Section 7.5 Water Environment and therefore all the corridors are assessed as likely to be compliant with this policy.					
NPP Policy WM1: Safeguarding and Enhancing the Water Environment	All corridors have the potential for effects on water quality both due to the release of pollutants as a result of construction activities and from run off and accidental spillages during operation. However it is anticipated that mitigation can be put in place to reduce effects. **Forestry felling potentially required for the Green, Blue and Purple corridors may have an adverse effect on hydrology and water quality, therefore these corridors may not be fully compliant with this policy.**					
LP Policy ENV10: Protecting the Water Environment	All corridors have the potential for effects on water quality both due to the release of pollutants as a result of construction activities and from run off and accidental spillages during operation. However it is anticipated that mitigation can be put in place to reduce effects. **Forestry felling potentially required for development within the Green, Blue and Purple corridors may have an adverse effect on hydrology and water quality, therefore these corridors may not be fully compliant with this policy.**					

Policy	Red	Brown	Yellow	Blue	Green	Purple
LP Policy ENV12: Surface Water Drainage	At this DRMB Stage 1, broad corridors are identified. An assessment of the corridors against this policy should be undertaken at a later DMRB stage when further information on surface water drainage arrangements is available.					
LP Policy ENV13: River Engineering Works and Culverts	These corridors could require extensions to existing culverts and channel straightening realignment as stated in Section 7.5 Water Environment. This will require to be assessed further when more detail is available to identify whether the options comply with this policy.		This corridor is for a viaduct structure, and therefore no river engineering works are anticipated. This is the preferred corridor in Section 7.5 Water Environment	These corridors are anticipated to require the construction of culverts under the new road, and may also require channel straightening realignment as stated in Section 7.5 Water Environment. This will require to be assessed further when more detail is available to identify whether these corridor options comply with this policy.		
LP Policy ENV16: Development in Medium to High Flood Risk Areas	None of the corridors are in medium to high flood risk areas and therefore there is no potential non-compliance with this policy.					
Access and Recreation						
NPP Policy REC1: Improving Opportunities for Leisure and Recreation	All corridors are proposed with the aim of providing safe access along this strategic trunk road which provides access to the various leisure and recreation opportunities, in particular countryside access, in the National Park and Argyll and Bute. Some temporary effects on rest stops along the A83 and also at the Rest and Be Thankful Car Park are identified in Section 7.3 Land Use as a result of materials storage. It is not considered that the corridors will have a direct conflict with this policy, however impacts such as loss of woodland, effects on core paths, nature conservation, cultural heritage and landscape effects will all influence the popularity of the area for outdoor recreation.					
NPP Policy REC2: Outdoor Recreation and Access Opportunities	As above.					
LP Policy REC3: Outdoor Sport and Recreation Opportunities	No formal sport or recreational facilities will be affected by the corridors.					
LP Policy TRAN7: Encouraging Outdoor Access	As per assessment against SP Proposal PROP TRANS1.	As per assessment against SP Proposal PROP TRANS1.	As per assessment against SP Proposal PROP TRANS1.	As per assessment against SP Proposal PROP TRANS1. **This corridor is potentially non-compliant with this policy**.	As per assessment against SP Proposal PROP TRANS1. **This corridor is potentially non-compliant with this policy**.	As per assessment against SP Proposal PROP TRANS1. **This corridor is potentially non-compliant with this policy**.

Policy	Red	Brown	Yellow	Blue	Green	Purple
Other Environmental Protection						
LP Policy ENV18: Protecting Air Quality	This policy presumes against development proposals which could have significant adverse effect on air quality. Section 7.9 Air Quality does not predict any significant effects on local air quality from any of the corridors. There are no Air Quality Management Areas affected. None of the corridors have potential conflict with this policy. However it is predicted that there may be significant effects on an adjacent SSSI as a result of increased nitrogen deposition (refer to Ecology and Nature Conservation policies above).					
LP Policy ENV19: Historic Land Contamination	A review of potential land contamination is undertaken in Section 7.4 Geology, Land Contamination and Groundwater. No areas of contamination have been identified through the consultation process, and it is considered unlikely that there is historical contamination due to the rural nature of the study area. None of the corridors are considered to have a potential conflict with this policy.					

Appendix F Socio-Economic Impact Assessment

OPTIMAL ECONOMICS

Socio-Economic Impact Assessment of A83 Rest and Be Thankful Road Closures due to Landslides

February 2013

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Contents

1 Introduction

1.1 Introduction

1.1.1 Optimal Economics was appointed by Jacobs to prepare an economic impact assessment of the effect of road closures on the A83 at the Rest and Be Thankful due to landslides on the parts of the local economy of Argyll and Bute.

1.1.2 The analysis considers the effect of road closures and the use of the current pre-planned diversion route. This pre-planned route takes traffic onto the A82 between Tarbet and Tyndrum, the A85 from Tyndrum to Dalmally and the A819 between Dalmally and Inverary before rejoining the A83. This route adds approximately 25 miles and around 45 minutes to a single journey between Tarbet and Inveraray.

1.2 Road Closures at Rest and Be Thankful

1.2.1 To set the context for the study, Table 1.1 provides a summary of the closures at the Rest and Be Thankful since 2007. The Table shows that the road has been closed six times between 1st January 2007 and 31st October 2012. These closures have been due to actual landslip events or where there was a high risk of a potential event. Across all events, the road has been closed for 34 days, which is an average of approximately 5.5[1] days per year.

Table 1.1: Date and Duration of A83 Rest and BeThankful Road Closures due to Landslide Events, 1/1/07 – 31/10/12

	Date & Time Closed	Date & Time Re-opened	Duration of Closure	Comments
1	28/10/07	13/11/07	17 days	
2	08/09/09 12:30	10/09/09 15:00	2 days 2½ hours	
3	01/12/11 07:00 03/12-13/12 16:00	03/12/11 08:30 04/12-14/12 08:30	2 days 1½ hours 11 x 16½ hours	 A83 open from 08:30 to 16:00 only from 03/12/11. This restriction was lifted from 14/12/11
4	22/02/12 13:00	24/02/12 10:30	2 days 22½ hours	
5	22/06/12 20:45	23/06/12 15:00	18¼ hours	Closure due to high risk of landslide
6	01/08/12 16:00	03/08/12 18:00	2 days 2 hours	
Total Duration			**34 days**	

[1] Assume that the 11 overnight closures are counted as 11 half days

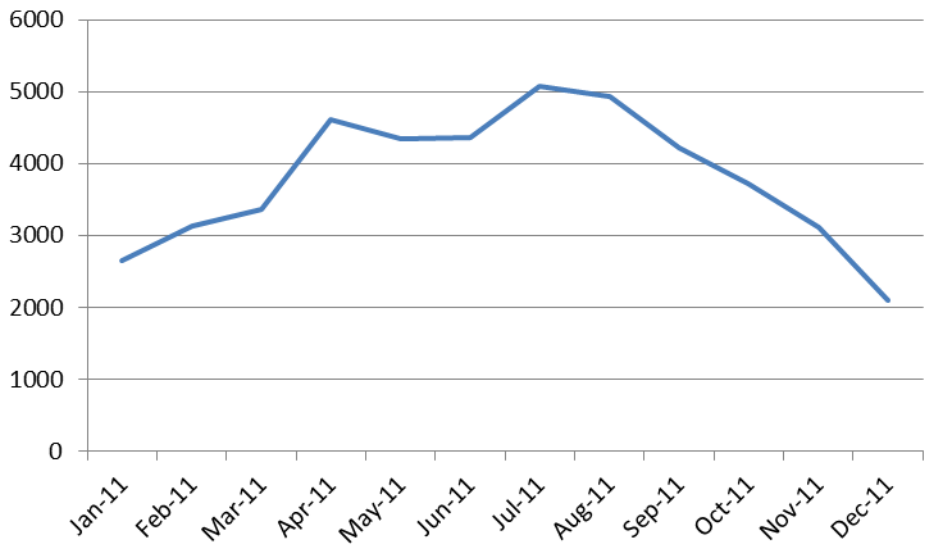
1.2.2 Between September 2010 and July 2012 the A83 was closed at Rest and Be Thankful six times for non-landslide reasons[2]. The shortest closure was eleven minutes and the longest was 12.5 hours with an average length of closure of just over 4 hours. Hence, the average time that the road is closed due to landslides is considerably longer than for closures due to other factors.

1.3 Traffic Flows at Rest and Be Thankful

1.3.1 Traffic volumes are measured as Annual Average Daily Traffic (AADT). This is the number of vehicles using the route per day when averaged over the year, to account for peaks such as summer traffic. On this section[3] of the A83 the AADT is approximately 4,000 vehicles.

1.3.2 The variation in monthly traffic flows is shown in Figure 1.2. As tourism is a key sector in the study area daily traffic flow is less than 3,000 vehicles in December and January, but rises to over 4,000 between April and September, and peaks at over 5,000 vehicles in July.

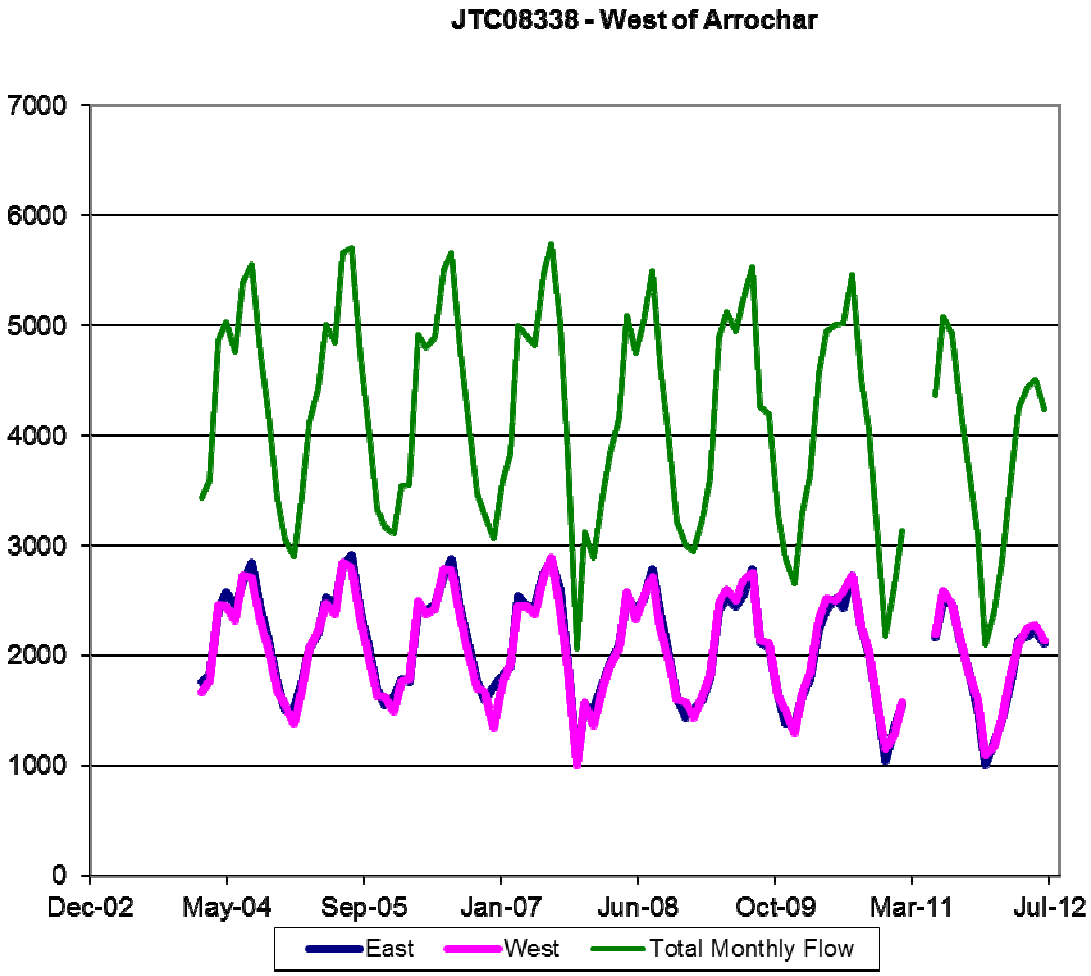
Figure 1.2: Monthly Traffic Flows, 2011



1.3.3 Figure 1.3 shows the historic trend in traffic flows on the A83 and it can be seen that these have been steadily reducing over time. The recent reductions are in line with national trends, including effects of the recession, but the longer term pattern could be partly due to the impact of the closures on the route.

[2] Mainly accidents and overturned vehicles
[3] A83 JTC08338 West of Arrochar

Figure 1.3: Average Monthly Flows, 2004 to 2012



1.4 Report Structure

1.4.1 The remainder of the report is organised as follows:

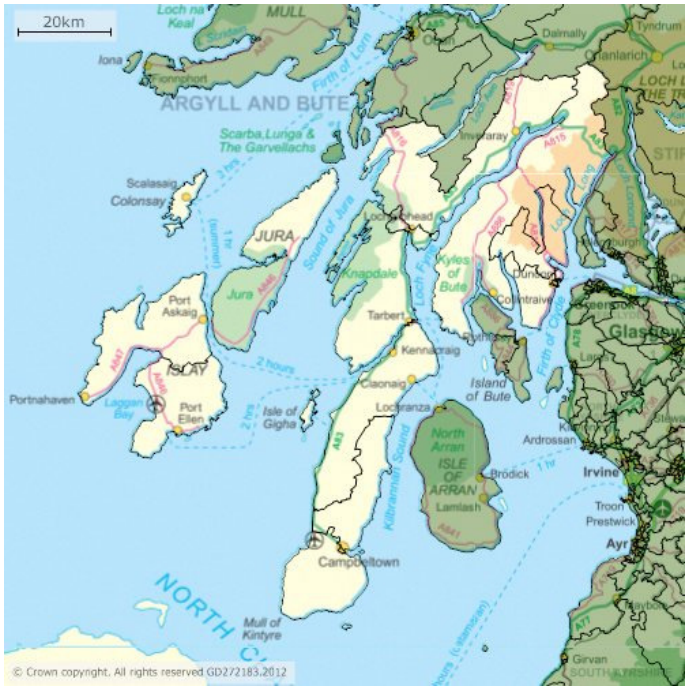
- Section 2 defines the area affected by the Rest and Be Thankful road closures and provides an overview of its economy;
- Section 3 sets out the key issues regarding the road closure and the diversion route from the perspective of businesses and organisations within the study area; and
- Section 4 provides an estimate of the lost income to the study area as a result of road closures and the use of the pre-planned diversion route. An estimate of the employment that would be supported by this income is also provided.

2 Economic Overview

2.1 Introduction

2.1.1 The area affected by closures of the A83 at Rest and Be Thankful includes Cowal, Mid Argyll, Kintyre, Islay Jura and Colonsay. This is referred to as the A83 study area and is shown in Figure 2.1[4].

Figure 2.1: A83 Study Area



2.1.2 The remainder of this section provides an overview of the performance of the A83 study area economy relative to Argyll and Bute and Scotland.

[4] A83 study area defined using CAS wards and includes Ardenslate, Auchamore and Innellan, Campbeltown Central, Craignish – Glenaray. East Central Kintyre, East Lochfyne, Holy Loch, Islay North, Jura and Colonsay, Islay South, Kirn and Hunter's Quay, Knapdale, Lochgilphead, Milton, North and West Kintyre and South Kintyre.

2.2 Socio Economic Context

Population

2.2.1 The population of the study area was 37,300 in 2011 which accounts for almost 42% of the total population of Argyll and Bute. However, the population of the A83 study area has declined by -2.5% between 2008 and 2011 compared to a decline of 1% across Argyll and Bute as a whole. Over the same period, the population of Scotland has grown by 1.7%. Details are shown in Table 2.1.

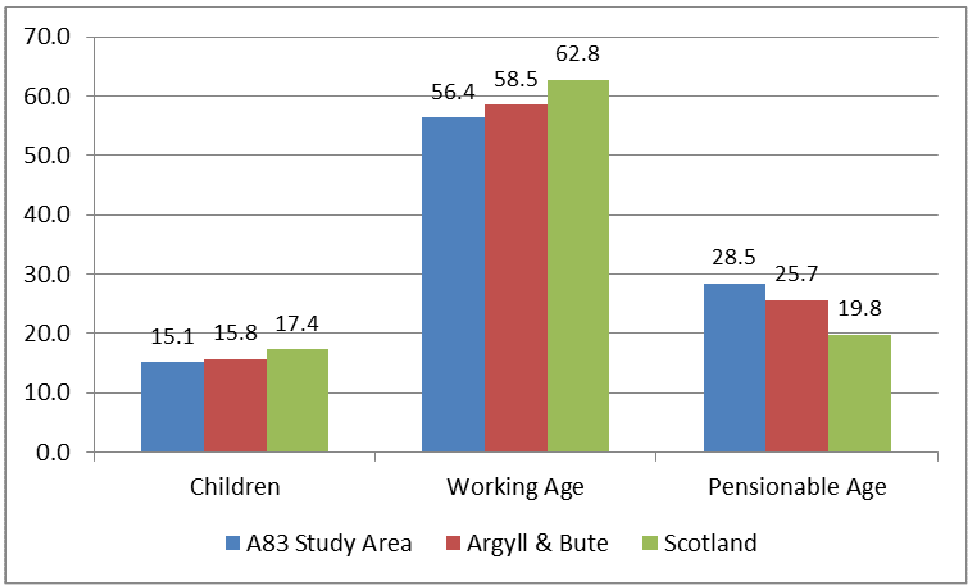
Table 2.1: Population Trend, 2008 and 2011

	2008 (000s)	2011 (000s)	As a % of Argyll & Bute	% Change ('08 to '11)
A83 Study Area	38.3	37.3	41.7	-2.5
Argyll & Bute	90.5	89.6		-1.0
Scotland	5,168.5	5,254.8		1.7

Source: Scottish Neighbourhood Statistics, Mid-year estimates

2.2.2 Figure 2.2 shows the distribution of the 2011 population across the main age categories – children, working age and pensionable age. The main point to note is that the proportion of the population of working age in the A83 study area is slightly lower (2 percentage points) than that of Argyll and Bute as a whole, but much lower (6 percentage points) than across Scotland as a whole. This is also seen in the relatively high proportion of the population which is of pensionable age in the A83 study area (28.5%). Hence, the A83 study area is characterised by a low proportion of people of working age and a high proportion of people of pensionable age compared to Argyll and Bute as a whole and Scotland.

Figure 2.2: Population Distribution by Main Age Group, 2011



Source: Scottish Neighbourhood Statistics, Mid Year Estimates

2.2.3 Between 2010 and 2035, the population of Scotland is forecast to increase by over 10% from 5.22 million to 5.76 million. However, growth is not forecast across all local authorities and Argyll and Bute is one of only ten local authorities forecast to experience population decline over the period to 2035. The forecast decline is over 7%. Details are shown in Table 2.2. Population projections are not available for sub-local authority areas, but is expected that the study area would also lose population over the forecast period.

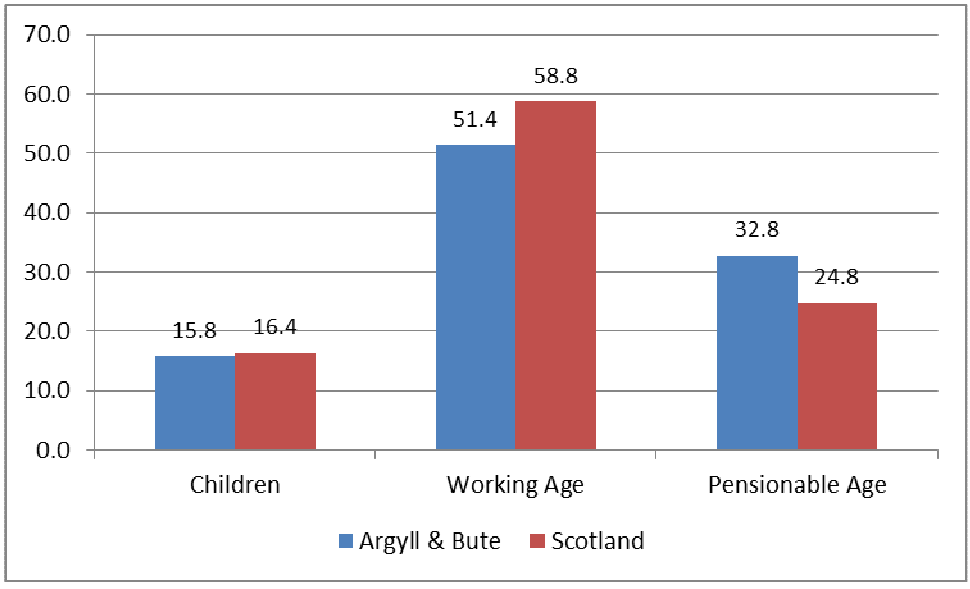
Table 2.2: Population Forecasts, 2010 and 2035

	2010 (000s)	2035 (000s)	% Change ('10 to '35)
Argyll & Bute	89.2	82.8	-7.2
Scotland	5,222.1	5,755.5	10.2

Source: 2010 Based Population Projections, General Register for Scotland

2.2.4 The age profile within Argyll and Bute is also forecast to continue towards a more elderly population with the proportion of people of working age declining while the population of pensionable age increases. By 2035, the proportion of the population of working age in Argyll and Bute is forecast to be 51.4% compared to almost 59% in Scotland as a whole while almost one third of the population in Argyll and Bute will be of pensionable age.

Figure 2.3: Population Distribution by Main Age Group, 2035



Source: 2010 Based Population Projections, General Register for Scotland

Gross Value Added

2.2.5 Gross value added (GVA) is a measure of income earned from the production of goods and services in the area. GVA generated in Argyll and Bute was £756 million[5] in 2010 which is a reduction in GVA of almost 14% (in real terms) since 2008. This reflects the effects of the recession on Argyll and Bute. Scottish GVA also fell (in real terms) between 2008 and 2010, but at almost 10%, the reduction was slightly less than in Argyll and Bute. Details are shown in Table 2.3.

Table 2.3: Gross Value Added, 2008 to 2010 (£m, 2010 Prices)

	2008	2010	% Change
Argyll & Bute	878	756	-13.9
Scotland	106,775	96,253	-9.9

Source: Scottish Annual Business Statistics 2010, Scottish Government, August 2011

2.2.6 GVA per employee is a measure of productivity in an area. In Argyll and Bute, GVA per employee was £33,346 in 2010 which is low in comparison to GVA per employee in Scotland of £59,934. Since 2008, GVA per employee in Argyll and Bute has fallen from 61% of the Scottish figure to 56% in 2010.

Employment

2.2.7 Employment in the A83 study area in 2011 was 15,300 which is just under 42% of employment in Argyll and Bute. Employment has remained relatively stable in the A83 study area and Argyll and Bute since 2008 while Scottish employment has declined by 1.8%. Details are shown in Table 2.4.

Table 2.4: Employment Change, 2008 – 2011 (000s)

	2008	2011	Change (000s)	% Change Per Annum
A83 Study Area	15.3	15.3	0.0	0.0
Argyll & Bute	36.8	36.8	0.0	0.0
Scotland	2,472.8	2,332.7	-130.1	-1.8

Source: Business Register and Employment Survey, © crown copyright

Note: Data have been rounded but change based on actual data

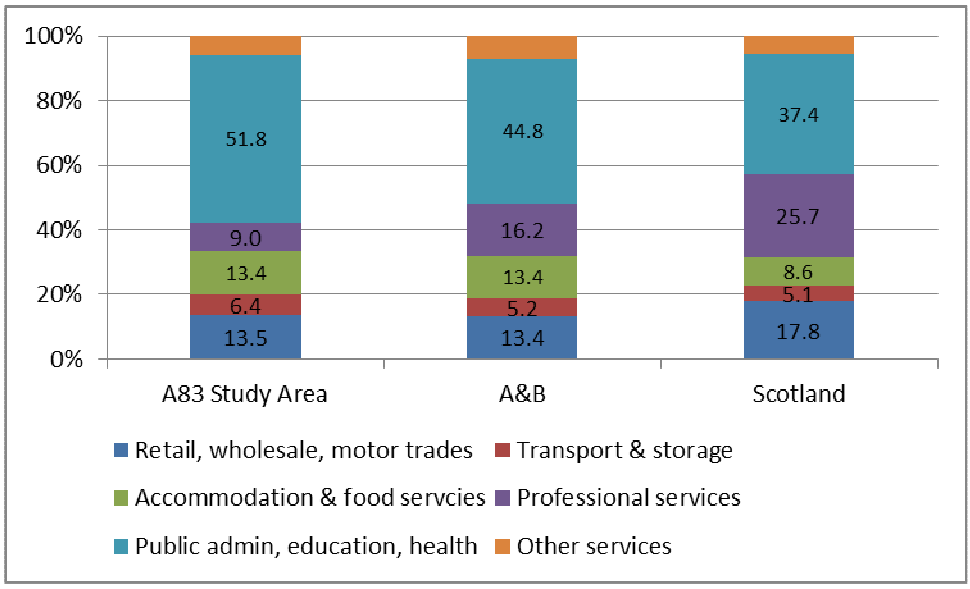
2.2.8 Employment in the A83 study area and Scotland is dominated by the service sector. The service sector accounts for over 84% and 82% of employment in the A83 study area and Scotland respectively. However, there are important differences in the structure of service sector employment in the A83 study area relative to both Argyll and Bute and Scotland. The distribution of service sector employment by industry is shown in Figure 2.4.

[5] Source is Annual Business Survey, but excludes part of agriculture, finance and the public sector

2.2.9 The main points to note from Figure 2.4 are:

- the majority of employment in the A83 study area is in public administration, education and health (almost 52%) compared to only 45% and 37% in Argyll and Bute and Scotland respectively;
- the importance of the tourism industry is reflected in the relatively high proportion of employment in accommodation and food services activities in both the A83 study area and Argyll and Bute; and
- the A83 study area has a very low proportion of employment in professional services.

Figure 2.4: Distribution of Service Sector Employment by Industry, 2011, %



Source: Business Register and Employment Survey, Crown Copyright

2.2.10 Location Quotients (LQs) can be used to highlight concentrations of employment by industry and whether employment in an area is over or under represented in a particular industry relative to the national economy. A LQ of one indicates that the area has the same proportion of employment concentrated in an activity as the average across Scotland as a whole. A LQ of more than one indicates that the area is over represented in that industry while an area is under represented in an industry is indicated by a LQ of less than one.

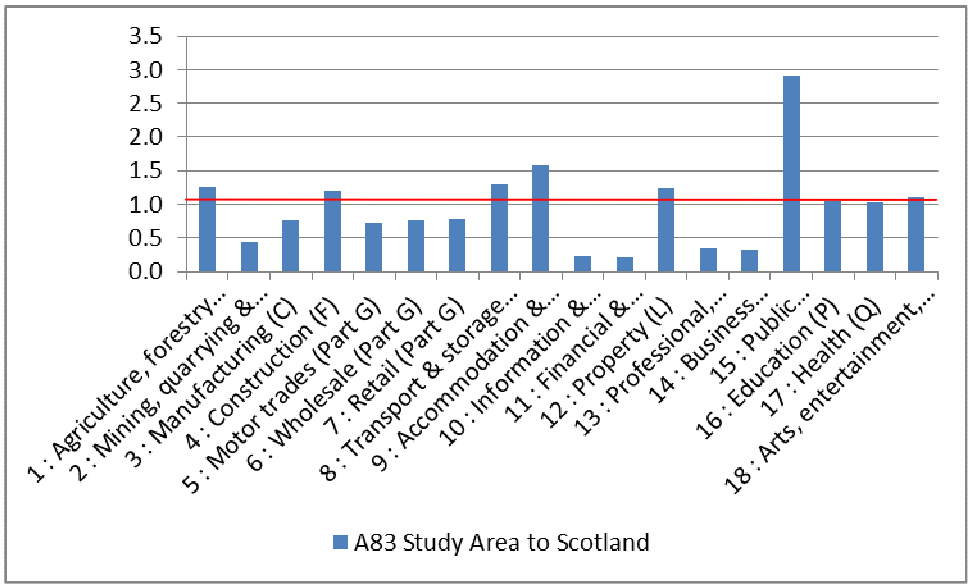
2.2.11 Figure 2.5 shows the LQs for the A83 study area relative to Scotland by industry. The following industries are important to the A83 study area:

- public administration with a LQ of 2.9;
- accommodation and food services with a LQ of 1.6;
- transport and storage with a LQ of 1.3; and
- agriculture, forestry and fishing with a LQ of 1.3.

Key Industries

2.2.12 Almost all employment in the agriculture, forestry and fishing sector is in forestry and fishing/aquaculture. Forestry is a particularly important industry in the A83 study area with Argyll and Bute production some 1 million metres^3 per annum which is approximately one sixth of Scottish production. Production in Argyll and Bute is likely to rise to 1.5 to 2 million metres^3 over the next ten to 20 years as forest blocks mature and are harvested. Most of the trees grown for timber, pulp, board and pallets are processed outside Argyll and Bute reflecting the difficult geography of the area and the recent trend for large scale timber processing plants to be situated close to the main markets.

Figure 2.5: Location Quotients for A83 Study Area relative to Scotland, 2011



Source: Business Register and Employment Survey, Crown Copyright

2.2.13 The forestry industry therefore gives rise to a need for the transport of timber out of the area. Although there is relatively little manufacturing, almost all goods landed/produced and consumed in the area have to be brought into/taken out of the area with road being the main mode of transport (see also food and drink below). Hence, the transport sector plays a key role in the economy both in generating jobs and facilitating other types of economic activity. In recent years the key issue facing this sector is increased costs, particularly related to fuel.

2.2.14 The accommodation and food services sector accounts for over 11% of employment in the A83 study area compared to 7% of employment in Scotland. This sector forms an important part of the tourism economy and reflects the importance of tourism to the study area. Key destinations include Inveraray and wider Loch Fyne, Kintyre, Portavadie Marina, Drimsynie Resort and the islands of Islay and Jura. Significant investments have been made in the tourist infrastructure in recent times, and road equivalent tariff (RET) fares have been introduced by Transport Scotland on the ferry routes to Islay/Jura and Gigha, in part to encourage tourist visits to these islands. The A83 study area is part of the Argyll, Loch Lomond, Stirling and Forth Valley tourist area which in 2011 had 1.747 million visitors who spent £363 million[6]. Between 2009 and 2011, visitors to this tourist area were down 6.1% and expenditure was down 16% (in real terms) compared to growth in visitors of 4.7% and growth in expenditure of 4% (in real terms) across Scotland as a whole.

2.2.15 Data are not available for the A83 study area or Argyll and Bute in terms of visitor numbers and expenditure, but survey evidence and visitor attraction data show the following:

- 44% of visitors[7] to Argyll and the Isles are visiting as part of a wider visit to Scotland e.g. touring Scotland;
- 11% of visitors to Argyll and the Isles make no bookings before travelling[7]; and
- visitor attractions in Argyll and Bute recorded a reduction in visitors of over 7% between January and August 2010 and January and August 2011[8]. This compares to an increase at attractions across Scotland of 2.6%.

2.2.16 Hence, the tourism sector in the A83 study area is important, but the performance of the wider tourist area of which the A83 study area is a part has been weak in recent years compared to Scotland as a whole. Tourists have a choice of destinations and competition between destinations is considerable.

2.2.17 The food and drink sector has an important presence in the area. In particular, whisky production is significant, with numerous distilleries on Islay and Jura and in Campbeltown. It is heavily reliant on road connections; most, if not all, of this commercial traffic uses the A83 to access the Scottish Central Belt.

2.2.18 Also noteworthy are developments in the energy sector. The Wind Towers Ltd plant at Machrihanish currently has around 100 employees and has wider strategic significance in the supply chain for wind turbine towers. It is hoped that the development of offshore wind sites west of Kintyre and Islay will see a significant increase in energy sector activity in the area in future years, including increased activity at Machrihanish.

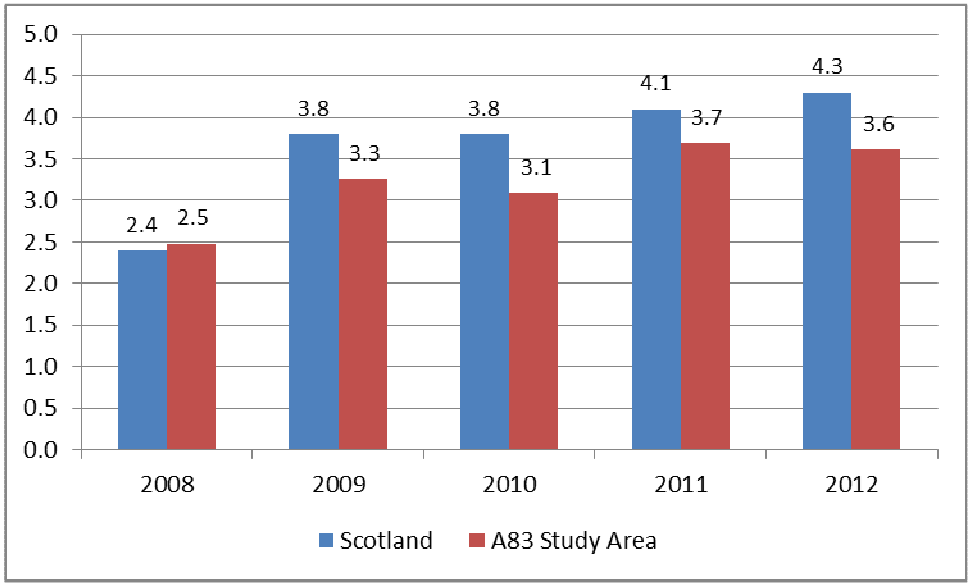
2.2.19 A general point which is relevant across sectors is that part of the rationale behind the designation of the A83 as a trunk road is the link it provides to ferry services, in particular the ferry connection to Islay, which connects, in turn, to Jura. Latest available figures9 show that crossings by both commercial vehicles and buses (10,900) and cars (56,000) are at historically high levels

[6] Tourism in Western Scotland 2009 and 2011, VisitScotland
[7] Scotland Visitor Survey 2011: Regional Results – Argyll and the Isles, VisitScotland
[8] Scottish Visitor Attraction Barometer Report, August 2010/11, Moffat Centre
[9] Source: Scottish Transport Statistics 2012, table 9.15 (http://www.transportscotland.gov.uk/news/Scottish-Transport-Statistics-2012)

Unemployment

2.2.20 The unemployment rate in the A83 study area in August 2012 was 3.6% compared to the Scottish rate of 4.3%. Although both the Scottish rate and A83 study area rate have both increased since 2008, the A83 rate has been below the Scottish rate since 2009. Details are shown in Figure 2.6.

Figure 2.6: Trend in Unemployment Rate, 2008 to 2012, %



Source: Claimant Count, Crown Copyright

2.3 Conclusions

2.3.1 The main conclusions to be made about the A83 study area economy are:

- It has an aging and declining population which is forecast to continue over the period to 2035;
- It has low GVA per employee suggesting that the area is not rich in "high value" activities; and
- Although, employment levels are stable, the area is over - dependent on a number of industries (including the public sector, transport and tourism) which are all facing challenging conditions.

3 Economic Issues Related to A83 Closures at Rest and Be Thankful

3.1 Introduction

3.1.1 During the study, telephone consultations were held with ten stakeholders in the local economy which covered the main sectors of the economy likely to be affected by road closures on the A83 at Rest and Be Thankful due to landslides and the use of the pre-planned diversion route via Crianlarich and Dalmally. The purpose of the consultations was to understand how the road closures on the A83 at Rest and Be Thankful due to landslides impacted on businesses and organisations. A summary of the main issues identified through the consultation process is provided below by main sector.

3.2 Forestry

3.2.1 As discussed in paragraph 2.2.13, Argyll and Bute is one of the key Scottish forestry production areas and the output of the area is forecast to grow over the next 10 to 20 years.

3.2.2 As there is no processing of forest products in Argyll and Bute, all timber production must be moved from the area. While some forest products move by sea to Ayrshire and Ireland, the majority of production moves by road to processors in the Central Belt, Ayrshire and Fort William. It is understood that approximately 40 loads per day move via the A83 and Rest and Be Thankful.

3.2.3 Depending on origin/destination of timber, most hauliers expect to make two return trips per day from Argyll and Bute. When the A83 at Rest and Be Thankful is closed, the time taken to travel the pre-planned diversion route prevents two return trips being made. This adds to the costs of the business and its ability to make deliveries as scheduled.

3.2.4 The effect of “missed” deliveries is felt further down the processing chain with sawmills/other processors often depending on a continuous supply of timber. This “unreliability” of supply could result in a longer term effect on future sales from the A83 area as sawmills/other processors source some timber from other areas to ensure that they have continuity of supply.

3.3 Transport

3.3.1 The issue of being able to make two return trips per day from the area also applies to other hauliers delivering some non-timber products with effects on costs and scheduling of deliveries. However, there can be additional pressure on hauliers delivering specific products to certain destinations (e.g. ports, supermarkets etc) where the haulier is given a specific delivery slot and the goods will not be accepted after this time. This again adds to costs and schedule planning.

3.3.2 Closure of the A83 at Rest and Be Thankful due to landslides also affects the provision of public transport. Public bus services between Glasgow and Campbeltown are affected by the use of the diversion route and require the operators to implement an alternative timetable. The normal timetable is organised to connect with the maximum number of ferries to/from Kennacraig, but the diversion timetable does not allow this.

3.3.3 Closure of the road and the use of the diversion adds to operating costs and the time taken for the journey – an additional 45 minutes. The additional time takes the driver to his legal limit (in driving hours) and the need for a 45 minute break. Rather than add 1.5 hours to the travel time of a single journey, the operator sends a relief driver to meet the service to ensure that the original driver can get his break and the additional time for the journey is kept to a minimum of 45 minutes. This adds to the costs of the operator.

3.3.4 It is also understood that on days when the A83 is closed at Rest and Be Thankful, passenger numbers on the public service bus route are reduced. However, it is not known whether these trips are not made at all or they are simply displaced to another time when the road is not closed. It is likely that some trips are "lost" and some are displaced.

3.3.5 During the consultations, some hauliers and transport operators provided information on the additional costs associated with using the diversion route which is used in Section 4 to quantify the additional costs associated with Rest and Be Thankful road closures and the use of the pre-planned diversion.

3.3.6 Some consultees also expressed concern about the use of the Old Military Road as a new diversion route and the need to operate this route in convoy. The convoy system means that the average length of time taken to travel the diversion route will depend on the time at which the vehicle arrives at the convoy. For vehicles arriving and being able to join the convoy without stopping the average journey time from Tarbet to Inverary would be approximately 35 minutes which, compared to the current diversion route, would be a saving of 25 miles and approximately 30 minutes. However, should the vehicle be the first on to arrive after the convoy has left, the journey time from Tarbet to Inveraray would be the same[10] as using the current pre-planned diversion route. In this situation, the only advantage of the Old Military Road is the reduction in costs from not having an additional 25 miles. However, the "unpredictable" time take to travel on the route was a major concern.

3.4 Tourism

3.4.1 Paragraphs 2,215 to 2.2.17 provided an overview of tourism in Argyll and Bute which showed that the area as a whole is not performing well when compared to tourism in Scotland as a whole.

3.4.2 The consultations highlighted the concern of businesses in the tourism sector that tourist trips are being lost as closure of the A83 at the Rest and Be Thankful and the use of the pre-planned diversion makes it more difficult to access the region. This will include people who are touring Scotland and intend to visit the area but decide, due to the closure, to visit another part of Scotland. While there may be no effect on tourism numbers in Scotland as a whole, there is an adverse effect on the local A83 area.

3.4.3 The A83 is the main route to the ferry port at Kennacraig for the ferries to Islay and Jura. Closure of the A83 at Rest and Be Thankful and the diversion route can cause difficulties for cars en-route to the ferry terminal. The capacity on the route is such that during the summer, if a car fails to make its pre-booked ferry slot, it might not be able to simply get the next ferry. This adds to costs and inconvenience for the visitor and may not encourage return visits to the area.

[10] Information from TranServe. Note there may be a couple of minutes saving if the journey is undertaken in December rather than April

3.4.4 Coach tours are planned with specific itineraries, distances and travel times to meet the needs of the driver and passengers. The A83 diversion route can pose problems for this part of the market in terms of meeting the itineraries and if the problem persists, there is a concern that tours will be put off travelling to the A83 area.

3.4.5 The cruise market is also an important part of the Scottish tourism sector. Many of the passengers arriving at Scottish ports take organised trips to nearby attractions. Passengers arriving at Greenock often visit Inverary but this is only possible when the A83 at Rest and Be Thankful is open as the additional time taken to travel the diversion route would be prohibitive. Given that there is a time constraint for these passengers on their trips, closure of the A83 and the diversion route would result in these trips visiting another part of Scotland and being lost to the A83 economy.

3.4.6 Tourism businesses in the area also expressed concern about the longer term effect of the A83 road closures and the diversion route on perceptions of the area. There is concern that the A83 study area economy will be perceived as being difficult to access or not having reliable access and that tourist trips will be lost as a result. The A83 study area is competing with other areas in Scotland that have better, more reliable access such that if people perceive that the A83 area is difficult to access, there could be a long term adverse effect on visitor numbers.

3.4.7 Tourism organisations suggested that their member businesses have experienced a reduction in turnover of between 20% and 36% per day when the A83 is closed at Rest and Be Thankful and the diversion route is in operation. This information is used in Section 4 to quantify the lost expenditure associates with Rest and Be Thankful road closures and the use of the pre-planned diversion.

3.5 Public Sector

3.5.1 Argyll and Bute covers a large area and there is often a need for public sector employees to move between offices. When the pre-planned diversion route is operational, the diversion adds to costs and the time taken for public sector employees to move between locations/ attend meetings etc.

3.5.2 The provision of emergency services in the A83 study area is also affected by closure of the A83 at Rest and Be Thankful and the use of the pre-planned diversion. Fire cover in the area is provided through a combination of full-time, retained and volunteer stations with the majority of stations being in the volunteer category. This means that there can be a need to provide additional resources from other stations in the event of an incident which incurs additional time and costs if the diversion route has to be used. The additional amount of time taken to get to the incident can have consequences regarding the severity of the incident.

3.5.3 Using the diversion route results in logistical problems for the fire and rescue service, but it also reduces the resilience of fire cover in the areas which have sent vehicles/resources onto the diversion route.

3.6 Other Potential Effects

3.6.1 Closure of the A83 at Rest and Be Thankful and the diversion route give the impression that the A83 study area is difficult to access and access is not reliable. Given the declining population of the area, there is a need to attract population, but perception problems surrounding access will make this more difficult, particularly given the links between the A83 study area and Glasgow for access to certain services e.g. hospitals.

3.6.2 There has also been substantial investment in the parts of the A83 study area in recent years (e.g. the wind turbine manufacturing site at Machrihanish and the Machrihanish Dunes golf and hotel complex) and it is important that further investment is not hampered by perceptions that the A83 is not a guaranteed link into the area.

3.7 Conclusions

3.7.1 The closure of the A83 at Rest and Be Thankful due to landslides and the use of the pre-planned diversion route raises a number of issues for businesses and organisations in the A83 study area. For most businesses the pre-planned diversion adds to costs and the time it takes to travel the route. However, for some businesses (e.g. hauliers, particularly in the forestry sector) the additional time taken on the diversion route prevents deliveries being made as scheduled as drivers are unable to make to return trips from the area.

3.7.2 Tourism businesses have experiences a reduction in turnover while the road is closed, but there is also a wider concern that people's perceptions that the A83 area is difficult to access or that access is not reliable will have a longer terms effect on visitor numbers.

3.7.3 Perceptions could also affect the ability of the area to attract inward investment if it is perceived that the A83 is not a guaranteed route into the area.

4 Economic Impact of A83 Closures at Rest and Be Thankful and Use of Pre-Planned Diversion Route

4.1 Introduction

4.1.1 This section uses the information collected during the consultations to quantify the additional costs to the transport and tourism sectors of the A83 study area from closure of the A83 at Rest and Be Thankful due to landslides and the use of the diversion route. These estimates should be considered as "minimum" additional costs, as many of the potential impacts identified in Section 3 have not been capable of quantification at this point in time, particularly long term effects on the tourism sector as a result of perceptions.

4.2 Methodology

4.2.1 The economic impact assessment has been undertaken for three (low, central and high) scenarios which consider different lengths of road closure. The central scenario should be considered the "best estimate" with the low and high scenarios provided to show the sensitivity of the results to different lengths of road closure.

4.2.2 There is some anecdotal evidence of wider impacts, including tourist businesses reporting a loss of business in the days following a closure, but it has not been possible to establish this. Data on traffic flows provide a possible indication of this for the long closure in 2007, i.e. flows did not immediately recover, but since then, closures show a reasonably quick bounce back subsequent to reopening (typically within 6-12 hours).

4.2.3 The scenarios are defined as follows:

- Low scenario: this is based on the average annual duration of road closures since 2009 which is 2.5 days;
- Central scenario: this is based on the average annual duration of road closures since 2007 which is 5.5 days. This calculation assumes that the eleven overnight closures which occurred between 3rd and 13th December 2011 are treated as eleven half day closures; and
- High scenario: this is based on the number of days the road has been closed over the last 12 months which is 13 days.

4.2.4 The basic approach to the assessment was:

- calculate the additional costs that are incurred per day from closure of the road and use of the pre-planned diversion by sector;
- gross up the daily costs to reflect the central scenario which assumes that on average the road is closed for 5½ days a year;
- convert the costs into 2010 prices.
- assume that the additional costs would result in reduced income to the study area and calculate the number of jobs that could be supported by the reduced income using GVA per employee.

- test the sensitivity of the results to the assumptions regarding length of closure through two sensitivity tests – low and high:

  low – the average duration of road closures since 2009 which is 2.5 days;

  high – the number of days the road has been closed over the last 12 months due to landslides which is 13 days

Transport

4.2.5 During the consultations with the transport sector, data were provided on the additional costs incurred per day when the A83 is closed at Rest and Be Thankful dues to landslides and the pre-planned diversion is in use. These costs were converted into an additional cost per vehicle and applied to the number of HGV and light goods vehicles travelling on the A83 using the data by vehicle type from the automated traffic counter for the site to the west of Arrochar[11]. This provides a total additional cost per day for the haulage sector of using the pre-planned diversion route.

4.2.6 Information was also received from the operator of the public bus service which operates the Glasgow to Campbeltown service on the additional cost per day of using the diversion route. Combing the additional costs for the haulage and public transport operator yields the total additional cost per day of using the diversion route.

4.2.7 For each scenario, this cost per day is grossed up by the number of days for which the road is closed. It is assumed that these costs reduced profits and therefore represent a direct reduction in GVA in the A83 study area. Using GVA per employee in the transport sector, the number of jobs that would be supported by this lost GVA is calculated.

Tourism

4.2.8 During the consultations with business and tourism organisations, data were provided on the reduction in turnover of tourism businesses per day when the A83 is closed at Rest and Be Thankful due to landslides and the pre-planned diversion is in use. To estimate the effect on the tourism[12] sector as a whole, the turnover and GVA[13] of the sector in Argyll and Bute was estimated. The A83 study area's share of turnover and GVA in the sector was estimated on the basis of its share of employment in the sector[14].

4.2.9 Having estimated the turnover of the tourism sector in the A83 study area, turnover per day was calculated. The percentage reduction in turnover experienced by the consultees[15] was applied to this figure to generate an estimate of lost turnover per day. GVA in the tourism sector in the A83 study area was 43% of turnover, such that 43% of the reduction in turnover would represent reduced GVA in the study area economy. This provides an estimate of the lost GVA per day in the tourism sector when the A83 is closed at Rest and Be Thankful and the pre-planned diversion route is in operation.

4.2.10 For each scenario, this lost GVA per day is grossed up by the number of days for which the road is closed. Using GVA per employee in the tourism sector, the number of jobs that would be supported by this lost GVA is calculated.

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[11] JTC08338 – five day average, averaged over 2011

[12] The Scottish Government definition of sustainable tourism was used which, in addition to accommodation and food services, includes activities related to museums and other cultural facilities and other recreational/sporting activities.

[13] Scottish Annual Business Statistics 2010, Scottish Government, August 2011

[14] Based on Business Register and Employment Survey

[15] A reduction in turnover of 30% was assumed

4.3 Economic Impact Results

4.3.1 The additional annual cost to the A83 economy from landslides at Rest and Be Thankful is estimated to be £286,300 (in 2010 prices) under the central scenario. If these additional costs are assumed to be a direct loss of income to the local area, the number of jobs which would be supported by this "lost" income is calculated using GVA per employee. Under the central scenario, the lost income would support almost 12 jobs in the A83 study area. Details are shown in Table 4.1.

4.3.2 The sensitivity analysis shows that the additional annual costs to the A83 economy from landslides at the Rest and Be Thankful are in the range £130,200 to £676,800. Assuming these costs represent a direct loss of income to the local area, the number of jobs which would be supported by this "lost" income is in the range 5 to 28.

4.3.3 GVA and employment impacts are also shown separately for transport and tourism. It can be seen that the GVA impact is practically the same for each but that the employment impact is higher in the more labour-intensive tourism sector.

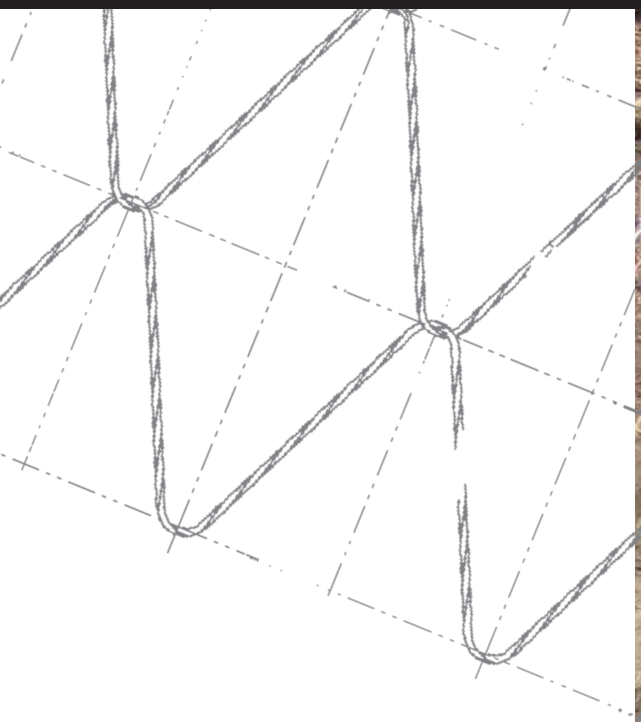
Table 4.1: Estimates of Lost GVA and Employment in A83 Study Area as a Result of A83 Closure due to Landslide and the Operation of the Pre-Planned Diversion Route

	GVA (£000s, 2010 prices)	Employment
Overall		
Low	130.2	5.4
Central	286.3	11.9
High	676.8	28.2
Transport		
Low	65.0	1.6
Central	143.0	3.6
High	337.9	8.5
Tourism		
Low	65.2	3.8
Central	143.4	8.4
High	338.9	19.8

Source: Optimal Economics. (Figures may not sum exactly due to rounding.)

Appendix G Debris Flow Barrier Product Literature

Flexible shallow landslide barriers: Cost-effective protection against natural hazards.



On unstable slopes, flexible shallow landslide barriers provide protection against landslips:

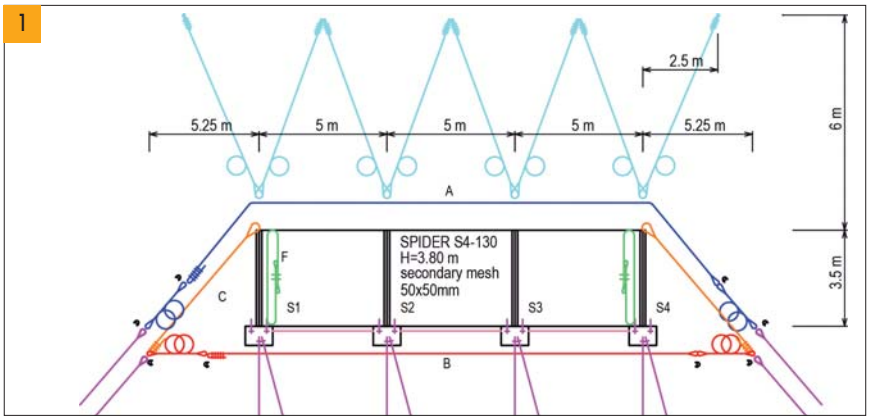
- **lightweight construction cuts costs**
- **easy installation**
- **can also withstand multiple impacts**
- **effectiveness proven in large-scale field tests**
- **dimensionable using FARO simulation software**

Flexible shallow landslide barriers.

1. Shallow landslide barrier SL 130/ 150 for pressure up to 150 kN/m²

A SPIDER® spiral rope net together with a secondary mesh with a mesh width of 50 mm is installed in the danger zone, with posts installed up to eight meters apart. The retaining ropes and the upper and lower support ropes affixed to the ends of the protective structure are fitted with brake rings. This type of protective structure is suitable for use with a span width of up to 30 m without support rope separation and a construction height of up to 4 m. It can withstand pressure of up to 150 kN/m².

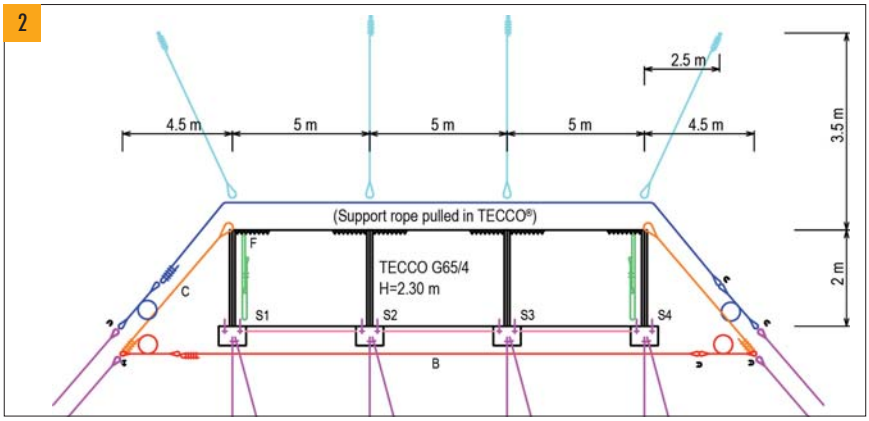
1



2. Shallow landslide barriers SL 100 for pressure up to 100 kN/m²

If the expected pressure is lower (up to 100 kN/m²), an alternative type of protective structure may be used: the installation of a TECCO® mesh G65/4 with posts spaced as far as five meters apart and a barrier height of two meters. This type of protective structure has no secondary mesh.

2



Carefully matched components function as an overall system.

SPIDER® spiral rope net

The SPIDER® spiral rope net – manufactured from a spiral rope made of high-strength 4 mm steel wires has a tensile strength of more than 1770 N/mm². The spiral rope net made with a rhomboid mesh shows a load capacity of 220 kN/m lengthwise.

The brake ring

Brake rings are incorporated in the support and retaining ropes. With major events the brake rings are activated, dissipating energies from the SPIDER® spiral rope net without damaging the ropes. The rope breaking load is not reduced by the activation of the brakes, enabling the force-path characteristic to be fully utilized.

The posts

For shallow landslide barriers we use posts of type RXI, that are mounted on a baseplate via a link. Their function is to guide the ropes to which the SPIDER® spiral rope net is suspended. The associated guides are rounded to protect these support ropes.

The spiral rope anchors

'If it can bend it won't break': The heads of our anchors are flexible and thus unsusceptible to impact. The spiral rope is made from steel wires with a strength of 1770 N/mm². Our spiral rope anchors are superior to traditional anchors – because they are also suitable for diverting forces in the direction of tension that can deviate by up to 30 degrees from the drill axis without loss of supporting capacity.

Self-drilling anchor with Geobrugg FLEX head

The FLEX head absorbs tension and bending forces according to the same principle as the head of the Geobrugg spiral rope anchor. It is unsusceptible to impact and can be mounted to self-drilling anchors available on the market. A concrete foundation is required for the transition from the anchor bar to the FLEX head.

Protective mesh apron

A protective apron is installed across the entire width of the barrier to form an erosion seal between it and the ground below and to prevent erosion and material seepage.

Application possibilities cover a wide range of areas.

Rest and be Thankful, Scotland

Problem

Following heavy rainfall, on September 8, 2009, a shallow landslide - the second in quick succession - struck the A83, a key through road in northwest Scotland, near the "Rest and be thankful" viewpoint. The area is susceptible to shallow landslides that are impossible to prevent. A suitable protective measure was needed to protect road users and ensure that the road could remain open in the event of another landslide.

Geobrugg solution

A shallow landslide barrier 80 m long and 4 m high was installed, complete with a SPIDER® spiral rope net and a secondary mesh with a mesh width of 50 mm. As a combined measure, an additional VX debris flow barrier, 15 m long and 4 m high and fitted with ROCCO ring nets, was installed in an adjacent gully to prevent material seepage from flooding beneath the road.

1

Giampilieri, Sicily, Italy

Problem

On October 1, 2009 in Giampilieri, Messina, heavy rainfall – 223 mm of rain in the space of seven hours - led to multiple shallow landslides. These sparked a debris flow event and dumped large amounts of material on the SP 33 highway, forcing its closure.

Geobrugg solution

To protect the highway, debris flow barriers were installed on the steepest part of the slope. Where the slope was less steep – approx. 60 degrees – two 3.5 meter high flexible shallow landslide barriers were installed, one 25 and one 60 meters long and both fitted with a SPIDER S4/130 spiral rope net and secondary mesh, covering a total length of 85 meters. Heavy rain in January 2010 triggered a further shallow landslide. Around 90 m^3 of material was successfully retained by the shorter of the two shallow landslide barriers, preventing the highway from having to be closed once again.

2

Lake Merwin, Washington, USA

Problem

In 2008, a wet snow storm in Amboy, Lake Merwin, Washington State, USA, triggered a shallow landslide, burying the road and damaging houses further down from the road. Loose masses of earth and unconsolidated soil on the steep slope posed a continued threat to the road and houses.

Geobrugg solution

To guard against a further shallow landslide, a 3-meter-high and 15-meter-long flexible shallow landslide barrier was installed, complete with SPIDER® S4/130 spiral rope net and secondary mesh. The barrier was dimensioned using FARO simulation software, which is calibrated using data from large-scale field tests.

3

The challenge: how can each running meter of barrier hold back 10 m^3?

It's all a matter of correct dimensioning

Our special retention aprons have to withstand a great deal. Shallow landslides generate huge forces, which we model using complex measurement and simulation methods. Data on the flow behavior and the dynamic impact of the earth masses enable flexible barriers to be constructed according to the load situation. The retention volume here is key: maintaining an optimum distance between the posts increases the amount of usable height available and provides sufficient retention space.

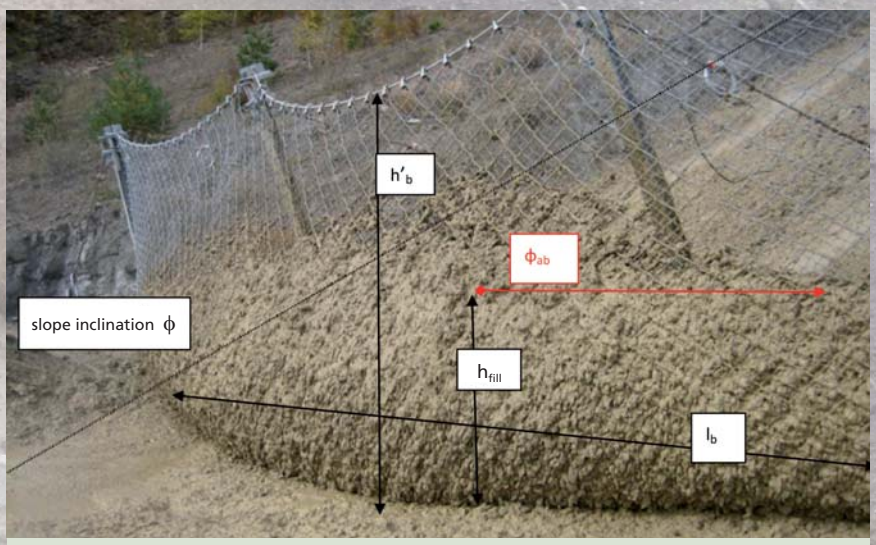
Simulating what the net has to hold back

In the numerical simulation, we calculate the forces acting on the barrier. The result is combined with the pressure on the force measurement plates in the direction of flow, which is calculated from tests. Empirical values from field tests are used to estimate this dynamic pressure. In addition, there is another, significantly smaller force component: the hydrostatic pressure caused by the flow depth. The dimensions that are relevant for dimensioning the dynamic impact are the initial density ρ of the shallow landslide and the speed v at the planned protection net. Using our FARO simulation software, we can use the pressure calculated on the test barrier in a variety of system configurations and carry out a realistic simulation in each case.

Top image: at the field tests in Veltheim, the deviation between simulation and actual measurement is only approx. 10%, thus providing useful information on the dynamic wave impact that the test shallow landslide produces.

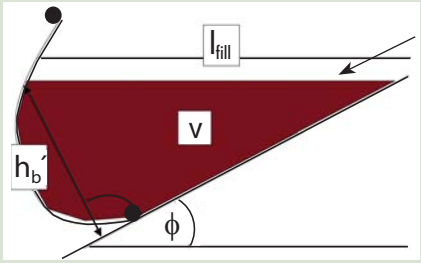
Under static and multiple load

After the first landslide, the net is filled evenly with mud, earth and rubble. Behind the barrier, a hydrostatic pressure distribution (P_{hyd}) initially builds up across the fill depth (h_{fill}). As the water drains away, this pressure is reduced to an active earth pressure (P_{stat}). If another landslide strikes, its dynamic pressure will overlap with the pressure exerted by the material still partially filling the barrier (picture-session below).



Geometric proportions of a filled shallow landslide net

l_b = impact width
ϕ_{ab} = inclination of retained material
hb, = reduced net height following impact
h_{fill} = fill depth of the shallow landslide net
l_{fill} = fill length of the shallow landslide net



Technical drawing: calculating the approximate maximum retention volume V of a shallow landslide net.

The simulation shows how the subsequent landslide pushes into the material already deposited. The load level at the barrier increases (h_{fill}+h_{fi}).

Calculating the incalculable ...

The retention volume of the protection net must be at least equal to or greater than the expected volume of landslide material, called the "breakout volume." As with snow-slides, the breakout volume is calculated from the area and force of the breakout. This latter can be determined using the hazard map or be identified on site by an engineer.

... and limiting the damage

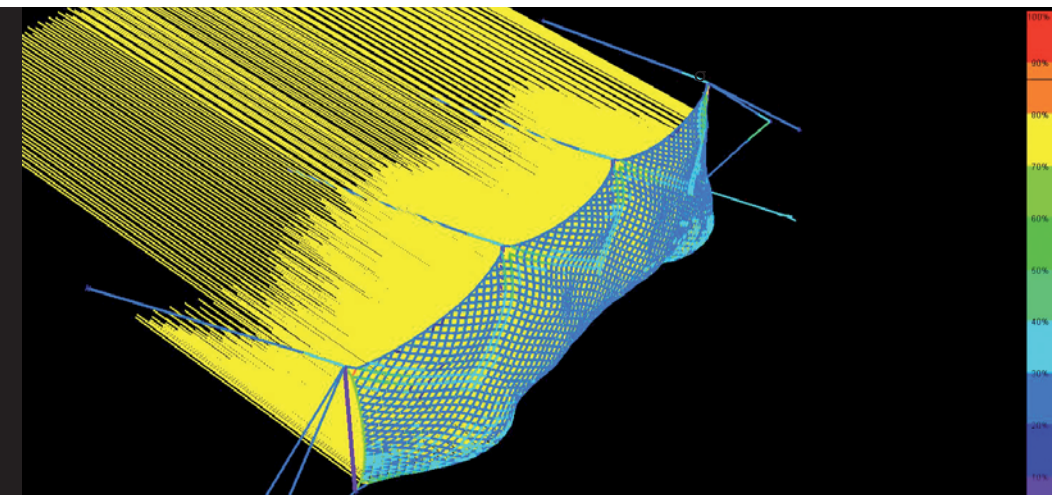
If the protection net is too small in terms of volume, or if the structure is shorter than the impact width, this restricts the potential for protection against shallow landslides. In this case, the difference between the breakout and retention volume is calculated. This difference, together with the speed at which the landslide flows around and over the net, is used to recalculate the damage and optimize the construction of the net accordingly.

Retention volume holds the key

Following the barrier filling process h_b'=3/4*h, the calculated height is compared to the installation height h. Assuming that the reduced net height following an impact h_b' is measured vertically to the slope, and ignoring the volume in the deformed bulge of the net, the retention volume V of a shallow landslide net is

$$V = \frac{1}{2} \cdot h_b' \cdot l_{fill} \cdot l_b = \frac{1}{2} \cdot \frac{3}{4} h_b \cdot \frac{3}{4} \frac{h_b}{\sin\varphi} \cdot l_b$$

$$= \frac{9}{32 \cdot \sin\varphi} \cdot h_b^2 \cdot l_b \quad [m^3]$$



Long service life and ease of maintenance: two decisive aspects.

Durability...

Flexible shallow landslide barriers are built on steep slopes where shallow landslides can form, to hold back large amounts of soil, wet clods of earth and water. Because neither water nor rubble flows over or through the barrier in this "standby phase", they are basically just as durable as rockfall and avalanche protection measures.

...thanks to outstanding protection against corrosion.

With a view to a long life and resistance to local corrosivity, all our steel components are hot-dip galvanized. The ropes and nets are treated with the GEOBRUGG SUPERCOATING® zinc/aluminum coating.

After an event...

Barriers that have retained shallow landslides must be inspected, emptied and maintained (image 1) in order to restore the retention volume (image 2). Here the emphasis must be placed on the evacuation and dumping of the material as this represents the principal outlay in time and cost. Experience shows that any dismantling and reconstruction work on the barrier is of much less significance.

...emptying and maintaining.

The easiest way is emptying the barrier from behind if accessible. More frequently the emptying happens from the front, as the deposit cone, compressed during the impact, is very stable. Nevertheless, the material can be excavated also from the front without dismantling the barrier (image above).

The main replacement parts are the brake rings: After events they must be inspected and changed where necessary. We also recommend that nets and ropes are inspected for serviceability.

1

2

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CASE HISTORY

Ref: SL/CH/SL/RF047 — Rev:01, Feb 12

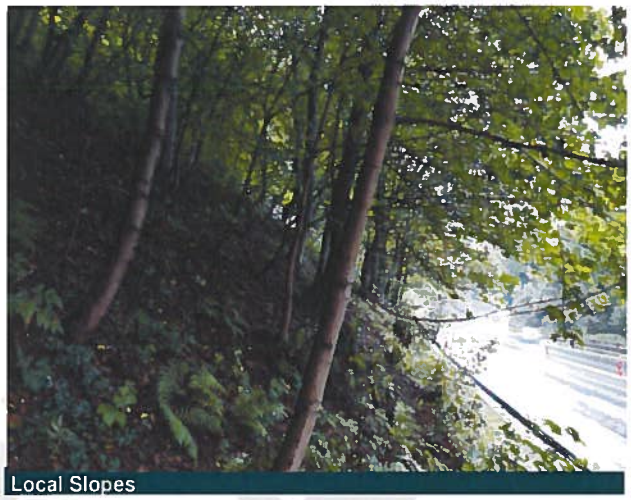
INFRASTRUCTURE PROTECTION

HRAD STREČNO, SLOVAK REPUBLIC

DEBRIS FLOW PROTECTION

Product: DF Series Debris Flow Fence

Highway



Local Slopes

Problem

The I/18 highway is one of the only routes through the Carpathian Mountains in eastern Slovakia.

In the region of Strečno - Dubná Skala near the river Váh and Hrad (castle) Stečno the single carriageway road is precariously positioned between the river and cliffs and steep beech forest slopes. Inevitably the road is regularly affected - and sometimes - closed by rockfalls and debris flows.

Solution

The client required urgent protection for approximately 400m of road following a fatal incident in 2007. The majority of areas required rockfall protection for which they chose CTR 04/07/B dynamic rockfall fences.

In one specific area the road was regularly affected by debris flows that travelled down pre-exisiting drainage channels. To solve this problem Maccaferri supplied a single field DF series debris flow fence. The fence was designed to intercept material within the channel and any material overtopping the channel sides.

Post Installation

Client:

SLOVENSKÁ SPRÁVA CIEST

Main contractor:

DOPRASTAV a.s

Designer:

BASLER & HOFMANN SLOVAKIA s.r.o

Products used:

TYPE 2 DF SERIES FENCE, CTR 05/07/B FENCES

Date of construction

AUTUMN/SUMMER 2008

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Bureau Veritas Certified Quality System Company with SINCERT and UKAS accreditation.

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CASE HISTORY

Ref: IT/CH/IT/RF048 — Rev:01, Feb 12

INFRASTRUCTURE PROTECTION

BROLO, SICILIA

DEBRIS FLOW PROTECTION

Product: DF Series Debris Flow Fence, Rockall Protection Mesh

Problem

The village of Brolo was one of many severely affected by heavy rains and serious flooding in autumn of 2009 in the Messina District of Sicily.

The flooding caused damage but also resulted many mud flows and debris slides that caused swathes of damage and many fatalities throughout the region.

Solution

Many areas required extensive civil engineering works during the rebuild process. Included amongst those was an important local road near the village of Brolo.

Here a steep hill above the road had brought numerous minor debris flows onto the road so the decision was taken to cover the slope with rockfall mesh to prevent minor failures from become bouncing rock falls. Secondarily, it was decided to use flexible debris flow fences to prevent future flows from reaching and affecting the road (and residential properties below the road).

Maccaferri worked closely with the designer to provide the required Type 3 DF Series fences. During heavy rains in Autumn 2010 the site suffered a catastrophic slope failure manifested as a debris flow.

Despite being far in excess of the design volume and parameters of the predicted flow the DF Series fence held the material with no component failures and prevented any injuries from being sustained below the failure.

Fence - Post Impact

Post Impact Condition

Client:

LOCAL GOVERNMENT

Main contractor:

SPECIALIST SUB CONTRACTOR

Designer:

CONSULTANT DESIGNER

Products used:

TYPE 3 DF SERIES BARRIER, ROCKFALL MESH

Date of construction

SPRING 2010

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CASE HISTORY

Ref: USA056, Issue Date: 10.01.2009

CALIFORNIA HWY 1 - DEBRIS FLOW BARRIERS

BIG SUR, CALIFORNIA, USA

Product: Maccaferri Debris Flow Barrier

Introduction

Maccaferri Debris Flow Barriers were installed at four sites upslope of HWY 1 in Big Sur, CA in order to mitigate potential debris flow activity following extensive wildfires. This project was designed by the client, California Department of Transportation (Caltrans), and was installed by AIS Construction.

Problem

Wildfires in the Summer of 2008 within the Big Sur, CA region resulted in the loss of vegetation and heat damage to the soil. As a result, these hillslopes are more prone to debris flows and mudslides until vegetation is re-established. Many of these hillslopes have steep gradients and can potentially transport significant volumes of soil and debris downslope to CA HWY 1. This may result in flooding from blocked drainage structures, safety issues to travelers, damage to structures, and/or potential road closures.

Solution

Caltrans identified debris flow barriers as a feasible solution to mitigate the potential issues that may result from a debris flow or mudslide incident. Maccaferri debris flow barriers were selected for installation at four separate sites above California HWY 1 in order to mitigate the potential debris flows. These structures were installed at the base of some of the drainage basins susceptible to debris flows approximately 20 to 60 feet upslope of HWY 1. The barriers were designed to be in place for five years or until vegetation is re-established and subsequent debris flow hazards are reduced.

Big Sur Coast

Canyon After Burn

Installed Debris Flow Barrier (drainage culvert in front of barrier)

Client:
California Department of Transportation (Caltrans)

Main contractor:
AIS Construction

Designer:
Caltrans

Products used:
Maccaferri Debris Flow Barriers

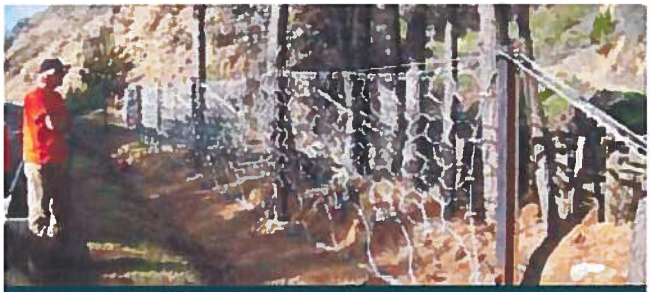
Date of construction:
Fall, 2008

MACCAFERRI

Completed Debris Flow Barrier

Description of Debris Flow Barriers

The four barriers ranged in dimension from 120 feet in length and 16 feet in height. The Maccaferri debris flow barrier is similar to the rockfall barrier, but has several differences, such as additional breaking elements and variable geometries. In addition, a combination of one foot and three foot diameter ring nets were used. The larger diameter ring nets were placed along the bottom of the structure in order to allow the small material and water to flow through. The barriers were designed to be in place until vegetation is re-established. They can then be removed leaving the foundation intact. They can be reinstalled if risks from debris flows increase in the future.



Debris Flow Barrier

Construction

California water quality regulations required that all point sources of sediment must be mitigated by October 15, 2008, the start of the rainfall season. This project was "emergency work" and was successfully supplied by Maccaferri and installed by AIS Construction within the limited timeframe and met the goal of the project.

Debris Flow Barrier (looking upstream)

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PR, Caguas
TN, Chattanooga
TX, Lewisville

MACCAFERRI

TECHNICAL DATA SHEET
Rev. 08, Date 17.10.2011

MAC.RO. SYSTEM - DEBRIS FLOW BARRIER

BARRIERS AGAINST DETRITAL FLOW

Series DF Barriers are finalized to stop mud-water masses (debris flow) or soil masses (landslide) sliding down from slopes and channels.

Standards:
UNI EN 10025 "Hot rolled products of structural steels — Part 2: Technical delivery conditions for non-alloy structural steels";
UNI EN ISO 1461 "Hot dip galvanized coatings on fabricated iron and steel articles — Specifications and test";
EN 12385-4 "Steel wire ropes Safety Part 4: Stranded ropes for general lifting applications";
UNI EN 10244-2 "Steel wire and wire products — Non ferrous metallic coatings on steel wire — Zinc or zinc-alloy coatings";
UNI EN 10264-2 "Steel wire and wire products — Steel wire for ropes - Part 2: Cold drawn non alloy steel wire for ropes for general applications".

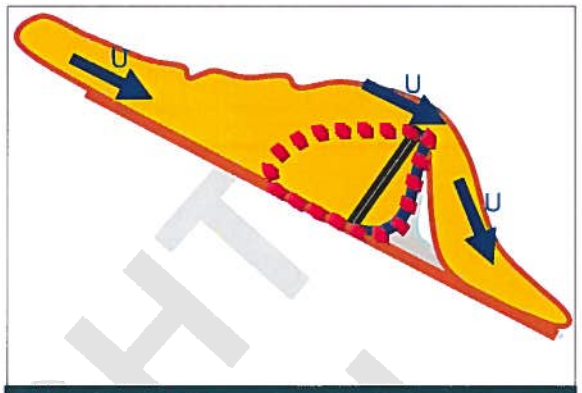

Fig.1: Analysis sketch

Technology
The components are made to reduce the damages after impact, minimizing the maintenance operations. The post are free released by the mesh and their main function is holding the upper longitudinal cable. The posts can be left out if the barrier will be install in small size channel. The upslope bracing cables are equipped with brakes to minimizing the effect of the impacts. When a post is damaged, the next one can still afford the barrier functionality. The main mesh is made by steel rings. Special panels can be installed on the barrier sides to close eventually openings whether the structure has been installed into channel. In case of request, the barrier could be send together with another DT net, used to stop the most fine materials.
The barrier meets quality certification standard UNI EN ISO 9001, at each step of design, manufacturing and marketing.

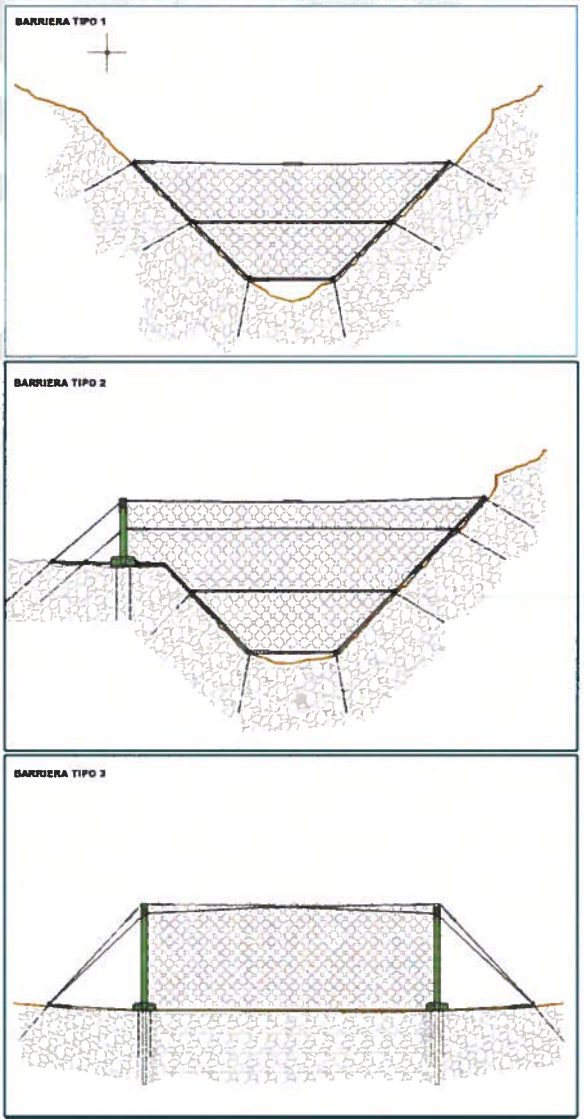

Fig.2: Types of OM CTR DF Barrier

Main barrier features
Series DF Barriers can be installed on each type of land, both on open slopes and depressions with difficult morphology. Their geometry configuration reduces both the impacting forces and consequently the entity of the foundations. The post foundations are made by steel bars or micropile.
Even if shown in the installation manual, the double twist mesh is generally useless and/or dangerous for debris flow barriers. Therefore it will be supplied upon request only. DT mesh function is contain smaller parts of the debris mass, with a global higher loading of the entire structure as consequence, caused by the regular hydraulic flows impediment. DT mesh can be request to stop smaller elements for infrastructures protection when the barrier (with posts) is installed on open slopes. Otherwise, when this type of structures (without posts) are installed into channel, far from sensitive infrastructures, the ring mesh only is suggested (in order to help the passage of water). The barrier could also be used as protection against rockfall (they are not tested in accordance to ETAG 027). The system is easy to install, with difficult conditions as well. The assemblage can be done shortly. Maintenance is necessary after impact.

Barrier Type	Suggested Height	Accessories (upon request)
Barrier OM CTR 20/04/A DF	4 ÷ 5 m	DT net
Barrier OM CTR 30/04/A DF	5 ÷ 6 m	DT net
Barrier OM CTR DF	Geometry dependents by the project	DT net
The optimum barrier length is frequently between 10 and 30m		

Design

DF barriers structure has been designed and verified to stop sliding soil masses and filtering their water contents eventually. All the elements are calculated: panel, posts, cables, foundations and accessories. The analysis carried out with the universities shown that energy and pressures acting on the barrier depend by the site morphology, granulometry and height of the debris flow.

The pressures developed by the deformable impacting mass are decomposed into their static and dynamic components. The panel equally loaded (critical condition) transmits the forces to the longitudinal cables (calculated with the "catenary" approach), posts, bracing cables and foundations.
For the design, the topography profiles, impacting volumes, its section, velocity and granulometry are needed.

The foundation design depends by the soil features end erosion effects eventually.
On site experiences and analysis proved the efficiency of these barriers. The efficiency of these barriers has been verified and validated by University of Parma.

Fig. 3. OM CTR DF Barrier

Fig. 4. OM CTR 20/04/A DF Barrier

Fig. 5: OM CTR 20/04/A DF Barrier impacted by debris flow

Fig. 6. OM CTR 20/04/A DF Barrier imparte by landslide (about 800mc)

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