Welsh Government

# A40 Llanddewi Velfrey to Penblewin Improvements

## Environmental Statement Chapter 14: Noise and Vibration

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# 14 Noise and Vibration

## 14.1 Introduction

14.1.1 This chapter describes the assessment work that was undertaken by Arup to determine the impacts and effects of the Scheme during both the construction and operational phases.

14.1.2 The assessment has included a baseline noise survey, calculation of construction noise and vibration impacts and detailed 3D computer modelling to determine the operational noise and airborne vibration impacts in line with the 'Detailed' methodology of Design Manual for Roads and Bridges (DMRB) (Highways Agency et al, 2011) (HD 213/11 Revision 1). An assessment of ground-borne vibration was scoped out (see 14.3.73).

14.1.3 The following figures in Volume 2 relate to this chapter:

a) Figures 14.1A and 14.1B Noise study area (including baseline noise survey and construction noise assessment locations) and baseline noise levels ($L_{A10,18hr}$).

b) Figure 14.2 Noise changes ($L_{A10,18hr}$) in the future year without the Scheme (2036).

c) Figure 14.3 Noise changes ($L_{A10,18hr}$) as a result of the Scheme in the baseline year (2021).

d) Figure 14.4 Noise changes ($L_{A10,18hr}$) as a result of the Scheme in the future year (2036).

14.1.4 The following appendices of Volume 3 relates to this chapter:

a) Appendix 14.1 Glossary of noise and vibration

b) Appendix 14.2 Baseline noise survey results

c) Appendix 14.3 Construction noise and vibration data

d) Appendix 14.4 Operational noise results

## 14.2 Potential Effects

14.2.1 The construction of the Scheme has the potential to give rise to temporary short-term increases in noise and vibration at sensitive receptors which include residential properties, community facilities,

educational facilities and commercial premises which are sensitive to noise and vibration.

14.2.2 The operation of the Scheme may give rise to changes in noise levels (both adverse and beneficial) due to the proposed changes to the alignment which would introduce traffic noise into new areas whilst reducing traffic noise impacts for a larger number of sensitive receptors around Llanddewi Velfrey.

## 14.3 Assessment Methodology

### Legislation, Policy Context and Guidance

**Legislation Framework for Construction**

14.3.1 The Environmental Protection Act[1] describes the duty of the Local Authority to take steps to abate any noise impact, including that from a construction site, deemed to be causing a statutory nuisance. Noise is outlined in Part III of the Act in relation to noise as a nuisance or that is prejudicial to health.

14.3.2 The Control of Pollution Act[2] gives the Local Authority powers to serve a notice to the developer requiring the control of site noise under Section 60 of the Act. This may include specific controls to restrict certain activities identified as causing particular problems. Conditions regarding hours of operation will generally be specified and noise and vibration limits at certain locations may be applied in some cases. All requirements must adhere to established guidance and be consistent with best practicable means to control noise only as far as is necessary to prevent undue disturbance.

**Legislation Framework for Operational Noise**

14.3.3 The Environmental Noise (Wales) Regulations 2006[3] (as amended 2009[4]) provide the mechanism for enacting the requirements of Directive 2002/49/EC[5] of the European Parliament (the Environmental Noise Directive) in Welsh law. Under the regulations, the Welsh Government was required to publish strategic noise maps and a Noise

[1] Environmental Protection Act 1990, Chapter 43 (HMSO, 1990)
[2] Control of Pollution Act 1974, Chapter 40 (HMSO, 1974)
[3] The Environmental Noise (Wales) Regulations (National Assembly for Wales, 2006)
[4] The Environmental Noise (Wales) (Amendment) Regulations (National Assembly for Wales, 2009)
[5] Directive 2002/49/EC of the European Parliament and of the Council (The European Parliament and the Council of the European Union, 2002)

Action Plan for Wales which identify noise Priority Areas (Noise Action Plan Priority Areas - NAPPA) and Quiet Areas (QA) to be considered in development decisions and long-term planning for noise reduction from transportation noise sources including roads.

14.3.4 The Land Compensation Act Part 1[6] entitles property or land owners to compensation if their property was reduced in value as a result of a public project such as a new or improved highway.

14.3.5 The Noise Insulation Regulations[7] (1975, amended 1988[8]) define the conditions under which dwellings are eligible for noise insulation to control internal noise levels. The conditions relate to the level of traffic noise at the façade, the increase in noise levels as a result of the highway and the contribution of the new or altered project to the noise level received at the façade. In summary, noise insulation qualification criteria require that:

a) the façade noise threshold of 68dB$L_{A10,18h}$ is met or exceeded;
b) there must be a noise increase of at least 1dB(A) compared to the prevailing noise level immediately before the construction of a highway or an additional carriageway were begun;
c) the noise caused by traffic on new or altered roads makes an effective contribution of at least 1dB(A); and
d) the property is 300m or less from the nearest point on the carriageway of a highway to which the Regulations apply.

14.3.6 An estimation of the number of properties that may qualify for statutory insulation is provided as part of the assessment.

**National and Regional Policy**

14.3.7 Planning Policy Wales Edition 10[9] describes the planning development policies of the Welsh Government. Of particular relevance to road infrastructure schemes are sections within Chapter 5 ‘Productive and Enterprising Places’ and Chapter 6 ‘Distinctive and Natural Places’ of this policy.

14.3.8 Section 5.3.4 discusses issues to be considered to minimise adverse effects from transport infrastructure on the natural, historic and built

[6] Land Compensation Act 1973, Chapter 26, Part 1 Compensation for depreciation caused by use of public works (HMSO, 1973)
[7] The Noise Insulation Regulations 1975 (HMSO, 1975)
[8] The Noise Insulation (Amendment) Regulations 1988 (HMSO, 1988)
[9] Planning Policy Wales Edition 10 (Welsh Government, 2018)

environment and on local communities. It also sets out the policy objectives with regard to noise from new development. In particular is the consideration of planning new routes to take advantage of existing landforms which can assist in providing natural screening, and where necessary, provide additional mitigation measures to minimise any negative impacts:

> *'Great care must be taken to minimise the adverse impacts of new or improved transport infrastructure on the natural, historic and built environment and on local communities, including on public health resulting from community severance and airborne pollution. Green infrastructure measures to mitigate negative effects and enhance environmental quality and connectivity should be considered at an early stage. Routes should make the best use of existing landforms and other landscape features to reduce noise and visual effects, subject to safety and other environmental considerations. Where no other alternative routes or options are practicable, transport infrastructure schemes should provide mitigation measures to minimise the negative impacts and enhance the positive ones caused by their construction and operation, including reducing exposure to airborne pollution.'*

14.3.9 Section 6.7 'Air Quality and Soundscape' promotes the ideas and ethos to achieving desired objectives of contributing to beneficial and positive benefits from improvements in soundscapes to enhance public health, amenity and well-being, as well as on biodiversity and ecosystems.

14.3.10 Section 6.7.3 discusses the negative impacts noise can have upon public health, amenity and well-being, and the importance of consideration given to reducing these effects as far as possible, and enhancement of natural and tranquil areas. This section also discusses the importance of consideration given to high priority areas as highlighted in the noise action plans (NAPPA):

> *'Certain sounds, such as those created by trees, birds or water features, can contribute to a sense of tranquillity whilst others can be reassuring as a consequence of their association with the normality of everyday activities. Problematic forms of sound are generally experienced as noise pollution and can affect amenity and be prejudicial to health or a nuisance. Noise action plans[147] drawn up by public bodies aim to prevent and reduce noise levels where necessary and preserve soundscape quality where it is good. Noise*

*levels used to identify priority areas contained in noise action plans are usually set quite high in order to focus resources on the most polluted areas and noise must meet a number of tests before it qualifies as a statutory nuisance. Lower levels of noise, however, can still be annoying or disruptive and impact on amenity and as such should be protected through the planning process wherever necessary. The planning system must protect amenity and it is not acceptable to rely on statutory nuisance under the Environmental Protection Act 1990 to do so'.*

14.3.11 Sections 6.7.4, 6.7.5, 6.7.10, 6.7.16, 6.7.17 and 6.7.25 reiterate and reinforce the statement of intent in 6.7.3 and section 6.7 with respect to ambient sound character and exposure to new noise sources. This is particularly in regard to known NAPPA sites (otherwise defined as pollution hot spots), and including areas such as landscape, historic and cultural value, as well as biodiversity and ecosystem resilience.

14.3.12 TAN 11[10] provides technical guidance on noise generating development including transportation projects. In relation to highway projects TAN 11 makes reference to the Noise Insulation Regulations as described above.

14.3.13 The Well-being of Future Generations (Wales) Act 2015[11] has a number of well-being goals to achieve through implementing sustainable development. Changes in noise levels can have an impact on the health of habitat and humans, as such the goals to create 'a resilient Wales' and 'a healthier Wales' are applicable.

**Local Planning Policy - Pembrokeshire County Council (PCC)**

14.3.14 Local Development Plan 2013-2021[12] Policies relevant to noise include:

a) GN.1: General Development Policy – Point 2 – developments will be permitted where they will not result in an increase in noise and vibration levels; and

b) GN.3: Infrastructure and New Development – provision must be made for mitigation of potential adverse impacts including noise intrusion.

[10] Planning Guidance (Wales) Technical Advice Note 11 (Welsh Assembly Government, 1997)
[11] Well-being of Future Generations (Wales) Act 2015 (Welsh Assembly Government, 2015)
[12] Local Development Plan, Planning Pembrokeshire's Future (up to 2021), Adopted 28th February 2013 (Pembrokeshire County Council, 2013)

c) GN.37: Protection and Enhancement of Biodiversity - policy to ensure that species and their habitats are protected from the potentially adverse effects of development, and where possible enhanced. Potentially adverse effects may include disruption to species and habitats prior to, during and/or after construction for example unacceptable noise.

**Relevant Guidance**

14.3.15 The Design Manual for Roads and Bridges (DMRB) is the regulatory standard for the design of a new road or improvements to an existing road. In particular, Volume 11 Section 3 Part 7: HD 213/11 Revision 1 (Highways Agency et al, 2011) (HD 213/11)[13] sets out the method for assessing noise and vibration associated with road traffic. HD 213/11 provides guidance on the selection of the Scheme assessment area and the relevant assessment years. This procedure was adopted for the purpose of this assessment.

14.3.16 HD 213/11 requires that road traffic noise is calculated under the method described in Calculation of Road Traffic Noise[14] (CRTN). This describes a procedure for determining the level of noise from the highway based upon the traffic flow parameters, road surface, propagation distance, screening, intervening ground cover and topographical features between the highway and receptor. This is the accepted methodology to quantify traffic noise levels for use with highway noise assessment procedures.

14.3.17 The British Standard BS 5228 Code of Practice for noise and vibration on construction and open sites – Part 1[15] and Part 2[16] provide guidance on the assessment and control of noise and vibration from construction activities. Part 1 of the Standard contains detailed information on noise reduction measures and promotes the 'best practicable means' approach to control noise and vibration to minimise the impact on local residents and construction workers. Part 2 of the Standard provides criteria for vibration with regard to perception and disturbance to residents and the onset of potential cosmetic or structural damage to buildings.

[13] Design Manual for Roads and Bridges, Environmental Assessment, Volume 11, Section 3, Part 7, HD 213/11 Revision 1 Noise and Vibration (Highways Agency et al, 2011)
[14] Calculation of Road Traffic Noise (Welsh Office, 1988)
[15] BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Noise (British Standards Institution, 2014)
[16] BS 5228-2:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Vibration (British Standards Institution, 2014)

14.3.18 Part 1 of BS 6472[17] provides guidance on the assessment of vibration from a variety of sources (including general construction) and its potential to cause disturbance to people. It does not cover vibration from blasting.

14.3.19 BS ISO 4866[18] provides guidance and methodologies for the measurement and effects of vibration upon buildings.

14.3.20 The World Health Organisation (WHO)[19] provides guidance in respect to community noise and recommends for outdoor living areas a criterion of 50 $dBL_{Aeq,T}$ *"to protect the majority of people from being moderately annoyed…"* and 55 $dBL_{Aeq,T}$ *"to protect the majority of people from being seriously annoyed…"* during the daytime. The new 'WHO environmental noise guidelines 2018' identifies the latest research on health issues (carried out between 1999 and 2015), which relates adverse health impacts to various sources of noise, including road transportation noise. This latest guidance has also been considered in the assessment. However, it should be noted that these new WHO guidelines align well with the recently published PPW 10 policy (Section 6) which also addresses and takes account of the 'negative impacts' that undesirable noise can have on public health, and strongly supports the importance when considering high priority NAPPA locations and also provision of 'Tranquil Areas', as discussed in section 6.7.3. In addition to this, the latest WebTAG analysis undertaken now takes account of health impacts such as Sleep Disturbance, Stroke, Dementia and AMI as part of its overall assessment.

14.3.21 BS 8233[20] provides guidance for the control of noise in and around buildings. It is applicable to the design of new buildings, or refurbished buildings undergoing a change of use, but does not provide guidance on assessing the effects of changes in the external noise levels to occupants of an existing building.

## Consultation

14.3.22 The Pollution Control Officer (PCO) at Pembrokeshire County Council was contacted via email and telephone on 23 and 24 May 2017 respectively regarding the methodology for the noise survey, and to

[17] BS 6472-1:2008 Guide to evaluation of human exposure to vibration in buildings. Vibration sources other than blasting (British Standards Institution, 2008)
[18] BS ISO 45866:2010 Mechanical vibration and shock. Vibration of fixed structures. Guidelines for the measurement of vibrations and evaluation of their effects on structures (British Standards Institution, 2010)
[19] World Health Organisation, Guidelines for Community Noise (World Health Organisation, 1999)
[20] BS 8223:2014 Guidance on sound insulation and noise reduction for buildings (British Standards Institution, 2014)

establish the presence of existing noise issues and any particularly sensitive noise and/or vibration receptors. The PCO highlighted the issue of the existing low levels of background noise in the area due to its rural nature and agreed with the methodology and approach used in choosing the noise survey locations, undertaking the noise measurements, and carrying out the assessment to quantify the impacts and effects as set out in this chapter.

## Approach to Identification of Baseline Conditions

14.3.23 Noise or vibration sensitive buildings were identified for inclusion in the assessment, as discussed in principle with the PCO. Baseline noise surveys were carried out at sufficient locations to represent all identified noise-sensitive areas either by use of a logger over a full day (>24 hours) or via sample measurements. Full details of the survey procedures and locations are provided in Volume 3 Appendix 14.2.

14.3.24 The measured baseline noise survey data was used for the construction noise assessment to represent baseline ambient noise levels at representative receptor locations. It is assumed that local noise conditions would not change substantively between the survey period and the commencement of proposed works.

14.3.25 The future baseline noise conditions for the operational traffic assessment were determined by the CRTN noise prediction model for a forecast traffic scenario prior to construction of the Scheme. This has provided detailed coverage across the entire study area. HD 213/11 makes clear that this is the preferred approach for establishing baseline noise conditions, which are then directly comparable with the noise levels predicted in the same way with the Scheme in operation for future assessment years. The future baseline noise level predictions are supplemented by the data obtained during the baseline noise measurement survey.

## Study Area

14.3.26 The determination of study area is based on the DMRB HD 213/11 guidance. For the Detailed level of assessment used for this study, HD 213/11 requires that a quantitative noise impact study is made for all noise-sensitive properties within 600m of all Scheme roads, by-passed roads and sections of existing roads within 1 km of the Scheme that are predicted to be subject to a change in noise level of more than

1dB$L_{A10,18hr}$ in the short term as a result of the Scheme in the baseline year. Existing roads subject to a change of 1dB(A) or more were identified by forecast traffic changes arising from the Scheme. HD 213/11 notes that a change in noise level of 1dB(A) is associated with an increase in flow by at least 25% or decrease by 20%, assuming other factors remain unchanged.

14.3.27 The study area also includes affected routes beyond 1km from the Scheme. However, for these routes an assessment of noise change is carried out using 'Basic Noise Levels' (BNLs) where dwellings lie within 50m of affected routes. The Basic Noise Level is the noise level at a reference distance of 10m from the carriageway edge, derived using the CRTN methodology.

## Methodology for Construction Impacts

14.3.28 Construction noise and vibration is temporary and cannot be assessed in the same way as more permanent operational impacts such as traffic noise.

14.3.29 Noise and vibration from the construction of the Scheme was determined using BS 5228 (Parts 1 and 2). This standard provides information on the prevention and control of construction noise and vibration and includes a procedure for predicting construction noise. Calculations of noise levels at selected receivers were based on typical source noise levels (mainly taken from BS 5228-1), propagation distance and details of the intervening ground cover.

14.3.30 Construction noise predictions are based on the anticipated programme and construction methods. Nevertheless, it was necessary to make assumptions with the advice of the construction planning manager. The details of the assumed equipment and programme are in Volume 3 Appendix 14.3 and are considered to provide a sufficient level of accuracy for this assessment.

### Construction noise impact evaluation

14.3.31 Assessment of the significance of construction noise was carried out based upon noise change as outlined in BS 5228-1. The Standard provides a number of methods for the assessment of significant effects. The 'ABC' assessment method described in BS 5228-1 was used to

establish the threshold of potential significant effect for construction noise at residential receptors.

14.3.32 Under this approach, the adverse impact threshold is determined at a dwelling using the existing ambient noise level, rounded to the nearest 5dB(A). This is then used to determine the assessment category: A, B or C, which then defines the adverse noise impact threshold, as described in Table 14.1.

14.3.33 The predicted construction noise level is then compared to the appropriate noise impact threshold level. If the $L_{Aeq,T}$ construction noise level exceeds the appropriate noise impact threshold level shown in Table 14.1, then an adverse impact with the potential to cause a significant effect is identified.

Table 14.1 Threshold of potential significant effect at dwellings according to ABC method in BS 5228–1:2009 + A1:2014

| **Assessment category and threshold value period** | **Threshold value, dB$L_{Aeq}$** | | |
|---|---|---|---|
| | **Category A** | **Category B** | **Category C** |
| Night-time (2300 – 0700) | 45 | 50 | 55 |
| Daytime (0700 – 1900) and Saturdays (0700 – 1300) | 65 | 70 | 75 |
| Other:<br>Weekday evenings (1900 – 2300)<br>Saturdays (1300 – 2300)<br>Sundays (0700 – 2300) | 55 | 60 | 65 |
| Category A: threshold value to use when ambient noise levels (rounded to the nearest 5dB(A)) are less than these values<br>Category B: threshold value to use when ambient noise levels (rounded to the nearest 5dB(A)) are the same as Category A values<br>Category C: threshold value to use when ambient noise levels (rounded to the nearest 5dB(A)) are higher than Category A values. | | | |

14.3.34 For example, for a site exposed to an existing daytime ambient noise level of 68dB(A), this would be rounded to 70dB(A). An ambient level of 70dB(A) is higher than the Category A value of 65dB(A), therefore the Category C value of 75dB(A) would apply in this case as a threshold for potentially significant effects.

14.3.35 Having established if there is a potentially significant effect using the ABC method, the final assessment of significance is made using

professional judgement. This is evaluated by considering various other factors such as the expected duration of the activity as described under Significance of Effect later on in this section from paragraph 14.3.74.

14.3.36 For non-residential receptors, significant effects would be evaluated on a receptor-by-receptor basis, using established noise impact criteria for the type of receptor and professional judgement based on the factors described under Significance of Effect.

**Construction vibration impact evaluation**

14.3.37 BS 5228-2 indicates that the threshold of perception in residential environments corresponds with a Peak Particle Velocity (PPV) of 0.3mm/s. The standard also states that a complaint is likely where levels occur above 1.0mm/s PPV at residential properties but this exposure can be tolerated if prior warning and explanation was given to residents. Levels of vibration of 10mm/s PPV and above are likely to be intolerable for any more than a very brief exposure to this level.

14.3.38 The overall significance of the effect is assessed using professional judgement by considering not only the criteria above but also other factors, as discussed under Significance of Effect.

14.3.39 Ground-borne vibration during the construction of the proposed carriageway may arise due to breaking out surfaces and foundations, excavation, and the use of compactors or rollers. Impacts at sensitive receptors will be dependent on their proximity to the works and the intervening ground conditions.

14.3.40 The effects in terms of community response are expected to be governed mainly by the time of day that the works are undertaken and whether prior notice was given. Effects in terms of cosmetic or structural damage to buildings may also be of concern where they are exposed to levels of vibration much higher than the lowest perceptible levels.

14.3.41 Table 14.2 defines the no observed adverse effect levels for ground-borne vibration with regard to risk of building damage. The background and evidence for these criteria is set out in the report 'Impacts of Tunnels in the UK'[21] and the criteria are derived from BS 7385 Part 2 Evaluation and measurement for vibrations in buildings –

[21] Impacts of Tunnels in the UK (High Speed Two (HS2) Limited, September 2013)

Guide to damage levels from ground-borne vibration (British Standards Institution, 1993).

Table 14.2 Impact criterion for damage to buildings from vibration

| **Category of building** | **Vibration impact criteria for buildings (conservation criteria below which there is no risk of cosmetic damage)** | |
|---|---|---|
| | **Transient[1] vibration** | **Continuous[2] vibration** |
| Potentially vulnerable buildings[3] | 6mm/s | 3mm/s |
| Structurally sound buildings | 12mm/s | 6mm/s |
| [1]Transient vibration relative to building response such as impulsive vibration from percussive piling.<br>[2]Continuous vibration relative to building response such as vibrating rollers<br>[3]BS 7385-2 highlights that the criteria for aged buildings may need to be lower if the buildings are structurally unsound. The standard also notes that criteria should not be set lower simply because a building is important or historic (listed). | | |

14.3.42 BS 5228-2 provides a methodology for predicting typical levels of vibration from certain types of construction activities based on case study data and empirical models. This was used to assess the likelihood that vibration from the works may exceed the thresholds for perception and disturbance.

## Methodology for Operational Impacts

14.3.43 Geographical Information Systems (GIS) were used to construct a three-dimensional noise model of the calculation area for the Scheme. The model includes terrain data, buildings and other structures that might screen or reflect noise, ground cover types and road links. Three-dimensional models of the Scheme design and groundworks were incorporated to ensure an accurate representation of the Scheme and existing roads.

14.3.44 For each road link in the model, data on traffic flow, speed, proportion of heavy goods vehicles (HGVs) and road surface type were obtained from the project traffic and highways engineers for inclusion into the model. Noise level calculations according to CRTN were carried out using proprietary noise modelling software. Traffic noise levels were calculated across a grid of receptor positions over the study area, and contours of noise level exposure were established. Additional

calculations were also conducted at each property façade to establish noise and nuisance change at each dwelling. In accordance with HD 213/11, the façade which is predicted to experience the least beneficial change as a result of the Scheme was used for the assessment. In some cases, this leads to a receptor on a façade facing away from the existing A40 being chosen and therefore the highest noise levels in the baseline situation are not always represented.

14.3.45 The traffic data used in the model were those forecasted under the Do-Something and Do-Minimum scenarios both in the Scheme opening year (baseline year), in this case 2021; and those in the future assessment year i.e. the year of maximum projected traffic flow within 15 years of opening, in this case 2036.

14.3.46 These traffic data were included in the noise model to produce the following scenarios:

a) Do-Minimum (without the Scheme) in the baseline year (2021);
b) Do-Minimum (without the Scheme) in the design year (2036);
c) Do-Something (with the Scheme) in the baseline year (2021); and
d) Do-Something (with the Scheme) in the design year (2036).

14.3.47 The study area and HD 213/11 calculation area are defined under Study Area above.

14.3.48 The noise prediction model was used to calculate noise contour levels within the noise study area, at a height of 4m above local ground level, in terms of the free-field $L_{A10,18h}$ index in accordance with CRTN methodology, as required by HD 213/11, for each of the four Scheme scenarios as listed above. In addition, façade corrected noise predictions were undertaken at each dwelling and other noise sensitive receptors, at ground floor and 1st floor levels, 1.5m and 4.0m above local ground level respectively.

14.3.49 The $L_{A10,18h}$ index represents the arithmetic mean of all the hourly values of $L_{A10}$ during the period between the hours of 0600 and 2400. The CRTN procedure is based upon empirical data with a slightly positive wind vector component blowing downwind from source to receptor. The CRTN prediction therefore assumes an adverse wind component to represent a typical worst-case scenario. The additional advice given in HD 213/11 was adopted regarding CRTN procedures.

These include revisions to vehicle classification, traffic data and corrections due to road surface.

14.3.50 Baseline noise survey results (as outlined in Section 14.4 and detailed in Volume 3 Appendix 14.2 were used as a general means of providing indicative information to assist in the validation of predicted noise climates across the study area.

14.3.51 As part of the procedure for a Detailed Assessment, HD 213/11 requires that the magnitude of the noise impact is reported using a suggested scale of magnitude to describe the increase or decrease in noise level associated with the Scheme. The magnitude scale is described in more detail later in this Section.

14.3.52 Following the HD 213/11 procedures, noise difference contour maps were produced using the results from the calculations to graphically represent the noise changes within the noise study area. The required assessment of impact magnitude is presented in Volume 2 Figures 14.2 to 14.4, for the following scenarios:

a) Do-Minimum scenario in the 2021 baseline year against the Do-Minimum scenario in the 2036 future year (long term);
b) Do-Minimum scenario in the 2021 baseline year against the Do-Something scenario in the 2021 baseline year (short term); and
c) Do-Minimum scenario in the 2021 design year against Do-Something scenario in the 2036 future year (long term).

14.3.53 HD 213/11 Detailed Assessment also requires that a night-time noise assessment is carried out. The $L_{night,outside}$ descriptor is used to represent the noise level at dwellings between the hours of 2300 and 0700. Method 3 from the Transport Research Laboratory (TRL) report *'Converting the UK traffic noise index $L_{A10,18hr}$ to EU noise indices for noise mapping'* was used for predicting $L_{night}$ noise levels. Method 3 uses daily traffic flow data converting predicted daytime noise levels ($L_{A10,18h}$) to night-time noise levels. This method was appropriate as there was nothing considered to be unusual in the proportionate traffic flow volumes for this route between daytime and night-time.

14.3.54 For the night-time noise assessment, only dwellings with a noise level over 55dB$L_{night,outside}$ are considered (as specified in HD 213/11). The assessment of impact magnitude for night-time noise follows the same method as the daytime and is required for the following scenarios:

a) Do-Minimum scenario in the 2021 baseline year against the Do-Minimum scenario in the 2036 future year (long term); and
b) Do-Minimum scenario in the 2021 design year against Do-Something scenario in the 2036 future year (long term).

14.3.55 HD 213/11 requires tabulated results of noise level changes, which summarise the number of dwellings and other noise-sensitive receptors subject to noise changes corresponding to each magnitude of impact in both the short term (baseline year) and long term (future year), for the daytime period. To evaluate the night-time effects, only the long-term impacts need to be considered. In accordance with the method, these tables are completed with noise levels calculated for the façade with the least beneficial change in noise.

14.3.56 In addition, traffic noise nuisance reporting tables are also required. The noise nuisance level is calculated at the least beneficial facade of each dwelling in accordance with HD 213/11 methodology and is presented in percentage bands relating to the change in percentage of people bothered by the noise change.

14.3.57 For the Do-Minimum scenario the change in 'steady-state' nuisance between the baseline and future years is reported. For the Do-Something scenario, it is the highest increase in nuisance that occurs between the opening and future assessment years that is reported.

14.3.58 The determination of study area is based on the HD 213/11 guidance and detailed under Study Area above.

14.3.59 This assessment has also taken into consideration NAPPA. These are existing noise-sensitive areas, i.e. residential, where noise exposure is shown to be particularly high, and where ameliorative measures should be considered a high priority. Residential areas around the A40 passing through the village of Llanddewi Velfrey are identified as a NAPPA.

**Traffic noise impact evaluation**

14.3.60 There is no established UK guidance which clearly defines criteria for the assessment of significant effects arising from road traffic noise. The response of people to noise is subjective and sensitivity to changes in traffic noise is therefore variable across the population. Given the variability of response and the potential for non-acoustic factors to influence perceptions of noise, any assessment of significance can only represent the general community response to traffic noise.

14.3.61 It is common practice to use the change in noise level climate brought about by a Scheme as the basis for evaluating noise impacts (i.e. the impact of the Scheme on the pre-existing noise environment and the effects this may have on the receptors in that environment).

14.3.62 The scale or severity of any noise change, positive or negative, requires description to indicate the degree of impact. This leads to the common practice of defining noise change impact categories with an associated semantic scale.

14.3.63 HD 213/11 assigns magnitude of impact descriptors associated to different levels of noise change in the short and long term. These magnitude of impact descriptors are shown in Table 14.3 (short term) and Table 14.4 (long term). The different scales describe the more sensitive response described in HD 213/11 for short-term changes in traffic noise, as opposed to the long-term response to differences in steady-state traffic noise.

Table 14.3 Classification of magnitude of noise impact in the short term under HD 213/11

| Noise Change [dB(A)] | Magnitude of Impact in the short term |
|---|---|
| 0 | No change |
| 0.1 – 0.9 | Negligible |
| 1.0 – 2.9 | Minor |
| 3.0 – 4.9 | Moderate |
| 5.0 + | Major |

Table 14.4 Classification of magnitude of noise impact in the long term under HD 213/11

| Noise Change [dB(A)] | Magnitude of Impact in the long term |
|---|---|
| 0 | No change |
| 0.1 – 2.9 | Negligible |
| 3.0 – 4.9 | Minor |
| 5.0 – 9.9 | Moderate |
| 10.0 + | Major |

14.3.64 The research cited by HD 213/11 states that even for those most sensitive to short-term change in noise, a change of less than 1dB(A) is imperceptible and hence is a negligible impact on the environment.

Equally, in the long term, a change of less than 3dB(A) is imperceptible and hence is a negligible impact on the environment.

**Traffic noise significance – general**

14.3.65 As discussed above, the effect of an impact on the noise environment would depend on the type of receptor subject to the impact.

14.3.66 Historically, the assessment of significant noise effects was often based on exceeding the Noise Insulation Regulations (NIR) qualification level (i.e. 68dB$L_{A10,18h}$). This is accepted as a very high level of external noise where the noise insulation provided by a closed, single-glazed window is insufficient to maintain internal noise levels that are consistent with quiet enjoyment of a property and restorative sleep.

14.3.67 HD 213/11 states that, following a change in traffic flow, perceptible changes were reported in the short term for traffic noise changes as small as 1dB(A). This is based on research of community response to noise indicating that people can be more sensitive to the abrupt noise change soon after opening of a new or altered road. The guidance notes that this heightened sensitivity to noise change is a temporary effect and the longer-term noise nuisance level after a number of years reverts to the 'steady-state' level.

14.3.68 Other research suggests that the reported sensitivity to small changes in noise levels (less than 3dB(A)) may be coloured by factors other than noise (Baughan & Huddart, 1993).

14.3.69 As required by HD 213/11, an assessment of the short-term and long-term change in noise levels comparing the Do-Minimum condition in the baseline year against the Do-Something condition, will be undertaken.

14.3.70 Whilst HD 213/11 does not advocate use of absolute noise levels as a means of assessing noise impact or effects on receptors, the IEMA, Guidelines for Environmental Noise Impact Assessment (Institute of Environmental Management and Assessment, 2014) notes that relying solely on noise change may not be always appropriate. There are two sets of circumstance that in particular warrant some further consideration:

a) Already very noisy locations: Receptors may already be exposed to very high levels of noise from other sources and hence any

increase in noise may be considered unsatisfactory and hence additional effort may need to be made to reduce the projected noise increase; and

b) Tranquil areas: In areas formally recognised for their tranquillity because of low noise levels, small increases in noise may again be considered significant.

**Proposed traffic noise potential significance criteria**

14.3.71 Arup has developed potential significance criteria for changes in road traffic noise at sensitive receptors based on the long-term impact tables in HD 213/11. These are given below in Table 14.5. The aim of this criteria are to clearly identify those receptors where a "potential "significant effect occurs. However, other factors specific to the individual receptors and the character of the noise impact are also considered in reaching a final assessment decision. Therefore, if potentially significant effects are identified, the overall assessment of significance is evaluated using professional judgement based on the additional factors described in Section 14.3.78.

Table 14.5 Assessment of magnitude and potential significance of impact

| Change in Noise Level in the long Term (dB(A)) | Initial Indicator of Significance |
|---|---|
| +5 or greater | Potentially significant increase |
| +3 to +4.9 | |
| +1 to +2.9 | Unlikely to be significant |
| +0.9 to -0.9 | Not significant |
| -1 to -2.9 | Unlikely to be significant |
| -3 to -4.9 | Potentially significant decrease |
| -5 or less | |

14.3.72 For residential receptors, the overall significance of the effect is assessed using professional judgement by considering not only the HD 213/11 noise impact criteria to determine potential significance, but also other factors, as discussed from paragraph 14.3.75 on Significance of Effect.

**Road traffic vibration**

14.3.73 HD 213/11 recommends that the effects of vibration should also be considered where appropriate. In the case of ground-borne vibration, the likelihood of perceptible vibration being caused is particularly

dependent upon the smoothness of the road surface. Research has shown that vibration levels caused by heavy vehicles travelling at 110kph over a 25mm hump (i.e. a large discontinuity consistent with poorly backfilled trench) could cause perceptible vibration at up to 40m from the road (Watts, 1990). This would infer that it is unlikely that significant levels of vibration would be generated at distances greater than this.

14.3.74 Also, with a newly laid road surface it is a requirement of new highway construction specification that the surface would be smooth and free from any discontinuities of this magnitude. Paragraph A5.26 of HD 213/11 states: *'Such vibrations are unlikely to be important when considering disturbance from new roads and an assessment would only be necessary in exceptional circumstances'*. No such exceptional circumstances are envisaged for the Scheme and hence no impacts or effects from ground-borne vibration are predicted.

14.3.75 HD 213/11 covers the potential for airborne noise, from heavy goods vehicles, to cause vibration nuisance close to main roads. As an indication of the scale of impact relative to noise effects, the guidance in HD 213/11 paragraph A6.21 states that for a given level of traffic noise exposure the percentage of people bothered very much or quite a lot by airborne vibration is 10% lower than the corresponding amount for noise nuisance. It is also noted in paragraph A6.21 that airborne vibration is expected to affect a very small percentage of people at exposure levels below 58dB$L_{A10,18h}$. Also, the significance of any change in airborne traffic vibration can be considered proportional to the significance of changes in traffic noise. As such, the assessment of airborne vibration can be included within the assessment of airborne noise.

14.3.76 The impact of vibration effects is discussed further in Section 14.6.63.

## Significance of Effect

14.3.77 All of the identified sources of noise and vibration will be evaluated to determine if there would be adverse impacts and the potential to cause significant effects according to the criteria described above.

14.3.78 If potentially significant effects are identified, the overall assessment of significance is evaluated using professional judgement based on the following factors:

**Residential:**

a) the magnitude of the impact and effect identified (based on overall noise level and noise change);

b) the number and grouping of adversely affected dwellings and shared open areas;

c) the level and character of the existing noise environment;

d) any unique features of the source or receiving environment in the local area, such as other ambient noise sources in the vicinity that might affect the perception of traffic noise changes;

e) combined exposure to noise and vibration;

f) duration of impact and effect (for construction); and,

g) the effectiveness of mitigation measures that could avoid or reduce the adverse effects.

**Non-residential:**

a) the generic use (e.g. outdoor amenity, educational, healthcare, religious buildings or community uses) and hence relevant guidance on noise;

b) the times of use;

c) the design of the receptor (especially windows, doors and ventilation systems) and hence ability of receptor to experience changes in external noise environment without significant change in internal noise conditions);

d) the layout - whether the most sensitive parts of the building are closest to and face the Scheme, or are located further from the Scheme and are on the opposite side of a building;

e) duration of impact and effect (for construction); and,

f) the effectiveness of mitigation measures that could avoid or reduce the adverse effects.

14.3.79 The sensitive receptors considered for this assessment are shown in Volume 2 Figure 14.1.

## Receptor Sensitivity

14.3.80 The closest residential receptors to the north of the Scheme are some 20m or more away and include Blackmoor, Bro Minau, Penrhiw Cottage, Pen-troydin-fawr Farm, and Bethel. Trefangor Cottage lies within the proposed Scheme and is to be demolished. The closest residential receptors to the south of the Scheme is Henllan Lodge some 13m away. Other nearby southern residential receptors include Penblewin Farm, Caermaenau-fach Farm, Trefangor Farm, Henllan

Lodge, Awel Deg, Maes-y-ffynnon and Blaen-pentroydin. Residential receptors are categorised as high sensitivity with regard to noise.

14.3.81 Non-residential receptors include Bethel Chapel some 20m to the north of the Scheme which is categorised as high sensitivity. Llanddewi Velfrey Village Hall and Llanddewi Velfrey Cricket Club are over 200m to the south and are categorised as medium sensitivity.

## Limitations of the Assessment

### Construction

14.3.82 The assessment considers construction noise and vibration on a month-by-month basis; this is based on representative construction methods suitable for this assessment (equipment details are provided in Volume 3 Appendix 14.3). Noise levels would vary day-to-day; the highest daily levels may sometimes be around 5dB(A) higher than the monthly average levels but would then be substantially lower on other days in that month. Noise and vibration from all construction activities, including short duration activities, is subject to control under the Construction Environmental Management Plan (CEMP) (Volume 3 Appendix 2.2: Pre-CEMP). Hence minimisation of noise as far as practicable is agreed with the relevant local authority by consent under the *Control of Pollution Act 1974* before the works can commence on site.

### Operation

14.3.83 The effects of noise and vibration from the operation of the Scheme were assessed based on traffic modelling (Traffic Forecasting Report Volume 3 Appendix 2.1). Other committed or planned developments may affect the predicted traffic using the Scheme and these have, as far as possible, been included within the Scheme traffic data on the basis of assumed dates for committed developments to be operational. It is likely that the changes in impact associated with any variability in programme for committed developments would be negligible in terms of predicted traffic noise levels.

14.3.84 There would be regular planned maintenance work along the route. Given the infrequent, irregular and short duration of works likely to cause appreciable noise or vibration, maintenance work is considered unlikely to give rise to significant noise or vibration effects.

## 14.4 Baseline Conditions

14.4.1 A noise survey was undertaken to establish baseline noise levels in the vicinity of A40 Llanddewi Velfrey to Penblewin. A baseline noise survey is recommended as part of the HD 213/11 detailed assessment procedure. The guidance also notes that:

> *'During the assessment process, measurements should not routinely be compared with calculations for the purpose of predicting changes in noise level. There is currently no methodology available to take account of the potential errors associated with comparing measurements with calculations, especially when the receptor is some distance from the noise source.'*

14.4.2 The purpose of the baseline noise survey was to provide data on noise climates at a sample of locations to supplement the traffic noise predictions and to provide baseline data for the construction noise assessment. The survey was also considered important to determine if any parts of the study area are dominated by noise from sources other than traffic noise, in which case the prediction results would not accurately reflect noise levels in that area.

14.4.3 It should be noted that, even where the noise climate is dominated by roads, some variance between existing measured noise levels and predicted noise levels for the future baseline year prior to opening of the Scheme would be expected. This might be due to differences in traffic flow levels between the present and the baseline year or meteorological conditions at the time of the survey.

14.4.4 Tables 14.6-14.8 show the range of measured baseline noise levels. Detailed results and the survey method are reported in Volume 3 Appendix 14.2 along with a plan of the survey locations.

14.4.5 The survey locations were selected to represent the nearest residential receptors. Noise loggers were used in selected locations to capture baseline noise over a period of more than 24 hours. There were 13 measurement locations, summarised as follows:

a) Location 1 (attended) – on the south side of Bethel Cottage;

b) Location 2 (attended) – on the pavement to the north side of Arfryn alongside the existing road;

c) Location 3 (attended) – to the south of the main residence at Valley View;

d) Location 4 (attended) – to the south of Castell;

e) Location 5 (attended) – to the north-eastern side of the main residence at Willow Tree School for Dogs (Blaen-pentroydin);

f) Location 6 (unattended logger) – to the south of Pen-troydin-fawr Farm at approximately the same level as the bedroom windows of the farmhouse;

g) Location 7 (attended) – on the south-western side of Awel Deg;

h) Location 8 (attended) – to the northern side of Maes-y-ffynnon;

i) Location 8a (attended) – to the southern side of Maes-y-ffynnon;

j) Location 9 (attended) – to the southern side of Penrhiw Cottage;

k) Location 10 (attended) – to the northern side of Henllan Lodge;

l) Location 11 (unattended logger) – to the north of Trefangor Farm;

m) Location 12 (attended) – to the eastern side of the farmhouse at Penblewin Farm.

14.4.6 Attended measurements at locations 1-8 and 12 followed the shortened measurement procedure described in CRTN to obtain the $L_{A10,18hr}$. Sample measurements made at locations 9 and 10 were compared with the 18-hour noise levels recorded at Location 11, which was subject to the same dominant noise source, to derive the 18-hour noise levels at these locations. See Volume 3 Appendix 14.2 for further information.

14.4.7 The dominant noise source at the attended measurements was road traffic on the A40. Other notable noise sources were distant farm vehicles and aircraft.

14.4.8 Low noise surfacing has recently been applied along a short length of the existing A40 within a speed restricted 40 mph zone, where it passes immediately to the north of the village of Llanddewi Vestry, which lies within a recognised NAPPA area. This has been taken into account and incorporated into the road noise calculation model. This will provide a small noise reduction over the previous Hot Rolled Ashphalt (HRA) road surfacing to dwellings within this village due to the 64kph (40mph) speed-controlled zone. This is explained in more detail in section 14.5.5.

Table 14.6 Measured daytime baseline noise levels (attended)

| Location | Sound level, dB (façade) | | | |
|---|---|---|---|---|
| | $L_{A10,18h}$[1] | Range of $L_{A10,15min}$ | Range of $L_{A90,15min}$ | Range of $L_{Aeq,15min}$ |
| 1 | 68 | 69-70 | 40-46 | 64-66 |
| 2 | 79 | 79-80 | 47-52 | 75-77 |
| 3 | 52 | 52-53 | 44-46 | 49-50 |
| 4 | 52 | 49-56 | 42 | 46-52 |
| 5 | 44 | 43-46 | 34-39 | 41-43 |
| 7 | 43 | 43-46 | 35-39 | 41-44 |
| 8 | 51 | 52-53 | 41-44 | 49-50 |
| 8a[2] | 64 | 65-66 | 47-51 | 61-63 |
| 9 | 72 | 74 | 51 | 69 |
| 10 | 75 | 77 | 45 | 72 |
| 12 | 61 | 62-63 | 52-54 | 59-60 |

Notes:

[1] $L_{A10,18hr}$ values are derived as the arithmetic average of the three consecutive $L_{A10,1hr}$ values (based on 15-minute samples) for each location minus 1dB(A) except at locations 9 and 10 where a comparative procedure with the logger at location 11 was used.

[2] Measurements taken at location 8a were five minutes in duration

Table 14.7 Summary of logger measurements taken at location 6

| Time period | Sound level, dB (free field) | | |
|---|---|---|---|
| | $L_{Aeq}$ (range) | $L_{A10}$ average (range) | $L_{A90}$ range |
| Day (0700-1900) | 56 (41-69) | 56 (41-74) | 30-57 |
| Evening (1900-2300) | 50 (35-58) | 49 (36-63) | 24-46 |
| Night (2300-0700) | 45 (19-58) | 40 (21-63) | 17-47 |

Notes:

Overall $L_{Aeq}$ values are the logarithmic (energy) average of the five-minute measurements for the respective time periods

Daytime measurements at this location were affected by non-typical events at the nearby farm and hence are not considered to be representative of the noise climate at this location. For this reason, an overall $L_{A10,18hr}$ is not presented

Table 14.8 Summary of logger measurements taken at location 11

| **Time period** | **Sound level, dB (façade)** | | |
|---|---|---|---|
| | **$L_{Aeq}$ (range)** | **$L_{A10,18hr}$** | **$L_{90}$ (range)** |
| Day (0700-1900) | 74 (70-77) | 77 | 50 (36-60) |
| Evening (1900-2300) | 71 (67-73) | | 45 (25-54) |
| Night (2300-0700) | 67 (22-74) | | 27 (15-50) |
| Notes:<br>Overall $L_{Aeq}$ values are the logarithmic (energy) average of the five-minute measurements for the respective time periods<br>The $L_{A10,18hr}$ was derived from the arithmetic average the $L_{A10,5min}$ values for the period 0600-2400 hours. | | | |

# 14.5 Mitigation Measures

## Construction

14.5.1 Best Practicable Means mitigation methods will be implemented to control construction noise. The use of low noise emission plant and processes (as specified in BS 5228-1 Annex B - Noise sources, remedies and their effectiveness) will be used. In addition, and wherever possible, the maximising of interveening distances between construction plant sources and the closest noise-sensitive receptors will also be sought. Where it is not possible to reduce noise levels enough by the methods already described above, then further noise mitigation would be sought by implementation of carefully considered and designed screening methods (to be determined by the Main Contractor, once construction methods and constrainst are clarified).

14.5.2 Some of the equipment with particularly high noise levels such as the chipper used during the site clearance and mobilisation activity should be located as far away as possible from noise-sensitive receptors to minimise the noise exposure. Localised screening around these construction plant operations where practicable, should also be used to provide additional noise mitigation measures which would further protect and minimise noise exposure to the nearest noise-sensitive receptors.

14.5.3 Vibratory rollers should not be used within 90m and 125m of sensitive receptors for steady and start-up/run down operations respectively. Alternatively - or in addition to this - vibration monitoring should be carried out, and acted upon, to minimise adverse effects and avoid

significant effects during the works. These distances were determined assuming the worst case 18 tonne vibratory roller as stated in Volume 3 Appendix 14.3 and assuming a cautious 5% probability of the predicted value being exceeded. There would be variability due to the ground type and the vibratory process used, however this is considered to be a robust, worst case assessment for typical conditions.

### Operation

14.5.4 The Scheme was designed to minimise noise impacts by putting the proposed new road into cutting where possible, creating natural screening of the noise source. Where the Scheme will follow the alignment of the existing A40, it was designed to be further away from the closest properties to the road wherever possible.

14.5.5 The Scheme would be surfaced with a Thin Surface Course System (TSCS) which is a low noise surface. A -3.5dB(A) correction (i.e. reduction) is applied in the modelling to account for this as compared with a -0.5dB(A) CRTN correction which is applicable to the existing A40 based on a HRA surface with an assumed 1.5mm texture depth. This benefit is only counted where traffic speeds are expected to be above 75kph as per the advice in HD 213/11; however, where average speeds were predicted to be between 70kph and 75kph, an interim allowance of -2.5dB(A) was allowed for to avoid an unrealistic step change in noise benefit. For TSCS, a -1dB(A) correction is assumed where traffic speeds are less than 75kph (or in this case, 70kph).

## 14.6 Assessment of Environmental Impacts

### Construction Impacts

**Construction Noise**

14.6.1 For the purposes of assessment, the site preparation and construction works were divided into the following stages for the Scheme works. Volume 3 Appendix 14.3 describes the plant machinery assumed for the assessment:

a) Site clearance and mobilisation
b) Earthworks
c) Drainage
d) Structures; and

e) Pavement.

14.6.2 The assumed timetable and phasing of works is in Volume 3 Appendix 14.3; the works proposed to take place between February 2019 and March 2020. The proposed hours for noise and vibration producing activities are Monday to Friday, daytime only for six hours a day based on information provided by the Contractor.

14.6.3 At the present time, it is not known exactly where the site compound will be located, however, it is considered likely to be situated centrally along the length of the Scheme, which would enable quick and direct access to and from the existing A40. The location will be away from the main centre of the village to minimise disturbance to residents. There is likely to be some noise from construction plant within the compound, for example, from mobile plant starting up and leaving the compound in the mornings, and then returning in the evenings. These events will only occur for a short duration during the start-up and shutdown periods. There will also be noise generated by occasional material delivery vehicles to the site compound. Any generator(s) situated within the site compound should be located away from noise-sensitive receptors.

14.6.4 In relation to noise and vibration, it was assumed that standard construction management measures (Best Practicable Means – BPM) would be implemented as part of the construction works. This requires that all reasonable measures are taken to minimise construction noise and vibration (as specified in Annex B of BS 5228-1). In particular, the contractor would be required to operate in accordance with the provisions of a CEMP for the works for agreement with the local authority. This will include measures which would be adopted to minimise the likelihood of significant disturbance to neighbouring properties. The construction noise assessment was based on such Best Practicable Means assumptions.

14.6.5 Night-time construction would be avoided for the majority of the proposed works; however, night-time working may be required for specific activities. An example of a specific activity would be tie-in works, i.e. joining existing to new road, where night-time working is likely to be required for road traffic management reasons to avoid daytime road closures. Such works are considered exceptional and would likely only occur for one or two contiguous nights at intervals throughout the works. Any such night-time works would not be

considered a significant effect due to their short-term impacts. Any noise effects arising from these short-term construction activities would be controlled by the management processes set out in the CEMP.

14.6.6 Daytime construction noise levels at a selection of the nearest sensitive receptors were predicted based on the relevant construction plant, propagation distances, on times and programme. The receptor locations included in the predictions are as follows:

a) Bethel Cottage
b) Blaen-pentroydin
c) Pen-troydin-fawr Farm
d) Maes-y-ffynnon
e) Penrhiw Cottage
f) Henllan Lodge
g) Trefangor Farm; and
h) Penblewin Farm.

14.6.7 The locations were based on the baseline survey locations shown in the Volume 2 Figure 14.1 however were adjusted to be positioned on the worst-case façade.

14.6.8 The results of the assessment of construction noise of the Scheme are presented in Table 14.9. The table shows the predicted range of monthly construction noise levels for the construction stages described above.

Table 14.9 Predicted noise levels at residential locations

| Receptor | Assumed worst-case distance to nearest centre of works, metres | Baseline | | | | Construction noise assessment | | |
|---|---|---|---|---|---|---|---|---|
| | | Equivalent noise survey location | Ambient noise level, $L_{Aeq,daytime}$ | ABC method category (BS 5228-1) | ABC threshold, $L_{Aeq,daytime}$ | Range of monthly predicted construction façade noise level, $dBL_{Aeq,daytime}$ | Number of months monthly construction noise levels exceed ABC threshold | Construction activities resulting in construction noise levels exceeding ABC threshold |
| R1 Penblewin Farm | 54 | 12 | 59-60 | A | 65 | 59-72 | 10 | West roundabout & west section – Site clearance and mobilisation, Earthworks, Pavement |
| R2 Trefangor Farm | 43 | 11 (logger) | 70-77 (74)* | C | 75 | 59-68 | - | - |
| R3 Henllan Lodge | 13 | 10 | 72 | C | 75 | 73-82 | 12 | Centre (Underpass & Ffynnon Woods) and west section – Site clearance and mobilisation, Earthworks, Pavement, Structures |

| Receptor | Assumed worst-case distance to nearest centre of works, metres | Baseline | | | | Construction noise assessment | | |
|---|---|---|---|---|---|---|---|---|
| | | Equivalent noise survey location | Ambient noise level, $L_{Aeq,daytime}$ | ABC method category (BS 5228-1) | ABC threshold, $L_{Aeq,daytime}$ | Range of monthly predicted construction façade noise level, $dBL_{Aeq,daytime}$ | Number of months monthly construction noise levels exceed ABC threshold | Construction activities resulting in construction noise levels exceeding ABC threshold |
| R4 Penrhiw Cottage | 19 | 9 | 69 | C | 75 | 67-76 | 1 | Centre (Underpass & Ffynnon Woods) – Site clearance and mobilisation |
| R5 Maes-y-ffynnon | 57 | 8<br>8a | 49-50<br>61-63 | A | 65 | 56-65 | 1 | Ch. 1900-2850 – Site clearance and mobilisation, Earthworks, Pavement |
| R6 Pen-troyden-Fawr Farm | 112 | 6 (logger) | 41-69 (56)* | A | 65 | 49-63 | - | - |
| R7 Blaen-pentroydin | 218 | 5 | 41-43 | A | 65 | 42-52 | - | - |
| R8 Bethel Cottage | 25 | 1 | 64-66 | B | 70 | 65-80 | 7 | East roundabout - Site clearance and mobilisation, Earthworks, Pavement, Drainage |

*Overall $L_{Aeq}$ values are the logarithmic (energy) average of the five-minute measurements for the time period 0700-1900 hours

14.6.9 The results show the BS 5288-1 ABC threshold for potential significant effects is not exceeded at receptors R2 Trefangor Farm, R6 Pen-troyden-Fawr Farm and R7 Blaen-pentroydin. As such, likely effects are assessed as **not significant** at these properties.

14.6.10 The BS 5228-1 ABC threshold is exceeded in some of the months at receptors R1 Penblewin Farm, R3 Henllan Lodge, R4 Penrhiw Cottage, R5 Maes-y-ffynnon and R8 Bethel Cottage. Table 14.9 shows the number of months the value is exceeded as well as providing an indication of the construction activities causing exceedance.

14.6.11 The predicted construction noise levels do not take into account screening either from the natural landform, the formation of cuttings as work progresses or from purpose-built noise barriers. Screening effects could reduce the predicted noise levels by around 5 to 10 dB. The provision of purpose-built noise barriers will be considered further in the CEMP.

14.6.12 In cases where the noise level would seriously affect the enjoyment of an eligible building for a substantial period of time, and no other form of mitigation is reasonably practicable, noise insulation under the Noise Insulation Regulations (1975) could be considered subject to further assessment. There is no set method for determining eligibility however, BS 5228-1 sets out an example which makes reference to a level of 75 $dBL_{Aeq,10hrs}$ being exceeded between the hours of 0800 and 1800 for a total number of days exceeding 40 in any 6 consecutive months amongst other criteria. Due to the small number of properties affected and the potential to mitigate these effects with noise insulation at individual properties, the likely effects are assessed as **not significant** in EIA terms.

14.6.13 The site clearance and mobilisation stage which takes place over the duration of a month results in the highest predicted noise levels. This stage includes tree felling and chipping. Other activities including high noise levels include the breaker during the pavement works and the larger bulldozer and dump truck associated with some sections of the earthworks.

**Construction Vibration**

14.6.14 There are no piling activities proposed however compaction will be required in the construction process within a few metres from some

sensitive receptors. Typical vibratory rollers which may be used are 4 tonne and 18 tonne Bomag Single Drum Rollers. Model types BW124 DH and 216 DH-5 were assumed respectively for the assessment.

14.6.15 As noted in Section 14.3.37 a complaint is likely where levels occur above 1.0mm/s PPV at residential properties but this exposure can be tolerated if prior warning and explanation was given to residents (BS 5228-2).

14.6.16 Assuming a cautious 5% probability of the predicted value being exceeded, the distance beyond which the vibration level from steady-state operation of the worst case 18 tonne roller is predicted to be below 1.0mm/s is 90m.

14.6.17 For start-up and run-down operation, the equivalent distance is 125m however these operations would be of relatively short duration. Beyond these distances the construction vibration effects are not likely to result in a complaint.

14.6.18 Prior warning and explanation should be given to residents of vibratory compaction activities to reduce the potential impact.

14.6.19 To avoid significant effects, work within these distances will need to be carried out via alternative methods (i.e. a static drum) and/or vibration monitoring would be required. Further assessment of the risk should be undertaken. Assuming that this can be adhered to the construction vibration effects are assessed as **not significant.**

## Operational Impacts

14.6.20 Daytime and night-time traffic noise levels within the Scheme study area were predicted in accordance with the methodology set out under Methodology for Operational Impacts. Noise level predictions were made for the Do-Something and Do-Minimum scenarios in both the baseline year (2021) and future year (2036).

14.6.21 Volume 3 Appendix 14.4, lists the noise levels and noise level changes predicted at all dwellings and sensitive receptors within the study area for all scenarios. The following tables are presented:

14.6.22 Table A14-20 shows the predicted noise levels and noise changes for the 18-hour day at all residential receptors.

14.6.23 Table A14-21 shows the predicted noise levels and noise changes during the night-time at all residential receptors.

14.6.24 Table A14-22 shows the predicted noise levels and noise changes during the 18-hour day at other sensitive receptors.

14.6.25 The magnitude of noise change is also shown graphically in the noise level difference contours described below. T he noise change magnitude bands correspond to the classification of magnitude of impact shown in Tables 3.1 and 3.2 of HD 213/11. The magnitude of noise change classifications is also described for the Scheme for the baseline and future years as part of the assessment text later in this section.

14.6.26 The following Volume 2 Figures show predicted daytime traffic noise levels and noise level changes represented in noise level contour maps:

14.6.27 Figure 14.1: Do-Minimum scenario in the 2021 baseline year;

14.6.28 Figure 14.2: Do-Minimum scenario in the 2021 baseline year against the Do-Minimum scenario in the 2036 future year (long-term Do-Minimum);

14.6.29 Figure 14.3: Do-Minimum scenario in the 2021 baseline year against Do-Something scenario in the 2021 baseline year (short-term Do-Something); and

14.6.30 Figure 14.4: Do-Minimum scenario in the 2021 baseline year against Do-Something scenario in the 2036 future year (long-term Do-Something).

14.6.31 The following assessment considers noise impacts and effects for both daytime and night-time periods in accordance with HD 213/11 procedure.

14.6.32 The assessment of the magnitude of daytime-noise change impact was made based on changes in the noise climate between baseline year (2021) without the Scheme and the baseline year with Scheme and baseline year without the Scheme and the future year (2036) with the Scheme.

14.6.33 The assessment of the magnitude of night-time noise change impact was made based on changes in the noise climate between baseline year without the Scheme (2021) and the future year (2036) with and without the Scheme where noise levels are predicted to be above 55dB$L_{night,outside}$ in any scenario.

14.6.34 Subsequently an assessment of the effects for both daytime and night-time was made. This describes whether the noise effects in an area affected by the Scheme are rated as significant or not, based on the criteria described under Significance of Effect (from paragraph 14.3.74).

14.6.35 Based on the noise modelling results, Table 14.10 to Table 14.12 give a summary of noise level changes as a result of the Scheme at dwellings and other sensitive receptors in the short and long term across the entire study area. The noise change bands shown in each table correspond to the DMRB HD 213/11 classification of magnitude of impact at each receptor shown in Table 14.3 and Table 14.4. The noise change bands are presented based on first floor results at a height of 4m above local ground as these represent the worst case in most situations.

Table 14.10 Short-term noise reporting table (HD 213/11 Table A1.1) with Scheme

| **Project/Option: A40 Llanddewi Velfrey to Penblewin** | | | | |
|---|---|---|---|---|
| **Scenario/Comparison: Do-Something 2021 compared to Do-Minimum 2021** | | | | |
| Change in noise Level | | DMRB Impact category (short term) | Daytime | |
| | | | Number of Dwellings | Number of 'other' sensitive receptors |
| Increase in noise level, $L_{A10,18h}$ dB | 0.1 – 0.9 | Negligible | 7 | 0 |
| | 1 – 2.9 | Minor adverse | 6 | 0 |
| | 3 – 4.9 | Moderate adverse | 4 | 0 |
| | 5 + | Major adverse | 3 | 1 |
| | | | | |
| No Change | 0 | Negligible | 12 | 0 |
| | | | | |
| Decrease in noise level, $L_{A10,18h}$ dB | 0.1 – 0.9 | Negligible | 30 | 1 |
| | 1 – 2.9 | Minor beneficial | 29 | 0 |
| | 3 – 4.9 | Moderate beneficial | 20 | 2 |
| | 5 + | Major beneficial | 43 | 2 |

Table 14.11 Long-term noise reporting table (HD 213/11 Table A1.2) with Scheme

| **Project/Option: A40 Llanddewi Velfrey to Penblewin** | | | | | |
|---|---|---|---|---|---|
| **Scenario/Comparison: Do-Something 2036 compared to Do-Minimum 2021** | | | | | |
| Change in noise Level | | DMRB Impact category (long term) | Daytime | | Night-time |
| | | | Number of Dwellings | Number of 'other' sensitive receptors | Number of Dwellings |
| Increase in noise level, $L_{A10,18h}$ dB | 0.1 – 2.9 | Negligible | 32 | 1 | 0 |
| | 3 – 4.9 | Minor adverse | 1 | 0 | 0 |
| | 5 – 9.9 | Moderate adverse | 6 | 1 | 0 |
| | 10 + | Major adverse | 1 | 0 | 0 |
| | | | | | |
| No Change | 0 | Negligible | 2 | 0 | 0 |
| | | | | | |
| Decrease in noise level, $L_{A10,18h}$ dB | 0.1 - 2.9 | Negligible | 58 | 1 | 1 |
| | 3 - 4.9 | Minor beneficial | 13 | 1 | 0 |
| | 5 - 9.9 | Moderate beneficial | 27 | 1 | 0 |
| | 10 + | Major beneficial | 14 | 1 | 1 |

Table 14.12 Long-term noise reporting table (HD 213/11 Table A1.2) Do-Minimum

| **Project/Option: A40 Llanddewi Velfrey to Penblewin** | | | | | |
|---|---|---|---|---|---|
| **Scenario/Comparison: Do-Minimum 2036 compared to Do-Minimum 2021[22]** | | | | | |
| Change in noise Level | | DMRB Impact category (long term) | Daytime | | Night-time |
| | | | Number of Dwellings | Number of 'other' sensitive receptors | Number of Dwellings |
| Increase in noise level, $L_{A10,18h}$ dB | 0.1 – 2.9 | Negligible | 106 | 5 | 1 |
| | 3 – 4.9 | Minor adverse | 0 | 0 | 0 |
| | 5 – 9.9 | Moderate adverse | 0 | 0 | 0 |
| | 10 + | Major adverse | 0 | 0 | 0 |
| | | | | | |
| No Change | 0 | Negligible | 6 | 0 | 0 |
| | | | | | |
| Decrease in noise level, $L_{A10,18h}$ dB | 0.1 - 2.9 | Negligible | 43 | 1 | 1 |
| | 3 - 4.9 | Minor beneficial | 0 | 0 | 0 |
| | 5 - 9.9 | Moderate beneficial | 0 | 0 | 0 |
| | 10 + | Major beneficial | 0 | 0 | 0 |

[22] Note: the number of dwellings for the Do-Minimum 2036 scenario includes a property which would be demolished with the Scheme (hence not included in tables above for Do-Something scenarios).

14.6.36 In general, the tables show that most dwellings will experience a noise decrease with the Scheme in both the short term and long term. There is an additional increase in noise level as a result of traffic growth on the existing A40 by 2036; predicted to be around +0.5dB(A), leading to more properties moving into the negligible noise increase band.

14.6.37 There are major beneficial impacts predicted at 43 properties in the baseline year including a number of properties currently experiencing very high noise levels in an area which was identified as a NAPPA around Llanddewi Velfrey. In the future year assessment major beneficial impacts are predicted at 14 properties.

14.6.38 In total, 92 residential properties in the baseline year and 54 in the future year are predicted to experience minor to major decreases in noise impact as a result of the Scheme. Two other (non-residential) sensitive receptors are predicted to experience a moderate noise decrease.

14.6.39 There are major adverse impacts predicted at three isolated residential properties and one other sensitive receptor in the short term on opening of the Scheme. In the future year there is only one remaining major impact

14.6.40 In total 13 residential properties in the baseline year and eight in the future year are predicted to experience minor to major adverse noise impacts as a result of the Scheme. One other sensitive receptor is predicted to experience a major adverse noise impact in opening and a moderate noise impact in the long term.

14.6.41 In the absence of the Scheme, 106 residential properties and five other sensitive receptors were predicted to experience a negligible noise increase between 2021 and 2036, six were predicted to experience no change and 43 residential receptors and one other sensitive receptor were predicted to experience a negligible noise decrease. The noise decreases would result from assumed resurfacing by the future year of the remaining section of the Scheme which is currently surfaced with HRA.

14.6.42 The noise level difference maps, Volume 2 Figures 14.2 to 14.4, show the changes in the noise levels between the Do-Something scenarios for years 2021 and 2036 and Do-Minimum scenario 2021 and 2036. Using the information from these figures, the following is a detailed

assessment identifying specific noise impacts and effects around the Scheme. It should be noted that in some cases the noise contours do not pick up the fine detail of the calculations and in this case results shown in Volume 3 Appendix 14.4 may be referred to, to provide further accuracy. The results given in Volume 3 Appendix 14.4 are presented for the façade with 'least beneficial change' for each receptor. This presents the worst-case noise change impact but may not pick up the highest absolute noise impact experienced at a property. Where an understanding of how alternative façades are affected aids understanding of the impacts, a description has been included in the following paragraphs. Further information on the predicted noise levels at all façades of each property is available on request.

14.6.43 Volume 2 Figure 14.2 shows the effects of traffic growth, along with the inclusion of low noise surfacing that would occur in the absence of the Scheme by the future year. This shows that there would be negligible noise increases or decreases (0.1 to 2.9dB(A) bands[23]). Noise increases of typically around 0.5dB(A) are predicted due to traffic growth in the baseline year. It should be noted that the low noise surface will provide -3dB(A) benefit where traffic speeds are predicted to be in excess of 75 km/h (47 miles/hour). Below this speed the noise benefit gradually reduces down to -1.0dB(A). Therefore, negligible noise increases are predicted through the village of Llanddewi Velfrey where traffic speeds are predicted to be below this. This sets the context against which the future year noise increases with the Scheme are considered below.

**Scheme Bypass Section**

14.6.44 Major noise increases are predicted in the Do-Something baseline year (short-term effects) to both the north and south of the Scheme bypass section (see Table 14.10). This affects a total of three residential properties and one non-residential property in the short term. The affected properties are to the north of the new A40 bypass around Llanddewi Velfrey at Valley View and Castell; properties at the northern extent of Glan Preseli (Brynwylfa and Llanddewi Village Hall) and Maes-y-ffynnon situated to the east of the new junction, equidistant at around 50m from the new bypass and the existing A40 through Llanddewi Velfrey. In the future year (long-term effects, see Table 14.11) there is only one remaining major impact predicted, on the north facing façade of Maes-y-ffynnon. Note that this would to some extent

[23] Note that HD 213/11 specifies different ranges of noise change band for opening (baseline) and future years.

be offset by minor to moderate noise reductions on the remaining façades of this property.

14.6.45 For the same affected properties to the north of the bypass (Castell and Valley View), noise increases affect all façades and lead to noise levels of around 44-45dB$L_{Aeq,16hr}$ (equivalent to 46-47dB$L_{A10,18hr}$ [24]) facing the Scheme in the future year. Although there is a large noise increase at these properties, the predicted absolute noise levels are still low and would be likely to lead to acceptable noise levels inside the properties even with windows open for natural ventilation (i.e. below BS8233 criterion of 35dB$L_{Aeq,16hr}$). Noise levels would also be below the WHO guidelines threshold for moderate annoyance of 50dB$L_{Aeq,16hr\ outside}$. Given that these are two isolated properties and not a larger community of dwellings, and the resulting noise exposure is relatively low, the noise impact is assessed as a not significant effect, based upon the significance criteria parameters defined in both Table 14.5 and Sections 14.3.75 and 14.3.76.

14.6.46 At Brynwylfa and Llanddewi Village Hall on Glan Preseli, to the south of the new bypass section but north of the existing A40, moderate and major noise impacts are forecast respectively in the baseline year. These impacts only affect very small areas of the eastern and northern façades of the two properties respectively which would be well screened from the existing A40 in the baseline situation hence magnifying the impact of noise from the new Scheme. In the future assessment year (long term) these impacts would be minor and moderate.

14.6.47 At the remainder of properties on Glan Preseli impacts range from minor adverse at the northern extents of the residential area to major beneficial at the southern extents in the short term; the majority of impacts on Glan Preseli would be negligible in the long term with just one additional moderate impact on the north-western façade of Awel Deg. Given that in the long term there would be just one moderate adverse noise impact on a non-residential receptor (medium sensitivity), along with one minor and one moderate adverse noise impact on residential properties coupled with absolute noise levels being low (< 55dB$L_{Aeq,16hr}$), effects on the area around Glan Preseli are considered to be not significant. This decision is based upon the significance criteria parameters defined in both Table 14.5 and Section

[24] Note this result is the highest overall predicted result which is different from the least beneficial change result shown in Volume 3 Appendix 14.4 in accordance with HD213/11.

14.3.75 and 14.3.76. The same significance decisions have also been applied to those other properties discussed in Sections 14.6.48 to 14.6.57.

14.6.48 At Maes-y-ffynnon, major adverse noise impacts are predicted in both the short and the long term on the north facing façade; however, there would be an overall reduction in the highest noise levels (>60dB$L_{Aeq,16hr}$[25] currently) experienced at the property (west, south and east façades) to around 48 to 56 dB $L_{Aeq,16hr}$ (on any façade). The bypass section would be in cutting here providing reasonable screening of the property. At the adjacent property Maes-y-Rhos, impacts are predicted to be negligible beneficial. As a result of all these factors, the impacts at these two properties are predicted to be not significant.

14.6.49 There would be a moderate adverse noise impact at Pentroydin fawr Farm as a result of the Scheme in the baseline year, which would also remain as a moderate adverse noise impact in the long term. Although the property is only around 90m from the new bypass, it is well screened by the natural landform and due to the A40 bypass being in deep cutting at this point, such that is passes beneath the existing local road to Llanfallteg. This local road also contributes to the noise climate at Pentroydin fawr Farm. Absolute noise levels are predicted to rise from around 51dB$L_{Aeq,16hr}$ to 56dB$L_{Aeq,16hr}$[26] which would still result in an acceptable external noise climate but may result in a little increased noise intrusion inside the property when windows are open for ventilation. Due to the minor adverse long-term impact being for an individual property and taking into account the relatively low absolute level of noise, this effect is considered to be not significant.

14.6.50 There would be a moderate adverse noise impact at Blaen-pentroydin, situated to the east of Glan Preseli, in the baseline year and future year with the Scheme. Absolute noise levels would remain below 50dB$L_{Aeq,16hr}$ and therefore this effect is assessed as being not significant.

**Llanddewi Velfrey Village (South of Existing A40)**

14.6.51 Receptors to the south of the existing A40 in and around the village of Llanddewi Velfrey are predicted to experience major beneficial noise impacts reducing to moderate and minor beneficial impacts with

[25] Note this result is different from the least beneficial change result reported in Volume 3 Appendix 14.4.
[26] Note this result is different from the least beneficial change result reported in Volume 3 Appendix 14.4.

distance from the existing A40 in the baseline year with the Scheme in operation. Several properties that are currently subjected to noise levels in excess of 70dB$L_{Aeq,16hr}$ (72dB$L_{A10,18hr}$) on façades facing the existing A40 will experience decreases of 15 to 20dB(A) which will significantly improve the external and internal noise environment within these properties. Moderate to major beneficial effects will remain at a number of properties in the future year (long term).

14.6.52 As the beneficial changes are of moderate to major impact for the community of Llanddewi Velfrey, this is considered to be a significant beneficial effect.

**End of Bypass Section to Penblewin Roundabout**

14.6.53 At the western end of the bypass section, the Scheme follows the route of the existing A40 approximately, up to Henllan Lodge. The closest property to this section of the Scheme is Penrhiw Cottage at around 20m. This cottage is currently exposed to high levels of road traffic noise (around 68dB$L_{Aeq,16hr}$[27]). Due to a slight movement of the alignment of the A40 away from the property coupled with the inclusion of a low noise surface, Penrhiw Cottage is predicted to experience a moderate noise decrease in the Scheme baseline year and a negligible noise decrease in the future year. This is based on the north facing façade of the property which is predicted to experience the least beneficial change. Changes on the southern façade of the property will result in noise level reductions from 72dB$L_{Aeq,16hr}$ in the baseline situation to 70dB$L_{Aeq,16hr}$[28] with the Scheme in the baseline year.

14.6.54 Similar impacts will apply at Ffynnon Chapel and surrounding properties. As there are only around five properties in this area, this effect is considered to be not significant.

14.6.55 Moving further west are the isolated properties of Henllan Lodge and Bro Minau. These properties are predicted to experience a minor noise reduction in the baseline year, largely due to the inclusion of the low noise surface with the Scheme. Noise changes at these properties are negligible in the long term.

14.6.56 There are three further properties to the south of the existing A40 between Henllan Lodge and Penblewin Roundabout; Trefangor Farm,

[27] Note this result is different from the least beneficial change result reported in Volume 3 Appendix 14.4.
[28] Note this result is different from the least beneficial change result reported in Volume 3 Appendix 14.4.

Cae'rmaenau-Fach and Penblewin Farm. Trefangor Farm is predicted to experience major noise decreases in the baseline year with the Scheme in operation and moderate noise decreases in the future year whilst Cae'rmaenau-Fach is predicted to experience moderate noise decreases in the baseline year and minor noise decreases in the future year. Penblewin Farm is predicted to experience moderate noise decreases in the short term on Scheme opening and minor noise decreases in the long term.

14.6.57 Given the isolated nature of these properties this is considered to be a not significant effect.

14.6.58 Based on the assessment undertaken no dwellings are likely to be eligible for noise insulation under the Noise Insulation Regulations; however, there are differences in the method of assessment for HD213/11 and NIR and hence this will need to be confirmed within six months of the Scheme opening to traffic via a dedicated NIR assessment.

**Night-time**

14.6.59 DMRB HD 213/11 requires an assessment of the long-term noise impacts at night restricted to properties experiencing noise levels in excess of 55dB$L_{night,outside}$ as impacts below this level are considered to be not significant. This decision is again based upon the significance criteria parameters defined in both Table 14.5 and Section 14.3.75 and 14.3.76.

14.6.60 Based on the assessment undertaken using the least beneficial change receptors, only one receptor which is directly affected by the Scheme was predicted to be exposed to noise levels in excess of 55dB$L_{night,outside}$ in the baseline Do-Minimum situation. This receptor is predicted to experience a decrease in night-time noise levels. In reality many more receptors close to the existing A40 are likely to be exposed above 55dB$L_{night,outside}$ on the façade facing the road and will see benefits of night-time noise reduction as a result of the Scheme.

**Indirect Effects**

14.6.61 Receptors to the west of Penblewin roundabout at Blackmoor Hill were included in the detailed calculation area as they are within 600m of the physical end of the Scheme. Effects at these properties are negligible in both the short and long term. The inclusion of a low noise surface in

both the Do-Minimum and Do-Something future year scenarios would result in a decrease in noise of 2.5dB(A). No.2 Blackmoor Hill is currently exposed to a noise level just over 55dB$L_{night,outside}$ and therefore will experience a not-significant indirect negligible benefit as a result of a low noise surface with or without the Scheme in the future year at night-time.

14.6.62 All other indirect effects have also been assessed as being negligible.

**Nuisance Assessment**

14.6.63 As part of the HD 213/11 Detailed Assessment, noise nuisance and airborne vibration nuisance reporting tables are required. Nuisance level is presented as the percentage of people bothered by traffic noise. The method of calculating nuisance level is described in the HD 213/11. The tables show the change in the percentage of people bothered by traffic noise at dwellings for the Do-Minimum and Do-Something scenarios. This has been reproduced in this assessment as Table 14.13 for noise and Table 14.14 for airborne vibration.

14.6.64 Again, it should be noted that no significant effects were assessed.

14.6.65 Within Table 14.13, in the Do-Minimum column the nuisance level presented represents the change in percentage of people bothered by 'steady-state' traffic noise calculated for Do-Minimum opening (baseline) and future years. In the Do-Something column the nuisance level presented is the greatest change in percentage of people bothered by traffic noise relating to either; the change in 'steady-state' noise levels between the Do-Minimum opening and Do-Something future years; or the short-term change in noise levels between Do-Minimum and Do-Something opening scenarios.

Table 14.13 Traffic noise nuisance reporting table (DMRB Table A1.3)

| Change in Nuisance Level | | Do-Minimum | Do-Something |
|---|---|---|---|
| | | Number of Dwellings | Number of Dwellings |
| Increase in nuisance level | < 10% | 106 | 27 |
| | 10 < 20% | 0 | 4 |
| | 20 < 30% | 0 | 6 |
| | 30 < 40% | 0 | 5 |
| | > 40% | 0 | 2 |
| | | | |
| No Change | 0% | 6 | 8 |
| | | | |
| Decrease in nuisance level | < 10% | 43 | 93 |
| | 10 < 20% | 0 | 8 |
| | 20 < 30% | 0 | 0 |
| | 30 < 40% | 0 | 1 |
| | > 40% | 0 | 0 |

14.6.66 HD 213/11 notes that the relationship between the percentage of people bothered very much or quite a lot by airborne vibration is similar to that for noise nuisance, except that the percentage of people bothered by vibration is lower at all exposure levels by 10%. It is also noted that on average, traffic induced vibration affects a very small percentage of people at exposure levels below 58dB$L_{A10}$ and therefore 0% should be assumed in these cases.

14.6.67 Table 14.14 gives the change in percentage of people bothered by airborne vibration at all dwellings within the study area for Do-Minimum and Do-Something scenarios.

Table 14.14 Traffic noise nuisance reporting table (DMRB Table A1.3)

| Change in Nuisance Level | | Do-Minimum | Do-Something |
|---|---|---|---|
| | | Number of Dwellings | Number of Dwellings |
| Increase in nuisance level | < 10% | 29 | 11 |
| | 10 < 20% | 0 | 0 |
| | 20 < 30% | 0 | 0 |
| | 30 < 40% | 0 | 0 |
| | > 40% | 0 | 0 |
| | | | |
| No Change | 0% | 125 | 143 |
| | | | |
| Decrease in nuisance level | < 10% | 0 | 0 |
| | 10 < 20% | 0 | 0 |
| | 20 < 30% | 0 | 0 |
| | 30 < 40% | 0 | 0 |
| | > 40% | 0 | 0 |

### Ground-borne Vibration

14.6.68 No ground-borne vibration impacts are forecast. This is because, in accordance with highway construction standards, the surface of the proposed upgraded roads would be smooth with no surface irregularities of sufficient size to generate significant levels of ground-borne vibration. It is a standard requirement under the specification for new highways that the new road surfaces would be free of significant discontinuities. The size of irregularities necessary to cause perceptible ground-borne vibration is only expected in 'exceptional circumstances' as discussed in Section 14.3.73. It is not considered that any such exceptional circumstances would arise during operation of the Scheme.

## Cumulative Impacts

14.6.69 No other developments were identified which could generate cumulative effects with the Scheme during the construction phase.

14.6.70 The traffic data that informs the noise assessment includes a growth factor to account for new developments and increased use of motorised vehicles in the local area. This was applied to the opening (baseline) and future year traffic data used in the assessment. No developments

were identified that could cause cumulative effects during the operational phase.

## 14.7 Monitoring

14.7.1 Noise and/or vibration monitoring may need to be undertaken during the construction period (as described in the Pre-CEMP, Section 7.2.21) to verify adequate controls of exposure levels at sensitive receptors.

14.7.2 Welsh Government has a duty under Regulation 6 of the NIR to assess noise levels following the opening of the Scheme to traffic. The purpose of this is to establish the buildings which previously did not qualify for an original offer of carrying out or making a grant in respect of carrying out noise insulation work, but which would have become eligible by virtue of increased traffic flow. Assessments would be carried out in accordance with the obligations set out in the NIR.

## 14.8 Summary

14.8.1 This chapter has described the standard methodologies applied to assess the noise and vibration effects associated with the Scheme according to the guidance given in DMRB noise assessment method HD 213/11. Significance criteria were established for construction and operational noise and the noise effects quantified across the study area.

14.8.2 Construction noise levels during the proposed works were assessed as not significant. Construction vibration levels during the proposed works were assessed as not significant. This is providing either the distance at which vibratory rollers operate is limited and/or construction vibration monitoring is undertaken along with a further assessment of the risk of impact.

14.8.3 Significant permanent direct beneficial effects were identified for the community of Llanddewi Velfrey as a result of the Scheme in the short and long term. No significant adverse operational noise effects were indicated from the assessment.