highways england

A1 Birtley to Coal House

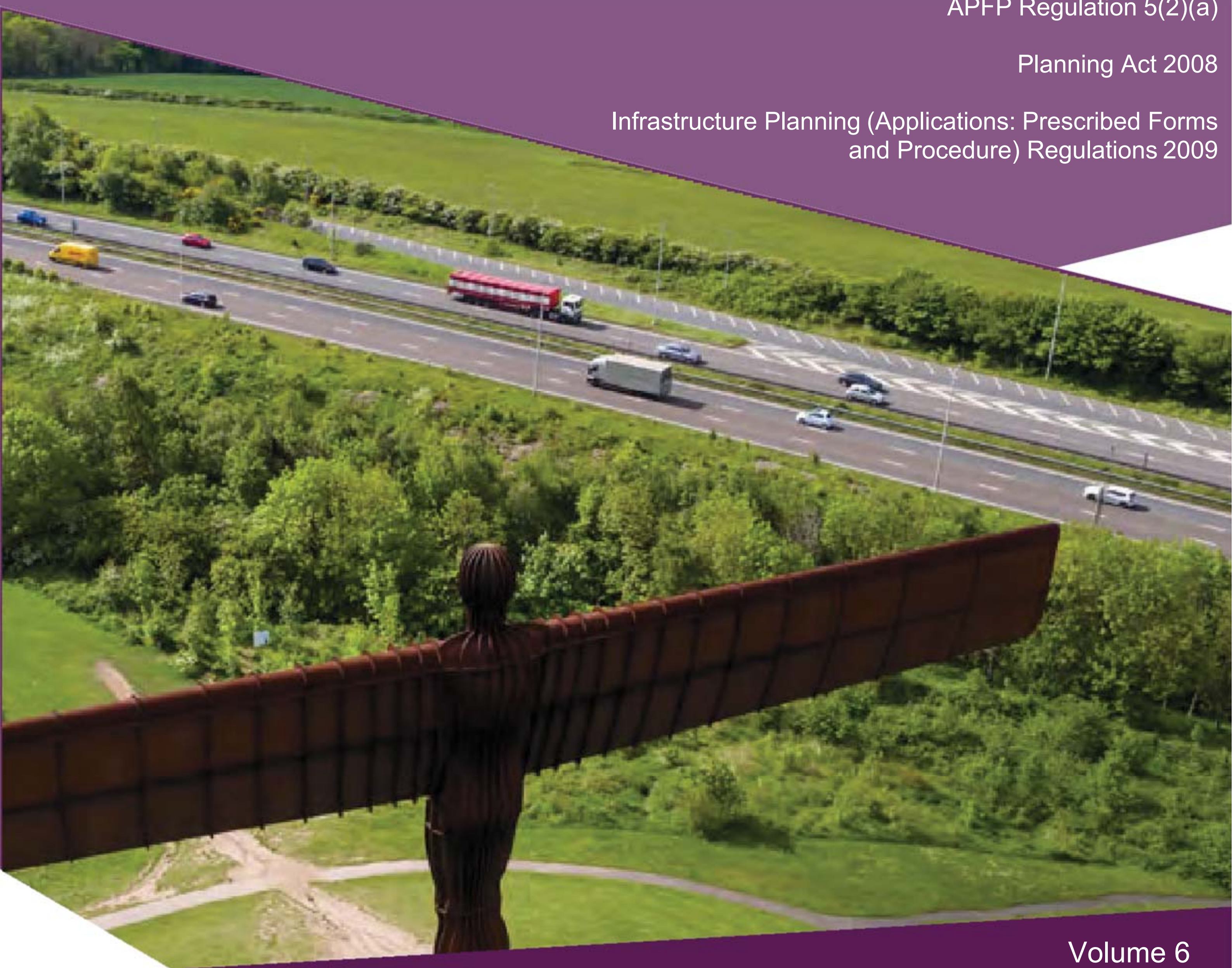
Scheme Number: TR010031

6.3 Environmental Statement – Appendix 11.4 Noise and Vibration Level Prediction and Modelling Methods

APFP Regulation 5(2)(a)

Planning Act 2008

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009



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Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedures) Regulations 2009

A1 Birtley to Coal House

Development Consent Order 20[xx]

Environmental Statement - Appendix

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NOISE AND VIBRATION LEVEL PREDICTION AND MODELLING METHODS

1.1. CONSTRUCTION PHASE

CONSTRUCTION NOISE

1.1.1. The methodology adopted for the prediction of construction noise effects follows that set out in BS 5228-1: 2009 + A1: 2014. The noise predictions have been made using Microsoft Excel spreadsheets, which have been developed in-house (by WSP) and apply the methodologies detailed within this Standard.

1.1.2. The BS 5228-1 calculation methods allow noise levels to be determined for various construction activities. However, the accuracy of such predictions is necessarily limited by assumptions that have to be made regarding the number and type of plant to be utilised, their location and detailed operating arrangements. Whilst this information will be clarified as the project design progresses and when resources are mobilised, other information (such as exactly where the plant operates and for how long) will remain uncertain, even after works have commenced.

1.1.3. As a consequence, it has been considered sufficient to perform the construction phase noise assessment based on current project knowledge and focussed on key activities, at specific locations where key construction working activities are anticipated to be required. This is with the aim of identifying the degree of impact, albeit temporary, that is likely to arise at the nearest sensitive receptors.

CONSTRUCTION VIBRATION

1.1.4. Groundborne vibration may arise at several stages during the construction process, the most common being during the construction of significant structures (including foundations). Other activities that could give rise to groundborne vibration include general site clearance actives and compaction of highway foundations (e.g. use of vibratory rollers).

1.1.5. The most recent guidance for the prediction of construction vibration is contained in BS 5228-2:2009+A1:2014. Where required, groundborne vibration predictions have been undertaken using Excel spreadsheets which have been developed in-house (by WSP) and apply the methodologies detailed within this Standard.

1.2. OPERATIONAL PHASE

ROAD TRAFFIC NOISE

1.2.1. The existing and future levels of road traffic noise have been predicted using scaled, three-dimensional PC based noise models created in the CadnaA® noise modelling suite. The extent of the model is to 1.5km from the Scheme, i.e. 500m greater than the extremities to which detailed noise level predictions are required.

1.2.2. Initially, the DM 2023 noise model was prepared, which was then used as the basis of the DM 2038, DS 2023 and DS 2038 noise models.

1.2.3. The DM 2038 noise model was prepared by updating the traffic flow, percentage HDVs and speed data contained in the DM 2038 noise model.

1.2.4. The DS 2023 and DS 2038 noise models were generated by incorporating the detail 3-dimensional earthworks and road layout design for the Scheme, replacing those roads and existing topographic information within equivalent areas of the DM 2038 noise model where this is proposed subject to change. The traffic flow, percentage HDVs and speeds were then updated for each DS model.

1.2.5. All traffic data, route speeds and percentage HDVs were provided by the WSP Transportation team, having been generated from the dedicated and detailed traffic model created for the scheme.

1.2.6. All traffic speeds have been pivoted and banded according to IAN 185/15.

1.2.7. The Do Minimum traffic data comprise the existing measured baseline data growthed to the adopted assessment years in addition to flows associated with those developments that fall within the top two (most likely) bands of the Proposed Developments Uncertainty Log, but with the exception that the proposed Scotswood to North Brunton (S2NB) Smart Motorway Scheme has not been included in the DM.

1.2.8. The Do Something traffic data comprises the Do Minimum data with additional flows and flow redistribution as associated with the introduction of both the Scheme and the proposed S2NB Smart Motorway Scheme. The completed assessment therefore represents the cumulative impacts arising as a result of the simultaneous operation of both the Scheme and the S2NB developments.

1.2.9. A series of validity checks were carried out to confirm that this approach represents a worst case. For example, if, for a given route, the Scheme gave rise to 3.5dB increase (significant), whilst the S2NB scheme gave rise to a 3.1dB decrease (significant), the combined affect would be +0.4dB, which would not itself be considered significant. Checks were therefore carried out to ensure that all potentially significant effects arising from the scheme alone were fully represented by the adopted assessment approach.

1.2.10. An additional set of road traffic noise level calculations were undertaken including S2NB within the DM scenarios. The short term (DM 2023 versus DS 2023) and long term (DM 2023 versus DS 2038) noise level changes were determined for all routes both with S2NB included within the DM (the resulting change being associated with the scheme alone) and without S2NB included within the DM (the resulting change being associated with the combined effect of S2NB and the Scheme). The resulting noise level changes were not significantly different between each approach, confirming that in acoustic terms the two schemes are essentially independent of each other.

1.2.11. Only one route was identified to be subject to a difference in the results of more than 1dB. Closer inspection of the result for that route identified that the difference arose as a result of the application of speed pivoting and banding, rather than as a result of the interaction of the two schemes. The application of IAN 185/15 results in a different speed band applying for one approach compared to the other, which gave rise to the difference of more than 1dB.

1.2.12. Based on the guidance in HD 213/11, any route with a speed below 20 kph has been corrected to this value. Also, where, a route has flows of less than 1,000 vehicles per 18-hour period (in all scenarios considered), this was removed from both the DS and DM noise models. This is because the flow level is below the threshold of accuracy of the CRTN noise level prediction method. This is not to say that changes won't be experienced on such links; however, at flows below this threshold, noise levels are considered to be sufficiently low for this not to be of significant interest to the assessment.

1.2.13. The approach adopted in the generation of the noise models is summarised as follows:

MAPPING

- Georeferenced Ordnance Survey 1:1250 MasterMap® was incorporated into the noise model. This included the topographic (map) detail, the buildings layer and existing road kerb lines.

TOPOGRAPHY

- The results of a site specific existing 3-D topographic survey for the Scheme route corridor were incorporated into the noise model.
- LiDAR Digital Terrain Mapping (DTM) with 1 and 2m spacing was incorporated and regenerated into ground contours of 0.5m height spacing. Preference was given to the 1m spaced data where there was coverage from this data set. The area of coverage was the full extent of that available in the vicinity of the scheme.
- Ordnance Survey Terrain 5® data were incorporated to complete the topographic map for all areas requiring 'in-fill', i.e. any areas not covered by the Scheme route corridor site specific topographic survey or the available LiDAR data.
- For DS models, the 3D earthworks design was incorporated replacing the existing ground contours for the equivalent area.
- The road gradients have been set according to local topography included in each scenario.

BUILDINGS

- Buildings were incorporated from the 1:1250 MasterMap buildings layer.
- Building heights were set based on the floor area of each building. A height of 2m was applied for floor areas of 2.5m^2 or less, 4m was applied for floor areas between 2.5 and 30.5m^2 and 8m was applied for floor areas of greater than 30.5m^2.

RECEPTORS

- Ordnance Survey AddressBase Plus® data (categorised and edited as detailed in Section 11.4.10 to 11.4.14 of Chapter 11 of the ES were incorporated into the noise models as building evaluations for each building related noise sensitive receptor (e.g. dwellings).
- These data were supplemented based on the results of the desk study and a review of the proposed/ approved developments as described in sections 11.7.2 to 11.7.3 of Chapter 11 of the ES.
- Building evaluation points (noise level prediction points) were located at all external façades of each building as associated with each address based sensitive receptor. In accordance with HD 213/11, the points are 1m away from the building façade. All sensitive buildings have been assumed to be at least two stories in height, with a ground floor height of 1.5m and an allowance of 2.8m per additional floor. For each receptor, a single predicted noise level has then been adopted for each scenario, that being for the location subject to the highest noise levels in the DM 2023 scenario (generally the façade facing towards the dominant noise source such as the A1).
- Other identified receptors (not building related) were incorporated as individual receiver points with a height of 1.5m above ground (free-field).

MODEL EXTENT

- The contribution from all road traffic noise sources within 600m from any building evaluation point or receiver was set to be accounted for. This was extended to 1500m for the generation of the noise contour and noise level change maps present in Figures 11.4 to 11.5 and 11.8 to 11.11.

ROAD TRAFFIC SOURCES

- All routes across the local area, and as included within the Transportation Model, were incorporated as road traffic sources. The results of the Transportation Assessment were adopted, specifically the 18-hour Annual Average Weekday Traffic (AAWT) flows, percentage HDVs and route speeds.
- All road traffic routes were incorporated using a 2D geo-referenced link diagram. The road traffic routes were checked for accurate z-height and general x-y alignment.
- Dual carriageways were incorporated as two separate single direction flows whilst non-dual carriageways were incorporated as combined 2-way flows.
- Road widths were set based on the kerb lines detailed within the1:1250 MasterMap data and the Scheme design.

ROAD SURFACE CORRECTIONS

- For the DM models, the latest ‘lane by lane’ top layer road surface data provided by the Transportation team have been adopted for the A1 mainline and the A1 on and off slips. Analysis of these data showed a mixture of bituminous, impervious surface (hot rolled asphalt) and low noise Thin Surface Course Systems (TSCS).

- For the remaining road network, standard hot rolled asphalt (HRA) with a 2mm texture depth has been assumed.
- For the DS models, the A1 mainline and on and off slips, where to set to be a low noise TSCS as proposed for installation.
- The CRTN correction for a HRA surface is dependent on both speed and texture depth. Below a speed of 75kph, the correction is constant, whilst above 75kph, the correction is variable, depending on texture depth. For all roads surfaced with HRA, a texture depth of 2mm has been assumed. Below 75kph a correction of -1dB has been applied whilst above 75kph no correction is applied.
- For a low noise TSCS, the HD 213/11 states "Where new carriageways are to be constructed and thin surfacing systems used, or where an existing surface is to be replaced with a thin surfacing system, a -3.5dB(A) correction should be assumed for the thin surface system." It goes on to state "This advice applies to roads where the mean traffic speed is ≥75km/h. Where the mean speed is <75km/h, a -1dB(A) surface correction should be applied to a new low-noise surface." However, it also states "If there is no information available, a -2.5dB(A) surface correction should be used for an existing low-noise surface in the baseline year."
- A correction of -3.5dB has, therefore, been applied where there is a low noise TSCS and speeds are ≥75kph in either of the DS scenarios and the DM 2038 scenario, whilst a correction of -2.5dB has been applied where speeds are ≥75kph in the DM 2023 scenario. Where speeds are below 75kph HD 213/11 states that a correction of -1dB applies and this is consistent across the DM and DS scenarios.
- Where different surfaces were identified within different lanes of the same road segment, the advice detailed within Road surface corrections for use in CRTN (proceedings of the Institute of Acoustics) has been applied.

MODEL SETTINGS

- To reflect the mixed ground type across the Calculation Area, a ground absorption coefficient of G=0.6 was set throughout, although roads and buildings have been assigned to have fully reflective ground (G=0).
- The software was set to complete noise level predictions compliant with the CRTN methodology and the additional information detailed in Annex 4 of HD 213/11.
- All noise levels were predicted as free-field levels using the $L_{A10,18h}$ noise index. Where required a manual façade correction of +2.5dB has been added in the analysis of the results.
- Night-time noise levels have been calculated by application of Method 3 as detailed within the TRL report Converting the UK Traffic Noise Index $L_{A10,18h}$ to EU Noise Indices for Noise Mapping, including the application of separate corrections for ‘motorway’ and ‘non-motorway’ noise sources.

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