14. Noise and Vibration

14.1. Introduction

14.1.1. This chapter presents the Design Manual for Roads and Bridges (DMRB) Stage 3 Environmental Impact Assessment (EIA) noise and vibration assessment for the Proposed Scheme. The chapter includes the definition of the noise and vibration study area; identification of the existing baseline conditions; and assessment of the scoped in noise and vibration effects associated with the Proposed Scheme.

14.1.2. The Proposed Scheme is located in Glen Croe, the glen contains a small number of noise and vibration sensitive receptors, two residential properties, two footpaths and two walking, cycling and horse-riding routes.

14.1.3. Through the scoping process, as detailed within the DMRB Stage 3 Scoping Report (refer to Chapter 6: Consultation and Scoping for further details), most noise and vibration assessments have been scoped out of the EIA as they were predicted to result in effects that are not significant.

14.1.4. Traffic flow on the existing Old Military Road (OMR) is currently negligible except when it is being used as a diversion route for the A83, this occurs for approximately 40 days each year. The scoped in element of the noise assessment relates to road traffic noise from the OMR diversion route during the construction phase which is expected to last for 3-4 years.

14.2. Approach and Methods

14.2.1. The assessment of the OMR diversion route has been carried out based on guidance contained in DMRB LA 111 Noise and vibration (DMRB LA 111). The approach and methods have been informed by legislation, policy and guidance and a full list of those that are relevant to the topic are contained in Volume 4, Appendix 14.1 Noise and Vibration Legislation, Policy and Guidance.

14.2.2. The diversion route methodology presented in DMRB LA 111 is based on night-time closures of major roads which do not typically occur for extended periods.

DMRB LA 111 states that it is not proportionate to calculate changes in noise levels due to diversion routes, it adopts a qualified approach, which assumes disturbance occurs at all receptors within 25m of the diversion route.

14.2.3. The OMR diversion route will be in place, day and night, during the majority of the construction period, 3-4 years; therefore, an alternative approach has been adopted. The adopted approach is based on the DMRB LA 111 operational road traffic assessment, due to the length of time the OMR diversion route will be in place, the adopted approach is more appropriate and detailed than the standard DMRB LA 111 diversion route assessment.

14.2.4. Road traffic noise calculations have been completed using traffic data provided by the traffic engineers, the distance between the receptors and A83 and the OMR diversion route; the relative heights of the source and receiver; ground absorption (G=1); and using the HMSO Department of Transport and Welsh Office (1988) Calculation of Road Traffic Noise (CRTN) method. Detailed 3D modelling has not been completed.

Study Area

14.2.5. A standard DMRB LA 111 operational study area is adopted for the assessment of the OMR diversion route. This is the area within 600m around the Proposed Scheme extents including the OMR diversion route.

Method of Baseline Collection

14.2.6. The baseline conditions have been derived from a desk study. Near the A83, road traffic is the dominant noise source in Glen Croe, at increasing distances away from the trunk road, sounds from natural sources become more present.

14.2.7. The Annual Average Weekday Traffic (AAWT) 18-hour (06:00-00:00) traffic on the A83 has been provided by the traffic engineers. For 2024, the AAWT,18h traffic flow is 4,083, the proportion of heavy vehicles is 20% and the average speed is 37 mph. Traffic flow on the OMR is negligible except when it is being used as a diversion route, this currently occurs for approximately 40 days each year.

Consultation

14.2.8. Consultation was undertaken throughout the DMRB Stage 2 and DMRB Stage 3 process through the Environmental Steering Group (ESG) which comprised, in relation to noise, of Argyll and Bute Council and the Loch Lomond and The Trossachs National Park Authority (LLTNPA).

14.2.9. Public consultation was undertaken between 26 May and 07 July 2023 which included four days of public exhibitions in Arrochar and Lochgilphead in June 2023 and the virtual exhibition online. Further public consultation was undertaken between 18 March and 10 May 2024 both online and at public exhibitions, including Campbeltown and Lochgoilhead.

Assessment Methodology

14.2.10. Within the study area there are two residential receptors, a Site of Special Scientific Interest (SSSI), two footpaths and two walking, cycling and horse-riding routes.

14.2.11. The residential receptors are:

- Laigh Glencroe (grid reference 224422, 705554) is 35m west of the A83 and 100m east of the OMR. The A83 runs at a higher elevation than the property and the OMR runs at a lower elevation.
- High Glencroe (grid reference 223328, 706978) is 250m west of the A83 and 140m west of the OMR. Both roads run at a higher elevation than the property.

14.2.12. The SSSI receptor is:

- Beinn an Lochain SSSI. This SSSI is located near the head of Loch Fyne, the site is notified for its siliceous scree (including boulder fields), tall herb ledge and upland habitat assemblage.

14.2.13. The designated features of Beinn an Lochain SSSI are not considered sensitive in terms of noise and vibration, and therefore not considered further.

14.2.14. The footpaths and other walking, cycling and horse-riding routes are:

- Footpath to Beinn Luibhean, accessed from a small parking area approximately 460m north of Laigh Glencroe (grid reference 224270, 705994). The footpath climbs directly up and down the hill from the A83. There is also a footpath which travels eastwards from the same parking area but remains on the south bank of Croe Water.
- Footpath to Ben Donich, accessed from the local road layby 50m south-east of the B828 (grid reference 222792, 706954). The footpath climbs directly up the ridgeline to the summit.
- The OMR is used as an informal walking, cycling and horse-riding route.
- The Forest Recreation Route (Ardgartan Peninsula Circuit) is an off-road cycling route which uses a section of forest track on the lower slopes of Ben Donich. This same section of trail is also used as a footpath (Loch Lomond and The Trossachs National Park Core Path) which can be accessed from the B828 to south-west of the Rest and Be Thankful car park.

14.2.15. Based on professional judgement, the effects on footpaths and other walking, cycling and horse-riding routes are not considered to be potentially significant, this is due to their transient use, and because the extent of the impact would be small relative to the length of the routes which extend beyond the study area. These receptors are not considered further, except for the OMR informal walking, cycling and horse-riding route.

14.2.16. A83 daytime road traffic noise levels are predicted at the two sensitive receptor dwelling buildings using AAWT,18h 2024 traffic data and the distance between the road and receptor. This is the baseline scenario.

14.2.17. OMR diversion route daytime road traffic noise levels are predicted at the two sensitive receptor dwelling buildings using AAWT,18h 2024 traffic data and the distance between the road and receptor. The A83 traffic data is assumed to transfer directly onto the OMR diversion route. This is the diversion route scenario.

14.2.18. Night-time road traffic noise levels for the existing baseline and diversion route scenarios are predicted by using the Transport Research Laboratory (TRL). P G Abbott and P M Nelson 'Converting the UK traffic noise index $L_{A10,18h}$ to EU noise

indices for noise mapping' method 3 equation, the equation converts daytime noise levels ($L_{A10,18h}$) to night-time noise levels (L_{night}). This method is referenced in DMRB LA 111.

14.2.19. The difference between the diversion route scenario noise levels and the baseline scenario noise levels is the change in noise level.

14.2.20. The magnitude of change is defined in accordance with Table 3.54a of DMRB LA 111, reproduced in Table 14.1. Noise level changes can be either positive, representing an increase in noise level (adverse) or negative, representing a decrease in noise level (beneficial).

Table 14.1 – Magnitude of change

Short-term magnitude	Short-term noise change (dB $L_{A10,18h}$ or L_{night})
Major	Greater than or equal to 5.0
Moderate	3.0 to 4.9
Minor	1.0 to 2.9
Negligible	Less than 1.0

14.2.21. In line with DMRB LA 111, significance is determined based on the noise level change and consideration of the absolute noise level at each receptor. Absolute noise levels are defined in accordance with Table 3.49.1 of DMRB LA 111, reproduced in Table 14.2.

Table 14.2 – Absolute noise level bandings

Time period	LOAEL	SOAEL
Day (06:00-24:00)	55 dB $L_{A10,18h}$ facade	68 $L_{A10,18h}$ facade
Night (23:00-07:00)	40 dB L_{night} free-field	55 dB L_{night} free-field

14.2.22. The term LOAEL stands for *lowest observed adverse effect level*. DMRB LA 111 defines this as the level above which adverse effects on health and quality of life can be detected.

14.2.23. The term SOAEL stands for *significant observed adverse effect level*. DMRB LA 111 defines this as the level above which significant adverse effects on health and quality of life occur.

14.2.24. An initial assessment of likely significant effect is determined in accordance with Table 3.58 of DMRB LA 111, reproduced in Table 14.3.

Table 14.3 – Initial significance bandings

Significance	Short-term magnitude of change
Significant	Major
Significant	Moderate
Not significant	Minor
Not significant	Negligible

14.2.25. Where the short-term magnitude of change is minor, moderate or major, Table 3.60 of DMRB LA 111, reproduced in Table 14.4, is used to determine final significance.

Table 14.4 – Determining final significance

Local circumstance	Influence on significance judgement
Noise level change (is the magnitude of change close to the minor/moderate boundary?)	1) Noise level changes within 1 dB of the top of the 'minor' range can indicate that it is more appropriate to determine a likely significant effect. Noise level changes within 1 dB of the bottom of a 'moderate' range can indicate that it is more appropriate to consider a change is not a likely significant effect.
Differing magnitude of impact in the long term to magnitude of impact in the short term	1) Where the long-term impact is predicted to be greater than the short-term impact, it can be appropriate to conclude that a minor change in the short term is a likely significant effect. Where the long-term impact is predicted to be less than the short term it can be appropriate to conclude that a moderate or major change in the short term is not significant. 2) A similar change in the long term and non-project noise change can indicate that the change is not due to the project and not an indication of a likely significant effect.
Absolute noise level with reference to LOAEL and SOAEL (by design this includes sensitivity of receptor)	1) A noise change where all do-something absolute noise levels are below SOAEL requires no modification of the initial assessment. 2) Where any do-something absolute noise levels are above the SOAEL, a noise change in the short term of 1.0 dB or over results in a likely significant effect.

Local circumstance	Influence on significance judgement
Location of noise sensitive parts of a receptor	1) If the sensitive parts of a receptor are protected from the noise source, it can be appropriate to conclude a moderate or major magnitude change in the short term and/or long term is not a likely significant effect. 2) Conversely, if the sensitive parts of the receptor are exposed to the noise source, it can be more appropriate to conclude a minor change in the short term and/or long term is a likely significant effect. 3) It is only necessary to look in detail at individual receptors in terms of this circumstance where the decision on whether the noise change gives rise to a significant environmental effect is marginal.
Acoustic context	1) If a project changes the acoustic character of an area, it can be appropriate to conclude a minor magnitude of change in the short term and/or long term is a likely significant effect.
Likely perception of change by residents	1) If the project results in obvious changes to the landscape or setting of a receptor, it is likely that noise level changes will be more acutely perceived by the noise sensitive receptors. In these cases, it can be appropriate to conclude that a minor change in the short term and/or long term is a likely significant effect. 2) Conversely, if the project results in no obvious changes for the landscape, particularly if the road is not visible from the receptor, it can be appropriate to conclude that a moderate change in the short term and/or long term is not a likely significant effect.

Limitations of the Assessment

14.2.26. The following limitations are identified:

- baseline noise monitoring has not been undertaken;
- A83 traffic data is assumed to transfer unchanged to the OMR diversion route;
- the calculation method assumes no screening between road and receptor;
- the calculation does not consider construction traffic movements accessing the site working areas via the A83; and
- a single calculation point is used for each sensitive receptor building, measured to the closest façade facing the carriageway. This is a deviation from the standard DMRB LA 111 method, it is considered appropriate and proportionate because in both scenarios considered, there is only one operational road.

14.2.27. The limitations do not materially affect the assessment results.

14.3. Baseline Conditions

Existing Baseline

14.3.1. Existing baseline road traffic noise levels at the residential receptors are predicted based on AAWT,18h 2024 traffic data using the A83, the results are detailed in Table 14.5.

Table 14.5 – Existing baseline road traffic noise levels

Receptor	Period	Noise level existing baseline	Noise level banding
Laigh Glencroe	Day	62.7 dB $L_{A10,18h}$ facade	>LOAEL & <SOAEL
Laigh Glencroe	Night	50.4 dB L_{night} free-field	>LOAEL & <SOAEL
High Glencroe	Day	54.2 dB $L_{A10,18h}$ facade	<LOAEL
High Glencroe	Night	42.9 dB L_{night} free-field	>LOAEL & <SOAEL

Future Baseline

14.3.2. The future baseline is expected to remain the same as the existing baseline. No consented developments have been identified which would be expected to materially alter the road traffic noise in Glen Croe.

Sub-Topics Scoped Out of the Assessment

14.3.3. Construction noise is scoped out, construction noise impacts will be appropriately controlled through the adoption of best practice mitigation techniques, which will be secured in the construction environmental management plan (CEMP). Considering the adoption of best practice mitigation techniques, distance to receptors and the linear nature of construction along the A83, construction noise impacts are considered unlikely to exceed applicable noise level criteria, determined in accordance with BS 5228-1:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites – Part 1: Noise' (BS 5228-1).

14.3.4. Construction vibration is scoped out as the two permanent residential receptors lie outside the standard DMRB LA 111 vibration study area, 100m from construction activities with the potential to generate vibration.

14.3.5. Construction traffic noise beyond the study area is scoped out of further assessment. All traffic (both normal and construction vehicles) will use the A83 beyond the study area, the additional construction vehicles are not expected to notably increase road traffic levels. Appropriate management of heavy vehicle movements will appropriately control construction impacts.

14.3.6. Operational noise is scoped out as the Proposed Scheme will not alter the road alignment and is not predicted to change vehicle flow, composition of vehicle types (e.g. cars and heavy vehicles), and vehicle speeds.

14.3.7. The debris flow shelter is a covered structure with predominantly open sides facing into the glen. Reflection effects within the debris flow shelter have the potential to increase road traffic noise in Glen Croe. The screening effect of the shelter roof would result in road traffic noise decreases on the footpaths that look down on the debris flow shelter.

14.3.8. Based on professional judgement, the operational road traffic effects are not considered to be potentially significant. The acoustic character of the area would not be changed by the debris flow shelter. Noise levels are expected to remain close to the LOAEL (55 dB $L_{A10,18h}$ facade) at the residential property High Glencroe. Peoples use of open space receptors such as the Rest and Be Thankful viewpoint is highly transient and there are large amounts of alternative space available that would be unaffected by the Proposed Development.

14.3.9. Operational road traffic noise changes in the glen would be dependent on the proximity to the debris flow shelter, in conjunction with the proximity to the A83 carriageway not in the debris flow shelter. For example, the Rest and Be Thankful viewpoint is less than 30m from the uncovered A83 and is more than 400m from the northern end of the debris flow shelter. Road traffic noise levels at the viewpoint would be dominated by vehicles travelling on the uncovered sections of the A83, this would not change once the debris flow shelter becomes operational.

14.3.10. In addition, the potential remedial measures available to reduce road traffic noise levels are not considered to be appropriate. Low noise road surfacing is not considered to be viable due to the traffic speed (less than 75 km/h). Speed limit and/or traffic volume restrictions are not considered to be viable on a trunk road.

14.3.11. Operational vibration is scoped out as a maintained road surface will be free of irregularities, so operational vibration would not have the potential to lead to significant adverse effects.

14.4. Potential Impacts

14.4.1. The potential impacts due to the OMR diversion route during the construction phase is increased road traffic noise at the two residential receptors.

Construction Impacts

14.4.2. During the period that the OMR diversion is in operation, a significant adverse noise effect occurs on the OMR informal walking, cycling and horse-riding route. The noise change has not been quantified as the noise level increase would be different along the route depending on the distance to the A83. At greater

distances from the A83 the adverse impact will increase, closer to the A83 the adverse impact would decrease. It is anticipated that walkers, cyclists and horse-riders will be prevented from using the OMR diversion route under traffic management and a shuttle-bus will transport walkers and cyclists along the OMR. The impact is classified as major adverse.

14.4.3. Predicted OMR diversion route road traffic noise levels at the residential receptors, based on AAWT,18h traffic data using the OMR diversion route, are detailed in Table 14.6.

Table 14.6 – OMR diversion route road traffic noise levels

Receptor	Period	Noise level OMR diversion route	Noise level banding
Laigh Glencroe	Day	55.4 dB $L_{A10,18h}$ facade	>LOAEL & <SOAEL
Laigh Glencroe	Night	43.8 dB L_{night} free-field	>LOAEL & <SOAEL
High Glencroe	Day	57.4 dB $L_{A10,18h}$ facade	>LOAEL & <SOAEL
High Glencroe	Night	45.7 dB L_{night} free-field	>LOAEL & <SOAEL

14.4.4. The noise change levels (OMR diversion route scenario minus existing baseline scenario) are presented in Table 14.7.

Table 14.7 – OMR diversion route noise level change

Receptor	Period	Noise level change	Magnitude of change
Laigh Glencroe	Day	-7.3 dB	Major benefit
Laigh Glencroe	Night	-6.6 dB	Major benefit
High Glencroe	Day	+3.2 dB	Moderate adverse
High Glencroe	Night	+2.8 dB	Minor adverse

14.4.5. At Laigh Glencroe, when the OMR diversion route is in operation, traffic is approximately 65m further away from the property. Road traffic noise levels are

predicted to reduce by more than 6 dB in both the day and night. The absolute noise levels, day and night, are above the LOAEL and below SOAEL.

14.4.6. At Laigh Glencroe, the reduction in road traffic noise at the property during the operation of the OMR diversion route is determined to be a significant benefit.

14.4.7. At High Glencroe, when the OMR diversion route is in operation, traffic is approximately 110m closer to the property. Road traffic noise levels are predicted to increase by approximately 3 dB in both the day and night, the daytime increase is classified as a moderate increase and the night-time increase is classified as a minor increase. However, the absolute noise levels remain low, in the daytime, noise levels are below the LOAEL; in the night, noise levels marginally exceed the LOAEL. Appropriate internal noise levels are achieved when windows are partially open providing background ventilation. BS 8233:2014 Guidance on sound insulation and noise reduction in buildings (BS 8233) states that *"In general, for steady external noise sources, it is desirable that the internal ambient noise level does not exceed the guideline values in Table 4".* Table 4 of BS 8233 is reproduced in Table 14.8. In addition, BS 8233 states that the noise insulation provided by a partially open window is 15 dB.

Table 14.8 – BS 8233 indoor ambient noise levels for dwellings

Activity	Location	Day (07:00 to 23:00)	Night (23:00 to 07:00)
Resting	Living room	35 dB $L_{Aeq,16h}$	Not applicable
Dining	Dining room/area	40 dB $L_{Aeq,16h}$	Not applicable
Sleeping (daytime resting)	Bedroom	35 dB $L_{Aeq,16h}$	30 dB $L_{Aeq,8h}$

14.4.8. At High Glencroe, when the OMR diversion route is in operation the noise level change is marginally inside the 'moderate' range in the day (+0.2 dB) and inside the 'minor' range in the night. The noise levels are above LOAEL and below the SOAEL. The acoustic character the area does not change. The increase in road

traffic noise at the property during the operation of the OMR diversion route is determined to be a non-significant adverse effect when considering the local circumstances.

14.5. Mitigation

14.5.1. A significant adverse effect is predicted to take place on the OMR informal walking, cycling and horse-riding route. As the OMR diversion route and the OMR informal walking, cycling and horse-riding route are the same, it is not possible to mitigate the noise impact.

14.5.2. At Laigh Glencroe (dwelling), consideration of mitigation is not required on account of the significant beneficial effect.

14.5.3. At High Glencroe (dwelling), consideration of mitigation is not required because the noise increase is classified as not significant.

14.5.4. Recommended mitigation measures for the construction phase are detailed in Table 14.9.

Table 14.9 – Noise and vibration mitigation measures

Mitigation reference	Mitigation measures
NV1	During the construction phase Best Practicable Means (BPM) (as defined in Section 72 of the Control of Pollution Act 1974) will be adopted, this includes the adoption of the advice contained within BS 5228-1:2009+A1:2014 and BS 5228-2:2009+A1:2014 and will be secured through the CEMP prepared by the Contractor.

14.6. Residual Effects

14.6.1. The residual effects of the OMR diversion route during the construction phase remain the same as reported in Section 14.4, a significant adverse effect on the

OMR informal walking, cycling and horse-riding route; a significant beneficial effect at Laigh Glencroe, and a non-significant adverse effect at High Glencroe.

14.6.2. Adverse noise effects due to the OMR diversion route during the construction phase of the Proposed Scheme would be temporary. The residual effects are detailed in Table 14.10.

Table 14.10 – Residual OMR diversion route noise effects

Asset Reference	Pre-Mitigation Effect - Magnitude	Pre-Mitigation Effect - Significance	Mitigation Measures	Post-Mitigation Effect - Magnitude	Post-Mitigation Effect - Significance
OMR informal walking, cycling and horse-riding route	Significant adverse	Significant adverse	Not applicable	Significant adverse	Significant adverse
Laigh Glencroe	Significant benefit	Significant benefit	Not applicable	Significant benefit	Significant benefit
High Glencroe	Not significant adverse	Not significant adverse	Not applicable	Not significant adverse	Not significant adverse

14.6.3. Monitoring is not required for the OMR informal walking, cycling and horse-riding route as it is not possible to mitigate the road traffic noise at this receptor because the OMR diversion route and the OMR informal walking, cycling and horse-riding route are the same. Monitoring is not required for Laigh Glencroe because it experiences a beneficial effect.

Compliance with Planning Policy

14.6.4. The completed assessment is compliant with national and regional policy. In the Loch Lomond and The Trossachs National Park LDP 2017-2021, the overarching policy 2 contains a suite of requirements, including that significant adverse impacts on noise and vibration shall be avoided. Whilst there is a significant adverse effect on the OMR informal walking, cycling and horse-riding route when the OMR diversion route is in operation; this will be temporary. In addition, peoples use of the OMR informal walking, cycling and horse-riding route is highly transient and there are large amounts of alternative space available that would be unaffected by the Proposed Development.