MEMO

TO	Trevor Rue, PAC Commissioner; cc: C&J Black	FROM	James Powlson
DATE	**20 February 2020**	CONFIDENTIALITY	**Confidential**
SUBJECT	**A5WTC – Noise Level Prediction Method and Low Noise Road Surface**		

1.0 INTRODUCTION

This memorandum has been prepared to describe the noise level prediction methodology that has been applied in the determination of both the Do Minimum (DM), i.e. 'without the scheme', and the Do Something (DS), i.e. 'with scheme' receptor noise levels for the A5 WTC scheme, in particular, how the adopted road traffic noise level prediction method can allow for the benefit of noise mitigation measures such as the use of low noise road surfacing.

The methodology as described below is that which was used to establish the receptor noise levels as assessed within both the 2016 ES, the 2019 ESA, as well as the memorandum submitted to proceedings on the 3rd day of the Public Inquiry into the scheme as dated 20 February 2020.

Table 7.7 of the ESA makes a like-for-like comparison of the operational road traffic noise assessment results between the ES 2016 and the ESA 2019. These results include for noise level reductions afforded by environmental barriers that are committed to be delivered as part of the A5 WTC, but do not include for the benefit of low noise road surfacing.

A key outcome of the assessment work undertaken and reported within the ES 2016 is confirmed at paragraph 13.3.30 of the ES 2016. This states that "*…low noise road surfacing should be included as part of the scheme proposals for the dual carriageway and two sections of single carriageway at the northern and southern ends of the proposed scheme"* (i.e the A5 WTC mainline), and that *"This would have the effect of reducing levels for a substantial number of those receptors located along the proposed scheme corridor by between 2 and 3dB(A).".*

This measure is confirmed within the Departmental Statement dated November 2017 in paragraph 6.15.2, which states "*Use of low noise road surfacing along the main carriageway will reduce the level of traffic noise when compared to traditional forms of road surface".*

Therefore, updated version of Table 7.7 of the ESA, including for the benefit of a low noise road surface on the A5 WTC mainline, was contained within the 20 February 2020 memorandum. For ease of reference this data is also contained within Table 1 on page 3.

Further details of the adopted noise level prediction method, including how the benefit of a low noise road surface is accounted for, are presented below.

2.0 ROAD TRAFFIC NOISE PREDICTION METHOD

The completed operational road traffic noise assessment has been undertaken in accordance with the Design Manual for Roads and Bridges Volume 11, Section 3, Part 7: HD 213/11 Revision 1: *Noise and vibration (*November 2011). As referenced for use within this methodology, the adopted road traffic noise level prediction method was that detailed within the *Calculation of road traffic noise* (CRTN) memorandum published by the former Department of Transport and Welsh Office (1988), in conjunction with the advice contained within HD 213/11, Annex 4: *Additional advice to CRTN procedures.* A summary of this calculation method is presented in Appendix A.

IMPLEMENTATION

It can be seen from Appendix A that road traffic noise level calculation method is extensive requiring hundreds of thousands of calculations when accounting for the number of receptors being assessed (over 16,000).

The process therefore lends itself to use of a computer modelling exercise in order to determine accurate results. There are several PC based environmental noise modelling packages that are available for the implementation of the CRTN calculation method in conjunction with the procedures detailed within HD 213/11 Annex 4.

For the A5 WTC, the NoiseMap Server edition 3-dimensional computer modelling package has been utilised. This package has been used to generate both DS and DM noise models. These models were set to implement the CRTN calculation procedure in full, including HD 213/11 Annex 4, for all receptors.

The noise models were generated utilising the following data sets, as appropriate to ensure account for all of the various factors taken into account in the calculation process (see Appendix A).

- Affected road links;
- OSNI base mapping including building locations;
- OS Landform Profile contours (topography);
- Receptor locations in the form of address point data;
- The proposed A5 WTC earthworks and engineering design;
- Annual Average Weekday Traffic flow data for affected roads, including composition (%HDVs) and speed;
- Road type/width;
- Road surface;
- Groundcover; and
- Noise barrier locations and heights.

Account of Low Noise Surface Benefit

For both the ES 2016 and ESA 2019, all road surfaces were set to be Hot Rolled Asphalt with a texture depth of 2mm. This is a tradition non-low noise road surface type, with no associated surface noise reduction.

To generate the revised ESA 2019 assessment results including for the benefit of the committed low noise road surface, the A5 WTC mainline road traffic links within the DS model were updated to have a surface correction of -3.5dB. This is the surface correction applicable for a low noise road surface (as specified in HD 213/11 Annex 4 – see Appendix A, final paragraph on page 6)[1].

After making this update, the models were re-run to provide the revised assessment results, as detailed in the final column of Table 1.

<u>Table 1 - Updated Daytime, Long Term, With Scheme, Residential Receptors, With Mitigation</u>

Change in noise level		ES Table 13.14 (Barriers but no low noise surface)	ESA Table 7.7 column 3 (Barriers but No Low Noise Surface)	Revised / Updated ESA Scenario (Barriers AND low noise road surface)
Increase in noise level, $L_{A10, 18h}$	0.1 - 2.9	6764	6965	7553
	3.0 - 4.9	2341	2459	1272
	5.0 - 9.9	1835	1620	583
	10 +	765	652	408
No change	0	494	335	431
Decrease in noise level, $L_{A10, 18h}$	0.1 - 2.9	3510	3473	4714
	3.0 - 4.9	358	439	832
	5.0 - 9.9	226	349	496
	10 +	3	4	7

Comparison of columns 4 and 5 of Table 1 allows appreciation of the benefits afforded by the committed low noise road surface.

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[1] At the receptors along the A5 WTC corridor, there can be a contribution from the local road network (road surfaces unchanged) which has the effect of diluting the final benefit, e.g. to between 2 and 3dB.

Appendix A

CRTN Road traffic noise level prediction methodology

CRTN sets out standard procedures for calculating noise levels from road traffic. The full procedure is lengthy, but a flow chart summarising the process is presented as chart 1 on Page 38 of CRTN. This has been duplicated overleaf and is described in textural form below.

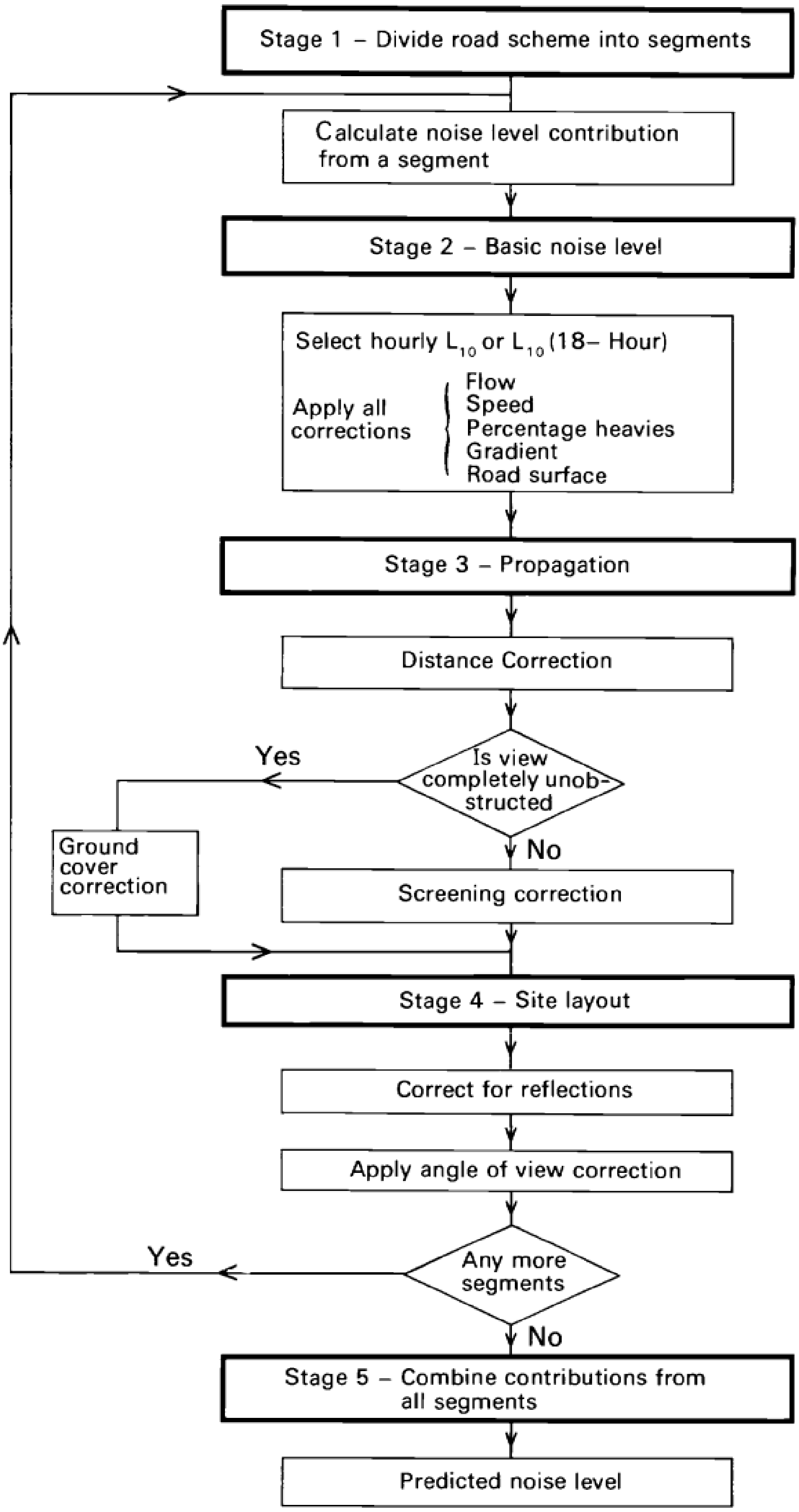
The calculation method uses a number of input variables, including traffic flow volume, vehicle speed, percentage of heavy duty vehicles (HDVs), type of road surface, site geometry and the presence of noise barriers or acoustically absorbent ground.

The noise prediction method comprises a five-stage process as follows:

- Stage one. For each point of interest (i.e. receptor), the road or roads which contribute to the noise level at the receptor are divided into segments, and a segment is selected.
- Stage two. The 'Basic Noise Level' (BNL) is calculated for the segment. This is calculated from the traffic flow, the traffic speed, the composition of the traffic (%HDVs), the gradient of the road, and the road surface. The BNL is determined at a reference distance of 10m from the nearside carriageway edge. The BNL is determined in terms of either the $L_{A10,18hour}$ or $L_{A10,1hour}$ noise level where the traffic flow input used is either the 18 hour Annual Average Weekday Traffic flow (AAWT)) or the 1 hour Annual Average Weekday traffic flow respectively. In the case of the A5 WTC noise assessment, the $L_{A10,18hour}$ noise levels have been predicted as required by the HD 213/11 assessment method.
- Stage three. A series of corrections are applied to account for the propagation effects between the BNL 10m reference distance and the receptor point. This includes account of the distance of the receptor from the segment, the nature of the intervening ground (e.g. whether it is acoustically absorptive, such as pastureland, or reflective, such hardstanding), and the presence of any acoustic screening such as that provided by intervening buildings, walls, topography and other forms of noise barriers.
- Stage four. Additional acoustic effects are then accounted for in the calculation, such as reflected noise (e.g. from other structures), façade corrections (noise reflected back from the receptor building) and the angle of view to the segment from the receptor).
- Stages two to four are then repeated for each road segment determined at Stage one.
- Stage five. The resulting noise level from all segments for the receptor are then summed (logarithmically, as required for the decibel scale) to obtain the combined overall noise level at the receptor.

The above process is then repeated to determine the noise level at each façade of each and every receptor within the noise study area and for each considered scenario (e.g. Do Minimum and Do Something). Where different noise level changes are determined on different receptor facades, the most adverse noise level change is reported in the assessment results.

CHART 1, FLOW CHART FOR PREDICTING NOISE FROM ROAD SCHEMES (CRTN PAGE 38).



HD 213/11, Annex 4: Additional advice to CRTN procedures

This Annex provides additional advice when implementing the CRTN calculation method to allow account of advances in road design, the development of new surface materials and improvements in noise mitigation since the publication of CRTN in 1988.

This Annex provides additional advice on low noise road surfaces at paragraphs A4.18 to A4.22. It is confirmed that a road surface correction of -3.5dB can be applied for low noise surfaces when used on high-speed routes (as proposed for the A5 WTC mainline). This correction is also stipulated within CRTN paragraph 16.2 under the title '*pervious road surfaces'*.