HORIZON NUCLEAR POWER

WYLFA NEWYDD

ENERGY WORKING FOR BRITAIN

Wylfa Newydd Project

6.6.6 ES Volume F - Park and Ride F6 - Noise and vibration

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6 Noise and vibration

6.1 Introduction

6.1.1 This chapter describes the assessment of potential noise and vibration effects resulting from the construction, operation and decommissioning of the Park and Ride Facility at Dalar Hir (hereafter referred to as the 'Park and Ride').

6.1.2 The chapter excludes noise and vibration effects associated with road traffic. These effects are considered in the assessment contained within chapter C5 (noise and vibration effects of traffic) (Application Reference Number: 6.3.5), which covers project-wide effects of traffic upon noise and vibration.

6.1.3 Please refer to chapter B6 (noise and vibration) (Application Reference Number: 6.2.6) and appendix B6-2 (Noise and Vibration Modelling and Assessment Methodology Report) (Application Reference Number: 6.2.21) for the technical basis for the assessment including a summary of legislation, policy and guidance; key points arising in consultation that have guided the noise and vibration assessment; and assessment methodologies and criteria.

6.1.4 A full description of the Park and Ride site can be found in chapter F1 (proposed development) (Application Reference Number: 6.6.1).

6.2 Study area

6.2.1 This section describes the study area relevant to the noise and vibration assessment for the Park and Ride.

6.2.2 The Park and Ride is located on the A5 Holyhead Road on greenfield land at Dalar Hir, immediately to the north-east of Junction 4 on the A55 and approximately 800 m north of the residential community of Llanfihangel-yn-Nhywyn. The preliminary study area adopted for the Park and Ride comprises a zone measuring approximately 600m from the boundary of the Park and Ride. The distance of 600m is based upon the guidance that is presented in the *Design Manual for Roads and Bridges* [RD1] and is consistent with the approach undertaken for other chapters within the Environmental Statement. Following the assessment of potential significant noise effects in the areas beyond the 600m boundary it is deemed that refinement of this study area is not required.

6.2.3 The study area therefore encompasses an area where potentially significant noise and vibration effects may occur from the relevant sources within the Park and Ride site.

6.2.4 The sensitivity scale set out in chapter B6 (Application Reference Number: 6.2.6) has been adopted to enable the categorisation of noise-sensitive receptors relevant to the construction, operation and decommissioning of the Park and Ride, and is presented in table F6-1.

Table F6-1 Human receptor sensitivities to noise effects

Sensitivity	Noise-sensitive receptor categories
High	Dwellings, hospitals and schools
Medium	Places of worship, open-air amenities used for recreation, community facilities and offices
Low	Commercial premises
Negligible	Industrial installations

Identified receptors

6.2.5 The following groups of residential receptors near to the Park and Ride site have been identified, and are shown in figure F6-1 (Application Reference Number: 6.6.38) along with the study area:

- residential properties at Alltwen Goch, south of the Park and Ride;
- residential properties, including a residential care home, on Holyhead Road, north of the Park and Ride;
- residential properties on London Road, north of the Park and Ride;
- residential properties and hotel surrounding the A55, west of the Park and Ride;
- residential properties surrounding Minffordd Road, south of the Park and Ride;
- residential properties at Bryn Goleu, east of the Park and Ride; and
- residential properties at Llanfihangel-yn-Nhywyn.

6.2.6 Other identified receptors are users of:

- commercial premises at Cartio Môn, east of the Park and Ride;
- commercial premises at Refail Newydd, Waste Transfer Station, south-east of the Park and Ride;
- Public Right of Way, north of the Park and Ride; and
- commercial premises at Llanfihangel-yn-Nhywyn.

6.2.7 There are no high sensitivity non-residential receptors within the 600m study area.

6.2.8 Ecological receptors are described in chapter F9 (terrestrial and freshwater ecology) (Application Reference Number: 6.6.9).

6.2.9 Heritage receptors are described in chapter F11 (cultural heritage) (Application Reference Number: 6.6.11).

6.3 Baseline environment

6.3.1 This section provides a summary of the baseline conditions for noise and vibration within the study area described in section 6.2.

Noise

6.3.2 Noise monitoring was undertaken at four locations in the vicinity of the proposed Park and Ride site. Noise monitoring comprised long-term monitoring between 22 June 2016 and 8 July 2016 and an additional short-term measurement was undertaken in the footprint of the proposed site on 16 June 2016. Details of the noise monitoring locations are described in table F6-2, whilst the noise monitoring results are summarised in tables F6-3 and F6-4. Full details of the noise monitoring, noise survey results and details of the equipment used and methodology employed are presented in chapter B6 (Application Reference Number: 6.2.6).

Table F6-2 Park and Ride baseline monitoring locations

Monitoring point reference	Location	Comments
LT1	Open land at rear of residential property in Cefn Rhosydd	Long term – duration one week
LT2	Open land adjacent to Holyhead Road	Long term – duration one week
LT3	Rear of Gwyddfor Residential Home, Holyhead Road	Long term – duration one week
ST1	Open land adjacent to B5111	Short term – duration three hours

6.3.3 Table F6-3 presents the noise levels for the daytime, evening/weekend and night-time periods (based on the time periods described in the example 'ABC' methodology in BS 5228-1:2009+A1:2014 [RD2]) obtained from the long-term measurement location. These monitoring locations have been considered to be representative of the existing baseline levels across the study area.

6.3.4 Observations undertaken during the survey period indicate the environment is rural in nature, with sources including livestock and bird song as well as overhead aircraft and local road traffic.

6.3.5 Baseline levels have been applied for the identified receptors based on their locality in comparison to the three long-term monitoring locations.

6.3.6 The data presented have been used in the construction noise assessments of the Park and Ride based on the guidance and requirements within BS 5228-1 [RD2].

Table F6-3 Baseline noise levels – Summary of measured $L_{Aeq,T}$ noise levels for use in construction noise assessment

Monitoring point reference	Ambient Noise Level, dB		
	Daytime, $L_{Aeq,12hr}$ (07:00-19:00)	Evening and weekends, $L_{Aeq,4hr}$ (19:00-23:00)	Night-time, $L_{Aeq,8hr}$ (23:00-07:00)
LT1	58	49	45
LT2	60	53	50
LT3	57	48	48

6.3.7 Table F6-4 presents the daytime and night-time background noise levels and is based on the time periods identified as required in BS 4142:2014 [RD3].

Table F6-4 Baseline noise levels – Summary of measured $L_{A90,T}$ noise levels for use in operational assessment (BS 4142)

Monitoring point reference	Daytime $L_{A90,16h}$ dB (07:00-23:00)		Night-time $L_{A90,15min}$ dB (23:00-07:00)	
	Mean	Mode	Mean	Mode
LT1	43	44	32	31
LT2	47	49	35	37
LT3	50	51	43	39

Vibration

6.3.8 No significant sources of vibration were identified in the immediate vicinity of the identified sensitive receptors at the Park and Ride, and consequently no baseline vibration measurements have been undertaken.

Evolution of the baseline

6.3.9 Between the baseline noise surveys and the construction of the Park and Ride, baseline noise levels (i.e. those that would occur in the absence of the Wylfa Newydd Project) may have changed, or may be likely to change, due to a number of non-project-related factors.

6.3.10 Road traffic is likely to increase over time, in common with most areas of the UK. The *Design Manual for Roads and Bridges* [RD1] advises that an increase of 25% in traffic flow in the short term would generally be required before an increase in traffic noise level is likely to be perceptible, with this approximating an increase of 1dB $L_{A10,18hr}$.

6.3.11 An increase of this level is considered to be unlikely to occur between the 2016 baseline survey and completion of the Park and Ride construction.

6.3.12 There is likely to be a change in the annual average daily traffic flow for the road links on the A55, which runs past the south of the site. This may result in a small increase in the baseline noise levels.

6.4 Design basis and activities

6.4.1 This section sets out the design basis for the assessment of effects. It sets out where any assumptions have been made to enable the assessment to be carried out at this stage in the evolution of the design. This section also identifies the embedded and good practice mitigation that will be adopted to reduce adverse effects as inherent design features or by implementation of standard industry good working practice.

6.4.2 As described in chapter F1 (Application Reference Number: 6.6.1), the application for development consent is based on a parameter approach. The assessment described within this chapter has taken into consideration the flexibility afforded by the parameters. A worst case scenario has therefore been assessed from a noise and vibration perspective within the parameters described in chapter F1 (Application Reference Number: 6.6.1).

Construction

6.4.3 There is a potential for noise effects at existing receptors in the vicinity of Park and Ride, due to the proposed construction activities. These activities include:

- building demolition;
- site clearance and groundworks;
- piling works for the main bus transfer building;
- building construction;
- hardstanding construction;
- road surface construction; and
- laying paths and landscaping.

6.4.4 The plant number and types were estimated by experienced construction engineers from a major civil construction engineering organisation based on the proposed construction activities and programme. There is potential for minor variations in the plant types or plant numbers from those presented. However, any minor variations in the plant type or number would not affect the outcome of the assessment presented in this chapter.

Basis of assessment and assumptions

6.4.5 Noise levels have been calculated for Park and Ride construction activities using the CadnaA noise modelling software. The prediction of noise within the CadnaA model aims to represent activity noise levels that could occur within a worst case period for daytime construction activities.

6.4.6 Demolition of the existing building within the Park and Ride site would include removal of the foundations, with the allowance for subsequent infill of the underground areas. Noise modelling of this activity has considered the use of tracked excavator, excavator with breaker attachment, dump truck and tipper lorry.

6.4.7 Site clearance and groundworks would involve the removal of trees and earthworks excavation to prepare and level the site for construction works.

Noise modelling of this activity has considered the use of tracked excavators, dozers and dumper trucks.

6.4.8 Building construction would involve the installation of temporary site cabins, the pouring of concrete building foundations, and the erection of proposed buildings including the bus transfer building and cycle store. Noise modelling of this activity has considered the use of mobile crane, dumper trucks, vibratory roller, forklift, tipper trucks, piling rig and concrete pump.

6.4.9 Hardstanding and road surface construction and landscaping would involve the preparation of sub surfaces, laying of tarmac road surfaces and landscaping of the site. Noise modelling of this activity has considered the use of a road planer, vibratory rollers, dumper trucks, tipper trucks, a wheel wash, backhoe loaders and circular saws.

6.4.10 The detailed information used for the noise and vibration assessments undertaken for the Park and Ride construction is presented in appendix F6-1 (Noise Model Inputs and Outputs) (Application Reference Number: 6.6.14). This appendix includes details of the construction noise sources, assumed quantities, as well as emission data and percentage on-times within the construction working hours. Other model and calculation inputs are also detailed.

Embedded mitigation

6.4.11 Embedded mitigation measures included to reduce potential noise and vibration effects during construction are presented below

6.4.12 In choosing the location of the contractor's compound, the distance between noise sources and noise sensitive receptors would be taken into account and increased as far as reasonably practicable. This would ensure that noise levels from the contractor's compound at sensitive receptors from activities within the contractor's compound would be reduced, as per the Park and Ride sub-Code of Construction Practice (CoCP) (Application Reference Number: 8.10).

6.4.13 Normal working hours for the construction of the Park and Ride would be as per the Park and Ride sub-CoCP (Application Reference Number: 8.10):

- Monday to Friday: 08.00 - 18.00; and
- Saturday: 08.00 to 13.00.
- No works are proposed during the evening and/or night time periods or during Saturday afternoons, Sundays or Bank Holidays.
- If construction work is required at these sites outside these hours, this will be identified by Horizon and justified in the Section 61 Control of Pollution Act 1974 (CoPA) application which will be made to the Isle of Anglesey County Council in advance of the works.

Good practice mitigation

6.4.14 The construction of the Park and Ride would meet the requirements as set out in the Wylfa Newydd CoCP (Application Reference Number: 8.6) and Park and Ride sub-CoCP (Application Reference Number: 8.10).

6.4.15 Good practice mitigation includes adopting Best Practicable Means (as defined in Section 72 of the Control of Pollution Act 1974). Where practicable, the control measures set out in Section 8 of BS 5228-1 [RD2] would be implemented.

6.4.16 Generic noise and vibration control measures as per the Wylfa Newydd CoCP (Application Reference Number: 8.6) include the following:

- Choice of methodology/technique for operations (including site layout) would be considered in order to eliminate or reduce emissions at sensitive locations.
- Fixed items of construction plant would be electrically powered in preference to diesel or petrol driven.
- Wherever practicable fabrication would be undertaken off-site.
- Noisy plant would be kept as far away as practicable from sensitive areas.
- Equipment would be well maintained and would be used in the mode of operation that minimises noise and vibration as far as practicable.
- Equipment would be shut down when not in use or throttled down to a minimum during any waiting periods.
- Vehicles and mechanical plant employed for any activity associated with the construction works would be fitted with effective exhaust silencers/suppression equipment.
- Plant employed for any activity associated with the construction works would be operated in a manner such that noise emissions are controlled and limited as far as reasonably practicable.
- Vehicles would not wait or queue on the public highway with engines running (unless the engine is required to power the operation of the vehicle e.g. concrete wagon).
- All materials would be handled in a manner that minimises noise as far as practicable.

6.4.17 It should be noted that all works would be consented through a prior consent for work on a construction site under Section 61 of the Control of Pollution Act 1974. Monitoring at locations representative of noise sensitive receptors during construction would ensure noise levels remain within the permitted levels under the Section 61 agreement. This agreement would set out the thresholds and details of the monitoring programme including monitoring equipment, locations, frequency and duration of measurement and personnel skills required. The proposed monitoring programme is likely to involve a combination of short-term spot check measurements and some longer-term monitoring, and review of these initial results to determine if ongoing monitoring is required, as per the Park and Ride sub-CoCP (Application

Reference Number: 8.10). Actions to be undertaken in the event that monitoring identifies a breach of a threshold are set out in the Wylfa Newydd CoCP (Application Reference Number: 8.6).

Operation

6.4.18 There is a potential for noise effects at existing receptors in the vicinity of Park and Ride from the Park and Ride operational plant and activities. These include car and bus activity around the site and building services equipment associated with the main bus transfer building.

Basis of assessment and assumptions

6.4.19 Noise levels have been calculated for Park and Ride operation activities using the CadnaA noise modelling software. The prediction of noise within the CadnaA model aims to represent activity noise levels that could occur within a worst case period for daytime and night-time operation.

6.4.20 The heat pumps have been modelled along the southern façade of the main bus transfer building.

6.4.21 Daytime and night-time bus movements include a maximum of 78 buses arriving and departing during the day, with a maximum of six movements during the night-time. Daytime and night-time shifts occur over three hours, with any daytime hour including a maximum of 11 buses arriving and departing. A maximum of two bus movements would occur within any 15-minute night-time period.

6.4.22 On the basis that a single bus can transport up to 50 workers at any one time, 550 car movements have been modelled for the daytime and 100 car movements have been modelled for the night-time period. Vehicle movements have been considered for arrival and departure during each calculated period.

6.4.23 All vehicle movements have been modelled at a height of 1m above local ground, to account for a worst case vehicle combined engine and exhaust height. The majority of effective source positions for the noise emissions are likely to be closer to the ground and therefore would potentially benefit from greater ground and screening attenuation than currently assumed.

6.4.24 The modelling work assumes that vehicular activity would be evenly distributed across the areas of use, defined by the Park and Ride car park and road layout. In the model set up, all vehicle movements have been positioned around the perimeter of each car park to allow for a worst case calculation.

6.4.25 An acoustic feature correction of 3dB has been applied to account for the impulsivity of vehicle car door slams. The assessment calculation for the worst affected property in each group of residential receptors is presented in appendix F6-1 (Application Reference Number: 6.6.14).

6.4.26 The following activities allow for a worst case assessment and have been modelled for both daytime and night-time periods:

- buses arriving and departing;

- cars arriving and departing;
- buses idling;
- cars idling and car doors slamming; and
- seven heat pumps in continuous operation.

6.4.27 The locations of the modelled operational sources as listed above are presented in figure F6-2 (Application Reference Number: 6.6.38).

6.4.28 The assessment of car alarms has not been included in the main Park and Ride assessment. Car alarm sound is considered to be atypical and is likely to be an infrequent event which is not representative of normal operation of the Park and Ride.

6.4.29 However, sensitivity tests have been undertaken to provide an indication of the effects from car alarm sound assuming a car is located in the closest parking position to the receptor groups considered in the main assessment.

6.4.30 The sensitivity tests have considered the total rating noise and are assessed using the principles of BS 4142 [RD3] for day and night-time periods, and have also considered $L_{Amax,F}$ levels during night-time periods.

6.4.31 The sensitivity tests indicate that the occurrence of a car alarm is unlikely to result in additional significant effects at all receptor groupings.

6.4.32 The input assumptions used in the noise assessment undertaken for the Park and Ride operation are presented in appendix F6-1 (Application Reference Number: 6.6.14). This appendix includes details of the operational noise sources, assumed quantities, as well as emission data and periods of operation. Other model and calculation inputs are also detailed.

Embedded mitigation

6.4.33 The following embedded mitigation has been identified for inclusion in the design and layout of the operation of the Park and Ride.

- The Park and Ride is positioned in a location which is of relatively low sensitivity to noise and vibration and relatively far away from residential communities.
- The bus transfer building and waiting area would be centrally located within the site to increase the offset distance between noise sources (e.g. fixed plant and buses) and nearby sensitive receptors, as per volume 3 of the Design and Access Statement (Associated Developments and Off-Site Power Station Facilities) (Application Reference Number: 8.2.3).
- The bus routes within the site would be designed as a one-way system in order to avoid the need for reversing buses, as per volume 3 of the Design and Access Statement (Application Reference Number: 8.2.3).

Good practice mitigation

6.4.34 The operation of the Park and Ride will meet the requirements set out in the Park and Ride sub-Code of Construction Practice (CoCP) (Application Reference Number: 8.10).

6.4.35 Good practice mitigation measures would be implemented during the operation of the Park and Ride, as per the Park and Ride sub-CoCP (Application Reference Number: 8.10) including:

- where practicable, buses would wait with their engines switched off;
- buses would not wait on the public highway; and
- the use of horns would not be permitted for any vehicles for non-emergency situations (e.g. to signal the attention of Park and Ride staff upon arrival).

6.4.36 The programme for monitoring operational noise at the Park and Ride Facility would be established and agreed with Isle of Anglesey County Council prior to commencement of operation. It is anticipated that monitoring would likely include off-site spot check noise surveys at receptors, and some onsite monitoring near particular noise sources at long-term intervals. Monitoring would be undertaken on a quarterly basis as a minimum. Review of these initial results would determine if ongoing monitoring is required as per the Park and Ride sub-CoCP (Application Reference Number: 8.10). Actions to be undertaken in the event that monitoring identifies a breach of a threshold are set out in the Wylfa Newydd CoCP (Application Reference Number: 8.6).

6.4.37 Workers using the Park and Ride Facility would be required to register their cars and contact details with Horizon, as per the Workforce Management Strategy (Application Reference Number: 8.5).

Decommissioning

6.4.38 There is a potential for noise effects at existing receptors in the vicinity of Park and Ride, due to the proposed decommissioning activity. Decommissioning would involve the removal of areas of hardstanding with the return of the site to an area of grassland.

Basis of assessment and assumptions

6.4.39 Noise levels have been calculated for Park and Ride decommissioning activities using the CadnaA noise modelling software. The prediction of noise within the CadnaA model aims to represent activity noise levels that could occur within a worst case period for daytime decommissioning activities.

6.4.40 Decommissioning of the Park and Ride site would involve the breaking up of any hardstanding, lifting and removal of concrete slabs. Noise modelling of this activity has considered the use of a tracked excavator, excavator with breaker attachment, dump truck and tipper lorry.

6.4.41 The detailed information used for the noise and vibration assessment undertaken for the Park and Ride decommissioning is presented in appendix F6-1 (Application Reference Number: 6.6.14). This document includes details of the construction noise and vibration sources, assumed quantities, as well as emission data and periods of operation. Other model and calculation inputs are also detailed.

Embedded mitigation

6.4.42 The decommissioning phase would employ the same embedded mitigation measures as the construction phase, presented in section 6.4.

Good practice mitigation

6.4.43 The good practice measures for the decommissioning phase would be the same as those employed for the construction phase and as given in this section.

6.5 Assessment of effects

6.5.1 This section presents the findings of the assessment of effects associated with the construction, operation and decommissioning of the Park and Ride.

Construction

Effects of noise at residential receptors

6.5.2 The construction noise assessment of the Park and Ride is based on the guidance within BS 5228-1 [RD2]. For further information, please refer to appendix B6-2 (Application Reference Number: 6.2.21).

6.5.1 Residential receptors are considered to have high sensitivity. Free-field noise levels have been calculated for each elevation and for each floor of each residential building within the study area, and for each month of the indicative programme. In order to provide a façade noise level, a +3dB correction has been applied to the model results.

6.5.2 This has enabled the magnitude of change to be established at all residential receptors potentially affected by the Park and Ride construction works, and an indication of the duration in months over which the effects could occur.

6.5.3 Table F6-5 presents both the effect magnitudes and criteria values that have been adopted to assess the magnitude of change from construction noise. Further information on the basis of these magnitude scales is provided in of chapter B6 (Application Reference Number: 6.2.6).

Table F6-5 Adopted magnitude scale for construction noise

Magnitude of change	Façade construction noise level LAeq,T 07.00 – 19.00 hours Mon to Fri 07:00 – 13:00 hours Sat	Comments
Large	≥75.0	75dB(A) is presented in BS5228-1 as an example threshold for the determination of noise insulation eligibility.
Medium	70.0 – 74.9	-
Small	65.0 – 69.9	-

Magnitude of change	Façade construction noise level LAeq,T 07.00 – 19.00 hours Mon to Fri 07:00 – 13:00 hours Sat	Comments
Negligible	<65.0*	65dB(A) is a threshold of potential significance defined by examples in BS5228-1 for low ambient noise areas.
* or less than a 3.0dB increase in the pre-existing ambient noise level		

6.5.4 The highest predicted monthly free-field noise level on any floor and on any side of a building during the entire programme of the Park and Ride construction phase has been used for the determination of the likely effects.

6.5.5 The above approach ensures that a reasonably cautious assessment is carried out and reported.

6.5.6 Appendix F6-1 (Application Reference Number: 6.6.14) provides an indication of the total number of residential receptors in the study area which fall into the various effect magnitude categories over each month of the indicative construction programme.

6.5.7 The highest daytime monthly noise level for each group of residential receptors is presented in appendix F6-1 (Application Reference Number: 6.6.14).

6.5.8 Table F6-6 provides a summary of the total numbers of residential receptors within the study area falling into each effect magnitude category, and an indication of the maximum duration of the likely effects. These figures are based upon consideration of the highest noise level calculated over the entire programme for each receptor, and the longest duration observed from any receptor falling into the effect magnitude category. This, again, ensures that a worst case assessment of the predicted noise levels is reported.

Table F6-6 Summary of noise effects at residential receptors (high sensitivity)

Magnitude of change	Noise level from plant and machinery LAeqT	Significance of effect at residential receptor (high sensitivity)	Approximate number of residential properties affected during day (07:00 – 19:00)	Maximum number of months that effect occurs
Large	≥75.0	Major significance	0	0
Medium	70.0 – 74.9	Major significance	0	0
Small	65.0 – 69.9	Moderate significance	0	0

Magnitude of change	Noise level from plant and machinery LAeqT	Significance of effect at residential receptor (high sensitivity)	Approximate number of residential properties affected during day (07:00 – 19:00)	Maximum number of months that effect occurs
Negligible	<65.0*	Minor (not significant)	85	18
* or less than a 3.0dB increase in the pre-existing ambient noise level				

6.5.9 Of the 85 residential receptors that fall within the 600m study area of the Park and Ride site, all receptors are expected to experience minor (not significant) effects based on the embedded mitigation assumptions set out above, and are not therefore considered any further in this chapter.

6.5.10 Table F6-6 presents the likely significant effects at residential receptors based upon the approach of determining and assessing the calculated noise levels typical (and likely) of those occurring during each month; considered to be a likely worst case.

6.5.11 Outside of the requirement (under the Environmental Impact Assessment Regulations) to identify the likely significant effects, a further series of noise levels have been calculated as part of a sensitivity testing exercise to provide an indication of the higher noise levels which may occur during certain transient phases of the works within any calendar month. These noise levels correspond to scenarios that assume the activities, which can take place over large areas across the site, are situated and concentrated at the closest practicable locations to the most sensitive receptors simultaneously. In combination with the other likely worst case and cautious assumptions already applied to the assessment, as described in appendix B6-2 (Application Reference Number: 6.2.21), these circumstances are considered to be highly unlikely and in any case would only occur for very short periods of time. These values are therefore reported for information only.

6.5.12 Figures F6-3 to F6-5 (Application Reference Number: 6.6.38) present predicted noise contours for the associated construction scenarios that correspond to the highest predicted noise levels over the entire programme. For the Park and Ride, the highest noise levels, over the whole group of receptors considered in this assessment, occur in months one, two, 10 and 14 of the Park and Ride's construction works programme. Proposed construction works during these months include the demolition of the existing building, piling and the formation of car parks/hardstanding. The contours have been calculated at a relative height of 4m above local ground to represent the worst affected floor of any receptor, as detailed in chapter B6 (Application Reference Number: 6.2.6).

Effects of noise at non-residential receptors

6.5.13 Appendix F6-1 (Application Reference Number: 6.6.14) presents the predicted noise levels at the specific non-residential receptors identified in section 6.2 of this chapter.

Table F6-7 provides a summary of the non-residential receptors within the study area that fall into each effect magnitude category presented in table F6-5 and the highest predicted façade noise level from the construction phase.

Table F6-7 Summary of noise effects at non-residential receptors

Name	Receptor type	Sensitivity	Highest predicted façade noise level from construction, dB LAeq,T	Magnitude of change	Significance of effect at non-residential receptor
Footpath to the north	Open-air amenities used for recreation	Medium	61.6	Negligible	Negligible (not significant)
Waste transfer station at Refail Newydd	Commercial	Low	53.6	Negligible	Negligible (not significant)
Function rooms at Cartio Môn	Commercial	Low	63.3	Negligible	Negligible (not significant)
Commercial premises at Llanfihangel-yn-Nhywyn	Commercial	Low	54.9	Negligible	Negligible (not significant)

6.5.14 The assessed commercial premises and open-air amenities used for recreation within the 600m study area are predicted to experience effects of negligible magnitudes, and are therefore assessed as not significant.

Effects of vibration at residential receptors

6.5.15 The potential sources of vibration during the construction of the Park and Ride include piling works and surface compaction through the use of a vibratory roller. Vibratory compaction is likely to be undertaken during the laying of road surfaces.

6.5.16 Table F6-8 presents both the effect magnitudes and criteria values that have been adopted to assess the magnitude of change from construction vibration. These values have been adopted to represent the onset of effects for human vibration response and building damage. The significance of these effects is

considered based on the methodology set out in chapter B1 (introduction to the assessment process) (Application Reference Number: 6.2.1).

Table F6-8 Adopted magnitude change for construction vibration

Magnitude of change	Vibration level threshold (peak particle velocity mm/s)
Large	≥10.0
Medium	5.0-9.9
Small	1.0-4.9
Negligible	<1.0

6.5.17 The modelling and assessment of construction vibration effects is discussed in broad terms within chapter B6 (Application Reference Number: 6.2.6), with further details pertaining to the methods adopted for construction compaction and piling presented below.

Piling at building

6.5.18 Continuous flight auger piling is to be adopted for the piling of Park and Ride building. The closest residential property is approximately 500m from the Park and Ride piling location. BS 5228-2:2009+A1:2014 [RD4] presents a summary of historic case history on vibration levels measured during rotary bored piling, presenting a peak particle velocity value of 0.54mm/s at a distance of 5m during augering mode. As such, vibration effects associated with continuous flight auger piling activities at the Park and Ride would be expected to be negligible and have not been considered further within this chapter.

Vibratory compaction from road and car park surfacing

6.5.19 The results of predictions of steady state vibration arising from the use of vibratory rollers during the Park and Ride construction works are presented in table F6-9. The radial distance from the roller, where free-field vibration levels are likely to be equal to the guideline vibration levels, has been determined using the calculation methodology in BS 5228-2 [RD4].

Table F6-9 Assessment of vibratory rollers during steady state operation

Magnitude of change	Vibration level threshold (peak particle velocity mm/s)	Distance from source during steady state operation (m)
Large	≥10.0	12
Medium	5.0-9.9	20
Small	1.0-4.9	62
Negligible	<1.0	>62

6.5.20 The closest residential property is approximately 200m from any roller activity at the Park and Ride site. As such, these properties would therefore

experience vibration levels considerably lower than 1.0mm/s, which would be assigned an effect magnitude of negligible and would not be significant.

Effects of vibration at non-residential receptors

Effects on humans

6.5.21 There are no high or medium sensitivity non-residential receptors, or open-air amenities used for recreation, within the 62m of any potential sources of vibration. As such, these properties would experience vibration levels of less than 1.0mm/s, which would be assigned an effect magnitude of negligible and would not be significant.

Effects on building structures

6.5.22 The function rooms at Cartio Môn are located at a distance approximately 150m east of the proposed Park and Ride site. As such, vibration levels of less than 1.0mm/s are unlikely. This would result in an effect magnitude of negligible and would not be significant.

Operation

Effects of noise at residential receptors

6.5.23 Daytime and night-time free-field noise levels have been calculated for each elevation and for each floor of each residential building within the study area.

6.5.24 Operational activities associated with the Park and Ride have been assessed using an assessment methodology based upon the method described in BS 4142 [RD3]. For further background on operational assessment methodology and derivation of the criteria, please refer to appendix B6-2 (Application Reference Number: 6.2.21).

6.5.25 The magnitude scale developed to determine the initial estimate of the effects for operational sound sources at residential receptors is summarised in table F6-10.

Table F6-10 Operational noise – magnitude of change at residential receptors

Magnitude of change	BS 4142 Difference between rating and background noise levels (dB)	Description of impact from BS4142
Large	≥15	A difference of around +10dB or more is likely to be an indication of a significant adverse impact, depending on the context.
Medium	10-14	
Small	5-9	A difference of around +5dB is likely to be an indication of an adverse impact, depending on the context.

Magnitude of change	BS 4142 Difference between rating and background noise levels (dB)	Description of impact from BS4142
Negligible	0-4	No description in BS4142, but described as between low and adverse impact for the purpose of this assessment.
	<0	Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

6.5.26 To ensure consistency with the assessment methodology described in BS 4142 [RD3], the criteria presented in table F6-10 are used to determine an 'initial estimate' of the noise effect. Further evaluation of this 'initial estimate' is carried out by placing the noise into 'context' enabling the overall significance of the effect to be determined. Further details on this approach are provided in appendix B6-2 (Application Reference Number: 6.2.21).

6.5.27 When placing the effects at residential properties in context, reference has been made to the following additional guideline values from the *Guidelines for Community Noise* [RD5] and the *Night Noise Guidelines* [RD6]. These are set out in table F6-11.

Table F6-11 Guideline values used to the inform the context of operational noise levels at residential receptors

Free-field noise level	Description of effect
<50dB $L_{Aeq,16h}$ (07:00 – 23:00)	Moderate annoyance for community noise in outdoor living areas, from Guidelines for Community Noise [RD5].
<45dB $L_{Aeq,8h}$ (23:00 – 07:00)	Sleep disturbance with a window open, when measured outside, from Guidelines for Community Noise [RD5].
Annual average of 40dB L_{night}	Lowest observed adverse effect level for night noise. A health-based limit value for protection of the public, including most of the vulnerable groups such as children, the chronically ill and the elderly, from the adverse health effects of night noise, from Night Noise Guidelines [RD6].

6.5.28 The effect thresholds developed for operational noise sources at non-residential receptors are summarised in table F6-12, and used to determine the onset of a potential significant effect.

Table F6-12 Operational noise effect criteria for non-residential receptors

Receptor type	External free-field noise level that relates to an onset of a small magnitude of change, dB $L_{Aeq,T}$	Relevant guidance	Description of guideline level
Educational	45	*Building Bulletin 93* [RD7]	Level below which no special measures likely to be necessary to protect buildings or playing fields from external noise.
Places of worship	47	BS 8233 [RD8]	Internal acoustic design criterion for new places of worship of 35dB(A).
Commercial	52	BS 8233 [RD8]	Internal acoustic design criterion for offices in new buildings of 40dB(A).
Industrial	52	BS 8233 [RD8]	Internal acoustic design criterion for offices in new buildings of 40dB(A).

6.5.29 Both daytime and night-time noise assessments have been undertaken following the principles of BS 4142 [RD3] and the assessment results are presented in appendix F6-1 (Application Reference Number: 6.6.14).

6.5.30 The initial calculations of magnitude of change conducted in accordance with BS 4142 [RD3] would indicate that moderate effects are likely as a result of the operational activities at the Park and Ride. These effects are likely at a property to the north on London Road.

6.5.31 However, existing background and rating sound levels are low and BS 4142 [RD3] advises to consider the context of both the existing and new sound sources. The standard suggests that absolute (or benchmark) noise levels may be as, if not more, important in such circumstances, and as such absolute noise criteria have been considered further. This is provided for in the criteria set-out in table F6-11.

6.5.32 The highest total noise level at the affected receptor, from operational activity at the Park and Ride, is calculated to be 40dB $L_{Aeq,T}$ during daytime and 34dB $L_{Aeq,T}$ during the night-time. These are below any of the absolute criteria given in table F6-11 and are below the lowest observed adverse effect level for night noise for protection of the public, including most of the vulnerable groups such as children, the chronically ill and the elderly, from the adverse health effects of night noise.

6.5.33 As such, and taking into consideration the assessment process set out in chapter B1 (Application Reference Number: 6.2.1), the negligible magnitude of change at the residential receptor areas considered would be minor and therefore not significant.

6.5.34 The assessment, taking into account context, is presented in table F6-13.

6.5.35 Figures F6-6 and F6-7 (Application Reference Number: 6.6.38) present predicted noise contours for the day and night time activities at the Park and Ride.

Table F6-13 Summary of operational noise effects at residential receptors

Significance of effect at residential receptor (high sensitivity)	Number of properties affected	
	Daytime 07:00 – 23:00	Night-time 23:00 – 07:00
Major significance	0	0
Moderate significance	0	0
Minor (not significant)	85	85

Effects of vibration at residential receptors

6.5.36 The Transport and Road Research Laboratory Report No RR53 [RD9] reports that vibration generated by such activities will tend towards a peak particle velocity level of <0.1mm/s at distances greater than 6m on a 'smooth' road surface. As such, due to the relatively high distances between the site and the nearest residential dwellings, vibration effects during operational activities at the Park and Ride have not been considered further within this chapter.

Decommissioning

Effects of noise at residential receptors

6.5.37 Noise levels arising from the decommissioning activities are not calculated to be worse than those calculated for the construction phase of the Park and Ride. The highest predicted façade noise level at each group of residential receptors is presented in table F6-14.

6.5.38 There are therefore no worse effects considered during the decommissioning of the Park and Ride and there would be no significant effects at all residential receptors.

6.5.39 Figure F6-8 (Application Reference Number: 6.6.38) presents predicted noise contours for the associated decommissioning scenario. The contours have been calculated at a relative height of 4m above local ground to represent the worst affected floor of any receptor.

Effects of noise at non-residential receptors

6.5.40 Appendix F6-1 (Application Reference Number: 6.6.14) presents the predicted noise levels at the specific non-residential receptors identified in section 6.2 of this chapter. Table F6-14 provides a summary of the non-residential

receptors within the study area that fall into each effect magnitude category and the highest predicted façade noise level from the decommissioning phase.

Table F6-14 Summary of noise effects at non-residential receptors

Name	Receptor type	Sensitivity	Highest predicted façade noise level from decommissioning, dB LAeq,T	Magnitude of change	Significance of effect at non-residential receptor
Footpath to the north	Open-air amenities used for recreation	Medium	60.4	Negligible	Negligible (not significant)
Waste transfer station at Refail Newydd	Commercial	Low	54.5	Negligible	Negligible (not significant)
Function rooms at Cartio Môn	Commercial	Low	64.5	Negligible	Negligible (not significant)
Commercial premises at Llanfihangel-yn-Nhywyn.	Commercial	Low	48.5	Negligible	Negligible (not significant)

6.5.41 The assessed commercial premises and open-air amenities used for recreation within the 600m study area are predicted to experience effects of negligible magnitudes, and are therefore assessed as not significant.

Effects of vibration at residential receptors

6.5.42 There are no potential sources of vibration during the decommissioning of the Park and Ride.

Effects of vibration at non-residential receptors

Effects on humans

6.5.43 There are no potential sources of vibration during the decommissioning of the Park and Ride.

6.6 Additional mitigation

6.6.1 In accordance with chapter B1 (Application Reference Number: 6.2.1), embedded and good practice mitigation measures relevant to noise and vibration were taken into account when determining the ‘pre-mitigation’

significance of effects. These are detailed in the design basis and activities section of this chapter.

6.6.2 Additional mitigation measures would be implemented to address potential significant effects identified in the assessment of effects section.

Construction

6.6.3 No additional mitigation is required for the construction phase of the Park and Ride.

Operation

6.6.4 No additional mitigation is required for the construction phase of the Park and Ride.

Decommissioning

6.6.5 No additional mitigation is required for the decommissioning phase of the Park and Ride.

6.7 Residual effects

6.7.1 With the application of the mitigation measures discussed, no significant adverse noise and vibration effects are anticipated during the construction, operation or decommissioning phases of the Park and Ride.

6.8 References

Table F6-15 Schedule of references

ID	Reference
RD1	Highways Agency. 2011. *Design Manual for Roads and Bridges.* Volume 11: Environmental Assessment, Section 3: Environmental Assessment Techniques, Part 7: Noise and Vibration (HD213/11 – Revision 1). London: The Stationery Office.
RD2	British Standards Institution. 2014. *BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites. Noise*. London: British Standards Institution.
RD3	British Standard Institution. 2014. *BS 4142:2014 Methods for rating and assessing industrial and commercial sound*. London: British Standards Institution.
RD4	British Standards Institution. 2014. *BS 5228-2:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites. Vibration*. London: British Standards Institution.
RD5	Berglund, B., Lindvall, T. and Schwela, D.H. (eds.) 1999. *Guidelines for Community Noise*. Geneva: World Health Organization.
RD6	Charlotte Hurtley (ed.) 2009. *Night Noise Guidelines for Europe*. Copenhagen: World Health Organization for Europe.
RD7	Department for Education and Education Funding Agency. 2015. *Acoustic design of schools: performance standards. Building bulletin 93*. [Online]. [Accessed: 18 January 2018]. Available from: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/400784/BB93_February_2015.pdf
RD8	British Standards Institution. 2014. *BS 8233 Guidance on Sound Insulation and Noise Reduction for Buildings*. London: British Standards Institution.
RD9	Transport and Road Research Laboratory. 1986. *Ground vibration caused by civil engineering works RR53*.