

A83 Trunk Road Route Study

Part A - A83 Rest and Be Thankful

Summary



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	Originated by	Checked by	Reviewed by	Approved by
ORIGINAL (Draft)	NAME Charles Macklin	NAME Graeme Herd	NAME Stuart Turnbull	NAME Helen Bradley
DATE 07/12/2012	INITIALS <i>Chm</i>	INITIALS <i>GH</i>	INITIALS <i>ST</i>	INITIALS <i>EHB</i>
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REVISION (Final)	NAME Charles Macklin	NAME Graeme Herd	NAME Stuart Turnbull	NAME Helen Bradley
DATE 22/02/2013	INITIALS <i>Chm</i>	INITIALS <i>GH</i>	INITIALS <i>ST</i>	INITIALS <i>EHB</i>
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DATE	INITIALS	INITIALS	INITIALS	INITIALS

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SUMMARY

Jacobs was appointed by Transport Scotland to undertake a study of the A83 Trunk Road to identify and appraise potential options to minimise the effects of road closures, investigate the feasibility of removing traffic pinch points and improve pedestrian safety in villages along the route.

The Part A report examines the issues at the Rest and Be Thankful and presents the results of the transport appraisal in accordance with Scottish Transport Appraisal Guidance and Stage 1 scheme assessment in accordance with the Design Manual for Roads and Bridges.

Analysis of Problems and Opportunities

The section of the A83 between Ardgartan and the Rest and Be Thankful car park has a history of hillside instability, in particular the slopes above the Rest and Be Thankful. This has led to road closures on six separate occasions between 1 January 2007 and 31 October 2012, resulting in the road being closed for a total period of 34 days.

Following a number of landslides in 2004, Transport Scotland undertook the Scottish Road Network Landslides Study. As part of the Implementation Study a hazard assessment and ranking was undertaken for debris flow. From this assessment the A83 Ardgartan to Rest and Be Thankful is amongst the most highly ranked debris flow hazard sites in Scotland.

As part of the current hazard reduction approach, some preventative measures have already been implemented including upgrading some culverts and the installation of approximately 168m of debris flow barriers and fences. A further 90m of debris flow barrier and a large catch pit will be completed during the early part of 2013. An Emergency Diversion Route has been created along the Old Military Road to provide a short-term alternative route in the event of road closures at Rest and Be Thankful due to landslides.



Glen Croe looking towards the Rest and Be Thankful ¹.

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Consultation undertaken during this study enabled stakeholders to share their views about the issues experienced by road users. This included the wider impacts of road closures due to landslides, based on using the diversion route via the A82/A85/A819. The consultation exercise has informed the identification of the evidence-based transport problems in the study area.

A review has been undertaken on the socio-economic impact of the road closures due to landslides at the Rest and Be Thankful. The outcomes from this review provide evidence in addition to, and not in place of, the standard economic appraisal which has been undertaken.

Using evidence from this review, 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).

Transport Planning Objectives

Transport appraisal in accordance with Scottish Transport Appraisal Guidance requires five main areas of impact to be considered: Environment, Economy, Safety, Integration and Accessibility & Social Inclusion. In addition, specific Transport Planning Objectives were developed to reflect the local situation and these were set as follows:

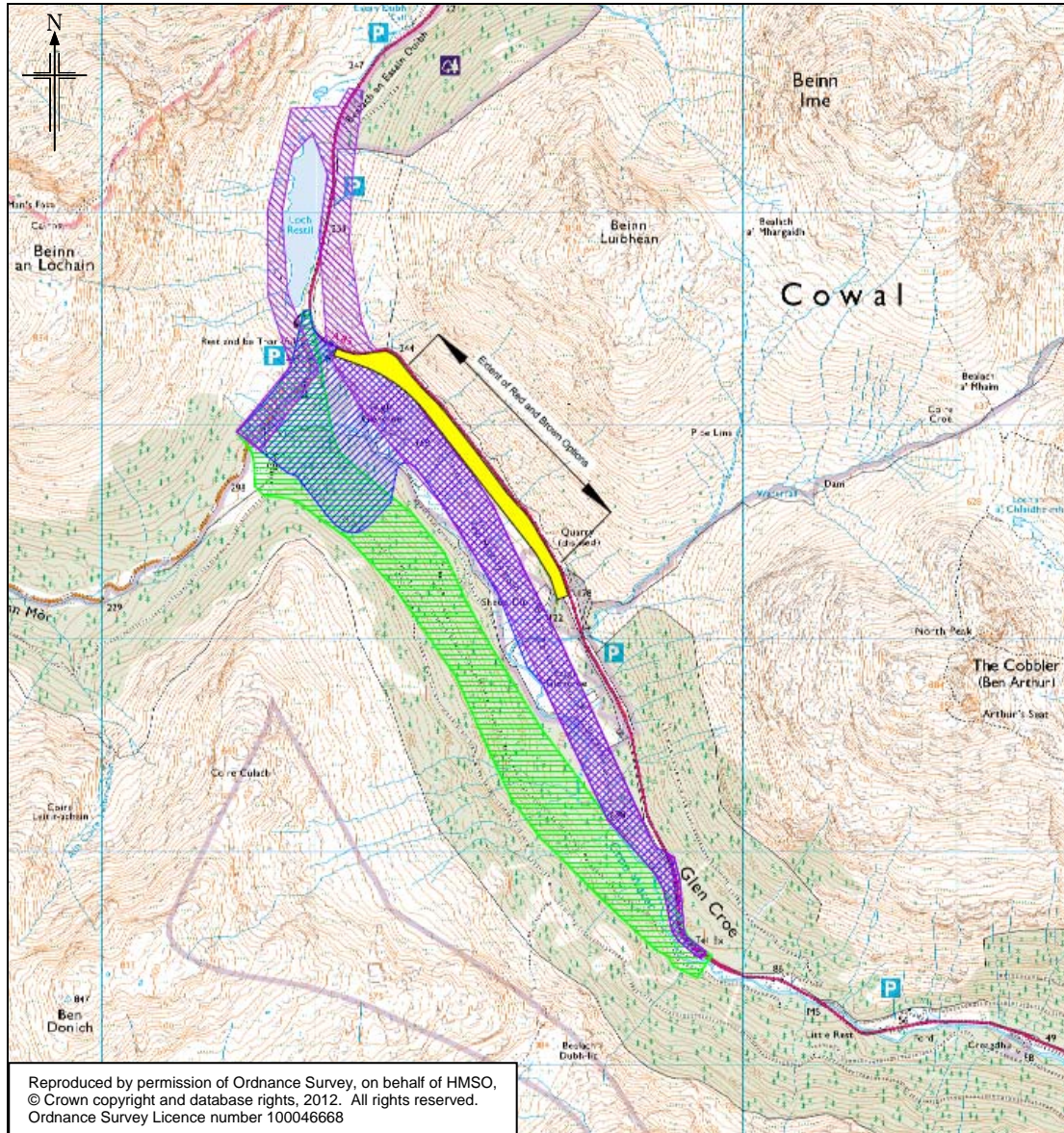
- Reduce the **impact on journey times** by reducing the frequency and duration of road closures caused by landslides, and;
- Reduce the **economic impact to the A83 study area** by reducing the frequency and duration of road closures caused by landslides.

Option Generation and Sifting

This study examined a range of potential long-term solutions in the form of alternative routes for access to the A83 study area. Route corridors remote from the Glen Croe valley were rejected at an early stage in the appraisal process since these options did not meet the transport planning objectives of the study. They resulted in increased journey times and the anticipated cost and potential environmental impacts of such routes were considered disproportionate to the identified problems on the existing A83 Rest and Be Thankful.

Six route options in the Glen Croe valley were identified for assessment. These potential options range from new route corridors within the valley, including options which incorporate a debris flow shelter or a multi-span viaduct or a tunnel or less heavily engineered hazard reduction measures on the existing A83 corridor.

The following section summarises the assessment of these six route options. It should be noted that, in principle, these options represent corridors within which variations are possible in terms of route alignment and/or structural form. For assessment purposes an appropriate outline alignment and/or structural form has been assumed which may be subject to refinement at a later stage, for any option(s) taken forward for further stages of DMRB assessment.



Glen Croe Route Corridor Options

Engineering and Environmental Assessment

The **Red Corridor Option** maintains the existing alignment of the A83 and includes a range of landslide mitigation measures such as: additional 440m of debris flow barriers at locations where the landslide hazard is considered highest; improved hillside drainage adjacent to and under the road, and; introduction of vegetation and planting on the slope. This option would significantly reduce the frequency of occurrence of landslide debris reaching the A83 Trunk Road causing a full road closure and offers the potential for implementation in phases. It is not considered to have any significant environmental effects. The cost estimate for this option is in the range £9-10 million (2012 prices, excluding VAT).

The **Brown Corridor Option** closely follows the alignment of the existing A83 and involves the construction of a debris flow shelter over a length of 1km to protect the road and road users in the event of future debris flow events. With this option the likelihood of landslide debris reaching the road, over the length of the debris flow

shelter, would be negligible. The introduction of debris flow shelters could have impacts on the local landscape and views, although the significance of these impacts would depend on the appearance and extent of the shelters. The cost estimate for this option is in the range £105 – 120 million (2012 prices, excluding VAT) and there would be significant disruption during construction, including periods of full road closures.

The **Yellow Corridor Option** provides a new 1.5km single carriageway alignment offset slightly from the existing A83. Around 1.2km of the new alignment is constructed on viaduct following a similar profile to the existing road with an average climbing gradient of 5%. The viaduct structure would be set at a sufficient level to permit debris flow events to pass below the A83 and the likelihood of road closures due to landslides, over the length of the viaduct, would be negligible. The introduction of a viaduct could have impacts on the local landscape and views, although the significance of these impacts would depend on the appearance of the viaduct and how well it is integrated with the surrounding landscape from a visual perspective. The cost estimate for this option is in the range £83 – 95 million (2012 prices, excluding VAT).

The Purple and Blue Corridor Options begin further down Glen Croe and generally run parallel to the Old Military Road until they reach the property at High Glencroe. The **Purple Corridor Option** continues northwards in tunnel and rejoins the existing A83 in the vicinity of Loch Restil. A short 600m single bore tunnel was initially considered, however the steep gradient of this design was considered unacceptable. A route alignment with a maximum gradient of 4% is considered feasible, resulting in a 1.9km long twin bore tunnel. With this option, the likelihood of road closures due to landslides is considered to be negligible. Potentially significant environmental impacts are anticipated in relation to ecology, landscape and visual intrusion. The cost estimate for this option is in the range £460 – 520 million (2012 prices, excluding VAT).

The **Blue Corridor Option** runs generally parallel to the Old Military Road and curves and climbs steeply at a maximum gradient of 8% around the top of the glen before joining the alignment of the green option which passes to the west of the Rest and Be Thankful car park and rejoining the existing road before Loch Restil. The road alignment of this option is below desirable minimum standards for a new Trunk Road and potentially significant environmental impacts are anticipated in relation to ecology, landscape and visual intrusion. With this option, the likelihood of road closures due to landslides is considered to be negligible. The cost estimate is in the range £66 – 75 million (2012 prices, excluding VAT).

The **Green Corridor Option** provides a new 4.0km single carriageway and follows the opposite side of the valley to the existing A83. While the alignment generally follows the line of existing forestry tracks, significant engineering measures would be required to form a new single carriageway road on this hillside, including measures to reduce the landslide hazard in this corridor. The cost estimate range for the Green option is £27 – 91 million (2012 prices, excluding VAT). This is a wide cost range and reflects a varying level of protection to landslides. At the low end of the cost range (£27 – 30 million), without significant landslide protection measures, the route may be as susceptible to closure due to landslides as the existing A83. The higher end of the cost range (£81 – 91 million) represents the expected cost to provide a route where the likelihood of closure due to landslides is negligible (comparable to the Brown and Yellow corridor options). This option may result in impacts on ecology and the local landscape and views, although the significance of these impacts would depend on the form and alignment of this route.

In addition to the six route options in the Glen Croe valley presented above, the study considered the landslide hazard of other sections of the A83 Trunk Road between Tarbet and Kennacraig, providing a wider context for issues at Rest and Be Thankful. There are nine other locations on the A83 with a landslide hazard ranking classification of High/Very High covering a route length of around 31km. The proposed options to address ground related hazards at Rest and Be Thankful should be accompanied by actions to address the ground related hazards to those other parts of the A83 Trunk Road, in particular at Glen Kinglas, Cairndow and Loch Shira, if the whole route length is to achieve comparable levels of risk reduction.

Appraisal Summary

The results of the engineering and environmental assessment were collated into a series of Appraisal Summary Tables which provide a mainly qualitative comparison of the potential options.

The Red Option 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.

The viaduct option (Yellow) performs better against the appraisal criteria in comparison to the debris shelter or tunnel options (Brown and Purple). The viaduct option has lower cost than both the debris shelter and tunnel options with lower environmental impact than the tunnel option and lower construction impact than the debris shelter option.

The Blue and Green corridor options have comparable estimated costs, in the range £27-91 million excluding VAT. For both of these options the residual risk of road closures due to landslides is considered to be negligible, as the options include appropriate mitigation measures in the form of engineering structures, in particular lengths of viaduct. The Green option however performs better against the safety criteria due to a more desirable route alignment and is therefore taken forward for further consideration.

As a result of this appraisal of options, the Brown, Purple and Blue options were sifted out of the appraisal and the Red, Yellow and Green options were taken forward to a more detailed economic appraisal.

Traffic and Economic Assessment

The economic appraisal has been conducted using standard economic welfare techniques, as set out in the Scottish Transport Appraisal Guidance. In this analysis the change in economic welfare can be approximated using the change in travel time and vehicle operating costs. In the case of the landslides at the Rest and Be Thankful site this change in costs is determined by the number of journeys affected, the type of journeys affected (e.g. car, bus, freight) and whether or not they use the diversion route.

The benefits of each of the options appraised will be dependent on the level of disbenefits associated with a landslide, which in turn is determined by the number of journeys affected and the proportion of trips that use the diversion route rather than travel to an alternative destination. The disbenefits associated with a landslide, calculated for the purposes of the economic appraisal, differ from those highlighted in the problems and opportunities section above, as the appraisal has taken into account the future use of the Old Military Road. The alternative analysis is a

snapshot of the estimated costs of previous landslide episodes, when the Old Military Road was not available.

The results of the analysis show that the Benefit Cost Ratio (BCR)s range from 0.04 to 0.43, with the best performing option the Red option. Under this core analysis none of the options provide a level of benefits greater than the present value of costs. The Red option results in a similar level of benefits over the appraisal period as the Yellow and Green options, for significantly less capital costs over the same period.

Performance of the Red, Yellow and Green options against the appraisal criteria are summarised in the following table:

Performance of Options Against Appraisal Criteria

Appraisal Criteria		Red Corridor Option	Yellow Corridor Option	Green Corridor Option	
Planning Objectives	Objective 1 – Reduce the impact on journey times by reducing the frequency and duration of road closures caused by landslides	Additional landslide mitigation measures would significantly reduce the frequency of landslide debris reaching the A83 Trunk Road causing a full road closure and the subsequent economic impact	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 and the subsequent economic impact	A new 4.0km alignment on the south-west side of Glen Croe 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 and the subsequent economic impact	
	Objective 2 – Reduce the economic impact to the A83 study area by reducing the frequency and duration of road closures caused by landslides				
Environment		Neutral	Minor impact Potential effect on local landscape and views	Moderate impact Potential effect on landscape and visual receptors and ecological effects (as a result of woodland loss) such as habitat loss, fragmentation and disturbance.	
Safety		Minor benefit Reduced risk of landslide debris causing road accidents	Moderate benefit Road alignment and cross section improvements as well as reduced risk of landslide debris causing road accidents	Minor benefit Road alignment and cross section improvements as well as reduced risk of landslide debris causing road accidents	
Economy	Present Value of Benefits (PVB) (£m)	2.54	2.67	2.47	2.67
	Present Value of Costs (PVC) (£m)	5.86	69.67	21.37	66.47
	Net Present Value (NPV) (£m)	-3.32	-67.00	-18.90	-63.80
	Benefit/Cost Ratio (BCR)	0.43	0.04	0.12	0.04
Integration		No impact	No impact	No impact	
Accessibility and Social Inclusion		Minor Benefit Improved accessibility due to reduction in road closures	Minor Benefit Improved accessibility due to reduction in road closures	Minor Benefit Improved accessibility due to reduction in road closures	

Conclusions

At the A83 Rest and Be Thankful, since publication of the Scottish Road Network Landslide Study (2005), appropriate physical hazard reduction measures have been introduced at locations considered to present the greatest hazard. Following the appraisal of the range of permanent options considered in this report, it is concluded that the Red Option offers the best performance against the assessment criteria.

The Red option comprises an additional 440m of debris flow barriers, representing a significant step-change in the landslide hazard reduction for the A83 Rest and Be Thankful. In addition, this option includes measures to improve the hillside drainage adjacent to and under the road. The planting of vegetation may also help contribute to this strategy though the beneficial effects of vegetation would be realised during a period around 15 to 35 years after planting. The cost of these measures is estimated to be in the range £9m-10m (excluding VAT). This represents a cost-effective way of reducing the impact on journey times and the subsequent economic impact as a result of road closures due to landslides at Rest and Be Thankful. The Emergency Diversion Route being brought into use by Transport Scotland would be required until the proposed measures had provided sufficient protection to the A83.

Actions are also recommended to address the ground related hazards at other locations on the A83 Trunk Road, in particular at Glen Kinglas, Cairndow and Loch Shira to give a comparable level of landslide protection to that proposed at the Rest and Be Thankful.