Lake Lothing Third Crossing DCO

Submission at Deadline 7 on behalf of
Northumbrian Water Limited

15 March 2019

CONTENTS

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1 INTRODUCTION

1.1 Northumbrian Water Limited ("**NWL**") made oral representations to the Examining Authority ("**ExA**")at Issue Specific Hearing 2 relating to environmental matters on 7 March 2019 in respect of Suffolk County Council's (the "**Applicant**") DCO application for a Third Crossing at Lake Lothing, Lowestoft.

1.2 This submission is made on behalf of NWL. It provides a summary of NWL's oral submissions at Issue Specific Hearing 2 on environmental matters and further representations in response to the Applicant's submissions at Deadlines 3 to 5, and in relation to further direct correspondence and discussions between NWL and the Applicant.

2 SUMMARY OF NWL'S ORAL SUBMISSIONS AT ISSUE SPECIFIC HEARING 2 (ENVIRONMENTAL MATTERS)

2.1 Basis for NWL Concerns – the nature of its operations at Trinity House

Further to the previous information NWL has provided in relation to its business operations at Trinity House, NWL invited the ExA to note that based on its latest financial accounts (March 2018), overall turnover for NWL was approximately £834.6M, with the vast majority of this revenue coming from its customers. Importantly, approximately 50% of the collection of customers' monies (both bills and debts) take place at Trinity House. In combination with the essential call centre services, this activity is critical to NWL's business operations. Any disruption or actions which interfere with NWL carrying out such activities would be likely to have significant impacts.

2.2 Noise (both during construction and during operation of the DCO Scheme)

2.2.1 NWL summarised its concerns in relation to noise in its written representations submitted at Deadline 3 (8 January 2019), and submitted a detailed sound survey and analysis of the noise assessments within the DCO application materials prepared by its acoustic advisors Peter Brett Associates (now part of Stantec) ("**PBA**"). PBA concluded in their report that:

(a) *There is a lack of clarity in the assessment methodology undertaken by the applicant and this raises concerns over the adequacy of the assessment;*

(b) *SCC have failed to identify Trinity House as a sensitive receptor with respect to its operations and this has resulted in a failure to adequately assess likely operational noise impacts on Trinity House; and*

(c) *There has been inadequate assessment of potential noise impacts on Trinity House during the construction of the Scheme.*

2.2.2 At Deadline 4 (29 January 2019), the Applicant submitted a response to the PBA report, but it was not possible to carry out a full review of this in time to make representations at Deadline 5.

2.2.3 Since Deadline 5, PBA has completed its review of the Applicant's Deadline 4 submissions, and an updated PBA report is provided at Appendix 1 to this submission, and should be treated as part NWL's written representations. It should however be noted that since Deadline 5, PBA has also been in direct discussion with the Applicant's noise specialists regarding NWL's concerns in an attempt to reach common ground.

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2.2.4 NWL can confirm that an agreement in principle has been reached regarding the proposed methodology for recording noise levels in relation to Trinity House prior to the start of construction (as a baseline) and for assessment of noise levels following completion of the DCO scheme to assess operational noise levels. It is intended that NWL and the Applicant will enter into a direct agreement to govern these assessments, and that this will include a mechanism for the Applicant to implement appropriate noise mitigation measures where it is determined that the operational noise levels have increased to the detriment of the operation of the call centre at Trinity House.

2.2.5 At the time of the Hearing on 7 March, detailed drafting of the proposed methodology was being prepared by the Applicant, and this is still awaited.[1] NWL made clear to the Examining Authority at the Hearing that should it not be possible reach full agreement on the noise assessment arrangements and the associated requirements for the Applicant to carry out mitigation measures prior to the end of the DCO Examination period, NWL would request that the Examining Authority include a requirement within the DCO under which the Applicant is obliged to:

(a) carry out pre-construction monitoring of noise levels in association with Trinity House in accordance with the principles set out in the ANC Guidelines – Noise Measurement in Buildings – Part 2: Noise from External Sources;

(b) carry out updated monitoring of noise levels following completion of the project authorised by the DCO (using the same methods as used for the pre-construction monitoring); and

(c) where there is a 3dB or more increase in internal noise levels within Trinity House arising from the operation of the DCO Scheme, to offer appropriate noise mitigation measures to the owners of Trinity House and if accepted to ensure such measures are carried out at the cost of the Applicant.

2.2.6 At the Hearing, the Examining Authority requested that NWL and the Applicant continue to engage on the issue of noise impacts, and to ensure that a written record of outstanding disputes is made available to the Examining Authority prior to the close of the examination should full agreement not be reached. NWL will seek to comply with this request.

2.3 Traffic and Transport

2.3.1 NWL set out its key concerns in relation to traffic and transport issues in its written submissions at Deadline 3 (8 January 2019) and this included a high level review from the PBA highways team of the relevant elements of the DCO application materials including the Applicant's Transport Assessment (TA). The PBA report provided on 8 January 2019 on behalf of NWL identified the following issues of concern which needed to be addressed (the Issue Numbers come from the Applicant's 'Response to Relevant Representation's Document SCC/LLTC/EX/2):

- HT4 - Waveney Drive increase in traffic
- HT5 - Waveney Drive link capacity
- HT6 - New Access Road / Waveney Drive Priority Ghost Island Junction
- HT7 - Rail level crossing on B1531 Victoria Road
- HT8 - Proposed New Access Road / New Canning Road Priority Junction

[1] Please note that the Applicant's noise advisors forward a proposed methodology to PBA on 14 March 2019 but it has not yet been possible to consider this.

- HT9 - Junction visibility splays at the Proposed New Access Road / New Canning Road Priority Junction
- HT10 - New Access Road 90 degree bend
- HT11 - Stopping up of Canning Road junction with Riverside Road
- HT12 - Canning Road accessibility
- HT13 - Pedestrian crossings on Waveney Drive
- HT14 - Car parking on Riverside Road and Canning Road
- HT15 - HGV impact (during construction)
- HT16 - HGV trip distribution and assignment (during construction)
- HT17 - Abnormal HGV loads

2.3.2 The Applicant had indicated that further transport information would be made available by Deadline 3, but this additional information was instead produced for Deadline 4 (29 January 2019). The Applicant sought through that material to respond to the concerns raised by NWL as set out above. The material produced by the Applicant included an updated assessment of the new junction into Riverside Business Park (described as a "sensitivity test").

2.3.3 Following receipt of the additional transport information at Deadline 4, on 12 February PBA sought from the Applicant details of the data and underlying information relating to the new junction capacity assessment to enable effective assessment (as had been possible for the materials provided with the TA). The Applicant's highways advisors (WSP) provided these additional materials on 25 February. As a result it was not possible for NWL to provide a response to the Deadline 4 transport material at Deadline 5. Having received the additional data and information underlying the revised transport assessment, on 28 February, PBA raised a number of further queries regarding the Deadline 4 updated transport information and its underlying data (as to which, see further below).

2.3.4 On 6 March 2019 (the afternoon before the Hearing), WSP provided a further "sensitivity assessment" of the new junction in response to PBA's request, again to respond to the concerns that had been raised by NWL in respect of the previous sensitivity assessment. In light of the late timing, it was not possible for NWL or its advisors to fully review this second assessment in detail prior to the Hearing (and the material had not in any event been made available to the Examining Authority).[2] NWL was able at the hearing to raise some high level comments on the second sensitivity test.

Consideration of the Applicant submissions from Deadline 4 and 6 March 2019

2.3.5 PBA, on behalf of NWL, has now prepared a second report ("PBA Second Report") which seeks to assess the updated materials and information produced by the Applicant up to and including 6 March 2019, and in response to oral submissions by the Applicant at the Hearing on 7 March 2019. This PBA Second Report is provided at Appendix 2 and should be treated as part NWL's written representations.

2.3.6 With reference back to the NWL's initial concerns, the PBA Second Report updates the NWL position. Certain issues remain unresolved, but a number of NWL's initial concerns have been

[2] This second sensitivity test/assessment is appended to the PBA Second Report.

addressed, either by providing further information to clarify PBA's concerns, or through Non-Material Changes to the design, as set out in the Summary Table below.

Issue Number	Identified Issue	NWL Response
HT4	Waveney Drive increase in traffic (significant adverse effects on fear and intimidation and severance for pedestrians, and PBA requested a further controlled crossing is provided on Waveney Drive near the New Access Road junction)	NWL has continued to press for an additional controlled pedestrian crossing on Waveney Drive located close to the New Access Road junction (the relocated Business Park access). This is because the Environmental Statement has demonstrated that as a result of the Scheme, there are significant adverse effects on fear and intimidation and severance for pedestrians on Waveney Drive. This is entirely in accordance with the National Planning Policy Framework (NPPF) in terms of giving priority first to pedestrian and cycle movements (para graph 1.10a), and is supported by the sections on safety (paras 3.9 and 3.10) and sustainable transport (paras 3.15 to 3.17) of the National Policy Statement for National Networks. The Applicant has however maintained that the present General Arrangement and indicative crossing are sufficient. They have stated that they have amended the draft DCO at Deadline 4 to provide for the detailed design of the highway constructed and improved by the Scheme to be approved by the County Planning Authority (SCC), and this approval process would include the provision/location/type of crossings. It will therefore be essential that this issue be revisited at the detailed design stage and that the DCO provides a means for effective and meaningful consultation on those details..
HT5	Waveney Drive link capacity	Resolved – the Applicant has responded and demonstrated that link capacity on Waveney Drive is within guideline limits. No further comments.
HT6	New Access Road / Waveney Drive Priority Ghost Island Junction	Not Resolved - The PBA Second Report provides a detailed review of this issue, and the outstanding basis for NWL's concerns.
HT7	Rail level crossing on B1531 Victoria Road	Resolved – further SATURN model flow difference plots have been provided. No further comments.
HT8	Proposed New Access Road / New Canning Road Priority Junction	Resolved – although as noted in the PBA Second Report, the junction visibility envelope has been
HT9	Junction visibility splays	

Issue Number	Identified Issue	NWL Response
	at the Proposed New Access Road / New Canning Road Priority Junction	shown to be outside the Order Limits, on third party land (NWL understand this to be owned by SCC).
HT10	New Access Road 90 degree bend	Resolved on the basis of Non-Material Change 8 proposed by the Applicant. The 90 degree bend has been replaced with a T junction through a Non-Material Change to the design in Deadline 4.
HT11	Stopping up of Canning Road junction with Riverside Road	Resolved on the basis of Non-Material Change 1 proposed by the Applicant which provides for the inclusion of a turning head on Canning Road.
HT12	Canning Road accessibility	Resolved – the Applicant has provided further clarification, in that due to the presence of the bridge structure, it is not possible to retain the current pedestrian/cycle connectivity at ground level on Riverside Road. NWL would still note however that the first pedestrian/cycle access to the Business Park for users travelling from the east is via the 1.8m wide footway next to the Riverside Children and Families' Centre located off Waveney Drive. Pedestrians/cyclists could 'cut-through' Trinity House frontage and car park since this is on their desire line to the Business Park.
HT13	Pedestrian crossings on Waveney Drive	Same comments as HT4 above.
HT14	Car parking on Riverside Road and Canning Road	Resolved on the basis of Non-Material Change 2 proposed by the Applicant, which puts forward amended parking proposals, including additional on-street parking on Riverside Road and Canning Road. 51 on-street car parking spaces were to be removed. The proposed change will instead result in the retention of 36 spaces, none of which will be subject to time restrictions (noting an overall loss of 15 spaces).
HT15	HGV impact (during construction)	Resolved, though PBA still believe there is some ambiguity in the wording/numbers of construction-related HGVs. However, this is short-term and temporary in nature, and NWL expect that this would be controlled and managed effectively through the Code of
HT16	HGV trip distribution and assignment (during	

Issue Number	Identified Issue	NWL Response
	construction)	Construction Practice which will include traffic management measures.
HT17	Abnormal HGV loads	Resolved.

2.3.7 In relation to the adequacy of the traffic counts used to establish baseline conditions for trips to the Riverside Business Park, PBA carried out a trips measurement survey over a 2 week period in December 2018, and this data was provided as part of NWL's Deadline 3 submissions. The data identified significantly higher numbers of vehicles than that used by the Applicant in its TA (which was based on counts on a single summer day). Despite the clear benefits of this extended recording during a more representative period, the Applicant has not sought to use or refer to this data in any of the subsequent 'sensitivity tests' but instead indicated during the Hearing that they did not consider the differences to be significant, and claimed that such differences would be overridden by the future growth values. The differences in trip values between the Applicant's single day summer recording, and NWL's 2-week record are clear (see NWL's Deadline 3 submission) and in NWL's view significant. Through not taking these into account, the baseline position in the transport assessments does not accurately reflect the actual position, and again calls into question the robustness of the Applicant's Transport Assessment and sensitivity tests. It should also be noted that the sensitivity tests identified traffic levels significantly higher than those identified in the original Transport Assessment (which had not properly allowed for future development) but the Applicant does not appear to have revisited the conclusions of its Environmental Statement (ES) (in particular on noise and air quality) in light of that change. This calls into question the adequacy of the ES. NWL reiterates its request that the Applicant acknowledge and adopt the December trip figures for its assessments or provide meaningful reasons for not doing so.

2.3.8 At the Hearing, the Applicant asserted that the existing signalised junction leading into Riverside Business Park provides ample spare capacity (being much more than is technically necessary), and that such excess capacity should not form the "benchmark" for the design of the replacement junction. It was indicated that in situations of existing over-capacity any new design should ensure no detriment, but this did not apply. Instead, the Applicant noted that accordance with policy only required them to provide "sufficient capacity to accommodate the existing and future growth". Accordingly, the Applicant claimed that it was acceptable to provide what is a materially worse junction to that currently in place while at the same time significantly increasing the traffic using that junction provided that it would still operate within capacity by 2037.

2.3.9 The overarching objectives of the Scheme are set out at paragraph 4.8.1. of the Case for the Scheme (Doc 7.1) which include seeking "*to open up opportunities for regeneration and development in Lowestoft"* and " *to reduce congestion in the town centre and improve accessibility"* and "*to improve bus journey times and reliability".* These objectives also need to be understood in the context of the overall aim of the Scheme as stated at paragraph 1.6.4 of the Outline Business Case (Doc 7.4) as being *"to stimulate regeneration, sustain economic growth, and enhance Lowestoft as a place to live and work in, and to visit."*

2.3.10 Paragraphs 4.28 to 4.35 of the National Policy Statement for National Networks (NN NPS) provide policy guidance on the criteria for "good design" for national network infrastructure and notes that good design should "*meet the principal objectives of the scheme by eliminating or substantially mitigating the identified problems by improving operational conditions and simultaneously minimising adverse impacts*" and is one that "*sustains the improvements to*

operational efficiency for as many years as is practicable, taking into account capital cost, economics and environmental impacts".

2.3.11 As currently envisaged, NWL consider the new access to the Riverside Business Park to be a retrograde step, moving from a signalised junction to a ghost island junction. This would reduce operational conditions (including possible safety concerns), would not provide for future capacity beyond those developments which are, in 2019, likely to come forward and so would not allow for the regenerative effects that the Scheme is intended to bring. The proposed design also creates currently unknown knock-on effects on the surrounding junctions.

2.3.12 At each stage of the Examination process, where NWL has identified specific transport concerns, the Applicant has largely acknowledged the errors and omissions in their material and sought to address them through repeated re-assessments or "sensitivity tests" and through proposed changes and amendments to the Scheme. NWL remains seriously concerned about the robustness of the proposals in relation to design of the highways access into the Riverside Business Park, and appropriateness of the proposed ghost island junction. It also has serious concerns that the errors in approach identified by PBA (on behalf of NWL) have not been picked up by the highway authority, SCC, either in its written or oral representations to the ExA. NWL notes that at the Hearing SCC indicated a willingness to answer technical questions from the ExA (if any). While none were raised at the Hearing, there remains the opportunity for the ExA to seek clarification from SCC through the second set of Written Questions to be issued on 22 March 2019.

2.3.13 The relocated access point is proposed as the only vehicular access to the Business Park, and therefore needs to provide sufficient resilience and security of access to maintain operational facilities on the Business Park, as well as providing an attractive proposition to future occupiers.

2.3.14 NWL continues to engage with the Applicant and its advisors on the above transport and traffic matters, but would note that it is for the Applicant to produce meaningful proposals which are adequately assessed so that the Examining Authority can effectively consider the merits of the application.

Bryan Cave Leighton Paisner LLP

15 March 2019

APPENDIX 1 PBA REPORT (MARCH 2019) – ADDITIONAL ACOUSTIC RESPONSES ON BEHALF OF NWL

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now part of

Application by Suffolk County Council for an Order Granting Development Consent for the Lake Lothing Third Crossing (Lowestoft)

Development Consent Order 201(…)

Planning Inspectorate Reference TR010023

Additional Acoustic Responses on behalf of Northumbrian Water Limited (Deadline 7)

On behalf of **Northumbrian Water Limited**

Project Ref: 42498/3002 | Date: March 2019

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For and on behalf of Peter Brett Associates LLP				

Revision	Date	Description	Prepared	Reviewed	Approved

This report has been prepared by Peter Brett Associates LLP ('PBA') on behalf of its client to whom this report is addressed ('Client') in connection with the project described in this report and takes into account the Client's particular instructions and requirements. This report was prepared in accordance with the professional services appointment under which PBA was appointed by its Client. This report is not intended for and should not be relied on by any third party (i.e. parties other than the Client). PBA accepts no duty or responsibility (including in negligence) to any party other than the Client and disclaims all liability of any nature whatsoever to any such party in respect of this report.

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Appendices

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1 Introduction

1.1.1 This report has been prepared by Peter Brett Associates ("PBA", now part of Stantec) on behalf of Northumbrian Water Limited ("NWL[1]") in relation to the Lake Lothing Third Crossing DCO. It follows a review of the Deadline 4 submission by Suffolk County Council ("SCC" – the Applicant) and subsequent additional information provided by SCC to PBA.

1.1.2 This report provides a summary of the latest position on acoustic issues (at the time of writing this report) and timeline of events.

1.1.3 The review is based on the following main documents submitted at Deadline 4 by the Applicant:

- Document SCC/LLTC/EX/51 - Appendix I: *Applicant's Response to Written Representations and Interested Parties Responses to Written Questions*

1.1.4 The above document included a response to Written Representations made by Bryan Cave Leighton Paisner LLP on behalf of NWL, which contained in Appendix 1 a report prepared by PBA entitled '*Acoustic Supporting Evidence for NWL'* (January 2019).

[1] Essex & Suffolk Water is the trading name for NWLs operations in the east of England

2 Timeline Summary of Events

2.1.1 This section provides a summary timeline of events in respect of transport/highways submissions.

September 2018

Bryan Cave Leighton Paisner LLP on behalf of NWL submitted relevant representations to the application setting out a summary of initial comments and concerns with the Scheme on the operation of Trinity House on 21st September 2018. These representations identified a number of noise and vibration concerns.

November 2018

The Applicant provided an initial response to the representations made in September 2018 in Document SCC/LLTC/EX/2: Response to Relevant Representations of 20th November 2018.

January 2019

For Deadline 3 (January 8th 2019), formal Written Representations were made by Bryan Cave Leighton Paisner LLP on behalf of NWL, which contained in Appendix 1 a report prepared by PBA entitled '*Acoustic Supporting Evidence for NWL'* (January 2019) (standalone report). This report set out identified issues with the Scheme. These specific issues PBA identified were associated with construction and operation noise impacts on NWL operations and some procedural issues with the wider ES.

For Deadline 4 (January 29th 2019), the Applicant submitted the following relevant documents:

- Document SCC/LLTC/EX/51: Applicant's Response to Written Representations and Interested Parties Responses to Written Questions

The above documents provided a response to Written Representations made by Bryan Cave Leighton Paisner LLP on behalf of NWL, which contained in Appendix 1 a report prepared by PBA entitled '*Acoustic Supporting Evidence for NWL*' (January 2019) at Deadline 3.

February 2019

NWL and SCC initiated discussions regarding reaching agreement on measures to address the NWL concerns relating to noise. Initial proposals for this were prepared by NWL and were discussed at a meeting on 27th February 2019. It was agreed that PBA and WSP would speak directly for the purposes of working out technical issues relating to a noise survey and assessment methodology.

March 2019

On March 4th 2019, WSP contacted PBA to discuss a proposed methodology. An email outlining the discussions was circulated on March 5th 2019. On March 14th 2019, PBA received a draft methodology prepared by WSP. We have not had sufficient time to review this methodology prior to Deadline 7.

3 Response to Deadline 4 Responses

3.1.1 A review of the Deadline 4 submission has been undertaken. WSP, on behalf of the applicant has presented a rebuttal of the points raised in our Acoustic Supporting Evidence in the form of a technical memo (Appendix I – ref SCC/LLTC/EX/51).

3.1.2 There are a number of points raised which are a result of incorrect assumptions, potential misunderstandings, professional disagreements in approach and factual corrections.

3.1.3 PBA has produced a detailed response to the points raised by WSP at Deadline 4. This is provided at Appendix A on the basis that many of the points are now dealt with through further direct discussions with WSP (see next section). Reference to supporting documentation is included where appropriate and relevant documents are appended to this note.

4 Proposed Requirements for the Protection of NWL Operations

4.1.1 NWL have raised valid concerns with respect to the potential for disruption to their operations due to both the construction and operation of the Lake Lothing Third Crossing. It is understood that SCC (WSP) agree in principle to proposals to carry out pre- and post-construction noise monitoring in relation to Trinity House and that SCC would provide noise mitigation where increases in noise were considered detrimental to the NWL operations.

Construction

4.1.2 A Section 61 process should be entered into by the Contractor with a detailed noise and vibration assessment undertaken. The assessment should consider the likely noise and vibration impact on the operation of Trinity House with details of mitigation measures identified where appropriate. If necessary, noise and vibration monitoring should be put in place to ensure that NWL operations are not adversely affected by the construction works.

4.1.3 NWL should be given the opportunity to review and comment on the construction noise and vibration assessment used to support the Section 61 process.

Operation

4.1.4 PBA are in discussion with the applicant's representatives (WSP) with respect to agreeing a survey methodology. We have received the applicant's proposed assessment methodology (14 March 2019) however we have not had sufficient opportunity to review the proposed assessment methodology prior to Deadline 7 submissions.

4.1.5 Preliminary discussions between PBA and WSP have been productive and are largely consistent (see attached correspondence – Appendix C) however we do not consider internal measurements when the building is occupied to be necessary or particularly helpful in determining the impact on NWL operations.

4.1.6 In summary, the agreed methodology should:

- Determine the existing (pre-construction) internal ambient noise levels within noise sensitive spaces within the call centre.
- Determine the post construction ambient noise levels within noise sensitive spaces within the call centre should be determined.
- If the internal ambient noise levels have changed by more than 3dB then provision should be made for the Applicant to upgrade the acoustic performance of the building façade to maintain the pre-construction internal ambient noise levels. In addition to the objective assessment outlined above, NWL would take a subjective view of the post construction internal ambient noise levels, with action only taken if the change in internal ambient noise level exceeded 3dB and NWL considered the resultant internal noise levels to be detrimental to the operation of the call centre.
- Indoor ambient noise levels within noise sensitive spaces should be determined by measurements undertaken in accordance with the relevant sections of the ANC Guidelines – Noise Measurement in Buildings – Part 2: Noise from External Sources as pertaining to non-steady, continuous noise. The measurements should be undertaken at an agreed time considered to be representative of typical traffic flows on the surrounding road network. Sound contributions from building services plant servicing Trinity House, and any operational activities should be excluded from the measurements.

Appendix A Response to Deadline 4 Response

PBA Reference	Applicant Response	PBA Response	Supporting Evidence
Internal Ambient Noise Criteria			
1	Section 2.3 of the PBA report seeks to identify appropriate internal noise criteria applicable to the call centre with reference to British Standard (BS) 8233:2014 'Guidance on sound insulation and noise reduction for buildings' and the British Council for Offices Guide to Specifications, Chapter 8: Acoustics. PBA conclude that the appropriate criterion is 35-40dB $L_{Aeq,T}$. However, the approach adopted by PBA is at fault because this criterion, as defined in BS 8233: 2014, is in relation to an executive office rather than an open plan office within a call centre.	We disagree that the appropriate criterion for the call centre is an 'open plan office' as defined within BS8233. Notwithstanding this point, NWL consider the existing internal ambient noise levels to be entirely appropriate for its use as a call centre. Any change in internal ambient noise level risks adversely affecting the operation of the call centre.	
2	It is also subsequently identified in the PBA report that the current noise levels as measured within the facility when operational, and which are then sought to be protected (suggesting their acceptability for purpose) are significantly higher than this criterion, which confirms the unreasonableness of the assessment criterion proposed by PBA.	This is incorrect. Comparing operational, occupied noise levels with a criterion which applies to unoccupied spaces is not appropriate. Unoccupied internal ambient noise levels are in the region of 35dB $L_{Aeq,T}$ during a typical working day.	
3	Notwithstanding consideration to the current operational noise levels within the facility, the correct approach to the selection of a target criterion is to adopt the guidance from Table 2 of BS 8233 for an open plan office, given that the call centre is predominantly an open plan space (see Figure 1, below). Therefore, the correct criterion to adopt in this case is 45–50dB $L_{Aeq,T}$, not 35-40dB $L_{Aeq,T}$ as suggested within the PBA report.	See response 1.	
4	The PBA report correctly identifies (at Section 2.3.1) that 'Workers within a call centre generally require an environment which has a sufficiently high background sound level to mask intruding speech', but the correct reference for this within BS 8233: 2014 is in relation to open plan offices, for which the applicable criterion is 45-50 dB $L_{Aeq,T}$. Quoting BS 8233: 2014 *"in some cases, such as open-plan offices..., a moderate noise level might provide making for acoustic privacy in shared spaces without causing disturbance, so upper and lower noise levels should be considered (see Table 2)."*	See response 1. In addition, we would note that BS8233 includes an open plan office as an example only and does not refer to call centres. Notwithstanding this point, NWL consider the existing internal ambient noise levels to be entirely appropriate for its use as a call centre. Any change in internal ambient noise level risks adversely affecting the operation of the call centre.	
Measured Internal Ambient Noise Levels at Trinity House			
5	Section 3.3.11 of the PBA sound survey report states that "The measurements were paused to exclude extraneous noise events occurring within the call centre (e.g. door closings, elevated speech)." It is unclear whether this relates to the measurements taken during the	This is an incorrect assumption. Measurements were paused during the evening measurements to exclude unrepresentative events (such as cleaner's vacuuming the space) as is standard practice for measurements of this type.	

PBA Reference	Applicant Response	PBA Response	Supporting Evidence
	evening (when no staff were present) or a typical working day. It is unlikely that this exclusion of events relates to the evening given that elevated speech would occur when staff are present. Therefore, assuming that these exclusions relate to measurements taken during the working day it is unclear why the decision was made to remove these events given that they form part of the typical noise climate within the call centre. It is therefore assumed that the actual noise levels are higher than reported and subsequently that the reported noise levels cannot be relied upon as being representative of the conditions at the time.		
6	The reported internal noise level of 33 dB $L_{Aeq,T}$ when no staff were present is well below the design range for an unoccupied open plan office (45 – 50dB $L_{Aeq,T}$). It is not clear from the PBA report whether this measured level includes operational air conditioning. As noted above, BS 8233: 2014 recognises that open plan offices require a moderate level of noise for acoustic privacy in shared spaces without causing disturbance, so upper and lower noise levels should be considered. Given that the measured noise level is some 12 to 17dB below the design range required to preserve acoustic privacy, one has to question whether the existing internal noise climate is appropriate for the maintenance of acoustic privacy (although it is noted that, given the operators within the call centre use headsets to make and receive calls (see Figure 1), the low ambient noise levels for privacy may be less relevant).	As stated by WSP the use of headphones means that privacy is less important. Notwithstanding this point, NWL consider the existing internal ambient noise levels to be entirely appropriate for its use as a call centre. Any change in internal ambient noise level risks adversely affecting the operation of the call centre.	
7	The PBA reported noise level of 51dB $L_{Aeq,T}$ within the occupied office at Trinity House is slightly lower than those found in previous studies of comparable office spaces. However, it is expected that the measured noise level would be higher had 'extraneous noise events' (as identified in the PBA report) been correctly included.	See response 5	
8	It is unclear why external noise level measurements have been undertaken by PBA given that employees at the call centre are only subject to internal occupation. This facility is a modern office with air conditioning and ventilation provision, and staff work in a regulated environment, with sealed windows, and therefore benefit from the noise attenuation afforded by the fabric of the building façade. The acoustic weak point in the external façade will be the windows and this	External noise level measurements were undertaken to: - Verify levels predicted in ES chapter; - Provide an indication as to the likely sound insulation performance of the building façade. It is reiterated that NWL consider the existing internal ambient noise levels to be entirely appropriate for its use as a call centre. Any change in internal ambient noise level risks adversely affecting the operation of the call centre.	

PBA Reference	Applicant Response	PBA Response	Supporting Evidence
	will determine the overall sound insulation performance of the façade. For double glazed windows, the sound insulation performance is assumed to be at least 30 to 35dB insulation as a minimum (30dB would be a very worst case). Given that the internal noise criterion (based on our analysis) is 45 to 50dB, it would take an external noise level of 75 to 80dB to exceed this criterion. Predicted noise levels from the Scheme are well below these levels.		
9	At Measurement Locations P1 and P2 identified in the PBA report, unattended continuous measurements were undertaken above the roof of the facility. These locations are not representative of the potential impact at the facility (i.e. at the façades of Trinity House behind which are internal working areas). As noted above, the value of using the existing external noise level to consider noise impact within a modern office/call centre is questionable and the results of these surveys add nothing to the assessment of impacts at Trinity House.	These measurements were undertaken to verify the results of the ES as detailed in paragraph 5.2.3 of our Acoustic Report.	
10	In summary, it is clear that the arguments submitted by PBA for treating Trinity House as a receptor that is especially sensitive to noise do not hold water. The arguments are based on an incorrect interpretation of the internal noise criteria set out in BS 8233: 2014 and the measured internal and external noise levels at Trinity House do not provide any support to an argument for treating Trinity House as a sensitive receptor.	See responses above.	
Assessment Methodology			
Scoping Report			
11	In accordance with DMRB, the Scoping Report identifies potentially sensitive receptors on the basis of whether they are classed as 'Dwellings' or 'Other Receptors'. Other receptors are defined in DMRB as those that are particularly sensitive to noise and include hospitals, schools, community facilities (such as places of worship, educational buildings and hospitals) etc.) Offices do not fall under any of the categories of sensitive receptors defined in DMRB and on that basis Trinity House has not been included as a sensitive receptor within the operational noise assessment detailed in the ES.	With reference to paragraph 4.3.4 of the Acoustic Report, DMRB does not present an exhaustive list of potential receptors as evidenced by the use of 'etc.' DMRB states in Volume 11 Section 3 Part 7 HD213/11, paragraph A1.13 [emphasis added]: *"…**Examples** of sensitive receptors include dwellings, hospitals, schools, community facilities, designated areas (…), and public rights of way".* It is therefore incorrect to exclude Trinity House (or indeed any other noise sensitive receptor not listed in DMRB) on the basis that it is not included as an example in DMRB. We would highlight that Suffolk County Council's guidance on Local Planning Application Validation Requirements identifies "workplaces" as noise sensitive and requires that a noise impact assessment is undertaken where proposals may	Extracts from DMRB Volume 11 Section 3 Part 7 HD213/11 SCC Local Planning Application Validation Requirements

PBA Reference	Applicant Response	PBA Response	Supporting Evidence
		have an impact on the receptor. Section 4.5 of IEMA's Guidelines for Environmental Impact Assessment identifies 'Commercial Premises' as being noise sensitive. Table 2 of the IEMA EIA Quality Mark Article – Guidelines for Environmental Noise Assessment – October 2014 identifies offices as being of medium sensitivity to noise (in the same category as residential receptors). Table 2.1 of the Scottish guidance on noise sensitive receptors includes office environments (ref. Assessment of Noise: Technical Advice Note – March 2011 - https://www.gov.scot/publications/technical-advice-note-assessment-noise/pages/2/) identifies offices as noise sensitive receptors and being of medium sensitivity.	IEMA Guidelines of for Environmental Impact Assessment IEMA EIA Quality Mark Article – Guidelines for Environmental Noise Assessment – October 2014 Assessment of Noise: Technical Advice Note – Scottish Government
12	With regard to construction noise impacts, BS 5228-1: 2009+A1: 2014: Code of Practice for Noise and Vibration Control on Construction and Open Sites. Part 1: Noise provides a methodology for the estimation of likely construction noise levels. Within BS 5228-1 separate threshold criteria are provided for residential dwellings compared to offices and the limits for offices are higher to account for their reduced sensitivity to noise. To ensure that previous comments during statutory consultation raised by NWL (which were concerned solely with construction phase impacts) were fully accounted for, the construction noise assessment was revised to include Trinity House.	It is not clear why the applicant accepts the potential construction impact on NWL (a temporary, short-term effect) worthy of consideration but not the potential operational impacts (a permanent, long term effect).	
Operational and Construction Traffic Data			
13	It is stated by PBA that construction traffic data is not provided within the ES. However, this is provided in Table 13-21 of the ES. A substantial amount of operational traffic data is presented in Chapter 19 of the ES: Traffic and Transport. In particular, operational AADT traffic flows are presented in Figure 19.4 of the ES.	Acoustic assessments undertaken in accordance with CRTN and DMRB are usually based on the AAWT 18-hour traffic data. It is not clear from the information provided by the applicant and the subsequent response whether the assessment has been based on the AAWT data (and this data not presented), or on another method. We would highlight that the Glossary of Terms in the ES does not define AAWT.	
Operational Noise and Vibration from Bridge			
14	DMRB states that for new roads and for existing roads maintained in good condition ground-borne vibration is very unlikely to be an issue. Groundborne vibration is generated by a sudden impart of energy into the ground, e.g. as associated with a	The applicant does not address the potential effects associated with impact noise generated by the interface between the tyre and the gap/interface between the fixed road and the moveable bridge something which is not specifically considered within DMRB.	

PBA Reference	Applicant Response	PBA Response	Supporting Evidence
	wheel or axle dropping into a road defect such as a pothole or similar. By contrast, the Scheme would be new with smooth road surfaces, eliminating the potential for the generation of significant groundborne vibration, even in close proximity. The DMRB recognises that low frequency noise can cause light-weight elements of a structure to vibrate (known as 'airborne vibration'), and this has been fully assessed within the ES (sections 13.3.17, 13.5.72, and Appendix 13D), based on the predicted operational noise levels. The potential for airborne vibration impacts is limited to relatively close proximity to the scheme and if it does occur it tends only to be superficial and whilst it may be noticeable by occupiers, it is very unlikely to cause any structural or even cosmetic damage. The DMRB provides an assessment method (which has been followed) limited to consideration of receptors within 40 metres from the source.	A generic assessment with respect to this issue has been undertaken however the potential impact associated with this interface has not specifically considered within the ES. It is possible that this issue could be addressed at a later stage in the design of the scheme but it is concerning that this has not been highlighted as a potential issue.	
Construction Effects			
15	With the appropriate mitigation in place, including compliance with a full Code of Construction Practice (CoCP), a noise reduction of as much as 10dB can be achieved and a level below the Lowest Observed Adverse Effect Level (LOAEL) is anticipated externally to Trinity House. For all other activities predicted construction noise levels with mitigation are anticipated to be below the No Observed Adverse Effect Level (NOEL). Greater information is provided in Table 13-18 of the ES where these conclusions are presented.	Noted.	
Operational Effects			
17	WSP is largely in agreement with the predicted noise level changes detailed in Table 4.1 of the PBA report, as associated with the introduction of the scheme. The actual predicted increases are 3.4dB in the long-term on the Waveney Road façade and 9.0dB in the long-term on the rear façade. However, in the case of an office facility, especially a modern facility with a sealed façade etc. (as in this case – see Figure 2 below), external noise level changes are not considered a good reflection of the likely impacts on the facility given that its use is centred on internal operations which benefit from the noise reduction associated with building façade. It is considered more appropriate to consider the resulting internal noise levels in absolute terms. This is confirmed through the approach of the PBA report to seek to	See response 1 and 4.	

PBA Reference	Applicant Response	PBA Response	Supporting Evidence
	determine appropriate internal target criteria and the undertaking of internal noise monitoring at the existing facility.		
16	It is however of note that, after accounting for the predicted noise level changes (which are greatest at the rear façade), the resulting noise levels (in absolute terms) remain considerably lower at the rear façade than those which currently prevail on the front façade. It can therefore be concluded that during the operational phase of the Scheme, the internal noise levels on the rear façade will be lower than those which currently prevail on the front façade. It is therefore difficult to argue that Trinity House will be adversely affected.	Given the nature of the office an increase in external noise levels would result in an increase in internal noise levels, regardless of whether the noise is greater at the front or rear facades. NWL remain concerned that changes in internal ambient noise level as a result of increases in external noise levels risk adversely affecting the operation of the call centre.	
EN35		Noted – no further comment	
EN36		Noted – no further comment	
EN38		Noted – addressed above.	
Other Issues			
17	As discussed previously, PBA paused internal noise measurements "to exclude extraneous noise events occurring within the call centre (e.g. door closings, elevated speech)." It is unclear why the decision was made to remove these events given that they form part of the typical noise climate within the call centre. It is assumed therefore that the actual noise levels with call centre activity are significantly higher than reported.	See response 5.	
18	Based on the full details of the attended survey within the call centre with general activity, the logarithmic average is 1dB higher than quoted in Table 4.4 of the PBA report, i.e. 52dB $L_{Aeq,T.}$	Noted.	
19	These were carried out at various points around the building. At each location a 5-minute measurement period was used and this is not considered of sufficient length to provide a representative figure.	The measurement was deemed representative by the site engineer and is considered appropriate for the purposes detailed.	
20	Internal noise levels within the open plan area are broadly similar, (at PBA reference locations A, B,C, G, H), with a range of 35-37dB. Whilst in the stairwell and meeting room the internal noise levels are much lower at 30-31dB. Given the modern design it is unlikely that the sound insulation of the building envelope differs to such a degree and therefore noise levels within the open plan area are likely to be influenced by other internal sources such as air conditioning extraction noise.	The meeting room in which the measurements were undertaken had no windows hence the lower measured noise level. In addition, you would expect internal noise levels to be greater in a larger space hence the difference in measured sound levels.	
21	Measurements E and F were undertaken inside/outside a stairwell	These do not form part of the assessment and were included for completeness.	

PBA Reference	Applicant Response	PBA Response	Supporting Evidence
	(non-sensitive areas) of Trinity House. It is unclear why such internal measurements were undertaken, and these are of little to no value in quantifying the noise environment within areas of the building that are subject to work related activities.		
	The noise levels reported or the CRTN measurements within Appendix D of the report appear inaccurate and inconsistent. The quoted L_{A90} levels are higher than the L_{A10} levels, and the L_{AFmax} levels are lower than the L_{Aeq} levels. This is mathematically impossible and brings into question the accuracy of the reported data.	Typographical error in table headings.	

Appendix B Supporting Documentation

VOLUME 11 ENVIRONMENTAL ASSESSMENT
SECTION 3 ENVIRONMENTAL ASSESSMENT TECHNIQUES

PART 7

HD 213/11 – REVISION 1

NOISE AND VIBRATION

SUMMARY

This revised Standard provides guidance on the assessment of the impacts that road projects may have on levels of noise and vibration. This revision replaces the previous Standard, and includes updated advice on calculating night time noise levels, determining the extent of the study area and selecting appropriate traffic speed data. Where appropriate, this standard may be applied to existing roads.

INSTRUCTIONS FOR USE

1. Remove existing contents pages for Volume 11 and insert new contents pages for Volume 11 dated November 2011.

2. Remove HA 213/11 dated February 2011 from Volume 11, Section 3 and archive as necessary.

3. Insert HD 213/11 into Volume 11, Section 3, Part 7.

4. Please archive this sheet as appropriate.

Note: A quarterly index with a full set of Volume Contents Pages is available separately from The Stationery Office Ltd.

DESIGN MANUAL FOR ROADS AND BRIDGES

HD 213/11
Volume 11, Section 3,
Part 7
Revision 1

THE HIGHWAYS AGENCY

TRANSPORT SCOTLAND

WELSH GOVERNMENT
LLYWODRAETH CYMRU

THE DEPARTMENT FOR REGIONAL DEVELOPMENT
NORTHERN IRELAND

Noise and Vibration

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HD 213/11 – REVISION 1

NOISE AND VIBRATION

Contents

Chapter

Annexes:

1. INTRODUCTION

Background

1.1 Although the previous version of this Standard was published in April 2011, this revision has been necessary in order to clarify some aspects of the guidance. These include:

- revision to the advice on calculating night-time noise and undertaking night-time noise assessment;
- clarification on determining the extent of the study area; and
- updated advice on selecting appropriate traffic speed data.

Scope

1.2 This Standard sets out the requirements to be adhered to in undertaking noise and vibration assessments, as well as providing guidance on the methodology to be used when assessing the noise and vibration impacts arising from all road projects, including new construction, improvements and maintenance. This Section should be read in conjunction with the Design Manual for Roads and Bridges (DMRB), Volume 11, Sections 1 and 2, which set out the overall framework for the environmental assessment process. A full description of the technical terms used in this Section is given in Annex 2. A description of the general terms used during environmental assessment is provided in Volume 11, Section 2.

1.3 The second chapter of this document covers how noise and vibration relates to the UK Highways, including legislation. Chapter 3 covers a brief overview of the assessment process. Advice on design and mitigation is given in Chapter 4 and guidance on the management of environmental effects is presented in Chapter 5. Chapter 6 covers the monitoring and evaluation of noise impacts. The requirements for reporting are given in Chapter 7, with the full assessment methodology described in Annex 1.

Purpose

1.4 The purpose of this document is to provide guidance for those undertaking noise and vibration assessments of impacts from road projects, such that all assessments are undertaken in an appropriate and consistent manner using best practice, which is compliant with requirements of the relevant legislation.

Mandatory Sections

1.5 Sections of this document containing mandatory requirements are identified by being contained in boxes. These requirements must be complied with or a prior agreement to a Departure from Standard must be obtained from the Overseeing Organisation. The text outside boxes contains advice and explanation, which is commended to users for consideration.

1.6 While this Standard provides a series of general methods for assessing potential impacts on the noise and vibration environment, it is inevitable that there will be unique situations where a requirement of the Standard is inappropriate or that an aspect is not covered by the Standard. GD 01 (Introduction to the Design Manual for Roads and Bridges) provides further details on the process of applying for a Departure from Standard.

Equality Impact Assessment

1.7 This guidance seeks to improve the noise and vibration environment and, in turn, should benefit all human users. Any adverse or beneficial impacts that result from the introduction and adoption of this guidance are not expected to discriminate against any defined group in society. No equality impact assessment has been carried out in the development of this Standard as it is not considered relevant.

Devolved Administration Issues

1.8 This document covers England, Wales, Scotland and Northern Ireland. The method used for assessment is the same for all countries. However, some aspects of legislation are different, and these are detailed in Chapter 2. The users of this document should always check if other differences exist.

1.9 The Environmental Noise Directive 2002/49/EC relates to the assessment and management of environmental noise in EU member states. The implementation of this Directive, through subsequent Regulations, is dealt with differently by each country. During an assessment, reporting and subsequent interpretation of results, any specific requirements of the relevant Regulations should be considered.

Implementation and Feedback

1.10 The Standard must be used forthwith on all road projects for the assessment of noise and vibration impacts associated with construction, improvements, operation and maintenance associated with motorways and trunk roads (and roads designated by the Overseeing Organisation in Northern Ireland) except where the procurement of works has reached a stage at which, in the opinion of the Overseeing Organisation, its use would result in significant additional expense or delay progress (in which case the decision must be recorded in accordance with the procedure required by the Overseeing Organisation).

Feedback

1.11 Any comments or feedback regarding the technical content and suggestions to improve this document should be directed to the Standards_Feedback&enquiries@highways.gsi.gov.uk mailbox or the KPGI Team at Highways Agency Woodlands, Bedford, MK41 7LW.

1.12 It is expected that those applying using this guidance will have experience and understanding of the noise and vibration effects associated with road projects.

2. NOISE AND VIBRATION – UK HIGHWAYS

Definition of Noise and Vibration

2.1 Traffic noise is a general term used to define the noise from traffic using the road network. A traffic stream is made up of a variety of vehicle types which have their own individual noise sources. Close to a road individual vehicles can be distinguished in the traffic stream, but further from the road the influence of individual vehicles is less noticeable as the noise from traffic becomes a continuous drone.

2.2 A road project has the potential to cause both increases and decreases in traffic noise on an existing road by altering the traffic composition. In the case of a new road, for example a bypass, a completely new noise source can be created.

2.3 The impact of a road project at any location can be reported in terms of changes in absolute noise level. In the UK the standard index used for traffic noise is the $L_{A10,18h}$ level, which is quoted in decibels.

2.4 The effect on people from a road project can also be reported in terms of nuisance. The assessment of nuisance in this document is based on the average percentage of people who were interviewed and had expressed a considerable degree of bother at the level of noise experienced when at home. This measure of nuisance has been correlated with external noise levels based on the standard index used for traffic noise ($L_{A10,18h}$). It should be noted that this definition of nuisance is not the same as that used in some statutory documents.

2.5 For assessing the impact of noise from road traffic at night, the index $L_{night,outside}$ is to be used. This noise index is recognised in the WHO publication 'Night Noise Guidelines for Europe' as an indicator of the long-term impact of night time noise on health.

2.6 The construction process of a road project also has the potential to cause noise impacts. The impact of construction activities is usually reported in terms of changes in absolute noise level using the L_{Aeq} index, although the maximum noise level, often referred to as the L_{Amax}, from any one activity may also be assessed.

2.7 A road project also has the potential to cause nuisance and physical damage through vibration. Vibration is a low frequency disturbance producing physical movement in buildings and their occupants. These impacts can happen during the operation of an existing or new road, during the improvement or maintenance of an existing road, and also during the construction of a new road. Vibration can be transmitted through the air or through the ground. Airborne vibration from traffic can be produced by the engines or exhausts of road vehicles with dominant frequencies in the 50-100 Hz range. Ground-borne vibration is more often in the 8-20 Hz range and is produced by the interaction between rolling wheels and the road surface. Ground-borne vibration is usually measured in terms of Peak Particle Velocity, or PPV, which is measured in terms of movement in mm/s.

2.8 The technical definitions of the various noise indices discussed in the above sections can be found in Annex 2.

Legislative Framework

2.9 Article 3 of Directive 85/337/EEC (as amended) requires Member States to assess the effects of noise from projects. This legislation provides the basis for the assessment process. In addition, there are several sets of legislation that provide the means to redress the adverse impacts of traffic noise and vibration resulting from the construction and use of new and improved roads on both land and people. These are set out in paragraphs 2.10 to 2.22.

New and Improved Roads – Operation

Land Compensation Act 1973
Land Compensation (Scotland) Act 1973

2.10 Part I of the Land Compensation Act provides a means by which compensation can be paid to owners of land or property which has experienced a loss in value caused by the use of public works, such as new or improved roads. Noise and vibration are two of the factors which would be considered in any claims for compensation, but the claim should consider all changes and effects, including betterment.

2.11 Claims can be made under Part I of the Act from 1 to 7 years after the opening of a road project. However, consideration of the likely extent of claims may be made during the design phase of a road project following the completion of statutory processes.

The Noise Insulation Regulations 1975 (as amended 1988)
The Noise Insulation (Scotland) Regulations 1975
The Noise Insulation Regulations (Northern Ireland) 1995

2.12 The Noise Insulation Regulations 1975 (as amended 1988) were made under Part II of the Land Compensation Act 1973. The Noise Insulation (Scotland) Regulations 1975 were made under the Land Compensation (Scotland) Act 1973. The Noise Insulation Regulations (Northern Ireland) 1995 were made under the Land Acquisition and Compensation (Northern Ireland) Order 1973.

2.13 With the exception of the Regulations applicable to Northern Ireland, Regulation 3 imposes a duty on authorities to undertake or make a grant in respect of the cost of undertaking noise insulation work in or to eligible buildings. This is subject to meeting certain criteria given in the Regulation. Regulation 4 provides authorities with discretionary powers to undertake or make a grant in respect of the cost of undertaking noise insulation work in or to eligible buildings, subject to meeting certain criteria given in the Regulation. Advice on the use of this discretionary power should be sought from the Overseeing Organisation.

2.14 In the Regulations applicable to Northern Ireland, Regulation 5 imposes a duty on the relevant authority to undertake or make a grant in respect of the cost of undertaking noise insulation work in or to eligible buildings. Regulation 6 provides the authority with discretionary powers to undertake or make a grant in respect of the cost of undertaking noise insulation work in or to eligible buildings, subject to meeting certain criteria given in the Regulation. Advice on the use of this discretionary power should be sought from the Overseeing Organisation.

2.15 It is noted that in Scotland, for the assessment of eligibility under the Noise Insulation Regulations, the use of the methodology provided in The Memorandum to Regulations 3 and 6 of the Noise Insulation (Scotland) Regulations should be used. This differs from England, Wales and Northern Ireland, where the methodology contained within CRTN should be used when calculating entitlement under the relevant Noise Insulation Regulations.

The Highways Noise Payments and Movable Homes (England) Regulations 2000 (as amended 2001)
The Highways Noise Payments (Movable Homes) (Wales) Regulations 2001

2.16 The Highways Noise Payments and Movable Homes (England) Regulations 2000 and The Highways Noise Payments (Movable Homes) (Wales) Regulations 2001, provide highway authorities with a discretionary power to provide a noise payment where new roads are to be constructed or existing ones altered. The relevant Regulations set out the criteria which should be applied in assessing eligibility for making such payments. Advice on the use of this discretionary power should be sought from the Overseeing Organisation. It is noted that there is no similar Regulation in Scotland.

New and Improved Roads – Construction and Maintenance

The Noise Insulation Regulations 1975 (as amended 1988)
The Noise Insulation (Scotland) Regulations 1975
The Noise Insulation Regulations (Northern Ireland) 1995

2.17 With the exception of the Regulations applicable to Northern Ireland, Regulation 5 provides relevant authorities with discretionary powers to undertake or make a grant in respect of the cost of undertaking noise insulation work in or to eligible buildings with respect to construction noise. This is subject to meeting certain criteria given in the Regulation. In the Regulations applicable to Northern Ireland, Regulation 7 provides such discretionary powers to construction noise. Advice on the use of this discretionary power should be sought from the Overseeing Organisation.

Control of Pollution Act 1974

2.18 The Control of Pollution Act 1974 Section 61 sets out procedures for those undertaking works to obtain ‘Prior Consent’ for construction works within agreed noise limits.

2.19 Applications for such consent are made to the relevant local authority and contain a method statement of the works and the steps to be taken to minimise noise. Under Section 60 of the Act, the local authority has powers to attach conditions to, limit or qualify any

consent to allow for changes and limit the duration of any consents. It is noted that although it is generally for those undertaking the works to decide whether or not to seek such consent, this is also dependent on the custom and practice of the local authority. Some local authorities request demonstration of best practicable means rather than formal 'Prior Consent' applications.

2.20 For the control of noise and vibration at construction sites, BS 5228: 2009 (Ref 9) (Code of Practice for noise and vibration control on construction and open sites – Part 1: Noise & Part 2: Vibration) provides guidance for predicting construction noise and also provides advice on noise and vibration control techniques.

Environmental Protection Act 1990

2.21 Under Part III of the Environmental Protection Act 1990 local authorities have a duty to investigate noise complaints from premises (land and buildings) and vehicles, machinery or equipment in the street. It does not apply to road traffic noise but may be applicable to some construction activities. The Noise and Statutory Nuisance Act 1993 amended Part III of the Environmental Protection Act 1990 by placing additional definitions in the list of statutory nuisances in Section 79 of the Environmental Protection Act. The definitions relate to nuisance caused by vehicles, machinery and equipment in the road.

2.22 If a local authority's Environmental Health Officer is satisfied that a complaint amounts to a statutory nuisance then the authority must serve an abatement notice on the person responsible or in certain cases the owner or occupier of the property. The notice could require that the noise or nuisance must be stopped altogether or limited to certain times of the day.

Other Legislation and Policy

The Environmental Noise (England) Regulations 2006 (as amended 2008, 2009)
The Environmental Noise (Northern Ireland) Regulations 2006
The Environmental Noise (Scotland) Regulations 2006
The Environmental Noise (Wales) Regulations 2006 (as amended 2009)

2.23 The above Environmental Noise Regulations have been introduced into the UK to implement the Assessment and Management of Environmental Noise Directive 2002/49/EC. This Directive relates to the assessment and management of environmental noise in EU member states. At the time of publication of this standard and in the future, Noise Action Plans and additional guidance may be available to those carrying out noise and vibration assessments that might need to be taken into account during the assessment of road projects. One such published example is Scotland's Draft Transportation Noise Action Plan. Advice should be sought from the Overseeing Organisations to establish the relevant information and guidance which needs to be considered during the assessment process.

National Noise Policy

Noise Policy Statement for England, DEFRA

2.24 DEFRA released the Noise Policy Statement for England (NPSE) in March 2010. The NPSE vision is to promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development. To achieve this vision the NPSE sets out the following aims for the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- avoid significant adverse impacts on health and quality of life;
- mitigate and minimise adverse impacts on health and quality of life; and
- where possible, contribute to improvement of health and quality of life.

Advice should be sought from the Highways Agency to establish the extent to which the NPSE should be considered during the assessment process of road projects on England's strategic road network. For projects involving the other Devolved Administrations, advice should be sought from the Overseeing Organisation as to the application of the relevant noise policy.

Key Issues

2.25 Traffic noise is a major source of complaint and the release of the Assessment and Management of Environmental Noise Directive (2002/49/EC) is part of a strategy to address this. The implementation of this Directive into national law via Regulations given at

Cl 2.22 and the production of action plans provides a framework to manage environmental noise, including traffic noise.

2.26 One of the issues to consider during an assessment of noise and vibration is the impacts upon people. This relates to people in their homes, their gardens and also outside in recreation areas. The impact upon other sensitive receptors and the enjoyment of these receptors is also important.

2.27 There is a growing body of evidence concerning the adverse effect noise can have on health and general quality of life. Current evidence indicates that prolonged exposure to high levels of noise can lead to mental health and physiological symptoms; however, further research is necessary to define noise level exposure parameters for such symptoms. (Ref 34 and 35))

2.28 Impacts on the noise climate from climate change are relatively unknown, but these could become an issue as this topic is better understood.

2.29 For a road project that involves introducing a new noise source into an area, a key consideration is the change in the level of night time noise. In the WHO's 'Night Noise Guidelines for Europe' (Ref 34) a night noise guideline (NNG) of 40 dB $L_{night,outside}$ is recommended. This noise level is considered by WHO to protect the public, including most of the vulnerable groups such as children, the chronically ill and elderly, from the adverse health effects of night noise. WHO also recommends an interim target (IT) of 55 dB $L_{night,outside}$ for situations where the achievement of NNG is not feasible in the short term. The guidance considers that this IT can be temporarily considered by policy-makers for exceptional local situations. No timescale is recommended to achieve these noise levels, only that Member States are encouraged to gradually reduce the proportion of the population exposed to levels over the IT within the context of meeting wider sustainable development objectives.

2.30 It should be noted that the WHO noise index, $L_{night,outside}$, relates to free-field conditions, i.e. reflection effects associated with facade assessments are ignored.

2.31 The use of congestion management schemes is becoming widespread, and the effect these have on the noise climate is still relatively unknown.

Interactions with Other Assessment Topics

2.32 During the assessment of a road project, the impact from noise and vibration may need to be considered by other environmental topic areas. Although most non-dwelling sensitive areas will be included in the noise assessment, some other environmental topics may require additional information on noise and vibration impacts in order to undertake their assessments (e.g. Nature Conservation).

2.33 Noise is one characteristic that determines the level of tranquillity. This is considered further within the Landscape and Visual Effects topic, and therefore, information may need to be provided to assist with the landscape chapter assessment.

Project Objectives

2.34 The design objectives of the road project should always be understood by those undertaking an assessment. This could include how the noise and vibration assessment fits into any wider design objectives.

2.35 If there are any design objectives set specifically for noise and vibration then those undertaking the assessments should fully understand the reasons for this requirement and the objectives that has been set. Any wider government objectives or strategies should also be considered.

2.36 Any local or legal requirements should also be understood before an assessment is undertaken.

3. PROCEDURE FOR ASSESSING IMPACTS

Overview of Process

3.1 The following guidance describes the assessment process for potential noise and vibration impacts arising out of road projects involving new construction, improvements, operation and maintenance. Methods are provided in Annex 1 which should be used to predict the potential noise and vibration impact of proposed road projects.

3.2 The general principle of DMRB Volume 11 Section 2 allocates an assessment method according to risk and the assessment of noise and vibration impacts follows the same process. This process uses three levels of assessment:

i) scoping;

ii) simple;

iii) detailed.

3.3 The assessment approach has been designed to be proportionate, consequently the level of assessment will depend upon the potential for impacts to occur, and this will in turn depend upon the scale of the proposed road project, the site and local circumstances, and the location of sensitive receptors. This approach can be equally applied to all road projects, including new construction, improvement and maintenance.

3.4 A key part of the process is to be able to conclude when either no effects will occur or the level of assessment is sufficient for the effect to be understood. Therefore the process includes several exits points when these points have been reached to avoid unnecessary effort.

3.5 Determining the appropriate level of assessment is dependent upon threshold criteria being met. The threshold criteria used for traffic noise assessment during the day is a permanent change in magnitude of 1 dB $L_{A10,18h}$ in the short term (i.e. on opening) or a 3 dB $L_{A10,18h}$ change in the long term (typically 15 years after project opening). For night time noise impacts, the threshold criterion of a 3 dB $L_{night,outside}$ noise change in the long term should also apply but only where an $L_{night,outside}$ greater than 55 dB is predicted in any scenario. The threshold criterion for traffic induced vibration is a PPV rise to above a level of 0.3 mm/s, or an existing level above 0.3 mm/s is predicted to increase.

3.6 A Simple Assessment would normally be appropriate where it is not expected or it is not clear that the threshold values will be exceeded at any sensitive receptor. A Detailed Assessment would be appropriate in situations where sensitive receptors are present and any of the threshold values are expected to be exceeded, for example where a new road is proposed. Where a Simple Assessment demonstrates that any of the threshold values are expected to be exceeded it will be appropriate to move to a Detailed Assessment.

3.7 Where sensitive receptors are identified during the Scoping Assessment at which exceeding the threshold values for noise or vibration are possible at such an early stage, it may be appropriate to move directly to a Detailed Assessment. However, caution should be applied to such an approach as at the Scoping Assessment sufficient data may not always be available to make this decision. Before such an approach is adopted, the Overseeing Organisation should be consulted.

3.8 The objective of an assessment is to gain an appreciation of the noise and vibration climate both with and without the road project, referred to as the Do-Something and Do-Minimum scenarios respectively. These scenarios need to be assessed for a baseline year and also a future year. The baseline and future assessment years for construction and operational effects are as follows:

- For an assessment of temporary noise and vibration impacts (i.e. from construction or maintenance activities), the baseline year is taken as that immediately prior to the start of works. The future assessment year would be a year during the period of construction/maintenance works.

- For an assessment of permanent noise and vibration impacts, the baseline year is taken as the opening year of the road project. This is considered to be the year which is most representative of the situation immediately before a road project opens to traffic. It is noted that the baseline year used for this assessment could be different to the year used when predicting the Prevailing Noise Level for any calculations undertaken for the relevant Noise Insulation Regulations. The future assessment year for operation is typically the 15th year after the opening year of the road project, but in some circumstances this may occur before the 15th year. For example, inspection of the traffic model outputs may highlight that the greatest traffic flows do not occur in the 15th year.

3.9 During the assessment process at Simple and Detailed, comparisons are made between scenarios in the baseline year and the future assessment year. At Simple level, the following two comparisons are made in order to determine the impact of the road project in the short term, and the long term.

i) Do-Minimum scenario in the baseline year against Do-Something scenario in the baseline year (short term).

ii) Do-Minimum scenario in the baseline year against Do-Something scenario in the future assessment year (long term).

3.10 At the Detailed level, the following three comparisons are made in order to better understand the impact of the road project.

i) Do-Minimum scenario in the baseline year against Do-Minimum scenario in the future assessment year (long term).

ii) Do-Minimum scenario in the baseline year against Do-Something scenario in the baseline year (short term).

iii) Do-Minimum scenario in the baseline year against Do-Something scenario in the future assessment year (long term).

3.11 For nighttime noise impacts, only comparisons in the long term are considered for both Simple and Detailed levels of assessment.

3.12 The assessment of noise and vibration should be based on the project with permanent mitigation as agreed by the Overseeing Organisation. In Scotland and Wales, an assessment of noise and vibration should also be undertaken without permanent mitigation in place. Any temporary mitigation installed (e.g. environmental barriers which will be removed after the construction phase) should only be included during the assessment of temporary impacts which the temporary mitigation will affect.

Temporary impacts

3.13 Temporary noise and vibration impacts are normally those that occur between the start of advance works and the end of the road project construction period. The term ‘disruption due to construction’ is commonly used to describe such temporary impacts which occur on both people and the natural environment. In addition to the impacts due to the construction of the road project itself, disruption can arise from advance works, for example to divert utilities, and these works may extend well beyond the road construction site. Where material needs to be transported to or from the construction site, the impacts of the additional traffic along access routes should be considered.

3.14 Although construction-related impacts are temporary, they may nevertheless be sufficient to require mitigation. Typical construction impacts might include a localised increase in noise, vibration, and a loss of amenity due to the presence of construction traffic.

3.15 Ground-borne vibration caused by the activities of heavy construction plant can become perceptible in dwellings and cause nuisance (Ref 21). People often express concern that vibrations they feel will cause structural damage to their dwelling. However, it has been shown that vibrations that can be felt indoors and which often cause occupants anxiety are an order of magnitude smaller than would be needed to activate pre-existing strains and cause cracks to propagate. It should be borne in mind that superficial cracks in plaster around openings such as doors and windows can often appear during the life of a building.

3.16 As there is an expectation that disruption due to construction is a temporary issue, the area in which it is considered to be a nuisance is generally more localised than where the impacts of the road project are likely to

be a cause of concern once it has opened to traffic. It has been shown (Ref 4) that the impact of construction nuisance in one form or another, diminishes rapidly with distance.

3.17 Certain projects may require the use of temporary diversion routes and receptors located in proximity to such routes may experience increased levels of noise and vibration. The duration of the temporary diversion is important when considering the potential impacts.

3.18 For on-line projects, e.g. carriageway widening, where temporary diversion routes are not viable, a restriction on road traffic speed is often implemented for reasons of safety allowing construction works to occur adjacent to a traffic stream. Such decreases in traffic speed can lead to temporary reductions in noise levels for nearby receptors. Although it is not necessary to include this element in the assessment, it should be taken into account when considering the potential public response following the opening of the project when traffic speeds are increased following project completion.

Permanent impacts

3.19 The noise arising from a stream of traffic has two main components. The first component is generated by the engine, exhaust and transmission systems of vehicles and is the dominant source of noise when traffic is travelling at fairly low speeds, or in a low gear. Engine noise from heavy vehicles is commonly the dominant source of low frequency noise. Engine and exhaust noise levels are closely related to engine speed, and transmission noise depends more on the relationship between road speed and engine speed than on vehicle speed.

3.20 The second component of traffic noise is generated by the interaction of tyres with the road surface and this is the dominant noise source when traffic is flowing freely at moderate to high speeds. Tyre noise contributes a significant proportion of high frequency noise, especially in wet weather. Tyre noise levels depend on the tyre characteristics and the road surface roughness, but always increase with vehicle speed in this speed range.

3.21 The noise level from a stream of traffic is an aggregate of the noise emitted by many vehicles. For a continuous flow of traffic, it is generally reasonable to consider this complex source as a single line with uniform emission characteristics, from which the noise level at a specified distance can be estimated.

3.22 The main factors influencing the noise level close to a road comprising freely flowing traffic is the traffic volume, speed and composition (% heavy vehicles), and the road gradient and surface characteristics. At a distant reception point the noise level is attenuated by a number of additional factors, including the distance from the noise source, the nature of the intervening ground surface and the presence of obstructions.

3.23 The total noise level from several sources cannot be combined by simply adding them together since noise levels are calculated as a function of the logarithm of sound pressure. A procedure for combining traffic noise levels is described in the Technical Memorandum Calculation of Road Traffic Noise (CRTN) (Ref 10), which provides a graphical illustration of how the stronger of two sources will have a dominant effect.

3.24 It is widely believed that a given level of traffic noise is more annoying at times when people are resting, especially at night. Historically, the fact that there is much less traffic at night has meant that night time noise assessments have not been undertaken as part of the DMRB assessment process. However, due to the increasing use of strategic networks by long distance goods traffic during night time hours and the potential to increase the level of noise and the perception of nuisance at night, a night time noise assessment should now be considered as part of the assessment process.

3.25 While traffic levels are generally lower at night their resultant long term noise impacts may be similar to those during the day. It is also noted that people tend to be more sensitive to night time noise (Ref 34). As noise during the night (11pm to 7am) is only covered slightly by the 18 hour measure used for assessing noise in this document, a separate quantitative assessment is required.

3.26 The TRL report ‘Converting the UK traffic noise index $L_{A10,18h}$ to EU noise indices for noise mapping’ (Ref 3) provides a technique for predicting night time noise levels (L_{night}). It presents three methods, with the applicable method dependent on the detail of traffic information available. The preferred technique is through the use of Method 1 which relies on the provision of hourly traffic flows. Method 2 allows for the prediction of night time noise levels where the traffic flow for that period is available. Using daily

traffic flow data, Method 3 converts predicted day-time noise levels ($L_{A10,18hr}$) to night time noise levels. Where Method 3 is used it is assumed that the diurnal traffic pattern from the given road scheme is typical for the type of road, otherwise errors may occur.

3.27 In deriving the L_{night} noise index using the above conversion it will be necessary to subtract 2.5 dB(A) from the result to estimate the $L_{night,outside}$ level. L_{night} derived from the $L_{A10,18h}$ is a facade level whereas $L_{night,outside}$ assumes free-field conditions.

3.28 The conversion methods contained within the TRL report to predict night time noise levels were derived through investigating the correlation between measured levels of $L_{A10,1hr}$ and $L_{Aeq,1hr}$ at 76 different urban sites. A good correlation was shown between these noise parameters where high noise levels were measured; however, a greater variance is shown where at lower noise levels. The report considers that this is due to the complex relationship between these indices as traffic flows decrease and the variability in noise level increases. Therefore, caution should be applied when using the TRL conversion formulae to predict night time noise levels. Despite this caution, the conversion methods contained within the TRL report are deemed the most suitable pending further research in this area.

3.29 Traffic vibration is a low frequency disturbance producing physical movement in buildings and their occupants. Vibration can be transmitted through the air or through the ground. Airborne vibration from traffic can be produced by the engines or exhausts of road vehicles and these are dominant in the audible frequency range of 50-100 Hz. Groundborne vibration is often in the 8-20 Hz range and is produced by the interaction between rolling wheels and the road surface (Ref 30).

3.30 Vibration can be measured in terms of Peak Particle Velocity, or PPV (i.e. the maximum speed of movement of a point in the ground during the passage of a source of vibration). For vibration from traffic, a PPV of 0.3 mm/s measured on a floor in the vertical direction is perceptible (Ref 32) and structural damage to buildings can occur when levels are above 10 mm/s (Ref 8). The level of annoyance caused will also depend on building type and usage, however, a building of historic value should not (unless it is structurally unsound) be assumed to be more sensitive (Ref 8).

3.31 Occupants of hospitals, educational establishments and laboratories or workshops where high precision tasks are performed may well be affected to a greater extent than residents of dwellings.

3.32 PPVs in the structure of buildings close to heavily trafficked roads rarely exceed 2 mm/s and typically are below 1 mm/s. Normal use of a building such as closing doors, walking on suspended wooden floors and operating domestic appliances can generate similar levels of vibration to those from road traffic (Ref 30).

Cumulative impacts

3.33 The impact from noise and vibration can contribute to the overall cumulative impact of a road project in the following ways.

3.34 Cumulative impacts from a single road project may arise from the combined action of noise or vibration and a number of different environmental topic-specific impacts upon a single receptor/resource. For example, a new road may increase noise at a dwelling, which may also be subject to a deterioration in air quality. Where there is an impact from the road project on a single receptor/resource from the combined action of noise and vibration, this should be treated as a cumulative impact. The forms of cumulative impact are discussed further in Section 2, Part 5, Chapter 1, with advice on how to consider the certainty of outcome and the probability of the predictions.

3.35 Cumulative impacts may arise from the combined action of a number of different road projects, in combination with the proposed road project, on a single receptor/resource. For example, the road project may be on a route where further road projects are scheduled for opening. These road projects may result in changes in traffic flow when each road project is completed and hence increase or decrease noise at dwellings. The traffic flows supplied for the noise and vibration assessment undertaken in accordance with Chapter 3 would normally consider the changes in traffic on the wider network and from other road projects. Hence, the information required to assess this type of cumulative impact may be readily available (e.g. from wider strategic studies), without the need for a further assessment. This should be clarified with the traffic consultant.

Magnitude of Impact

3.36 Section 2 of Volume 11 includes HA 205/08. This provides a method for the classification of the magnitude of impact and the significance of an effect in order to arrive at an overall level of significance. In terms of road traffic noise, a methodology has not yet been developed to assign a significance according to both the value of a resources and the magnitude of an impact. However, the magnitude of traffic noise impact from a road project should be classified into levels of impact in order to assist with the interpretation of the road project. Therefore, for the assessment of traffic noise that is covered by this document, a classification is provided for the magnitude of impact.

3.37 A change in road traffic noise of 1 dB $L_{A10,18h}$ in the short term (e.g. when a project is opened) is the smallest that is considered perceptible. In the long term (typically 15 years after project opening), a 3 dB $L_{A10,18h}$ change is considered perceptible. The magnitude of impact should, therefore, be considered different in the short term and long term. The classification of magnitude of impacts to be used for traffic noise is given in Table 3.1 (short term) and Table 3.2 (long term).

Noise change, $L_{A10,18h}$	Magnitude of Impact
0	No change
0.1 – 0.9	Negligible
1 – 2.9	Minor
3 – 4.9	Moderate
5+	Major

Table 3.1 – Classification of Magnitude of Noise Impacts in the Short Term

Noise change, $L_{A10,18h}$	Magnitude of Impact
0	No change
0.1 – 2.9	Negligible
3 – 4.9	Minor
5 – 9.9	Moderate
10+	Major

Table 3.2 – Classification of Magnitude of Noise Impacts in the Long Term

3.38 Research into the response to changes in road traffic noise is largely restricted to daytime periods. Until further research is available only noise impacts in the long term is to be considered and Table 3.2 should be used to consider the magnitude of noise change at night. However, given the caution with predicting night time noise levels as traffic flow fall (see 3.24), only those sensitive receptors predicted to be subject to a $L_{night,outside}$ exceeding of 55 dB should be considered. The $L_{night,outside}$ of 55 dB corresponds to the Interim Target level specified in the WHO Night Noise Guidelines for Europe.

3.39 Methods are available for evaluating the significance of construction noise and vibration. These methods are described in Annex E of BS 5228 (Ref 9) and should be used unless an alternative method is agreed with the Overseeing Organisation.

3.40 Table 3.1 should be used in the assessment of noise impact associated with construction traffic on the local road network and from temporary diversion routes resulting from construction of the road project. For road projects where construction traffic and temporary diversions occur at night, the Overseeing Organisation should be consulted to agree a suitable methodology for assessing the associated noise impact.

3.41 The level of vibration at sensitive receptors has the potential to increase and decrease. If the level of vibration at a receptor is predicted to rise to above a level of 0.3 mm/s, or an existing level above 0.3 mm/s is predicted to increase, then this should be classed as an adverse impact from vibration.

Uncertainty and validity

3.42 During an assessment of the impacts from noise and vibration, the uncertainty associated with input data is an important factor in determining how confident the Overseeing Organisation's supply chain can be with the assessment results. As the road project progresses, the quality and accuracy of the assessment should normally improve. This in turn will influence the accuracy of designed mitigation measures, for example the height and positioning of any barriers. The most up to date scheme design and traffic flow information should be used in the final assessment.

3.43 For the prediction of road traffic noise the methodology given in the CRTN should be used. Annex 4 provides additional guidance on the use of CRTN.

3.44 The method used to assess noise nuisance in this guidance is based on data that is at least 15 years old. The surveys which provided the basis for this method of assessing nuisance were conducted at sites where road traffic was the dominant noise source. The noise exposure at those sites ranged from 65 to 78 dB $L_{A10,18h}$, with the changes in traffic noise being up to 10 dB $L_{A10,18h}$ at dwellings up to 18m from the roadside kerb. On this basis this method should be used with caution.

3.45 For the prediction of vibration from an existing road, the methodology given in Watts 1990 (Ref 30) could be used to predict the maximum vertical PPV at the foundations of a building. However, this methodology requires detailed knowledge of the ground type which may only be available at advanced stages of assessment. If this methodology is to be used for the prediction of expected vibration levels from a new road, then the Overseeing Organisation should first be consulted and the proposed use agreed.

3.46 The method to assess airborne vibration nuisance in this guidance was restricted to dwellings within 40m of the carriageway where there were no barriers to traffic noise. There should be caution when using this guidance to make predictions of disturbance caused by airborne vibration where the receptors are screened or are not sited within 40m of the road, since this is outside the range of the data on which the method is based.

4. DESIGN AND MITIGATION

4.1 A road project should be designed in order to fulfil the objectives from the project brief. This brief may include noise and vibration related objectives. As far as practicable the mitigation of impacts should be addressed through optimising horizontal and vertical alignments to achieve the necessary mitigation. However, this optimisation may be insufficient to achieve or address some or all principal objectives, and thus additional measures may be necessary.

4.2 In terms of permanent impacts, a change of 1 dB(A) in the short-term (e.g. when a project is opened) is the smallest that is considered perceptible. In the long-term, a 3 dB(A) change is considered perceptible. Such increases in noise should be mitigated if possible. A predicted increase in the level of groundborne vibration at any receptor above a PPV level of 0.3 mm/s, or where an existing level is above 0.3 mm/s and is predicted to increase this should mitigated if possible.

4.3 Some examples of design and mitigation techniques that may influence noise and vibration impacts are described below. Except where noted, they will help to mitigate both noise and vibration impacts.

i) **Horizontal alignment** – By moving a route away from sensitive receptors.

ii) **Vertical alignment** – Keeping a route low within the natural topography to exploit any natural screening and enhancing this by the use of cuttings and, in exceptional circumstances, sub surface and surface tunnels.

iii) **Environmental barriers** – These can be in the form of earth mounding or acoustic fencing of various types, or a combination of the two. Conventional environmental barriers are not effective in reducing ground borne vibration and may be only partially effective against airborne vibration. They should, therefore, be ignored in assessing vibration nuisance unless tests show benefits from the design proposed. The use of reflective and absorptive barriers could also be considered. Further advice on how the assessment can consider such barrier types in the modelling process is given in Annex 4.

iv) **Low-noise surfaces** – The principal benefit of low-noise surfaces is the reduction in mid and higher frequencies of noise generated by tyres at speeds in excess of 75 km/hr. They are less effective in reducing noise at low speeds where engine noise particularly from heavy vehicles is more dominant. These surfaces also create a relatively smooth running surface that in some cases can help to eliminate ground borne vibration.

v) **Speed and volume restrictions** – The effect of the speed of vehicles on noise level is one of the most fundamental in the noise prediction process. Above 40 km/hr, noise level increases with the speed of the vehicle and a reduction in speed will normally cause a reduction in noise level. In a similar way, the volume and composition of traffic has a direct influence on the noise level.

4.4 The potential benefits of mitigation measures vary widely according to circumstances. For example, environmental barriers can provide reductions of 10 dB or more for well-screened locations relatively close to the source. But at further distances, and especially where the barrier provides only a small deflection of the transmitted sound waves, actual noise reductions may only be 1 or 2 dB. Beyond 200-300m, the effects are often zero as ground attenuation becomes the most significant factor.

4.5 The use of shrubs or trees as a noise barrier has been shown to be effective only if the foliage is at least 10m deep, dense and consistent for the full height of the vegetation (Ref 16, 29). The effect on noise from the removal of such foliage density will require consideration when undertaking any predictions as this may lead to an elevation of noise level. Guidance from the Overseeing Organisation should be sought in considering the potential effects of foliage on noise.

4.6 The benefits of adjusting alignments are difficult to determine without complex calculations; a horizontal realignment can often take advantage of natural screening or provide opportunities to create landscaped features. Lowering a road into cutting may be more attractive than erecting noise barriers and may generate extra fill which can be used for earth mounding to enhance the screening effect.

4.7 Although putting a road into a tunnel will eliminate the noise from the enclosed section, there is potential for reverberant noise to be emitted at either end of the tunnel and increase the noise from traffic on the approaches. Noise may also be exacerbated by reflections between the flanking retaining walls. Noise absorptive surfaces within the entrance of the tunnel and on the retaining walls can help to reduce this if it is a problem.

4.8 CRTN cannot deal with the effects of partial reflections or with 3D effects and there may be need for a sophisticated analysis of noise if there are sensitive receptors in close proximity to the end of a tunnel. Work has shown that the reflection effects at a tunnel portal are localised, and possibly only noticeable within 100m of the portal.

4.9 The presence of movement joints in structures and carriageways may lead to adverse response from nearby sensitive receptors. Noise emitted from vehicles passing over movement joints can emanate from a number of paths including, tyre interaction with the joint and associated vibration, particularly of a structure. Although the noise emissions can be perceptible against that of general traffic flow noise, particularly at night, due to the variation in the noise spectrum resulting from these events, it is unlikely that measured levels of L_{A10} would be affected by their presence. However, the potential public response to noise emanating from movement joints should be considered where new joints are proposed or where they currently exist but the carriageway is being replaced by a surface with a lower road surface influence (RSI).

4.10 Reducing the noise and vibration impact from a road is just one of the factors to be considered in design, and conflicts can exist. Consideration should be given to cases where such conflict may exist, e.g. an acoustic barrier may introduce unacceptable visual intrusion or safety implications. In addition, any mitigation measure should perform to an acceptable level in traffic, road safety, economic and other environmental terms.

4.11 The impact from construction noise can be mitigated to a certain extent both by applying powers within the relevant Land Compensation Act or by imposing contractual working restraints. The Land Compensation Act allows for temporary re-housing when the disruption is of such an extent that continued occupation is not reasonably possible. Regulations made under Part II of the Act also permit the insulation of eligible buildings against construction noise where that noise seriously affects, for a substantial period of time, the enjoyment of the building. This is independent of any requirement for noise insulation resulting from traffic noise. However, where houses are eligible for insulation from traffic noise, the insulation work could be carried out early enough for the recipients to benefit during the construction period.

4.12 Contractual working restraints are important where the natural environment needs to be protected against potentially adverse impacts caused by particular construction methods. For example, restrictions can be written into the contract documents that prevent the storing of borrow or surplus material in particular areas. Contract conditions can also be used to limit noise from the construction site, to control working hours (especially for potentially disruptive operations), to prevent access to sensitive areas, to restrict construction traffic to suitable haul routes, and to ensure that such routes are cleaned or swept regularly. It is important that contractual working restraints are discussed in advance with the local authority Environmental Health Officer. Monitoring of conditions noise and vibration may be necessary during construction.

4.13 Nuisance from construction vibration can be reduced by the use of specialised equipment. Martin (Ref 22) gives further guidance on mitigation measures to reduce vibration and describes a method of predicting vibration levels. In considering possible methods of mitigating adverse impacts during the construction period, it will be necessary to balance the severity of an impact with its duration. For example, it may be acceptable if greater disruption occurs over a short period than lesser disruption over an extended period.

5. MANAGEMENT OF ENVIRONMENTAL EFFECTS

5.1 It is important to note the conclusion of noise and vibration assessments may depend on mitigation features built into the design, e.g. noise barriers or low noise surfacing. The validity of these conclusions will depend on these mitigation features being maintained as fit-for-purpose and this is the assumption that is made during the compiling of the assessment such that the road project should deliver the objectives over the assessment period. This will include the managing of any proposed mitigation in order to deliver any predicted benefits.

5.2 For noise, the long term effectiveness of any low-noise surfaces and noise barriers is important in achieving any claimed benefits. This process starts with the choosing of an appropriate surface or barrier, through the installation period and then during the operation of the road project.

5.3 The effectiveness of low-noise surfaces is dependent upon wear to the surface and clogging of the surface, with the noise reducing properties of the surface becoming less due to clogging. A possible measure to manage the low-noise surface is to clean the surface to avoid clogging. Cleaning can be undertaken by a variety of means, although each has disadvantages associated with cost, time, and the potential need to close lanes to traffic.

5.4 The effectiveness of a noise barrier is dependent upon its ability to prevent sound passing through, over, or around it. Following installation, this can be managed by undertaking regular inspections to ensure that there is no significant degeneration in its construction.

5.5 For vibration, imperfections in the road surface are the main cause of vibration. The monitoring of surface condition is an important part in preventing traffic induced vibration.

5.6 An important part of the management of the noise and vibration impacts from a road project is the management of stakeholder expectations. Exhibitions and consultations will usually be held to inform stakeholders of the potential impacts and associated mitigation. The Overseeing Organisation's supply chain should ensure that the noise and vibration impacts and any mitigation are correctly conveyed. The management of temporary impacts from construction can be particularly important as these can often involve a sudden change in noise level.

6. MONITORING AND EVALUATION

6.1 Although there is currently no general requirement for noise and vibration monitoring following the completion of a road project, the Overseeing Organisation's supply chain should check whether any monitoring requirements have been written into the design specification. This may be required if an objective of the road project is to reduce noise.

6.2 Monitoring during construction may be required and the scope of this would usually be covered by agreements with the local Environmental Health Officer.

7. REPORTING OF ASSESSMENTS

7.1 When reporting the potential impact of noise and vibration, completed tables A1.1, A1.2, A1.3 and A1.4 should be supported by the results of the assessment methods as well as other technical and qualitative information sufficient to provide a transparent decision-making process. The results of the assessments may be intended for inclusion in an Environmental Statement and to document and support decision making. The results should be capable of bearing public scrutiny and debate and should, therefore, be robust enough to withstand such scrutiny. Records of assessments, consultations, analyses and conclusions should be comprehensive, meticulous and consistent. For further general guidance on reporting potential effects DMRB 11.2 'General Principles of Environmental Assessment' should be consulted. In particular, HD 48/08 'Reporting of Environmental Impact Assessments' gives guidance on reporting the results of the processes described in the standard.

7.2 The assessments will produce reports in various formats for different purposes. Technical reports on data collection or fieldwork may often be stand-alone documents, but they should be prepared bearing in mind that certain aspects may contribute to the environmental plans or management plans (or equivalent) for the road project.

7.3 Reports should conform to the Overseeing Organisation's preferred style or formatting, and observe any protocols for the presentation of electronic documents or data.

7.4 Reports should be prepared including the results of all assessments, whether at Scoping, Simple or Detailed level, taking account of the level of detail required for the particular stage in road project delivery and the decision making process associated with the road project.

7.5 Any recommendation given in assessment reports to proceed to a formal Environmental Impact Assessment should be agreed with the Overseeing Organisation and that agreement confirmed in writing by the Overseeing Organisation.

7.6 Annex 1 of this guidance details the approach for the assessment of noise and vibration for new road projects.

Scoping

7.7 For the report at Scoping, the indicative layout for the specialist topics given in HD 48/08 (Table 2.1) should be followed unless directed otherwise by the Overseeing Organisation. The noise and vibration scoping report should also report the following for each option under consideration:

- A description of the road project objectives in relation to noise and vibration.
- Define and display the study area and the main sources of noise and vibration in the area (See A1.11 of Annex 1 on defining the study area).
- Whether there is likely to be a change in noise level of 1 dB $L_{A10,18h}$ or more in the short-term or 3 dB $L_{A10,18h}$ in the long-term at any sensitive receptor within the study area.
- Whether these is likely to be a change in noise level of 3 dB $L_{night,outside}$ or more in the long term at any sensitive receptor within the study area where an $L_{night,outside}$ greater than 55 dB is predicted.
- Whether there is likely to be an increase in the PPV level of groundborne vibration at any sensitive receptors within the study area to above a level of 0.3 mm/s, or an existing level above 0.3 mm/s is predicted to increase.
- The outcome from any consultations and also any known noise levels.
- The data sources used to gain information for assessment. This should also include an indication of whether or not (and why) a site visit has been undertaken.
- A view on the likely impact and if the assessment should proceed to either Simple or Detailed and the reasoning for this.

- Any limitations in the data used or assumptions made during the assessment process.

Simple

7.8 The report for a Simple Assessment should be written in accordance with any instructions from the Overseeing Organisation, and should also report the following:

Reporting of permanent impacts

- A description of the road project objectives in relation to noise and vibration.
- Define and display the study area, and the main sources of noise and vibration in the area.
- The results from the assessment (Table A1.1 and A1.2) including potential night time noise impacts.
- Provide a list of predicted noise levels at all sensitive receptors used in the assessment, including the associated magnitude of change. Where a large number of sensitive receptors exist it may be suitable to include these in an Annex to the main report.
- The results from the Basic Noise Level (BNL) comparisons. A qualitative entry can be given to describe any potential impacts at sensitive receptors further than 50m from any affected link.
- Any possible cumulative impacts.
- Any possible vibration impacts or results from surveys.
- The results from any noise surveys.
- The outcome from any consultations.
- A view on the likely impact and whether or not (and why) an assessment at Detailed is recommended.
- Noise change contour maps. These should show areas with noise change of 1 dB $L_{A10,18h}$ or greater in the baseline year and a change of 3 dB $L_{A10,18h}$ or greater between the baseline year Do-Minimum and future Do-Something assessment year.
- Any limitations in the data used or assumptions made during the assessment process.

Reporting of temporary impacts

- Number of sensitive receptors that are likely to be affected.
- Any construction operations that may have an impact, including the extent of activities and duration.
- Changes in noise and vibration at sensitive receptors.
- The outcome of any consultations.
- A general indication of the extent of any increases likely on the local road network due to construction activities, if necessary considering those emanating from temporary diversion routes.
- Any limitations in the data used or assumptions made during the assessment process.

Detailed

7.9 The report for a Detailed Assessment should be written in accordance with any instructions from the Overseeing Organisation, and should also report the following:

Reporting of permanent impacts

- A description of the road project objectives in relation to noise and vibration.
- Define and display the study area, and the main sources of noise and vibration in the area.
- The results from the assessment (Table A1.1, A1.2 and A1.3) including night time noise impacts.
- Provide a list of predicted noise levels at all sensitive receptors used in the assessment, including the associated magnitude of change. Where a large number of sensitive receptors exist it may be suitable to include these in an Annex to the main report.

- The results from the relevant BNL comparisons. A qualitative entry can be given to describe any potential impacts at sensitive receptors further than 50m from any affected link.
- Any possible cumulative impacts.
- Any possible groundborne vibration impacts or results from surveys.
- The results from the assessment of potential airborne vibration impacts (Table A1.4).
- The results from any noise surveys.
- Noise change contour maps. These should show areas with noise change of 1 dB $L_{A10,18h}$ or greater in the baseline year and a change of 3 dB $L_{A10,18h}$ or greater between the baseline year Do-Minimum and future Do-Something assessment year.
- The outcome from any consultations.
- Any limitations in the data used or assumptions made during the assessment process.

Reporting of temporary impacts

- Number of sensitive receptors that are likely to be affected.
- Any construction operations that may have an impact, including the extent of activities and duration.
- Changes in noise and vibration at sensitive receptors.
- The outcome of any consultations.
- A general indication of the extent of any increases likely on the local road network due to construction activities, if necessary considering those emanating from temporary diversion routes.
- Any limitations in the data used or assumptions made during the assessment process.

8. REFERENCES

Assessment and Management of Environmental Noise Directive 2002/49/EC

Control of Pollution Act 1974

Environmental Protection Act 1990

Land Compensation Act 1973

Land Compensation (Scotland) Act 1973

Noise and Statutory Nuisance Act 1993

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ANNEX 1 ASSESSMENT AT SCOPING, SIMPLE AND DETAILED LEVELS

A1.1 This Annex guides the Overseeing Organisation's supply chain through the methods for assessment to be applied at Scoping, Simple and Detailed levels.

A1.2 The flow chart shown in Figure A1.1 has been developed to guide the Overseeing Organisation's supply chain through the assessment process. This indicates the key decision to be taken at each stage. The methods to be applied for each level of assessment are described in greater detail in paragraphs A1.3 onwards.

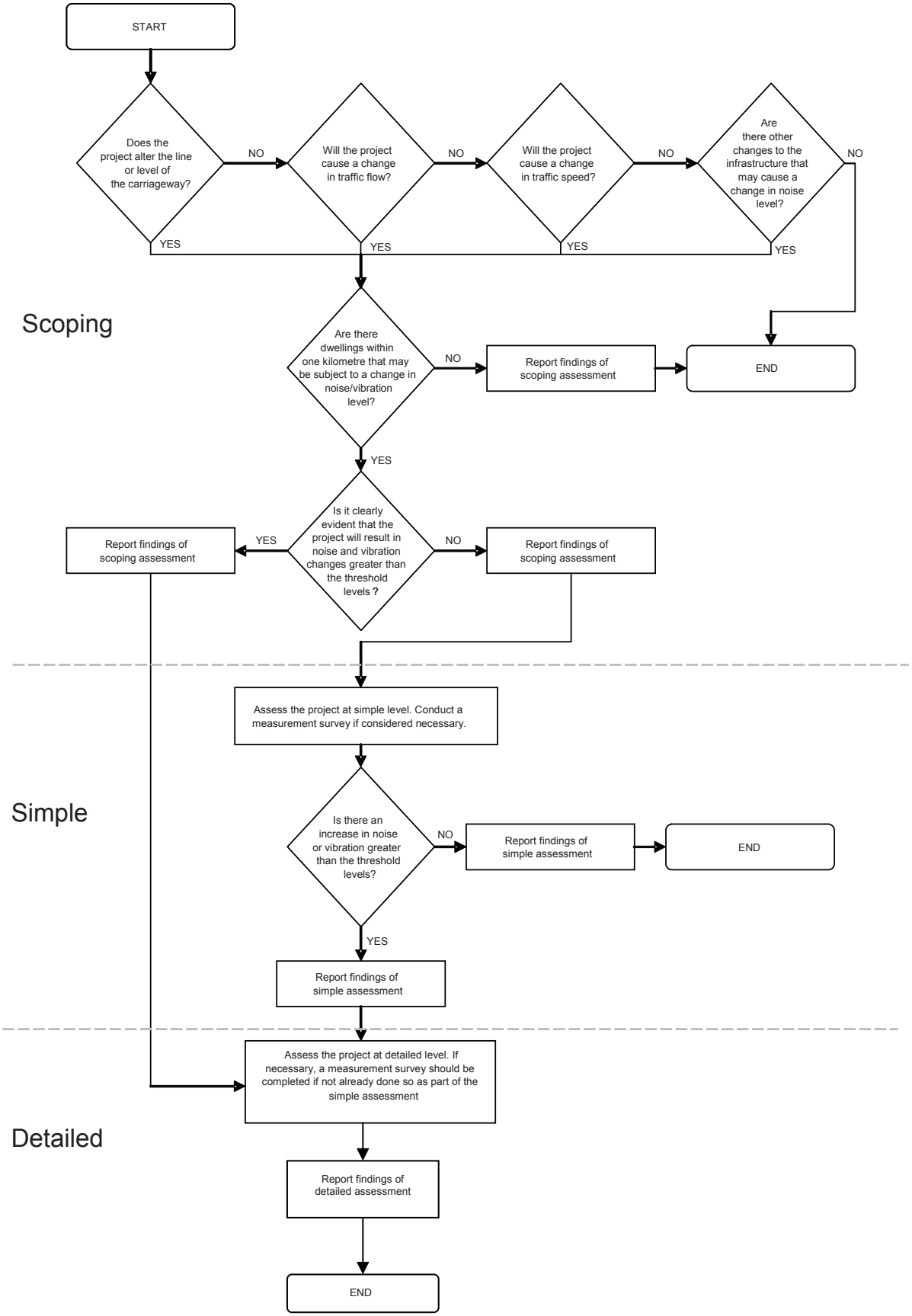

Figure A1.1: Flowchart for Main Stages of Noise and Vibration Assessment

Scoping Assessment

A1.3 This is predominately a desk-based exercise to determine the need for a noise and vibration impact assessment for any of the project options being considered. This process includes identifying sensitive receptors and considering any other relevant local information.

A1.4 This process also allows stakeholders to register concerns or particular requirements during the period of data collection for this assessment. Those potentially affected will need a full appreciation of the project and the context in which the works are taking place. Depending on the nature of the project, the activities may affect people in their homes or in the vicinity for some or a lot of the time, during day or night, or have impacts on sensitive receptors within a wider area.

A1.5 As a general rule, an assessment will be required where there is a potential for new road construction, improvements, operation or maintenance to affect the quality of life or the local environment as the result of noise and/or vibration.

A1.6 The objective of assessment at this level is to gather sufficient data to provide an appreciation of the likely noise and vibration consequences associated with the project identified by the Overseeing Organisation's supply chain and agreed with the Overseeing Organisation. Any option that could involve significant disruption due to the proximity to population centres, or the possible need for tunnelling, bridgeworks or other intrusive construction processes, should be identified. At this stage of the assessment a site visit is often appropriate.

A1.7 An important part of the overall environmental assessment process is liaison with stakeholders. This could include the local planning authority, Environmental Health Officers and residents associations. Local consultations may serve to acquire existing information and help to identify the appropriate level of assessment. This can ultimately save time and costs in developing the road project and result in better informed solutions.

A1.8 To determine whether the assessment continues to the next stage, the Scoping assessment should identify whether the threshold values (see 3.5) are likely to be met or exceeded. This can be determined by examining if any of the following conditions are likely to be met.

i) the road project alters the alignment of any existing carriageways. This would include new sections of road, additional junctions and slip roads, and hence could result in the introduction of a new noise or vibration source, or a change to noise or vibration levels from an existing road source;

ii) changes in traffic volume on existing roads or new routes may cause either of the threshold values for noise to be exceeded. A change in noise level of 1 dB $L_{A10,18h}$ is equivalent to a 25% increase or a 20% decrease in traffic flow, assuming other factors remain unchanged and a change in noise level of 3 dB $L_{A10,18h}$ is equivalent to a 100% increase or a 50% decrease in traffic flow;

iii) changes in traffic speed or proportion of heavy vehicles on the existing roads or new routes may cause a change in noise level of 1 dB $L_{A10,18h}$ in the short-term or 3 dB $L_{A10,18h}$ in the long-term either during construction, including temporary diversion routes, or when the road project is completed;

iv) if sufficient traffic flow information is available, then it is acceptable to use this to determine whether there is likely to be a change of 1 dB $L_{A10,18h}$ in the short-term or 3 dB $L_{A10,18h}$ in the long-term which will result from a combination of traffic flow, speed and composition, instead of using ii) and iii) above in isolation;

v) changes in traffic volume, composition and speed on existing roads or new routes during the night may cause the long-term night time threshold value to be exceeded;

vi) any physical changes to the infrastructure surrounding the road or any change in the way in which the existing road is used that could cause a change in noise level of 1 dB $L_{A10,18h}$ in the short-term or 3 dB $L_{A10,18h}$ in the long-term. This could include, but not be restricted to, such works as re-surfacing, congestion management schemes, bridge building and barrier installation. Where necessary advice shall be sought from the Overseeing Organisation to agree whether such Projects could cause a change in noise level of 1 dB $L_{A10,18h}$ in the short-term or 3 dB $L_{A10,18h}$ in the long-term.

A1.9 The construction or maintenance activities associated with the road project are likely to cause temporary adverse impact for nearby sensitive receptors. This is particularly important for works being undertaken during the night. In determining whether the assessment continues further consideration should be given to the potential for exceeding the criteria provided in BS 5228 for significant change.

A1.10 Where it is not clear whether the threshold values will be met or exceeded at sensitive receptors then the assessment process must proceed to the Simple level. If the above (A1.8) conditions indicate that the threshold values are likely to be met or exceeded at any sensitive receptors or should it be considered likely that temporary impacts will result in significant noise change (A1.9) then the assessment process must proceed to a Detailed Assessment. However, caution should be applied to such an approach as at the Scoping level sufficient data may not always be available to make this decision. Hence, guidance must always be sought from the Overseeing Organisation before making such a recommendation. For all other situations, further assessment will not normally be required unless stakeholders put forward a reasoned justification for considering particular local impacts. If one or more of the above criteria is met then the assessment must continue.

A1.11 The study area is defined by the following process:

i) Identify the start and end points of the physical works associated with the road project.

ii) Identify the existing routes that are being bypassed or improved, and any proposed new routes, between the start and end points.

iii) Define a boundary one kilometre from the carriageway edge of the routes identified in (ii) above.

iv) Define a boundary 600m from the carriageway edge around each of the routes identified in (ii) above and also 600m from any other affected routes within the boundary defined in (iii) above. The total area within these 600m boundaries is termed the 'calculation area'. An affected route is where there is the possibility of a change of 1 dB $L_{A10,18h}$ or more in the short-term or 3 dB $L_{A10,18h}$ or more in the long-term (i.e. conditions (ii), (iii), (iv) or (v) given in A1.8).

v) Identify any affected routes beyond the boundary defined in (iii) above.

vi) Define a boundary 50m from the carriageway edge of the routes identified in (v) above.

A1.12 In determining the study area, consultation with traffic engineers will be required to determine the traffic model extent. In some circumstances this may result in a reduced study area to that outlined in A1.11.

A1.13 If any sensitive receptors are identified within the study area then the assessment must continue to Simple. Examples of sensitive receptors include dwellings, hospitals, schools, community facilities, designated areas (e.g. AONB, National Park, SAC, SPA, SSSI, SAM), and public rights of way. If no sensitive receptors are identified then further assessment would not normally be necessary, and the results of the Scoping exercise reported, clearly stating why no further assessment was considered necessary.

A1.14 For open space sensitive receptors consideration should be given to the assessment location within the open space. In general, this should be identified by a representative position in close proximity to the road project within the open space where the public could potentially be apparent. Justification should be provided for selecting this location.

A1.15 At this stage the local Environmental Health Officer(s) should be consulted about the existing noise climate. This consultation should include any known sources of complaint, either from traffic or other environmental sources, any polices relating to temporary or permanent noise sources, and the

identification of particularly sensitive receptors. Any noise constraints arising from Local or National Plans should also be identified at this stage.

Simple Assessment

A1.16 The objective of the Simple Assessment is to undertake a sufficient assessment to identify the noise and vibration impacts associated with the road project. These impacts could be temporary or permanent, or both. Should it be apparent that the threshold values (see 3.5) will be exceeded by either temporary or permanent impacts the road project should be considered at the Detailed Assessment level.

A1.17 If it is considered that the only impacts from the road project would be temporary then there is no requirement to assess or report the permanent impacts at the Simple Assessment level. An example of this could be where construction noise or a specific maintenance activity would only cause a temporary impact. If this is the case the Overseeing Organisation's supply chain need only assess and report the temporary impacts at Simple Assessment level.

A1.18 This stage may be a desk-based exercise to determine the impact at known sensitive receptors and to determine whether the road project needs to be considered at the Detailed Assessment level. It is noted that on some occasions not all the data required to complete this assessment will be available. In these instances the assessment should be undertaken with the data available and commentary be added to any report to indicate the limitations in the data or where assumptions have been made.

Assessment of permanent impacts

A1.19 The steps that should be taken at this stage are:

i) Undertake noise calculations for all sensitive receptors in the calculation area as defined in A1.11 (iv). Full calculations should be undertaken in accordance with procedures given in CRTN and Annex 4 of this document.

ii) The contribution from all roads within the 600m calculation area should be considered. For sensitive receptors towards the edge of the 600m calculation area, consideration should be given to the contribution from roads outside the 600m area. The extent of this is left to the professional judgement of the Overseeing Organisation's supply chain.

iii) The noise levels calculated should be façade levels unless the sensitive receptor is an open space. For open spaces, free-field levels should be calculated. All levels should be calculated in $L_{A10,18h}$ at a default height of 1.5m above ground level. For dwellings with a first floor, the noise level should be calculated at 4m above ground level. Further advice should be sought from the Overseeing Organisation where dwellings of over three habitable floors are within the area where noise calculations are to be undertaken. The appropriate height for calculations at non-dwelling sensitive receptors should be determined on an individual basis.

iv) All sensitive receptors where calculations have been undertaken in (i) above should be classified in the categories given in the Table A1.1 (short term) and Table A1.2 (long term). These tables should be completed for the following two comparisons:

  i) Do-Minimum scenario in the baseline year against Do-Something scenario in the baseline year (short term).

  ii) Do-Minimum scenario in the baseline year against Do-Something scenario in the future assessment year (long term). For night-time noise impacts, comparisons in the long term should only be considered.

v) The calculations of BNL should be reported for each of the affected routes identified in A1.11 (v). A count of the number of sensitive receptors within 50m of the centreline of these affected routes should then be undertaken. Comparisons the same as those in A1.19 (iv) should be undertaken, and reported in an appropriate way.

vi) Where a building is predicted to experience different changes in noise level on different façades, the least beneficial change in noise level should be reported in the assessment Table. When all facades show a decrease in noise level, then the smallest decrease should be reported. When all facades show an increase in noise level then the largest increase should be reported. If this approach would lead to the reporting of two or more facades (i.e. where the same least beneficial change in noise level is shown on two or more facades) then the change on the façades with the highest noise level in the Do-Minimum scenario should be reported. A similar approach of reporting the least beneficial change in noise level should be used for the impact at areas within open spaces or sensitive receptors such as footpaths.

vii) It is acknowledged that the results from this assessment may often show the worst case and highlight mainly the adverse impacts of a road project. Where the road project has beneficial impacts that are not clear from the assessment these should be reported by the Overseeing Organisation's supply chain.

viii) For sensitive receptors that are within one kilometre of a route defined in A1.11 (ii) but not within 600m of an affected route, a qualitative assessment of any possible noise impact should be undertaken.

ix) If any other comparisons are identified that would further demonstrate the noise and vibration impact of the project, these should also be calculated and reported. For example, although the comparison between Do-Minimum and Do-Something in the future assessment year is not required in the decision making process of whether to move from a Simple to Detailed Assessment, this comparison may be useful when comparing options or explaining potential impacts to stakeholders.

x) Prepare a map showing the study area and the sensitive receptors that are included in the assessment. Maps should also be prepared for each of the comparisons identified in (iv) above. This information can be shown as noise difference contour plots, or another appropriate format that clearly indicates the level of noise change at each sensitive receptor. Changes are to be shown in 1 dB intervals with all sensitive receptors clearly identified on the maps. If the 1 dB interval is considered too narrow then a more appropriate interval should be chosen. However, it is essential that the sensitive receptors experiencing a change in noise level of 1 dB $L_{A10,18h}$ in the short term or 3 dB $L_{A10,18h}$ in the long term or more are clearly identified.

xi) Produce a list of predicted noise levels as identified in (iv) above for all sensitive receptors in the study area.

xii) Undertake an assessment of night time noise in the long-term. Such an assessment would be necessary when there are changes in night time noise that meet the threshold values (see 3.5) and where receptors will be exposed to an $L_{night,outside}$ of 55 dB or greater in any scenario. Night time noise changes for sensitive receptors meeting these criteria should be included in Table A1.2. In the absence of a specific prediction methodology, the TRL report 'Converting the UK traffic noise index $L_{A10,18h}$ to EU noise indices for noise mapping' (Ref 3) should be used in the assessment of night time noise. This report provides three methods for predicting night time noise levels (L_{night}) with the applicable method being dependent on the detail of traffic information available. The method used should be agreed with the Overseeing Organisation. A correction of 2.5 dB(A) should be deducted from the derived L_{night} level to obtain the equivalent $L_{night,outside}$ free-field level.

xiii) Sensitive receptors should be highlighted which meet the following night time noise criteria in the long-term:

- where the introduction of a project results in a sensitive receptor being exposed to night time noise levels in excess of 55 dB $L_{night,outside}$ where it is currently below this level; and
- where a receptor is exposed to pre-existing $L_{night,outside}$ in excess of 55 dB and this is predicted to increase.

A1.20 The assessment should show predicted noise changes calculated to the nearest 0.1 dB(A) and agreed mitigation should be taken into account (excluding any statutory noise insulation).

A1.21 Although noise calculations are based on future traffic flows, the impact of the changes can only be recorded for people living and using facilities in the affected area in the year the assessment is undertaken. Where planning permission for a residential development or any other sensitive receptor has been granted but for which construction has not started, the potential impacts on these locations should be estimated and reported separately.

Assessment of permanent traffic induced vibration impacts

A1.22 If ground-borne vibration on existing routes is considered to be a potential problem, calculations or measurements of vibration at the foundations of typical buildings considered to be at high risk may be taken in order to establish whether increasing vibration levels would be likely to exceed the threshold values (see 3.5). Based on these results at a sample of dwellings, an estimate can be made of the number of buildings likely to be exposed to perceptible vibrations along the affected route. This will only apply in rare cases where, for example, traffic is expected to pass very close to buildings. The number of buildings and an estimate of peak vibration levels (PPVs) should be included in the assessment.

Assessment of temporary impacts

A1.23 The steps that should be in the assessment of temporary noise and vibration impacts are given below:

i) Estimate the number of sensitive receptors within the study area. The study area should be as a minimum the same as that used for the assessment of permanent impacts, but may need to be wider in order to include other temporary noise sources, such as any haul routes associated with construction traffic.

ii) Identify any construction operations which could have a significant impact – for example, the scale of earth movements within the construction site, the storage and treatment of surplus material before it can be removed from the works site (such as wet peat which needs to be dried out and which may need to cover a large area of ground), the extent of special operations such as piling, bridgeworks or tunnelling, and the likelihood of night time working.

iii) Assess the extent and duration of potential impacts, taking account of proposed mitigation agreed with the Overseeing Organisation, such as the early provision of environmental barriers or noise insulation, restrictions on noise levels or any other special conditions to be written into the contract documents. At this stage the availability of detailed construction information is unlikely and this will determine the level of assessment feasible at this stage.

iv) A separate assessment may be required of the impact from construction traffic using the local road network. In addition, an assessment may be required where temporary diversion routes are in place. This requirement will depend on the period that the diversion route will be in place and further advice should be sought from the Overseeing Organisation to determine this.

v) For on-line projects, e.g. carriageway widening, where temporary diversion routes are not viable, a restriction on road traffic speed is often implemented for reasons of safety allowing construction works to occur adjacent to a traffic stream. Such decreases in traffic speed can lead to temporary reductions in noise levels for nearby receptors. Where this occurs a qualitative consideration should be made of the potential implications of this short term reduction in noise level.

Assessment of cumulative impacts

A1.24 An assessment of cumulative noise and vibration impacts should be undertaken. This should include identifying where impacts are expected from the combined action of noise and/or vibration with other environmental topic-specific impacts upon sensitive receptors. This should also include identifying where impacts are likely to occur due to the combined action of noise and vibration on receptors. Cumulative impacts expected as a result of the combined action of different road projects should also be described.

Detailed Assessment

A1.25 This level of assessment may be a desk-based exercise, supplemented with site-collected information needed to inform a quantitative assessment. At this level there should be close consultation with stakeholders and it should include a noise measurement survey if not already undertaken, or if noise levels could have changed. Disruption due to construction activities and where applicable temporary diversion routes should also be taken into account at this stage.

Assessment of permanent traffic noise impacts

A1.26 The assessment and reporting of permanent traffic noise impacts at the Detailed level is the same as at the Simple level except that the following three comparisons should undertaken:

i) Do-Minimum scenario in the baseline year against Do-Minimum scenario in the future assessment year (long term).

ii) Do-Minimum scenario in the baseline year against Do-Something scenario in the baseline year (short term).

iii) Do-Minimum scenario in the baseline year against Do-Something scenario in the future assessment year (long term).

A1.27 For night time noise impacts, comparisons in the long term (i.e. A1.26 (i) and (iii)) should only be considered.

A1.28 The assessment process defined in A1.19 to A1.21 should be followed. The noise contour maps and a list of sensitive receptor noise levels required in A1.19 (x) and (xi) should be provided for the comparisons identified in A1.26 (i) to (iii) above.

Assessment of permanent traffic nuisance impacts

A1.29 The steps to take at this stage are:

i) Calculate the change in nuisance for all dwellings at which full CRTN noise calculations have been undertaken for the assessment of permanent traffic noise impacts. The increases or decreases in the number of people bothered by noise should be tabulated in <10 percentage points, 10<20 percentage points, 20<30 percentage points, 30<40 percentage points, or >40 percentage points. The following assessments should be undertaken:

   1) Do-Minimum scenario in baseline year against Do-Minimum scenario in the future assessment year.

   2) Do-Minimum scenario in the baseline year against Do-Something scenario in the future assessment year.

ii) These comparisons are undertaken in order to compare the Do-Minimum scenario in the baseline year with the two possible scenarios that are available in the future assessment year. All calculations should be based on the highest nuisance levels calculated during the first 15 years after opening. Additional guidance on the calculation of nuisance is given in Annex 6. The results from this assessment of nuisance should be presented in Table A1.3.

A1.30 For the Do-Minimum scenario (e.g. comparison 1 in A1.29(i)), only gradual changes in traffic noise are likely. In this case the 'steady state' curve (Figure A6.1) should be used to estimate baseline and future

nuisance levels (i.e. percentage bothered). The 15th year nuisance levels are likely to be the worst, in which case the change in nuisance is the difference between the 15th year value and the value of nuisance in the baseline year.

A1.31 Where there are predicted to be increases in traffic noise in the baseline year as a result of the road project, the nuisance in the Do-Minimum scenario should first be estimated from the steady state curve presented in Figure A6.1. The immediate increase in nuisance as a result of the road project should then be estimated from the short term response curve using the change in dB between the Do-Minimum and Do-Something scenarios in the baseline year in Figure A6.2. The level of nuisance in the baseline year is the sum of the % of people bothered in the Do-Minimum scenario from Figure A6.1 and the change in people bothered in the baseline year from Figure A6.2. The level of nuisance in the future assessment year in the Do-Something scenario should then be estimated from the steady state curve in Figure A6.1. This level should then compared with the level of nuisance in the Do-Something baseline year and the higher of the two levels forms the reported level of nuisance. If the highest level of nuisance is in the baseline year then it is the level of change on opening that should be reported.

A1.32 Where there are predicted to be decreases in traffic noise in the baseline year as a result of the road project, the level of nuisance in the Do-Minimum scenario should first be estimated from the steady state curve. The change in nuisance based on the highest nuisance in the first 15 years after opening as a result of the road project is again required. Generally this will be the 15th year value from the 'steady state' curve, hence the value of nuisance in the future assessment year in the Do-Something scenario should be estimated from the steady state curve. The change in nuisance should then be estimated by subtraction, using values from the 'steady state' curve (i.e. Do-Something in 15th year minus Do-Minimum in the baseline year). Where there is doubt whether the highest level of nuisance will occur in the 15th year, it can be checked against that expected soon after the road project opens. The immediate decrease as a result of the road project should be estimated from the short term response curve. The new nuisance level is that in the Do-Minimum scenario minus the decrease. However, if this reports a negative value then a value of zero (per cent of people bothered) should be assumed.

A1.33 Using the highest level of nuisance in the first 15 years after a change means that for most situations where traffic levels will decrease in the baseline year the immediate benefit, as shown in the short term response curve, is ignored.

A1.34 The nuisance calculations should be undertaken on the façade with the least beneficial change in noise (i.e. the one used for the noise assessment, A1.19(vi)).

Assessment of permanent traffic induced vibration impacts

A1.35 Where appropriate, an assessment of traffic-induced vibration nuisance should be undertaken. The steps to take at this stage are:

i) Calculate the change in vibration nuisance (See Annex 6) for all dwellings within 40m of roads where noise levels predictions have been undertaken as required in A1.28.

ii) The increases or decreases in the number of people bothered by vibration should be tabulated in <10 percentage points, 10<20 percentage points, 20<30 percentage points, 30<40 percentage points, or >40 percentage points. The following assessments should be undertaken:

   1) Do-Minimum scenario in baseline year against Do-Minimum scenario in the future assessment year.

   2) Do-Minimum scenario in the baseline year against Do-Something scenario in the future assessment year.

iii) The results from this assessment of vibration nuisance should be presented in Table A1.4.

A1.36 If ground-borne vibration on existing routes is identified as a potential problem, calculations or measurements of vibration at the foundations of typical buildings considered to be at high risk may be taken in order to establish whether increasing vibration levels would be likely to exceed the threshold values (see 3.5). Based on these results at a sample of dwellings, an estimate can be made of the number of buildings likely to be exposed to perceptible vibrations along the affected route. This will only apply in rare cases where, for example, traffic is expected to pass very close to

buildings. The number of buildings and an estimate of peak vibration levels (PPVs) should be included in the assessment.

Assessment of temporary impacts

A1.37 For an assessment of possible disruption at the works site, the steps to take are:

i) Confirm the number of sensitive receptors within the study area for the road project, and highlight any that could be particularly sensitive to any disruption. The study area should be as a minimum the same as that used for the assessment of permanent impacts, but may need to be wider in order to include other temporary noise sources, such as any haul routes associated with construction traffic.

ii) Identify any construction operations which could have a significant impact – for example, the scale of earth movements within the construction site, the storage and treatment of surplus material before it can be removed from the works site (such as wet peat which needs to be dried out and which may need to cover a large area of ground), the extent of special operations such as piling, bridgeworks or tunnelling, and the likelihood of night time working.

iii) Assess the extent and duration of potential impacts, taking account of proposed mitigation agreed with the Overseeing Organisation, such as the early provision of environmental barriers or noise insulation, restrictions on noise levels or any other special conditions to be written into the contract documents.

iv) A separate assessment may be required of the impact from construction traffic using the local road network. In addition, an assessment may be required where temporary diversion routes are in place. This requirement will depend on the period that the diversion route will be in place and further advice should be sought from the Overseeing Organisation to determine this.

vi) For on-line projects, e.g. carriageway widening, where temporary diversion routes are not viable, a restriction on road traffic speed is often implemented for reasons of safety allowing construction works to occur adjacent to a traffic stream. Such decreases in traffic speed can lead to temporary reductions in noise levels for nearby receptors. Where this occurs a qualitative consideration should be made of the potential implications of this short term reduction in noise level.

Assessment of cumulative impacts

A1.38 An assessment of cumulative noise and vibration impacts should be undertaken. This should include identifying where impacts are expected from the combined action of noise and/or vibration with other environmental topic-specific impacts upon sensitive receptors. This should also include identifying where impacts are likely to occur due to the combined action of noise and vibration on receptors. Cumulative impacts expected as a result of the combined action of different road projects should also be described.

Project/Option:			
Scenario/Comparison:			
		Daytime	
Change in noise level		Number of dwellings	Number of other sensitive receptors
Increase in noise level, $L_{A10,18h}$	0.1 - 0.9		
	1.0 - 2.9		
	3 - 4.9		
	5 +		
No Change	0		
Decrease in noise level, $L_{A10,18h}$	0.1 - 0.9		
	1 - 2.9		
	3 - 4.9		
	5 +		

Table A1.1 – Short-term Traffic Noise Reporting Table for Simple and Detailed Assessments

Project/Option:				
Scenario/Comparison:				
		Daytime		Night-time
Change in noise level		Number of dwellings	Number of other sensitive receptors	Number of dwellings
Increase in noise level, $L_{A10,18h}$	0.1 - 2.9			
	3 - 4.9			
	5 - 9.9			
	10 +			
No Change	0			
Decrease in noise level, $L_{A10,18h}$	0.1 - 2.9			
	3 - 4.9			
	5 - 9.9			
	10 +			

Table A1.2 – Long-term Traffic Noise Reporting Table for Simple and Detailed Assessments

Project/Option:			
Scenario/Comparison:			
		Do-Minimum	Do-Something
Change in nuisance level		Number of dwellings	Number of dwellings
Increase in nuisance level	< 10%		
	10 < 20%		
	20 < 30%		
	30 < 40%		
	> 40%		
No Change	0%		
Decrease in nuisance level	< 10%		
	10 < 20%		
	20 < 30%		
	30 < 40%		
	> 40%		

Table A1.3 – Traffic Noise Nuisance Reporting Table for Detailed Assessments

Project/Option:			
Scenario/Comparison:			
		Do-Minimum	Do-Something
Change in nuisance level		Number of dwellings	Number of dwellings
Increase in nuisance level	< 10%		
	10 < 20%		
	20 < 30%		
	30 < 40%		
	> 40%		
No Change	0%		
Decrease in nuisance level	< 10%		
	10 < 20%		
	20 < 30%		
	30 < 40%		
	> 40%		

Table A1.4 – Traffic Airborne Vibration Nuisance Reporting Table for Detailed Assessments

ANNEX 2 GLOSSARY OF ACOUSTIC AND OTHER TERMS

A-weighting In addition to its non-linear amplitude response, the human ear has a non-linear frequency response; it is less sensitive at low and high frequencies and most sensitive in the range 1 kHz to 4 kHz (cycles per second). The A-weighting is applied to measured sound pressure levels so that these levels correspond more closely to the subjective response. A-weighted noise levels are often expressed in dB(A).

AAWT Annual Average Weekday Traffic.

Ambient Noise Ambient noise is the total sound in a given situation at a given time usually composed of sound from many sources, near and far.

Baseline year For an assessment of noise and vibration, the baseline year is taken as the opening year of the road project.

Basic Noise Level (BNL) The BNL is a measure of source noise at a reference distance of 10m from the nearside carriageway edge. It is determined from obtaining the estimated noise level from the 18 hour flow and then applying corrections for vehicle speed, percentage of heavy vehicles, gradient and road surface as described in CRTN.

Calculation of Road Traffic Noise (CRTN) The technical memorandum issued by the Department of Transport and Welsh Office that describes the procedures for calculating noise from road traffic.

Decibel This is the unit of measurement used for sound pressure levels and noise levels are usually quoted in decibels (dB). The decibel scale is logarithmic rather than linear. The threshold of hearing is zero decibels while, at the other extreme, the threshold of pain is about 130 decibels. In practice these limits are seldom experienced and typical levels lie within the range of 30 dB(A) (a quiet night time level in a bedroom) to 90 dB(A) (at the kerbside of a busy street).

Dwelling A building used for living purposes. A mobile home used for permanent living should be included in an assessment. If calculations are being conducted for compensation purposes then some mobile homes are dealt with under the Highways Noise Payments and Moveable Homes Regulations.

Facade Sound Level A facade sound level is that determined 1 metre in front of a window or door in a facade. Sound is reflected from hard surfaces in a similar manner to light by a mirror and the effect is to produce a slightly higher (about 2.5 dB) sound level than would occur if the building was not there. For façade levels at dwellings required for this assessment process, the level 1 metre from the façade should be calculated with a reflection correction.

Free-Field Sound Level The sound level which is measured or calculated, in the open, without any reflections from nearby surfaces. For free-field levels at dwellings required for this assessment process, the level one metre from the most exposed façade should be calculated without a reflection correction.

Future assessment year	The future assessment year is the year between baseline and the 15th year where the maximum impact from the road project would occur.
L_{A10} index	L_{A10} is the A-weighted sound level in dB that is exceeded 10% of the measurement period. This is the standard index used within the UK to describe traffic noise.
L_{A90} index	The background noise level is commonly quoted using the L_{A90} index. This is the A-weighted sound level in dB that is exceeded 90% of the measurement period.
$L_{A10,18h}$ index	The $L_{A10,18h}$ noise level is arithmetic mean of all the levels of L_{A10} during the period from 06:00 to 24:00. From research it has been found that subjective response to road traffic noise is closely linked to higher noise levels experienced and is correlated well with the $L_{A10,18h}$ index.
L_{Aeq} index	The equivalent continuous sound level L_{Aeq} is the level of a notional steady sound, which at a given position and over a defined period of time, would have the same A-weighted acoustic energy as the fluctuating noise.
L_{Amax} index	The maximum A-weighted level measured during a given time period.
Nuisance	In this document nuisance is intended to generally refer to 'bother' or 'annoyance' and is not necessarily the same as that used in some statutory documents.
L_{night} index	The L_{night} index in this document is a facade noise index derived from the $L_{A10,18h}$ index using TRL conversion method.
$L_{night,outside}$ index	For the purpose of night-time noise assessment in this document, the $L_{night,outside}$ index is the equivalent continuous sound level $L_{Aeq,8h}$ for the period 23:00 to 07:00 hours assessed outside a dwelling and is free-field.
Sensitive receptor	Receptors which are potentially sensitive to noise and vibration. Examples include dwellings, hospitals, schools, community facilities, designated areas (e.g. AONB, National Park, SAC, SPA, SSSI, SAM), and public rights of way.

ANNEX 3 NOISE AND INDICES

Sound

A3.1 Sound is a disturbance propagated through the air as a pressure wave. The fluctuations in atmospheric pressure are detected by the ear and produce the sensation of hearing. The frequency of the pressure wave is converted to pitch and its amplitude to loudness. The human ear can respond to a very wide range of amplitudes and frequencies of sound, although its sensitivity to high frequencies deteriorates with age. Noise is generally considered to be unwanted sound.

A3.2 The response of the hearing system to the amplitude of sound pressure is non-linear and can be characterised by a logarithmic relationship. The relationship is also frequency dependent and an adjustment or weighting is applied to the response of a microphone to different frequency components of a sound in order to produce a scale that better reflects the hearing system. In addition, in order to characterise sounds that fluctuate in intensity, it is necessary to derive a statistic that applies over a period of time.

A3.3 A variety of statistics are used in different circumstances and an explanation of the different noise scales is presented later. The standard index used to characterise traffic noise in the UK is the noise level exceeded for 10% of the time between 06:00 and 24:00 on an annual average weekday.

A3.4 The human system of hearing is very complex and is capable of analysing specific sound patterns such as speech in the presence of noise. However, background noise can mask the structure of meaningful sounds if it contains a similar range of frequencies as the sound of interest. As background noise levels rise, the effort of concentrating on meaningful sounds becomes greater. Depending on the circumstances, this may lead to a sense of frustration or annoyance, especially if the noise is generated by a source that is outside the individual's control.

A3.5 Very low frequencies of sound may resonate within the chest cavity or with floors, doors and windows and are often perceived as air borne vibration. When experienced within the home, these low frequency effects are sometimes confused with those arising from ground borne vibrations being transmitted through structural foundations.

Units of Measurement

A3.6 Sound pressures are measured in units of Pascals (Pa). The range of sound pressures, from the minimum detectable to the onset of pain, is vast. To cope with such a range in values it is convenient to measure sound in terms of a logarithmic ratio of sound pressures. These values are expressed as sound pressure levels (SPL) in decibels (dB) and are defined as:

> SPL – 20 log (p/po) dB where p is the sound pressure and po the sound pressure at the threshold of hearing.

A3.7 The audible range of sounds expressed in terms of sound pressure levels (dB) can now be conveniently covered within the range 0 dB (the threshold of hearing) to 130 dB (the threshold of pain). Figure A3.1 below gives a broad indication of typical $L_{A10,18h}$ traffic noise levels likely to be encountered at various distances from the road for two different traffic conditions. The first is representative of a heavily trafficked road (about 150,000 vehicles per day) and the second a lighter trafficked road (about 50,000 vehicles per day).

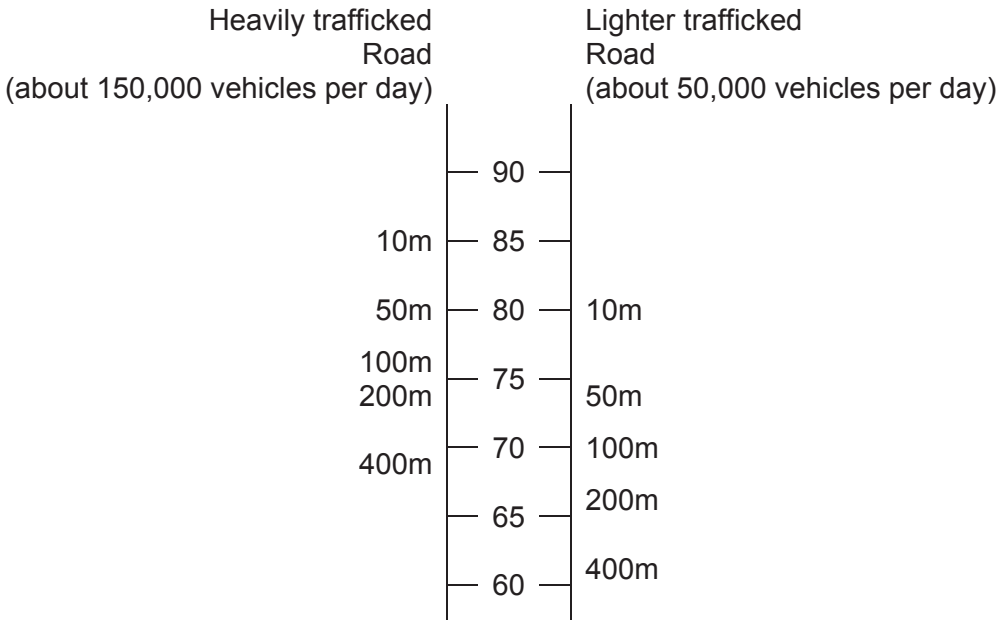

Figure A3.1 – Example of Typical Traffic Noise Levels, $L_{A10,18h}$

A3.8 A further advantage in adopting a logarithmic scale is that the response of the human hearing system to changes in noise level is logarithmic rather than linear in behaviour. Over most of the audible range, a subjective impression of a doubling in loudness corresponds to a 10 fold increase in sound energy which conveniently equates with an increase in sound pressure level of 10 dB. Doubling the energy level (for example the volume of traffic) increases the noise level by 3 dB.

A3.9 The frequency of sound is the rate at which a sound wave oscillates, measured in number of cycles per second, or Hertz (Hz). The human ear is more sensitive to frequencies important for voice communication and hearing sensitivity decreases markedly at frequencies below about 250 Hz. Frequencies below 20 Hz are usually perceived as vibration. The upper frequency limit of audibility is around 20 kHz, but decreases with age.

A3.10 Several different weightings have been proposed to convert measured sound pressure to a measure that correlates with perceived loudness in different circumstances. The 'A' weighting is by far the most commonly used and correlates well with the perceived noisiness of road vehicles. Logically the characteristics of the weighting should be slightly different for higher level sounds.

A3.11 The noise from a traffic stream is not constant but varies from moment to moment and it is necessary to use an index to arrive at a single-figure estimate of the overall noise level for assessment purposes. The index adopted by the Government to assess traffic noise is $L_{A10,18h}$ which is the arithmetic mean of the noise levels exceeded for 10% of the time in each of the 18 one hour periods between 6am and midnight. (Note: 'A' in the subscript denotes that the sound levels have been 'A' weighted). A reasonably good correlation has been demonstrated between this index and residents' expressed dissatisfaction with traffic noise over a wide range of exposures. In addition, the prediction and measurement techniques using this index are well developed in the UK.

A3.12 A commonly used alternative index is the equivalent continuous sound level, L_{Aeq}, which is the level of a notional continuous constant noise that would deliver the same sound energy over the period of measurement as the actual intermittent or time varying noise. Using this measure, a fluctuating noise can be described in terms of a single noise level. This index is easily adapted to describing sources that consist of occasional short periods of noise interspersed with relatively long quiet periods – for example intermittent noise from industry, construction or demolition activity, and from railways and aircraft. However, it does not

appear to provide a better correlation with people's dissatisfaction with road traffic noise than the L_{A10} index.

A3.13 An index sometimes used to describe background noise levels in the absence of a dominant source is L_{90}, which is the level exceeded for 90% of the time. This index may give a more realistic indication of noise changes in rural areas at a considerable distance from a new road because in such circumstances the main noise effect is likely to be on background noise levels. However, its usefulness as an indicator of noise impact is uncertain and there has been no research to assess how it correlates with people's reactions to noise, nor on how it can be modelled.

ANNEX 4 ADDITIONAL ADVICE TO CRTN PROCEDURES

A4.1 Since the revision of the technical memorandum Calculation of Road Traffic Noise (CRTN) in 1988 (Ref 10), there have been significant advances in road design, the development of new surface materials and improvements in noise mitigation. In addition, over the intervening years certain procedures have required further clarification. It is, therefore, timely to address some of these issues and provide additional advice for assessment to that already published in CRTN.

A4.2 It is acknowledged that there are other areas where the methodology contained within CRTN may not fully take into account the influences of certain features or conditions. However, these areas have not been addressed in the following text as there is currently insufficient knowledge or research to support any changes.

A4.3 Where calculations are being undertaken for entitlement purposes under the relevant Noise Insulation Regulations, the use of this advice should be discussed with the Overseeing Organisation.

Dual Source Lines

A4.4 In 1989 the Secretary of State for Transport announced additional measures to relieve congestion on major roads in England which included increasing the capacity of existing routes by introducing road widening projects, typically 4-lane dual carriageways.

A4.5 A fundamental assumption in the CRTN method is that the noise from a stream of traffic distributed over the entire width of the highway can be simulated by a single source line positioned 3.5m in from the nearside carriageway and 0.5m above the road surface. A consequence of these new road widening projects was to increase the spread of traffic across each carriageway further than had previously been examined when the method was first developed.

A4.6 Research carried out by TRL in 1994 recommended that the procedures which already exist in CRTN for predicting the noise from separate carriageways (paragraph 13.1) should also apply to dual carriageway roads with four or more lanes per carriageway, irrespective of the horizontal separation or vertical alignment of the carriageways (Ref 1).

A4.7 However, in adopting a dual source line approach for dual carriageways with 4 or more lanes does introduce an inconsistency when up-grading an existing 3-lane dual carriageway to four lanes. The pre-project noise levels would be based on a single source line model compared with post-project predictions assuming a dual source line approach.

A4.8 A further problem can arise where a barrier alongside a dual carriageway only provides partial screening. Prediction of noise levels at a receiver which is sufficiently elevated that traffic on the farside carriageway is not screened by the barrier may be significantly underestimated where a single source line model is adopted compared with a dual source line approach (Ref 28).

A4.9 Furthermore, under certain circumstances, particularly where a receiver is close to a dual carriageway (i.e less than about 50m) and the traffic is not screened, noise levels predicted using the dual source line approach will give lower values than corresponding levels calculated using a single source line approach. However, when predicted noise levels are compared with measurements there is evidence to suggest that the dual source line model performs marginally better than the single source approach under such site conditions (Ref 25).

A4.10 To resolve these problems and provide a method which is internally consistent, it is recommended that the dual source line approach is adopted for all dual carriageways irrespective of the number of lanes per carriageway or the separation of horizontal or vertical alignments.

Median Barriers

A4.11 Median barriers, designed to prevent vehicles from crossing the central reserve, may provide additional benefits in screening noise. Where a concrete barrier is constructed along the central reserve, the screening performance of the barrier relating to the

farside source line should be taken into account according to the procedures described in paragraph 22 of CRTN.

A4.12 In situations where there is additional screening, for example from a purpose-built noise barrier erected alongside the nearside carriageway, then the combined screening of both barriers should be calculated according to the procedures described in paragraph 35 of CRTN when calculating the noise contribution from traffic on the farside carriageway. Generally, the height of the median concrete barrier above the road surface is less than 1.5m and therefore, reflection and screening effects from the nearside source line are negligible. However, where the height of the median concrete barrier is equal to or greater than 1.5m, a reflection correction is required when calculating the noise contribution from the nearside traffic and calculated according to the procedure described in paragraph 26.2 of CRTN or paragraph 36 where there is additional screening provided by a barrier alongside the road.

Vehicle Classification

A4.13 The vehicle classification system described in CRTN identifies two vehicle groups 'light vehicles' and 'heavy vehicles' which are defined according to the unladen weight of the vehicle i.e. vehicles with unladen weight greater than 1.525 tonnes are classified as 'heavy vehicles'. The classification assumes that vehicles within each group are acoustically similar. However, since this classification system was first introduced in 1975, the proportion of vehicles within the range 1.525 tonnes to 3.5 tonnes has grown significantly and the maximum permissible weight of heavy vehicles has increased from 38 to 44 tonnes. Therefore, the range in vehicle noise emissions within the heavy vehicle category has increased. To address this problem it is recommended that the heavy vehicle category is redefined as vehicles with unladen weight greater than 3.5 tonnes. Those vehicles with an unladen weight between 1.525 and 3.5 tonnes should be treated as light vehicles.

Traffic Forecasts and Speeds

A4.14 The traffic flow used in the calculations should be that expected between 06.00 hours and midnight on an average weekday in the appropriate year. The most likely growth forecast should be assumed in the calculations for determining predicted noise levels in future years. However, where particular local conditions indicate growth forecasts significantly different from these or where unusual traffic patterns exist then the local data are to be applied.

A4.15 Transport models typically represent 12 daytime hours of an average weekday in a neutral month. Standard practice is to model weekday morning and evening peak periods and the weekday inter-peak period separately. Representing the remaining 12 night-time hours is not technically difficult, though it is not commonly carried out. Using these results to generate hourly flows for input to the calculation of $L_{A10,1h}$ for each hour, then aggregating the results to give $L_{A10,18h}$ is likely to produce more reliable results than using an 18hr AAWT (itself based on modelled traffic flows) for input to the direct calculation of $L_{A10,18h}$. Noise analysts should discuss their requirements with transport modellers at an early stage in a study, to ensure that their needs are taken into consideration during the design of the transport model.

A4.16 For the prediction of night time noise levels in accordance with the TRL report 'Converting the UK traffic noise index $L_{A10,18h}$ to EU noise indices for noise mapping' (Ref 3) night time traffic data should be used where available. Preferable hourly night time traffic flows should be used in predicting noise levels (L_{night}) in line with Method 1 of this TRL report. Where such traffic flow information is not available the use of Method 2 and 3 may be necessary. The method used shall be agreed with the Overseeing Organisation.

A4.17 Traffic noise is sensitive to changes in speed and CRTN includes a table of traffic speed values typical for different road types. These should be used as default values when no other data is available. However, the Overseeing Organisation should be consulted in order to establish whether any alternative speed data is available, such as from traffic models. Where traffic models have been used to provide hourly flows, they should also be used to estimate hourly traffic speeds. Where traffic models have been used to provide 18hr AAWT flows, the inter-peak flow group should be used as a proxy for the day and night time periods, providing the speeds are appropriate for the link. In some situations, it may be possible to use observed speeds if the measurements are robust. It is recognised that the correction for speed within the CRTN method is only valid within the range 20 to 130 km/h. A default speed of 20 km/h and 130 km/h should be used where the mean speed is shown to fall below or above this CRTN speed range respectively. It should be ensured if traffic

model speeds are used, that these allow for carriageway gradients. Where they do not the corrections in CRTN paragraph 14.3 should be applied as necessary.

Surface Correction for Thin Surfacing Systems

A4.18 CRTN provides advice on appropriate road surface corrections to be applied within noise assessments and this advice should continue to be used. However, this advice does not currently extend to the range of proprietary thin bituminous surfacing materials, commonly regarded as a low-noise surfacing, which emerged in the late 1990's. Paragraphs A4.19 to A4.33 set out an example methodology which can be used to determine appropriate road surface corrections for low-noise surfaces.

A4.19 Low-noise surfaces are normally characterised by their 'Road Surface Influence' (RSI) value, which provides a measure by which they can be specified in highway works under the Highways Authorities Product Approval Scheme, HAPAS (Ref 7). However, the RSI value alone does not give an indication of the long term performance of the surface. In addition, no long term measurement data is currently available for thin surfacing systems from which any robust correction factors for use in noise assessments can be readily obtained.

A4.20 In the absence of more accurate long term data, it is generally considered that thin surfacing systems will not be able to provide better long term noise reduction performance than other low-noise surfaces such as porous asphalt.

A4.21 On the basis of results from RSI_H (High speed) measurements on a porous asphalt surface and the accepted correction of –3.5 dB(A) implicit in the CRTN method, the following interim relationship has been developed to estimate the benefit of thin surfacing systems for use in noise assessments:

$$\text{Surface correction for thin surfacing systems} = 0.7 * (\text{RSI}) \text{ dB} \qquad \text{(A4.1)}$$

where RSI ≥ -5 dB(A) and derived from the HAPAS approval scheme for high or medium speed roads, RSI_H or RSI_M, respectively or by an appropriate similar method agreed with the Overseeing Organisation. For an RSI < -5 dB(A) an RSI of -5 dB(A) should be entered into equation A4.1.

A4.22 Therefore, as a result of applying the equation A4.1, **for any situation a maximum allowable surface correction of -3.5 dB(A) can be claimed from using thin surfacing systems**, compared with hot rolled asphalt surfaces.

Existing Low-Noise Surfaces

A4.23 Where the benefit of an existing thin surfacing system needs to be determined, information regarding RSI_H or RSI_M for the existing surface should be sought from the Overseeing Organisation in order to obtain an appropriate surfacing correction using equation A4.1.

A4.24 Where an RSI value has been determined through measurements then this value should be entered into equation A4.1 to derive a surface correction, taking into account the limitations given in A4.19. This RSI value could have been derived from measurements on the surface in question or on a surface of the same specification from the same manufacturer elsewhere.

A4.25 If there is no information available, a -2.5 dB(A) surface correction should be used for an existing low-noise surface in the baseline year.

A4.26 For the future assessment year, a correction of -3.5 dB(A) should be applied for a low-noise surface which is expected to be in place on an existing road. For existing motorways and major trunk roads clarification from the Overseeing Organisation should be obtained on any potential future resurfacing proposals.

A4.27 The above advice applies to roads where the mean traffic speed is ≥ 75 km/hr. Where the mean traffic speed is <75 km/hr, a -1 dB(A) surface correction should be applied to a low-noise surface. This is applicable to the baseline and future assessment years. Although it is likely that thin surfacing systems will provide more acoustic benefit at lower speeds, until further research is carried out to provide reliable estimates, it is advised that a qualitative statement highlighting the possible additional acoustic benefits is also included in the assessment.

A4.28 Alternatively, recourse to the measurement method described in CRTN-Section III can be used to estimate the basic noise level which would include the influence of the road surface on traffic noise levels and the façade noise levels determined according to the procedures described in paragraph 37. However, applying this method may not provide a reliable estimate of RSI when comparing measured and

predicted noise levels due to other contributing factors. For example, the RSI value will be dependent on the proportion of heavy vehicles in the traffic stream and it is, therefore, advisable that measurements are carried out when traffic conditions are typical for the 18-hour period (06:00 to midnight). However, where the RSI value is required as input to equation A4.1 to determine the surface correction to be used in CRTN, recourse to the measurement method as described in the HAPAS approval scheme should be applied.

New Low-Noise Surfaces

A4.29 Where new carriageways are to be constructed and a thin surfacing system used, or where an existing surface is to be replaced with a thin surfacing system, a -3.5 dB(A) correction should be assumed for the thin surface system (i.e. equivalent to a -5 dB(A) value being entered into equation A4.1), unless any information is available regarding the specific surface to be installed. This advice applies to roads where the mean traffic speed is ≥ 75 km/h. Where the mean traffic speed is <75 km/h, a -1 dB(A) surface correction should be applied to a new low-noise surface.

Assumptions and Limitations

A4.30 Generally the RSI_H or RSI_M is determined by averaging the results from at least two sites. If the information for each site is known, then, for the purposes of determining the surface correction for thin surfacing systems the least negative value should be used for RSI and the surface correction determined from equation A4.1.

A4.31 For both existing and new road projects, these corrections only apply to situations where the surfacing across the carriageway is predominantly thin surface. For example, in calculating the noise level from a three lane carriageway where two of the lanes have a thin surface applied, the appropriate correction for a thin surface would be applied. If only one lane had a thin surface applied then no correction would be used.

A4.32 For roads not subject to a speed limit of less than 60 mph and the mean traffic speed is ≥ 75 km/h, the RSI_H value should be used to determine the RSI value and the surface correction determined using equation A4.1.

A4.33 Similarly, for roads subject to a speed limit of 50 mph and the mean traffic speed is ≥ 75 km/h, the RSI_M value should be used to determine the RSI value and the surface correction determined using equation A4.1.

Extrapolating Beyond 300 Metre Limit

A4.34 Research carried out by TRL has shown that noise levels from field measurements out to 600m from a motorway, where the intervening ground cover was grass, were in good agreement with predicted noise levels using CRTN with the attenuation with distance functions, Chart 7 and 8, extrapolated to 600m (Ref 2). It is, therefore, recommended that this is adopted for predicting noise levels out to 600m from the road. For distances greater than 600m from the road, predicted noise levels become less reliable and the benefits from ground absorption diminish with distance. An approximate indication of noise level can be calculated by applying the attenuation with distance function Chart 7 (extrapolated to distances in excess of 600m) with the correction for ground absorption function Chart 8 (extrapolated to 600m). For this it is assumed that the attenuation rate for distances in excess of 600m is approximately 3dB/doubling of distance.

Sound Absorptive Noise Barriers and Retained Walls

A4.35 Although CRTN recognises that sound absorptive noise barriers will reduce reflection effects when positioned along the opposite side of the road or where a road is flanked on both sides with sound absorptive noise barriers (paragraph 36iii), no allowance is given in the method to take this into account. Similarly, where a retaining wall has been designed with sound absorbing properties, no allowance is given in the method to take into account a reduction in reflection effects. However, to inform the decision process when assessing mitigation, an estimate of the additional potential benefits in noise mitigation provided by the use of sound absorptive materials in the design of noise barriers or retaining walls should be included in the assessment.

A4.36 The potential benefits should be calculated from the reflection correction as described in paragraph 26.2 or 36 of CRTN depending on the type of road project. However, research carried out by TRL (Ref 33) has shown that the predicted benefits from changing a reflective barrier to one which is sound absorptive was over estimated by CRTN when compared with

measurements. It is, therefore, recommended that where potential benefits of designing barriers or retaining walls with sound absorbing materials are included in the assessment it is stressed that these benefits are likely to be overestimated and should only be used as a guide to their performance.

Reflection from Opposite Facades

A4.37 Reflection from opposite facades, paragraph 26.2 of CRTN, provides a correction for reflections where there are houses, other substantial buildings or a noise fence or wall beyond the traffic stream along the opposite side of the road. However, there is no advice given concerning the position of the reflecting façade relative to the position of the traffic stream to determine when to apply the correction. Research based on a theoretical model has shown the reflection correction is dependent on the ratio of the distance between the receiver and the source line and the distance between the source line and the opposite façade (Ref 15). From this work the following advice is recommended when determining whether the reflection from opposite facades (including barriers) should be applied.

Apply correction for reflection effects from opposite facades:

1. when $d < 12$ m and $D \leq 20$ m

or

2. when $12 \text{ m} < d \leq 300$ m and $D \leq 10^{(0.825 + 0.4 \log_{10}(d + 3.5))}$ m

where

d is the horizontal distance between the receiver and the nearside kerb and D is the horizontal distance between the source line and the opposite façade

Congestion Management Schemes

A4.38 The assessment of road projects that are designed to manage and reduce congestion are not specifically covered in the CRTN procedures. Advice is given below on methods to adopt when calculating traffic noise from various regimes. Advice from the Overseeing Organisation should be sought where congestion management regimes are not covered by the advice given below.

A4.39 **Variable speeds.** The modelling of roads with a variable speed limit should be undertaken as normal with any predicted changes in average traffic speed together with changes in flow and composition being taken into account by the input parameters to the noise calculations.

A4.40 **High occupancy lanes and Hard shoulder running.** If the road project does not provide additional lanes then the assessment of such a regime should be treated as normal, with the effect of the additional lane being taken into account by any predicted changes in traffic parameters. Where additional lanes are included, the position of the source line may need to be adjusted where this effects the position of the edge of the carriageway. A noise model that predicted on a lane by lane basis is not recommended.

A4.41 The majority of hard shoulder running schemes and potentially high occupancy lane schemes will be implemented for a discrete period during the day, for example at AM and PM peaks. During these periods the road traffic noise source is repositioned. If viable, it is recommended that daily ($L_{A10,18hr}$) and night time ($L_{night,outside}$) noise levels for such projects be derived through the prediction of hourly noise levels throughout the day. This will enable the prediction of noise at a sensitive receptor which takes into account periods when the scheme is in operation and when it is not. The prediction methodology for such schemes should be agreed with the Overseeing Organisation.

A4.42 Ramp metering. Using CRTN to calculate traffic noise levels in the immediate vicinity of a ramp metering project is not recommended. The impact may be better described by a Qualitative entry. If it is considered by the Overseeing Organisation's supply chain that a Quantitative assessment is required then the scope of this should be agreed with the Overseeing Organisation. Where ramp metering is part of a larger road project then this advice should still be used.

Noise Measurements

A4.43 Noise measurements should not be undertaken within the 24 hour period after rainfall where a thin surface system is present on any section of road contributing to the noise climate. This applies to roads either partially or fully surfaced with a thin surface system, on either carriageway.

Shortened Measurement Procedure

A4.44 Although the following paragraphs do not provide any new advice, they contain analysis showing that the shortened measurement procedure is still a valid method for evaluating the $L_{A10,18h}$.

A4.45 The preferred method for calculating noise levels from road traffic is by prediction rather than by measurement (CRTN, paragraph 3). There are several reasons why the prediction method is preferred. In particular noise levels, although generally dominated by traffic noise, can be affected by non-traffic sources. Unless the extraneous noise from other sources is edited the results may lead to an over-estimation of traffic noise levels. However there are occasions when it is necessary to resort to measurements (CRTN, paragraph 38).

A4.46 The shortened measurement procedure deals with estimating the noise index $L_{A10,18h}$ by averaging three consecutively measured $L_{A10,1h}$ values carried out between 10:00 and 17:00 hours and subtracting 1 dB from the result. Since the method was first introduced in 1975 the pattern of traffic flow over the 18-hour period (06:00 to midnight) may have significantly altered due to changes in social behaviour (e.g. as society moves towards a 24-hour economy) and therefore, it is important to establish whether the relationship used to estimate the noise index $L_{A10,18h}$ is still valid.

A4.47 To provide an indication of the accuracy of the method, values of the noise index $L_{A10,18h}$ measured outside residential dwellings at 1160 sites from the National Noise Survey carried out by the Building Research Establishment in 2000 were analysed (Ref 36). The survey was designed to represent the noise exposure outside residential dwellings in the UK. Although the measured noise exposure includes noise from all sources, the predominant noise source was from road traffic. The results of this analysis are described below.

A4.48 Figure A4.1 shows the relationship between the measured noise index, $L_{A10,18h}$ and the corresponding estimated values using the equation given in CRTN paragraph 43, as described above.

A4.49 The Figure shows that for all the five possible estimates of the noise index, $L_{A10,18h}$, there is a good correlation between the measured and estimated noise indices. The regression equation shows the best-fit line drawn through the data points which passes through the origin of the graph, indicating that 93% of the variance in the measured value can be accounted for by the regression equation ($R2 = 0.93$). The slope of the regression equation (0.991) indicates that the relationship between the measured and estimated traffic noise indices that was developed over thirty years ago is still valid for today's traffic conditions.

A4.50 However, it is noted that for measured values below 60 dB $L_{A10,18h}$ there is a noticeable increase in the scatter of the data compared with measured values above 60 dB $L_{A10,18h}$. A possible cause is that at quieter sites the dominant noise source may not be from road traffic alone or that traffic flows at quieter sites are likely to be low and the traffic pattern throughout the 18-hour period may be more variable than compared with the noisier sites where traffic flows are likely to be higher.

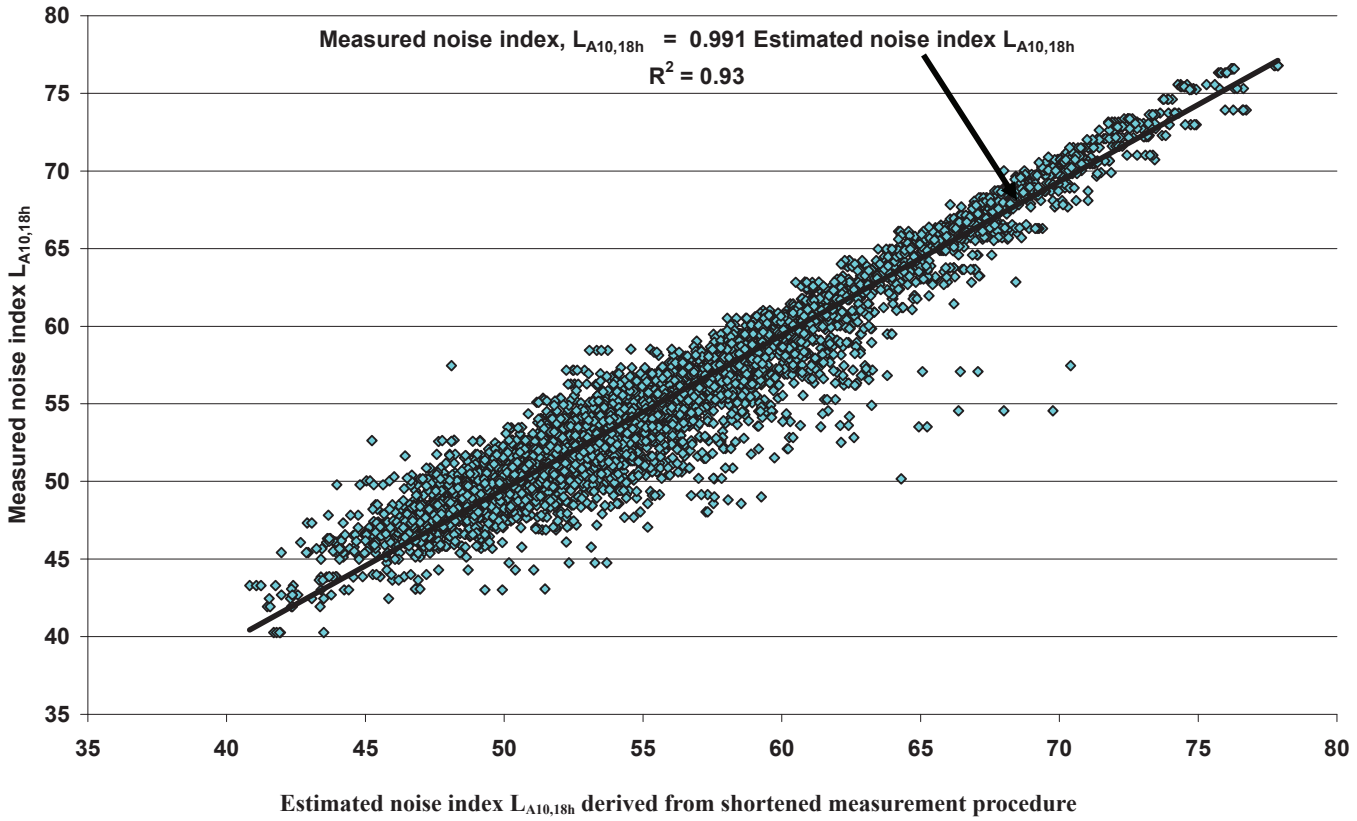

Figure A4.1 – Relationship Between Measured and Estimated Noise Index $L_{A10,18h}$: BRE National Noise Survey 2000

A4.51 Figure A4.2 shows the same relationship as that shown in Figure A4.1 except that only those sites where the measured noise index was equal to or greater than 60 dB $L_{A10,18h}$ have been selected. As expected, the overall statistical relationship has improved with a significant reduction in the scatter of the data points around the regression equation.

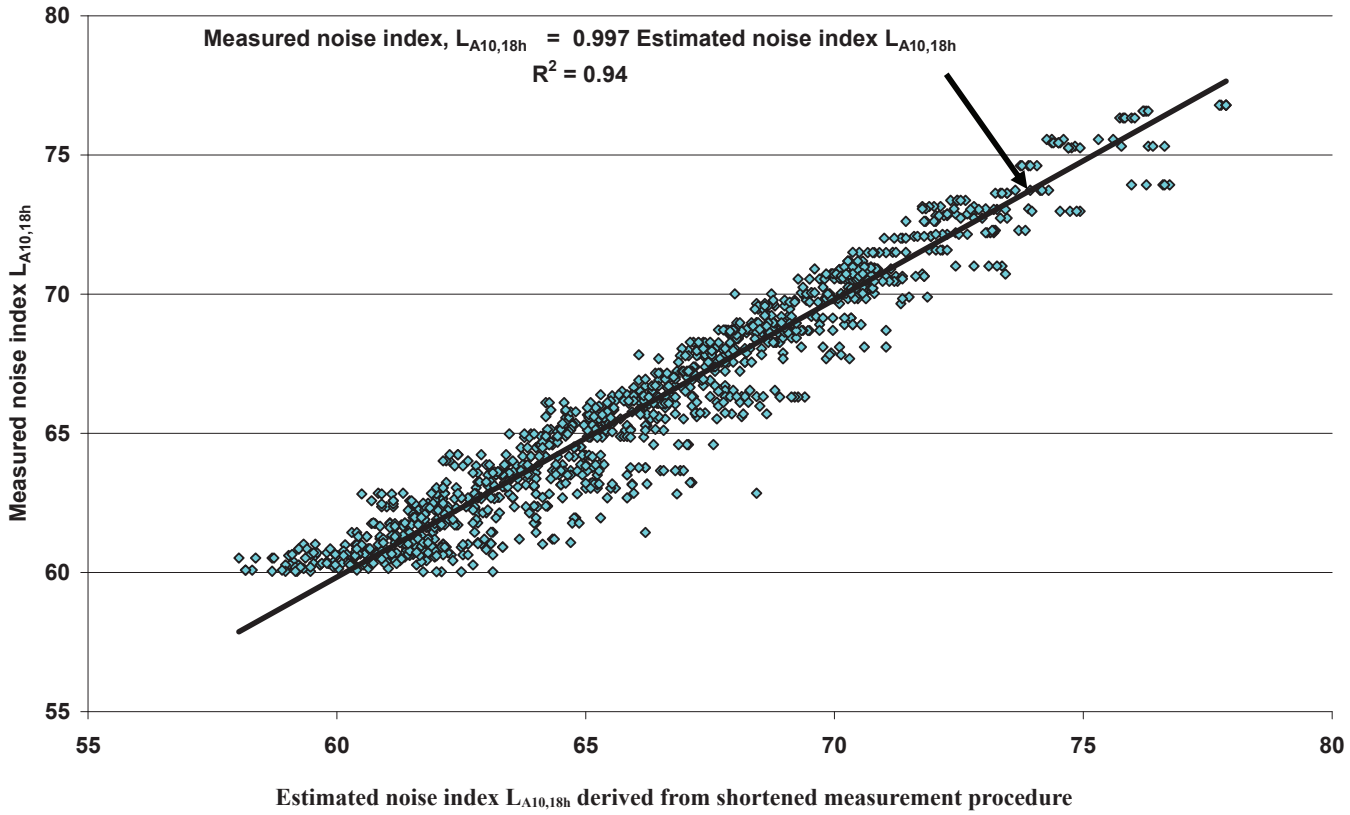

Figure A4.2 – Relationship Between Measured and Estimated Noise Index $L_{A10,18h}$: BRE National Noise Survey 2000 – Measured Noise Levels > 60 $L_{A10,18h}$

A4.52 To illustrate this further, Table A4.1 shows the mean error (measured minus estimated $L_{A10,18h}$ values) and the standard deviation between the measured and estimated noise indices.

Sample	Number of data points	Mean error (measured-estimated) dB(A)	Standard error dB(A)
All	5,800	-0.5	1.9
$L_{A10,18h} \geq 60$	1,290 (30)	-0.2 (-0.4)	1.0 (0.8)
$L_{A10,18h} < 60$	4,510	-0.6	2.0

[1] Values in brackets show corresponding results from similar surveys carried out in the early 1970's.

Table A4.1 – Differences in Measured and Estimated Noise Index, $L_{A10,18h}$: Derived from BRE National Noise Survey 2000[1]

A4.53 For the whole data set, the mean error is -0.5 dB(A) indicating that on average the method slightly overestimates measured noise levels by 0.5 dB(A). The standard error provides an estimate of the range in the population mean e.g. a standard error of 1.9 dB(A) indicates that the probability of the measured value is within 2 standard errors (± 3.8 dB(A)) of the estimated value is 0.95.

A4.54 Restricting the sample to include only data where the measured index is equal to or greater than 60 dB $L_{A10,18h}$ not only improves the mean error to -0.2 dB(A) but significantly reduces the standard error to 1 dB(A). Comparing this result with the corresponding values derived from a similar but smaller survey carried out in the early 1970's shows no significant difference and provides further evidence that the relationship has not significantly altered over the past 30 years. For completeness the corresponding statistics for sites where the measured index is less than 60 $L_{A10,18h}$ is also shown, indicating a mean error of -0.6 dB(A) and a standard error of 2 dB(A).

Sampling Period

A4.55 There is allowance in the measurement procedure as described in CRTN for hourly noise levels to be estimated by sampling over shorter periods. The minimum length of sample required to obtain a valid estimate of the hourly noise level is dependent on a number of factors as given in paragraph 41.2 of CRTN. An additional consideration in determining the period of sampling is when the traffic flow is not freely flowing, particularly when measuring near to junctions or roundabouts. It is advised that under such traffic conditions, sampling over the whole hour should be adopted when determining hourly noise levels.

Wind Conditions

A4.56 In paragraph 4, CRTN contains the statement '…noise propagation conditions are consistent with moderately adverse wind velocities…'. This statement is often misinterpreted and an explanation of the background is given below. During the development of the algorithms used for CRTN, measurements were undertaken to develop the relationship between traffic flow and noise level. In order to provide a robust relationship these measurements were undertaken during adverse wind conditions (i.e. a wind from the source to the receiver).

ANNEX 5 RESEARCH INTO TRAFFIC NOISE AND VIBRATION

A5.1 Many surveys have investigated the relationship between traffic noise and its impact on people. 'Nuisance' and 'Annoyance' are often used as general terms to describe this impact, and surveys usually employ ratings on scales such as satisfaction-dissatisfaction or 'bother' as a way of measuring it.

A5.2 The early survey work compared noise and nuisance levels at sites where conditions were generally steady – i.e. no sudden changes in exposure had recently taken place or were in prospect. Such surveys yield 'steady state' relationships between noise exposure and nuisance. Figure A6.1 shows a 'steady-state' relationship between noise exposure and noise nuisance, derived from three surveys (Ref 16, 24 and 31).

A5.3 Nuisance here is measured as the percentage of people bothered by traffic noise (i.e. those who say they are 'very much' or 'quite a lot' bothered by noise on a four point scale, which includes 'not much' and 'not at all' as alternatives). Figure A6.2 shows a relationship between changes in noise nuisance (on the same nuisance scale) and changes in noise exposure.

A5.4 Later surveys of residents before and after changes in noise exposure had occurred as the result of road projects indicated that people are more sensitive to abrupt changes in traffic noise than would have been predicted from the steady state evidence described above. In the period following a change in traffic flow, people may report positive or negative benefits when the actual noise changes are as small as 1 dB(A). As this noise change is equivalent to an increase of 25% or a decrease in traffic flow of 20%, this reaction may be partly attributed to an awareness of the changes in traffic rather than noise.

A5.5 These enhanced reactions last for a number of years and may persist as long as the respondents are those who were interviewed before the change took place. In the longer term, the level of nuisance may tend towards the steady state level associated with the noise exposure as the population interviewed acquires new residents who have no memory of the prior situation.

A5.6 The level of nuisance generated by the opening of a road project has been shown to persist for seven years at least. It seems clear that people living in a previously quiet area will continue to notice the excess noise caused by traffic, but people moving into the area will take account of it in making their choice of house. It is arguable that by the future assessment year changes in population may well cause overall nuisance levels to return to those predicted by the steady-state relationship.

A5.7 The methods of assessing nuisance in the steady state and as the result of changes in noise level are described in Annex 3.

Sleep Disturbance

A5.8 Measurements of noise from roads indicate that on average night time traffic noise (i.e. noise between 23:00 and 07:00 on the following day) is approximately 10 dB(A) less than daytime levels. The 18 hour average noise level only takes some account of the night time period.

A5.9 There is mounting concern about disturbance from heavy goods vehicle movements during the hours of night and early morning. Noise in the hours before 6am can cause people to awaken earlier than they would otherwise. Similarly, noise from heavy lorries late at night is likely to cause some people difficulty in getting to sleep. Much of the research on sleep disturbance has focussed on aircraft noise, but the noise of isolated heavy vehicles has strong similarities to the effect of aircraft during otherwise quiet periods.

A5.10 A comprehensive synthesis of field and laboratory studies undertaken before 1980 concluded that sleep disturbance could be significant at quite low noise levels (Ref 27). Attempts to find a relationship between sleep disturbances reported in social surveys and noise indices have indicated that there is a rather poor correlation between awakenings and measurements or predictions of noise.

A5.11 Research undertaken in America (Ref 11) on the impact of night time road traffic noise in cities has indicated that 25% of people exposed to an external noise level of 54 dB L_{Aeq} between the hours of 10pm

and 6am were very annoyed; the percentage very annoyed rose to 50% for noise level of 65 dB L_{Aeq}. These rates of annoyance are comparable with the result of applying the annoyance relationship given in Figure A6.1 to a noise level 10 dB(A) higher than that measured at night. Although this time period (i.e. 10pm to 6am) is different to that used for the assessment of night time noise in this document, it is considered that a similar relationship for annoyance would exist.

A5.12 A recent meta-analysis of sleep studies undertaken for the EU (Ref 23) has found relationships between the number of noisy events and proportion of people disturbed by aircraft, railways and road traffic at night. The approach recommended to the EU has converted this data into a method of predicting the proportion of people likely to be disturbed from the average night time noise exposure for different sources. However, as these relationships have been based on self-reported disturbance, it is not surprising that they diverge from the DfT study, which was based on measuring body movements. The EU relationship for night time disturbance from road traffic produces much lower rates of annoyance than found in the German study. There is a clear tendency for road traffic noise to be considered more disturbing than railway noise, which is consistent with the trend found for daytime noise.

Low Ambient Noise

A5.13 While there is an accumulation of evidence about the adverse impacts of noise from new roads through quiet country areas mainly in the form of complaints, objective research has been rather limited.

A5.14 A preliminary study by TRL of a rural bypass (A41 Kings Langley/Berkhamsted) concluded that although people living in quieter surroundings tended to be rather articulate and live in relatively expensive dwellings, there was not enough evidence to show that the impact of noise changes in this case was any different from that predicted from earlier bypass studies where ambient noise levels were higher.

A5.15 The distance over which traffic noise can be detected in rural areas, especially under favourable conditions, is extensive and may give rise to a large number of complaints. As noise is attenuated according to the logarithm of distance, differences in source noise are translated into relatively large changes in the area affected when the threshold of detection is low.

Noise Hotspots

A5.16 Previous studies of the impact of noise changes had been undertaken in cases where there had been significant changes in traffic. The provision of noise mitigation measures at a selection of noise 'hotspots' on England's Strategic Road Network where there had been a history of complaints about high levels of noise gave an opportunity to study reactions to noise changes where the traffic generally remained unchanged.

A5.17 The measures were either noise barriers, or quieter surfaces, or in one case a combination of the two. Surveys similar to those conducted in the bypass studies were undertaken before and after implementation of the measures. Although there were one or two anomalies, the trend of responses was to confirm a reduction in the level of dissatisfaction that broadly corresponded with the change in noise level in accordance with the steady state relationship.

A5.18 However, there was strong evidence of a higher level of dissatisfaction with the noise level before the change than would have been expected from the 'steady state' relationship. This was attributed to a degree of sensitisation as the result of local campaigning and possibly enhanced by anticipation of the change. In at least one case, an increase in dissatisfaction was attributed to disappointment with the reduction in noise actually achieved by the measures compared with expectations.

Effects on Fauna

A5.19 Noise from man-made sources can affect animal behaviour where it masks sounds that are important to their ecology. Examples of impacts are on the breeding behaviour of birds and on prey-predator interactions e.g. owls and small mammals. Most research has been directed at effects of noise on birds.

A5.20 Research in the Netherlands has indicated a wide range of sensitivity, both according to species and depending on whether the noise is continuous or intermittent. It is well-known that colonies of geese for example thrive near airfields where the advantages of relative seclusion overcome the disturbance due to noise. Ducks, on the other hand, appear to be more sensitive to aircraft noise. Dutch research (Ref 26) on the effects of traffic noise showed an increasing impact with increasing noise levels above about 45 dB L_{Aeq} for a range of woodland, marsh and grassland species in certain circumstances. The threshold of sensitivity to

traffic noise of coot was 60 dB, similar to that shown by black duck to aircraft noise. If considering any impact of noise on birds, care should be exercised in relation to the height of the receptor for which the noise predictions are conducted. The noise levels experienced by birds also depends upon on the habitat and behaviour of the birds because they experience different rates of attenuation in different environments.

Nuisance where Traffic is not Freely Flowing

A5.21 Langdon (Ref 19) found that at sites where traffic does not flow freely, perceived noise nuisance was only weakly related to existing noise indices. The best predictor of noise nuisance at non free-flow sites was found to be the logarithm of the percentage of heavy vehicles (greater than 1,525 kg gross weight) in the traffic flow. However, since Langdon carried out these surveys in the early 1970s, noise emissions from heavy vehicles have been reduced to conform with successive amendments to the vehicle type approval limits.

A5.22 There would be inconsistencies if different methods of predicting nuisance were used in locations where traffic is not free flowing for part of the day. It is, therefore, recommended that Figure A6.1 in Annex 6 is used to estimate noise nuisance even on routes where traffic is not free flowing, taking account of the effect of reduced speeds on noise during periods of congestion if hourly speed/flow data is available.

A5.23 Speed variations at junctions should generally be ignored in assessing noise nuisance as there is a trade-off between the effects of reducing speed and the additional engine noise generated by deceleration and acceleration. An appropriate average speed may be used for predicting the noise from traffic on large gyratory systems.

Vibration Effects

A5.24 There are two impacts of traffic vibration that need to be considered; impacts on buildings and disturbance to occupiers.

i) Impacts on Buildings

A5.25 Ground-borne vibrations are produced by the movement of rolling wheels on the road surface and can be perceptible in nearby buildings if heavy vehicles pass over irregularities in the road. It has long been a popular belief that such vibrations can lead to damage in buildings. Extensive research on a wide range of buildings of various ages and types has been carried out (Ref 30), but no evidence has been found to support the theory that traffic induced vibrations are a source of significant damage to buildings. Minor cracking of plaster may possibly occur at high exposure sites (i.e. existing heavily trafficked roads with poor surfaces and sub grade conditions) but it is very unlikely that this would be distinguishable from cracking due to other causes. There was no evidence that exposure to airborne vibration had caused even minor damage.

A5.26 Significant ground-borne vibrations may be generated by irregularities in the road surface. Such vibrations are unlikely to be important when considering disturbance from new roads and an assessment will only be necessary in exceptional circumstances. Furthermore, as the irregularities causing ground-borne vibration can be rectified during maintenance work, relief of these vibrations should not be presented as a benefit of a new road project.

ii) Disturbance to Occupiers

A5.27 Ground-borne vibration is much less likely to be the cause of disturbance than airborne vibration, but where it does occur the impacts can be more severe. At highest risk are occupants of buildings founded on soft soils close to heavily trafficked older roads where the road surface is uneven or constructed from concrete slabs which can rock under the weight of passing heavy vehicles. Ground-borne vibration levels depend on many factors and are, therefore, difficult to predict with precision, however peak levels and attenuation with distance can be estimated if the size of the road irregularity is known and the speed of traffic and type of sub-grade can be determined (Ref 30).

A5.28 Traffic-induced vibrations from low frequency sound emitted by vehicle engines and exhausts can be a source of annoyance to local people and can occur to some extent along any type of road. Such sound may result in detectable vibrations in building elements (for example, windows, doors and in some cases, floors), as reported in two surveys which investigated the relationship between physical measures of noise, vibration and traffic parameters, and measurements of nuisance obtained by interviews (Ref 5 and 30). It was found that $L_{A10,18h}$ index was among the physical variables most closely associated with average vibration disturbance ratings.

ANNEX 6 ASSESSING TRAFFIC NOISE AND VIBRATION NUISANCE

A6.1 The nuisance caused by noise mainly affects people in their homes or when they are in the streets. However, areas of open space that are also used for recreational purposes can also suffer from noise pollution.

A6.2 Attempts to measure noise nuisance or annoyance usually make use of questionnaire surveys that attempt to relate the degree of annoyance expressed by the people interviewed with some physical measurement of the source noise level. These surveys have revealed that individuals vary considerably in their sensitivity to noise and this is reflected in their ratings of traffic noise nuisance. In addition it has been found that attitudes to traffic noise are also related to satisfaction with the neighbourhood in general.

A6.3 Given this variability in individual responses, practical research has moved from the ideal of explaining individual attitudes or annoyance with noise and has instead adopted the concept of an average or community annoyance rating for each noise level.

A6.4 Most of the information on the relationship between traffic noise and perceived traffic noise nuisance comes from studies in which the noise exposure has been fairly stable, with changes (mostly increases due to traffic growth) taking place over many years. There have been many such studies, and while the rate of change in nuisance with change in noise has been fairly consistent across all surveys, the absolute level of nuisance at any given noise level tends to vary from survey to survey. Figure A6.1 shows a curve derived from the combined data of three steady-state surveys (Ref 18, 24 and 30).

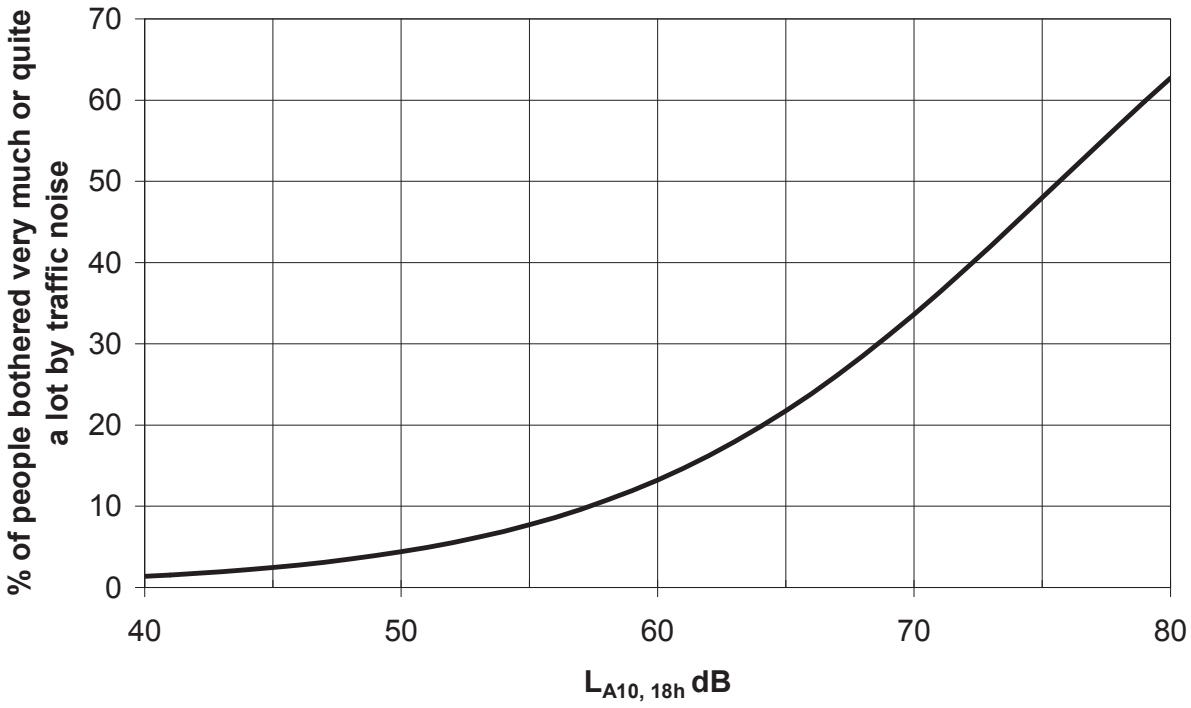

Figure A6.1 – Estimation of Traffic Noise Nuisance – Steady State or Before Noise Change

A6.5 The curve in Figure A6.1 was derived from the results of these three surveys. For each survey the mean % bothered was calculated for each 2 dB(A) band. The curve was the best fit through the resultant set of points. The curve has been derived from the equation:

$$\% \text{ bothered} = \frac{100}{(1+e^{-\mu})}$$

where $\mu = 0.12(L_{A10,18h}\ \text{dB}) - 9.08$

A6.6 A number of studies have measured changes in perceived noise nuisance associated with changes in traffic exposure (Ref 6, 12, 17 & 20). These studies have found that nuisance ratings change more than would be predicted from the 'steady-state' relationship shown in Figure A6.1. The possible explanations for this excess change in nuisance are complex, and are discussed by Huddart and Baughan (Ref 17). However, the excess annoyance appears to reflect a real change in nuisance that persists for several years.

A6.7 The change in nuisance ratings in these situations can be estimated from Figure A6.2. This curve was based on 'before' and 'after' studies at 14 sites in England (Ref 17), supplemented by data from seven site studies by Griffiths and Raw (Ref 12). The change in nuisance was measured on a seven-point satisfaction/dissatisfaction scale and transformed to percentage very much or quite a lot bothered using a TRL steady-state survey. However, an adjustment was applied to the 'decrease' part of the curve, as described below.

A6.8 Huddart and Baughan (Ref 17) found that ratings of traffic noise nuisance before a decrease in traffic were significantly higher than those measured under 'steady-state' conditions. The question arises of whether environmental assessments should include or exclude this component of the observed change in ratings. Two possible explanations of the before/steady-state difference are given.

A6.9 The first is that steady-state surveys show that at a given level of noise, nuisance varies considerably between sites. If the high nuisance sites tend to be the ones chosen for remedial action, 'before change' nuisance will indeed tend to be higher than steady state nuisance at the same noise level. This explanation would imply that the effect is a real one, and should be taken into account in assessments provided that the project being appraised came forward in the same way as the projects covered by the research surveys.

A6.10 Second, expectations and publicity associated with the forthcoming change may sensitise people to traffic nuisance. This explanation would mean that before surveys would give an inflated estimate of the underlying level of nuisance, and that the assessment should be based on the difference between the steady-state and after levels of nuisance.

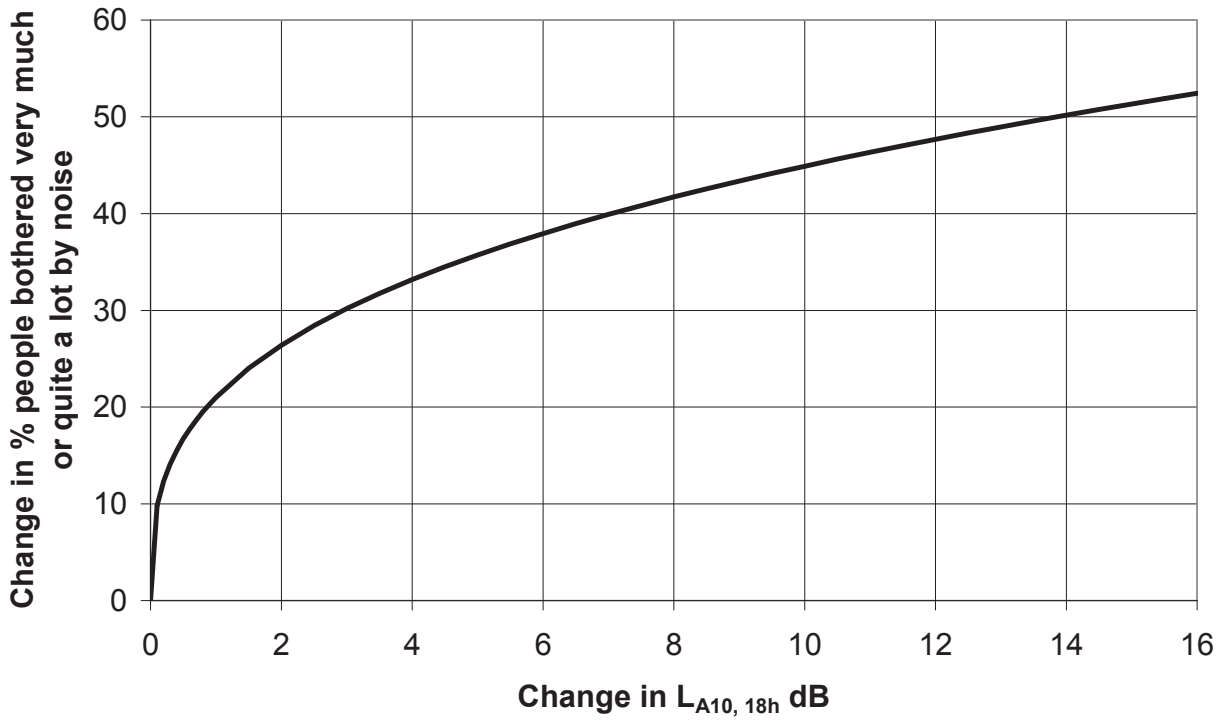

Figure A6.2: Estimation of Traffic Noise Nuisance – Change in % Bothered Very Much or Quite a Lot by Traffic Noise

This curve has been derived from the equation;

$$\text{Change of \% bothered} = 21 \, (\text{Change of } L_{A10,18h} \text{ dB})^{0.33}$$

A6.11 Huddart and Baughan argue that both the above impacts are likely to be operating, but that the first is probably the more powerful. This implies that at least part of the difference between before and steady-state nuisance should be included in assessments. However, problems arise when an attempt is made to build this idea between the two scales into a practical assessment method. For example, it is difficult to specify exactly when the current level of nuisance should be estimated from the steady-state relationship, and when the 'before' relationship should be used instead.

A6.12 It has, therefore, been decided to exclude the before/steady-state difference from the assessment method described here. The effect of this is probably to tend to underestimate the environmental benefits arising from reductions in traffic noise.

A6.13 Nuisance ratings before an increase in noise do not differ significantly from the 'steady-state' ratings. Therefore, no adjustment was required for increase in traffic noise.

A6.14 Once the adjustment for decreases in noise has been made, the relationship between change in noise and change in nuisance was found to be very similar for increase sites and decrease sites. Figure A6.2, therefore, shows a single curve applying to both increases and decreases.

A6.15 Research indicates that the large nuisance changes observed in before and after studies are not simply short term impacts. Griffiths and Raw (Ref 13) found 'after' levels of nuisance to differ from 'steady-state' levels at seven and nine years after the change in traffic noise exposure. What happens to nuisance levels in the longer term is uncertain. They may move slowly back towards those which would have been predicted from the 'steady-state' relation between noise exposure and nuisance.

A6.16 The assessment method described in this advice assumes that this does happen, and that the nuisance 15 years after a road project is opened can be estimated from the 'steady-state' relationship. One reason for expecting this is that people who move in after the change in noise may react to the noise in a similar manner to people living at 'steady-state' sites. Individuals who experienced the noise change may continue to have a different level of nuisance, but the level of nuisance for the site as a whole may change as more of the original population are replaced by new residents.

A6.17 The method for assessing traffic noise nuisance described in this manual will give estimates for an 'average' site. The level of annoyance caused by changes at any individual site may differ from this 'average' estimate.

A6.18 It should be made clear that the surveys which provided the basis for this method of assessing nuisance were conducted at sites where road traffic was the dominant noise source. Noise exposures ranged from 65 to 78 dB $L_{A10,18h}$, the changes in traffic noise were up to 10 dB $L_{A10,18h}$ and the dwellings were up to 18m from the kerb.

A6.19 When the pre-project noise level is not dominated by traffic noise, it should be measured using the noise index $L_{Aeq,18h}$. It is recommended that this is used as a substitute for $L_{A10,18h}$ to estimate pre-project levels of nuisance in these situations, using Figure A6.1. When estimating the change in nuisance from Figure A6.2, the difference between the 'after' level of noise as $L_{A10,18h}$ and the 'before' noise level as $L_{Aeq,18h}$ should be used.

A6.20 The method is based on surveys of noise changes caused by changes in traffic volume. It will not necessarily give a good prediction if traffic noise changes were brought about by some other means, such as barriers or low-noise road surfaces. A recent study has shown that although a noise reduction by such means reduced nuisance, the limited number of responses showed this decrease not to be as great as where actual traffic volume changes occur. However, further research is required before traffic noise nuisance changes can be estimated for these situations with any certainty.

A6.21 The relationship between the percentage of people bothered by largely airborne vibration and this noise exposure index is similar to that for noise nuisance except that the percentage of people bothered by vibration is lower at all exposure levels. For the purposes of predicting vibration nuisance, the curve in Figure A6.1 should be employed by making a suitable adjustment to the percentage bothered. For a given level of noise exposure the percentage of people bothered very much or quite a lot by vibration is 10% lower than the corresponding figure for noise nuisance. On average traffic induced vibration is expected to affect a very small percentage of people at exposure levels below 58 L_{A10} dB and therefore, zero per cent should be assumed in these cases.

A6.22 The survey of vibration nuisance was restricted to dwellings within 40m of the carriageway where there were no barriers to traffic noise. When using this graph to make predictions of disturbance caused by airborne vibration, professional judgement is needed in cases where the buildings are screened or are not sited within 40m of the road, since this is outside the range of the data on which the empirical method is based.

Table of Data from Figures A6.1 and A6.2

Figure A6.1

Noise exposure, $L_{A10,18h}$ dB	Approx % bothered by traffic noise
<41	1
41-45	2
45-48	3
48-50	4
50-52	5
52-54	6
54-55	7
55-56	8
56-57	9
57-58	10
58-59	11
59-60	12
60-61	14
61-62	15
62-63	17
63-64	19
64-65	21
65-66	23
66-67	25
67-68	27
68-69	29
69-70	32
70-71	35
71-72	38
72-73	40
73-74	43
74-75	46
75-76	49
76-77	52
77-78	55
78-79	58
79-80	61
80-81	64
82-83	68
83-84	72
84-85	75
>85	79

Figure A6.2

Change in noise exposure, dB	Change in % bothered by traffic noise
<2	23
2-3	28
3-4	31
4-5	34
5-6	37
6-7	39
7-8	41
8-9	42
9-10	44
10-11	45
11-12	47
12-13	48
13-14	49
14-15	51
>15	53

Noise Nuisance Changes: Worked Examples

Example 1. Do-Minimum

(i) Do-Minimum in the baseline year noise level of 68.2 dB $L_{A10,18h}$, 29 per cent of people are bothered by traffic noise (Figure A6.1).

(ii) In the future assessment year the noise level is predicted to rise to 70.1 dB $L_{A10,18h}$, when 34 per cent will be bothered by traffic noise (Figure A6.1).

(iii) There will, therefore, be an increase of five per cent, in the number of people bothered, and this value should be entered into the assessment table.

Example 2. Increases in Traffic Noise

(i) Do-Minimum in baseline year noise level of 65.9 dB $L_{A10,18h}$, 24 per cent of people are bothered by traffic noise (Figure A6.1).

(ii) An increase of 3.0 dB to 68.9 dB $L_{A10,18h}$ is predicted in the baseline year as a result of the road project, so the immediate increase in the percentage of people bothered will be 30 per cent (Figure A6.2), so 54 per cent will be bothered.

(iii) By the future assessment year the noise is predicted to rise to by a further 1.0 dB $L_{A10,18h}$ to 69.9 dB $L_{A10,18h}$ so 33 per cent of people will be bothered (Figure A6.1).

(iv) The highest level of bother (54 per cent) is, therefore, on opening, and the increase in bother for the assessment table is, therefore, 30 per cent.

Example 3. Decreases in Traffic Noise

(i) Do-Minimum in baseline year of 73.1 dB $L_{A10,18h}$, 42 per cent of people will be bothered (Figure A6.1).

(ii) A noise reduction of 6.0 dB $L_{A10,18h}$ to 67.1 dB $L_{A10,18h}$ is expected in the baseline year as a result of the road project, so the immediate decrease in the percentage of people bothered will be 38 (Figure A6.2), so 4 per cent will be bothered.

(iii) By the future assessment year, the noise is predicted to rise by 1.2 dB $L_{A10,18h}$ to 68.3 dB $L_{A10,18h}$, so the percentage of people bothered is 29 (Figure A6.1).

(iv) The highest level of bother is, therefore, in the future assessment year, and the reduction in bother is 13 per cent, and this value should be entered into the assessment table.

ANNEX 7 ADDITIONAL GUIDANCE WHEN UNDERTAKING MEASUREMENTS

A7.1 Conducting a noise measurement survey may be an integral part of the assessment process and would usually be undertaken at Detailed Assessment level. A noise survey can assist with the understanding of the existing noise level and in explaining the noise climate of a particular area.

A7.2 Before undertaking measurement work, the Local Authority Environmental Health Officer should be consulted about the availability of existing baseline noise data for the area. However, before using any such data the Overseeing Organisation's supply chain needs to be aware of the circumstances of the measurement (e.g. weather conditions, date and time of measurements, noise weightings used).

A7.3 The measurement methodology contained within CRTN for measurements is strictly for circumstances when predictions are not possible for the assessment of entitlement under the relevant Noise Insulation Regulations.

A7.4 For a noise survey of existing conditions where the noise climate is dominated by road traffic the general guidelines that are contained in CRTN for undertaking measurements should always be followed.

A7.5 Other guidance documents are available to assist with undertaking noise surveys and the Overseeing Organisation's supply chain should choose the most appropriate methodology to be used and agreed with the Overseeing Organisation. This will be dependent on the circumstances of the road project. In all cases, best practice should always be followed.

A7.6 The number and location of measurement sites is left to the Overseeing Organisation's supply chain to determine, and will be very much dependent upon the complexity of the road project. The number of sites should be appropriate to describe the noise climate in the area of the road project. If measurements are conducted at an early stage, sufficient sites should be selected to represent all possible options.

A7.7 When selecting measurement sites, the possible need to conduct post completion noise measurements and potential compensation claims should be considered. For example a road in a rural area may have impacts beyond 600m.

A7.8 To fully understand the noise climate of an area it may be necessary to conduct a full 24 hour measurement at some sites. A night time measurement should certainly be considered if traffic flows on nearby roads are too low for prediction or where receptors are located in rural areas where a new road project will be introduced nearby.

A7.9 Traffic noise can vary widely on an hourly, daily and seasonal basis. Care is needed in interpreting any measured data as the effects of varying weather conditions are particularly noticeable when the propagation distance is large. Therefore, in order to estimate the existing noise level within an area, if possible a series of measurements can be taken on several occasions during the assessment period. Where a strong prevailing wind is known to exist between the road and the receiver, the majority of measurements should be taken in those conditions.

A7.10 The weather conditions, especially the wind direction, can have a strong influence on measured noise levels, especially at some distance from the source. Weather conditions should be recorded during all measurement surveys. This could be in the form of a portable measuring device, direct observations on site or information from a reliable calibrated local source.

A7.11 Where the ambient noise level is comprised of a combination of emissions from several non road traffic sources, for example a rural setting with occasional noise from machines, aircraft or animals, the assessment of the noise using L_{A10} would be inappropriate. It would be more appropriate to determine the ambient noise in these situations by also using the L_{Aeq} index. However, it is important to measure over a sufficient time period to ensure the measurement is representative.

A7.12 Situations may arise where the ambient noise is either partially or completely dominated by noise other than from road traffic. In such situations it is recommended that the baseline noise levels are measured at representative locations during periods when the non-road traffic noise source is both present and not present.

A7.13 During attended measurements it is essential that notes are made of the main noise sources and any other noise producing activities. It should also be noted whether any events were excluded from the measurement, and the reason for the exclusion. A description, sketch and selection of photographs of all sites is considered essential.

A7.14 For unattended measurements, if the logging equipment allows, other parameters may be measured in order to help describe the noise climate. These may include the logging of events above a certain threshold or the use of a shorter measurement period to allow removal of suspect data. However, in this situation care should be taken when calculating, for example, an hourly average from several shorter periods. The comparative measurement procedure in CRTN could also be considered.

A7.15 Noise measurements should not routinely be undertaken in school holiday periods, particularly nearby to main roads as traffic flows can differ during these periods when compared to other periods in the year. Where the noise environment is not dominated by road traffic, measurements within school holidays may be suitable.

A7.16 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. For situations where it is not possible to undertake calculations in the Do-Minimum scenario but it would be possible in the Do-Something scenario (e.g. at a receptor with existing low noise levels but a noise source is to be introduced with the project), it may be necessary to compare measurements with calculations.

A7.17 As a minimum a noise survey report will include a map showing the location of all measurement positions, a description of each position and a table of results (including meteorological conditions) with appropriate commentary for each attended measurement period. An explanation should be given of all the noise sources that contribute to the noise climate at each measurement position. Commentary should also be made of any changes in the noise climate that are expected to occur between the time of the noise survey and the time when the road project is planned to open. This could include expected changes in traffic composition or new or intensified usage of existing developments. If any measured noise levels are above any statutory exposure limits or guideline levels then these should be noted in the report and highlighted to the Overseeing Organisation.

Vibration survey

A7.18 If a vibration survey is required, this should be undertaken in accordance with available guidance. The decision on whether to undertake a vibration survey should be based on an assessment of likely impacts, which would be determined by such factors as the distance between the road and sensitive receptors, ground type and road condition. However, the Overseeing Organisation's supply chain should seek the approval of the Overseeing Organisation before undertaking any ground-borne vibration survey.

A7.19 When undertaking measurements the Overseeing Organisation's supply chain should also, if possible, include an indication of the expected level of vibration from everyday household activities (e.g. the closing of doors).

A7.20 In reporting the results from any vibration survey, the Overseeing Organisation's supply chain should highlight the number of events likely to be above noticeable levels and also consider the likely cause of the events.

Development Section, Economy, Skills & Environment

Local Planning Validation Requirements

As reported to Development Control Committee on 20 July 2015

Introduction

1.1. The Town & Country Planning (Development Management Procedure) Order 2015[1] (as amended) sets out the national information requirements for planning applications: **the national list**. All planning applications must be accompanied by the information set out in the national list. Without this information, your planning application cannot be validated and the process for deciding the application will not commence.

1.2. Further guidance on this is contained in "Guidance on information requirements and validation" published by Government in 2010.

1.3. Local Planning Authorities (LPAs) are encouraged by Government to publish a list of their local information requirements for applications, **(the local list).** [2]

1.4. These requirements should be "reasonable having regard, in particular, to the nature and scale of the proposed development" and "may require particulars of, or evidence about, a matter only if it is reasonable to think that the matter will be a material consideration in the determination of the application".[3]

1.5. Suffolk County Council has reviewed its local list to reflect the advice in the National Planning Policy Framework (NPPF) and the Growth & Infrastructure Act 2013 and Planning Practice Guidance.

Suffolk County Council's list of local Information requirements (the

[1] The Town & Country Planning (Development Management Procedure) Order 2015 [2015 no595] (as amended)
[2] National Planning Policy Framework, March 2012, Department for Communities & Local Government. See in particular Paragraphs 192 & 193.
[3] Growth & Infrastructure Act 2013

local list)

1.6. SCC is local planning authority for minerals & waste development and for development carried out by the County Council. This local list applies **only** to these developments.

1.7. SCC considers it important that sufficient information is submitted with planning applications to;

- Clearly describe the scale and extent of the development proposed;
- Ensure that the potential impacts of the proposal are identified so that stakeholders in the planning process (consultees and members of the public) can make informed comments, and;
- Ensure that proper decisions are made by the County Council based on adequate environmental and other material information.

1.8. Applicants are encouraged to discuss development proposals with the County Council prior to submission. This provides an opportunity to discuss, in advance, the likely information required. It should ensure that applications are not invalidated because of insufficient or inadequate information.

1.9. The NPPF and the County Council's Statement of Community Involvement http://www.suffolk.gov.uk/planning-and-environment/planning-applications/minerals-and-waste-development-planning/statement-of-community-involvement/ encourage applicants to engage with the local community before submitting applications. This is particularly important for "major" applications and for applications relating to minerals & waste development.[4]

1.10. Additional assessments may be required. A list is provided in Appendix A. This is not exhaustive and applicants are encouraged to discuss requirements with the planning authority.

1.11. For information requirements in respect of applications requiring an Environmental Statement, please refer to The Town and Country Planning (Environmental Impact Assessment) Regulations 2011.

1.12. For applications under Section 73 of the Town & Country Planning Act (Variation of Conditions of an existing Planning Permission or Minor Material Amendments), a statement setting out the reason for the proposed changes and relevant information from sections A-D depending upon the nature of development being suggested will be required.

1.13. If you are in any doubt about the information that will be required to accompany your application you are advised to contact:

Development Section
planning@suffolk.gov.uk

[4] Major applications are defined as those having an area of over 1 hectare or a floor space of over 1000sq metres and all minerals & waste developments.

Contents

SECTION A: Applications for County Council development under Regulation 3 of the Town & Country Planning General Regulations 1992.

1. In addition to any specific assessments that may be required from those set out in Appendix A the following information will be required in respect of the particular developments shown.

- Sustainable Drainage Strategy
    - Surface water drainage proforma: http://www.greensuffolk.org/about/SFRMP/
    - Plans showing location of and type of proposed SuDS
    - Drainage design layout and calculations
    - Proposals for protection of SuDS and watercourses during construction,
    - Details of adoption & maintenance
- External games/sports areas, or where external security lighting is proposed.
    - A plan showing the position of proposed lighting and lighting columns, identifying the height above ground, and the luminance of the lamps' beam.
    - Isolux diagram showing Lux levels measured in the horizontal plane at boundaries of the site and adjacent properties.
- Developments which directly affect playing fields
    - A plan showing existing pitch layouts (summer and winter)
    - A plan showing the proposed pitch layouts (summer and winter) after proposed development

SECTION B: For Mineral extraction & restoration / Waste landfill applications

1. In addition to any specific assessments that may be required from those set out in Appendix A the following information will be required in respect of the particular developments shown.

- Details of boreholes or trial pit analysis identifying
    - The results of soil surveys and investigations including depth of soil(s)
    - mineral content
    - position of the winter water table (details of which must be included on sectional drawings)

- A Utilities Statement
    - identifying existing and proposed changes or new connections to utility services above and below ground, i.e. electricity, water, gas and foul drainage

- Topographical land survey to at least 1:2500 scale identifying;
    - Pre-development contours over and within 250 metres of the site
    - Existing trees, hedges, ditches, water courses and water bodies
    - Location of buildings on the site or within 250 metres of the site, identifying their current use
    - Position of any existing infrastructure services above and below the surface
    - Position of Public Rights of Way, as recorded on the Definitive Map and Statement, within and adjacent to the site
    - Existing means of access to the site.

  Note: for small sites or where proposals are more complex, submissions may benefit from larger scale plans

- A Proposed Scheme of Working Drawing, to at least 1:2500 scale identifying as much of the following as is relevant
    - Limits of extraction and /or land filling
    - Identification of trees to be retained or removed
    - Positions for storage for top soil, subsoil, overburden
    - Proposals for site screening, e.g. soil bunds, advance planting,

- Location of plant, buildings, and ancillary structures/plant e.g. weighbridge, wheel cleaning, sheeting bays,
- Direction of working, phasing of extraction and restoration
- Location of internal haul routes
- Location of site drainage and discharge arrangements
- Location of landfill gas control infrastructure where relevant
- Location of any landfill leachate control infrastructure where relevant
- The proposed diverted position of overhead or underground infrastructure affected by the development
- Identification and management of soil types where the site includes land of the "best and most versatile" agricultural category including the arrangements for removing and replacing soils stripped from the site, and the phasing of soil movement

- <u>A Proposed Scheme of Restoration Drawing, to at least 1:2500 scale, identifying</u>
  - Proposed final contours. For landfill proposals involving non inert waste, proposed final pre and post settlement contours
  - Arrangements for replacing soils stripped from the site, and the phasing of soil movement
  - Areas of any retained trees and hedges and proposed planting
  - Proposals for land drainage including any water areas and ditches or outfalls and sluices where appropriate.
  - Where water areas are proposed, details of water depth and typical bank gradients and margins
  - Where proposals involve agricultural land of the best and most versatile quality, or propose an after use to nature conservation, an Outline Aftercare Strategy statement of intentions for management and rehabilitation of the land for a period of 5 years post restoration.

- <u>Sectional drawings to at least 1:2500 scale, identifying</u>
  - maximum depth of mineral extraction in relation to the geological strata
  - position of the winter water table where relevant

  - quarry edges in relation to soil bunds and stores, and the level of the

undisturbed adjacent land and any adjacent infrastructure (i.e. rail, road, watercourse)

- restoration levels
- restoration landscape features, e.g. planting, water features, wetland and semi-wetland habitats.
- Public access arrangements.
- Typical cross section of storage mounds for overburden, subsoil, and topsoil, with dimensions
- Profiles of landfill site lining and capping infrastructure in relation to restored soil profiles, surface water drainage and any surface restoration features, i.e. planting or surface tracks/paths

SECTION C: Mineral processing development not involving extraction, [e.g. asphalt production plants, concrete batching plants (but not concrete crushing or alternative aggregates production)]

- A Utilities Statement
    - identifying existing and proposed changes or new connections to utility services above and below ground, ie electricity, water, gas and foul drainage

- Details of fixed plant and buildings
- Cross –sections and elevations
    - At least two directions identifying the principal elements of the proposed development, existing buildings, operational plant, roads, paths, infrastructure and natural features.
    - details of cladding or surface finishes, and colour including British Standard reference number.

- A Restoration Plan
- Details of site/plant external lighting
    - A plan showing the position of lighting and lighting columns, identifying height above ground, luminance of the lamps' beam
    - Isolux diagram showing lux levels in the horizontal plane at boundaries of the site and nearest residential property
    - Hours of use

SECTION D: Waste Management development not associated with mineral working or landfill (including concrete crushing or alternative aggregates production)

- A Utilities Statement
    - identifying existing and proposed changes or new connections to utility services above and below ground, ie electricity, water, gas and foul drainage

- Details of odour abatement measures and discharges to air to be employed
- A Bio-aerosol Assessment
    - undertaken where windrow and any outdoor composting operations are proposed within in 250 metres of dwellings, or other sensitive receptors
    - may be required for closed composting, Mechanical Biological Treatment plants, waste water treatment works, incinerators or Anaerobic Digestion plants, depending on the design. The parameters of the assessment should be agreed with the waste planning authority

- Site Cross Sections and elevations
    - At least two directions identifying the principal elements of the proposed development, existing buildings, operational plant, roads, paths, infrastructure and natural features.
    - details of cladding or surface finishes, and colour including British Standard reference number

- Site / plant external lighting
- Details of site/plant external lighting
    - A plan showing the position of lighting and lighting columns, identifying height above ground, luminance of the lamps' beam
    - Isolux diagram showing lux levels in the horizontal plane at boundaries of the site and nearest residential property
    - Hours of use

SECTION E: Applications for Listed Building Consent or Conservation Area Consent (where proposed by the County Council)

Note; these applications will be administered by the County Council but will be determined by the appropriate Secretary of State.

- Heritage Statement
- Demolition or alterations involving demolition
    - A structural survey and appraisal, in line with best conservation practice, of the condition of the building to be demolished, including the implications of the demolition on the structural integrity of any adjoining building
- Alteration or removal of any part of the frame in a timber framed building
    - scaled drawings of the existing frame in the affected area and scaled drawings showing how the new work would relate to the existing frame in the range 1:20-1:200

Appendix A: List of assessments which may be required depending on the nature, scale and location of the development proposed

A Flood Risk Assessment:

- Further information on preparing Flood Risk Assessments is available at https://www.gov.uk/flood-risk-assessment-for-planning-applications

A Biodiversity or Geodiversity Assessment: where the site includes or is close to:

- sites designated for their biodiversity or geodiversity importance, i.e. Sites of Special Scientific Interest (SSSI), RAMSAR sites, National Nature Reserves (NNR), Special Areas of Conservation (SAC), Special Protection Areas (SPA), County Wildlife Sites (CWS), and Habitats listed in the UK and Suffolk Biodiversity Action Plans (BAP) and Regionally Important Geological/geomorphologic Sites (RIGS) designations; See Appendix A, Tables 2 & 3.

- areas including or close to recorded locations of Protected Species, and Species listed in the UK and Suffolk Biodiversity Action Plans (BAP), See Appendix A, Table 1; and;

- other areas identified in pre-application discussions as potentially containing Protected and BAP species.

  Where Assessment is required according to the development type and Species affected as identified in Tables 2 and 3, the appropriate seasons for undertaking ecological surveys are identified in Figure 2 attached to Table 1.

A Heritage Statement: where the site is within or adjacent to;

  - a designated Conservation Area or,
  - affects a Listed Building or its setting, or
  - affects a Historic Park or Garden on the Register maintained by English Heritage
  - or any other designated heritage asset.

An Archaeological Assessment: where the site is close to a Scheduled Ancient monument (SAM) or site of known archaeological importance, recorded in the Suffolk Historic Environment Record (HER).
A Lorry Management Plan: covering Traffic Routeing & Management if the development would give rise to Heavy Goods Vehicle traffic.

A Transport Assessment: The Council would generally seek a Transport Assessment for developments where they fall within the thresholds indicated in Appendix B of the Department for Transport's: Guidance on Transport Assessment (2007)

A Travel Plan:

A Noise Impact Assessment: where sensitive locations could be affected by the proposed development, e.g. dwellings, schools, hotels, residential institutions, workplaces or other locations of noise sensitive occupation or use.

A Dust Impact Assessment: where sensitive locations or use could be affected by the proposed development, e.g. dwellings, schools, hotels, residential institutions, workplaces, or locations of dust sensitive industry.

An Air Quality Assessment: where the proposal is within or adjacent to a designated Air Quality Management Area.

A Land Contamination Assessment: where contamination is known or suspected and the proposed use would be vulnerable.

A Landscape and Visual Impact Assessment: for all major development (>1 hectare or > 1,000 sq metres of new floor space) including mineral extraction development. Such assessments may also be required for other development in nationally or locally designated landscapes such as Areas of Outstanding Natural Beauty or where it s apparent that the development is in a sensitive location within the landscape.

A lighting assessment: for all applications which include floodlighting for, for example, sports facilities or car parking areas or for security purposes

TABLE 1

Local Requirement for Protected and Priority (UK BAP) Species:
Criteria and Indicative Thresholds (Trigger List) for when a Survey and Assessment is Required with an Application to meet BS42020:2013

Column 1 **Proposals for Development That Will Trigger a Survey for the relevant Protected Species**	Bats	Barn Owls	Breeding Birds	Gt. Crested Newts	Otters	Dormouse	Water Vole	[redacted]	Reptiles	Amphibians	Schedule 8 Plants & Fungi	Stag Beetle	Aculeate hymenoptera	Other Priority species
Proposed development which includes the modification, conversion, demolition or removal of buildings and structures (especially roof voids) involving the following:														
▪ all agricultural buildings (*e.g.* farmhouses and barns) particularly of traditional brick or stone construction and/or with exposed wooden beams greater than 20cm thick;	●	●	●											
▪ all buildings with weather boarding and/or hanging tiles that are within 200m of woodland and/or water;	●													
▪ pre-1960 detached buildings and structures within 200m of woodland and/or water;	●													
▪ pre-1914 buildings within 400m of woodland and/or water;	●													
▪ pre-1914 buildings with gable ends, peg tile or slate roofs, regardless of location;	●													
▪ all tunnels, mines, kilns, ice-houses, adits, military fortifications, air raid shelters, cellars and similar underground ducts and structures;	●													
▪ all bridge structures (especially over water and wet ground).	●				●		●							
Proposals involving lighting of churches and listed buildings or flood lighting of green space within 50m of woodland, water, field hedgerows or lines of trees with obvious connectivity to woodland or water.	●	●	●			●								
Proposals affecting woodland, or field hedgerows and/or lines of trees with obvious connectivity to woodland or water bodies.	●		●			●		●			●	●		
Proposed tree work (felling or lopping) and/or development affecting:														
▪ old and veteran trees that are older than 100 years;	●	●	●									●		
▪ trees with obvious holes, cracks or cavities,	●	●	●											
▪ trees with a diameter greater than 1m at chest height;	●	●	●											

	Bats	Barn Owls	Breeding Birds	Great Crested Newt	Otters	Dormouse	Water Vole	[redacted]	Reptiles	Amphibians	Schedule 8 Plants & Fungi	Stag Beetle	Aculeate hymenoptera	Other BAP species
Proposals affecting gravel pits or quarries and natural cliff faces, crevices or caves.	●		●	●					●				●	
Major or Large proposals within 500*m of a pond/moat or Minor proposals within 100*m of pond/moat. (Note: A Large proposal is one that is more than 10 dwellings or more than 0.5 hectares or for non-residential development is more than 1000m^2 floor area or more than 1 hectare)				●			●			●				
Proposals affecting or within 200*m of rivers, streams, lakes, or other aquatic habitats such as reedbed, grazing marsh and fen.	●		●		●		●		●	●	●			
Proposals affecting brownfield sites, allotments and railway land.			●	●				●	●	●		●		
Proposals for large wind turbines: see Natural England TIN 051 (bats and onshore wind turbines) , TIN 059 (bats and single large wind turbines) and TIN069 (Assessing the effects of onshore wind farms on birds) http://publications.naturalengland.org.uk/category/9001	●		●											
Proposals for small wind turbines: see flowchart for bats on www.suffolkbiodiversity.org)	●	●	●											
Proposed development affecting any buildings, structures, feature or locations where protected or priority (BAP) species are known to be present **.	●	●	●	●	●	●	●	●	●	●	●	●	●	●

* Distances may be amended to suit local circumstance on the advice of the local Natural England team and/or Suffolk Biodiversity Partnership planning support group.

** Confirmed as present by either a data search (for instance via the Suffolk Biological Records Centre www.suffolkbrc.org.uk) or as notified to the developer by the local planning authority, and/or by Natural England, the Environment Agency or other nature conservation organisation.

Exceptions for When a Full Species Survey and Assessment may not be Required

a. Following consultation by the applicant at the pre-application stage, the LPA has stated in writing that no protected or priority species surveys and assessments are required.

b. If it is clear that no protected or priority species are present, despite the guidance in the above table indicating that they are likely, the applicant should provide evidence with the planning application to demonstrate that such species are absent (*e.g.* this might be in the form of a brief report from a suitably qualified and experienced person, or a relevant local nature conservation organisation).

c. If it is clear that the development proposal will not affect any protected or priority species present, then only limited information needs to be submitted. This information should, however, (i) demonstrate that there will be no significant impact on any protected or priority species present and (ii) include a statement acknowledging that the applicant is aware that it is a criminal offence to disturb or harm protected species should they subsequently be found or disturbed.

In some situations, it may be appropriate for an applicant to provide a protected or priority species survey and report for only one or a few of the species shown in the Table above *e.g.* those that are likely to be affected by a particular activity. Applicants should make clear which species are included in the report and which are not because exceptions apply.

TABLE 2

Local Requirements for Designated Sites and Priority Habitats and Habitats Listed in Suffolk BAP: Criteria (Trigger List) for When a Survey and Assessment are Required with an Application

1. DESIGNATED SITES (as shown on the Council's Development Plan Proposals Map)

Internationally designated sites and identified HRA constraint zones	Special Protection Area (SPA) Special Area of Conservation (SAC) Ramsar Site
Nationally designated sites	Site of Special Scientific Interest (SSSI) National Nature Reserve (NNR)
Regionally and locally designated sites	County Wildlife Sites (CWS) Local Nature Reserve (LNR)

2. PRIORITY HABITATS (Habitats of Principal Importance for Biodiversity under S.41 of the NERC Act 2006) & Regulations 9 (1) and 9 (5) of Conservation of Habitats & Species Regulations 2012) (BAP)

- Arable field margins
- Coastal and Floodplain grazing marsh
- Coastal saltmarsh (see combined Suffolk plan for saltmarsh & mudflats)
- Coastal sand dunes
- Coastal vegetated shingle
- Hedgerows
- Intertidal mudflats (see combined Suffolk plan for saltmarsh & mudflats)
- Lakes
- Lowland calcareous grassland (e.g. species-rich chalk and limestone grasslands) No Suffolk plan at present
- Lowland dry acid grassland (see combined Suffolk plan for Heathland)
- Lowland Fen (e.g. fen, marsh & swamp)
- Lowland heathland (see combined Suffolk plan for Heathland)
- Lowland meadows (e.g. species-rich flower meadows) (Suffolk plan is lowland hay meadows)
- Lowland mixed deciduous woodland (ancient woodland)
- Maritime cliff and slopes
- Mixed deciduous woodland
- Mud habitats in deep water
- Open Mosaic Habitats on Previously Developed Land
- Ponds
- Reedbeds
- Rivers & streams
- Saline lagoons
- Seagrass beds
- Sheltered muddy gravels
- Sub tidal sands and gravels
- Traditional orchards
- Wet woodland
- Wood-pasture and parkland

3. OTHER BIODIVERSITY FEATURES

These may also be a material consideration if identified by the Suffolk Biodiversity Partnership see paragraph 84 ODPM Circular 06/2005); such features may include: and Mature/Veteran Trees, Caves and disused tunnels and mines (*e.g.* roosts for bats), Trees and scrub used for nesting by breeding birds; Previously developed land with biodiversity interest, Urban green space (*e.g.* parks, allotments, school grounds and railway embankments) and other habitats and features identified in the Suffolk Biodiversity Action Plan (www.suffolkbiodiversity.org.uk .

Exceptions When a Full Survey and Assessment May Not Be Required

International and National Sites: A survey and assessment will not be required where the applicant is able to provide copies of pre-application correspondence with Natural England, where the latter confirms in writing that they are satisfied that the proposed development will not affect any statutory sites designated for their national or international importance.

Regional and Local Sites and Priority Habitats: A survey and assessment will not be required where the applicant is able to provide copies of pre-application correspondence with the Local Planning Authority's ecologist (where employed), or ecological advisor and/or the Suffolk Wildlife Trust that they are satisfied that the proposed development will not affect any regional or local sites designated for their local nature conservation importance or any other priority habitats or listed features

TABLE 3

Local Requirements For Designated Geodiversity Sites And Features
Criteria (Trigger List) for when a Survey and Assessment are Required

1. DESIGNATED SITES (as shown on the Council's Development Plan Proposals Map)
See Earth Heritage Suffolk Handbook Part 2 Protecting Our Geodiversity p S1and S2

Nationally designated sites	Site of Special Scientific Interest (SSSI) National Nature Reserves (NNRs)
Regionally and locally designated sites	Regionally Important Geological/Geomorphological Sites (RIGS) Public County Geosites/Local Geodiversity Sites as in Earth Heritage Suffolk Part 6 Gazetteer p G1 – G8

2. OTHER GEODIVERSITY CONSERVATION FEATURES
See Earth Heritage Suffolk Handbook

Natural

- Coasts and estuaries – cliffs, beaches, salt marshes, processes
- Rivers and streams – valleys, channels, interfluves, processes
- Groundwater – springs, seepages, solution features, processes
- Relic landforms – terraces, periglacial patterned ground, palaeosols, etc.
- Buried interest – geological deposits including fossils and former lake beds

Man Made

- Quarries and pits – active and disused
- Road and rail cuttings
- Underground features – wells, tunnels, etc.
- Built environment, including building stone, decorative stone, artificial stone
- Large stones – sea defences, erratics and sarsens (as features), etc.
- Works of art, memorials, street and pub etc. signs.

- Unavailable sites – landfill, major engineering sites, etc.

Exceptions When a Full Survey and Assessment May Not Be Required

International and National Sites: A survey and report will not be required where the applicant is able to provide copies of pre-application correspondence with Natural England, where the latter confirms in writing that they are satisfied that the proposed development will not affect any statutory sites designated for their national importance.

Regional and Local Sites: A survey and report will not be required where the applicant is able to provide copies of pre-application correspondence with appropriate local geological specialists (such as GeoSuffolk) that they are satisfied that the proposed development will not affect any regional or local sites designated for their geodiversity conservation importance.

Appendix B ECOLOGICAL SURVEY SEASONS **Key: Optimal Survey Time** **Extending into**

The survey calendar below broadly indicates appropriate survey periods – for further details, reference should be made to published guidance and mitigation guidance documents listed below.

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
[redacted]												
Bats (Hibernation Roosts)												
Bats (Summer Roosts)												
Bats (Foraging/Commuting)												
Birds (Breeding)												
BIRDS (Over Wintering)												
Dormice												
Great–Crested Newts TERRESTRIAL												
AQUATIC												
Invertebrates												
Amphibians												
Otters												
Reptiles												
Water Voles												
White-Clawed Crayfish												
Habitats/Vegetation												

Points to note regarding surveys are as follows:

- It is important that surveys for protected (and priority) species are carried out at an appropriate time of year, as indicated by published guidance and/or nationally recognised survey guidelines/methods where available. This is so that there is the greatest chance of detecting protected (and priority) species if present. At other times of year, it can be very difficult to detect protected (and priority) species as their levels of activity decreases as temperatures decline and the weather worsens, they take refuge in areas that are difficult to access and bad weather destroys evidence of their presence. Therefore, surveys undertaken at an inappropriate time of year will not provide a true reflection of the likely impacts of a proposed development on protected (and priority) species.
- For certain species and habitats surveys can be carried out at any time of year, but for other species, particular times of year are required to give the most reliable results, as indicated above.
- Surveys conducted outside of optimal times will be unreliable. As a consequence, there may be insufficient information for determination of an application. For certain species (*e.g.* Great Crested Newt) surveys over the winter period are unlikely to yield any useful information. Similarly negative results gained outside the optimal period should not be interpreted as absence of a species and further survey work maybe required during the optimal survey season. This is especially important where existing surveys and records show the species has been found previously on site or in the surrounding area.
- Species surveys are also very weather dependent so it may be necessary to delay a survey or to carry out more than one survey if the weather is not suitable, *e.g.* heavy rain is not good for surveying for otters, as it washes away their spraint (droppings). Likewise bat surveys carried out in wet or cold weather may not yield accurate results.
- Absence of evidence of a species does not necessarily mean that the species is not there, nor that its habitat is not protected (*e.g.* a bat roost is protected whether any bats are present or not).
- Suffolk Biological Records Centre may have useful existing information and records (www.suffolkbrc.org.uk)

Published Survey and Mitigation Guidance

Competent ecologists should carry out any surveys & assessments. Where surveys involve disturbance, capture or handling of a protected species, then only a person licensed by Natural England can undertake such surveys. Surveys should follow published national or local methodologies set out below. Further details may be found on the following web sites:
Biodiversity Planning Toolkit at: www.biodiversityplanningtoolkit.com – one stop shop for planning and biodiversity
IEEM at: www.ieem.org.uk/Publications.htm - Guidelines for Survey Methodology)
Natural England: http://publications.naturalengland.org.uk/category/9001

The following is a list of published guidance on protected species which gives information on survey methodologies, assessment of impacts, and mitigation measures.

Bats

Bat Conservation Trust (2007). *Bat Surveys: Good Practice Guidelines.* London: Bat Conservation Trust.

Mitchell-Jones, A.J. (2004). *Bat Mitigation Guidelines*. Peterborough: English Nature.

Mitchell-Jones, A.J. & Mcleish, A.P. (2004). *Bat Workers' Manual.* Peterborough: JNCC.

Schofield, H.W. (2008). *The Lesser Horseshoe Bat Conservation Handbook*. Ledbury: The Vincent Wildlife Trust.

Great Crested Newts

English Nature (2001). *Great Crested Newt Mitigation Guidelines*. Peterborough: English Nature.

Langton, T., Beckett, C. & Foster, J.(2001). *Great Crested Newt Conservation Handbook*. Halesworth: Froglife.

Dormice

Bright, P., Morris, P. & Mitchell-Jones, A.J. (2006). *The Dormouse Conservation Handbook 2nd Ed.* Peterborough: English Nature.

Otters

Countryside Council for Wales (2009). *Otters: A Guide for Developers.* Bangor: Countryside Council for Wales.

Scottish Natural Heritage (2008). *Otters and development*: http://www.snh.org.uk/publications/on-line/wildlife/otters/biology.asp

Chanin, P. (2003). *Ecology of the European Otter. Conserving Natura 2000. Rivers Ecology Series No. 10*. English Nature, Peterborough.

LIFE publications on otters available to download from: www.english-nature.org.uk/lifeinukrivers/species/otter.html

Water Voles

Strachan, R. & Moorhouse, T. (2006). *Water Vole Conservation Handbook 2nd Ed.* Oxon: The Wildlife Conservation Research Unit.

Welsh Assembly Government & Countryside Council for Wales (2009). *Water Voles and Development.* Bangor: Countryside Council for Wales.

[redacted]

Countryside Council for Wales (2005). [redacted] *A Guide for Developers.* Bangor: Countryside Council for Wales.

RSPCA (1994). *Problems with* [redacted] Horsham, Sussex: RSPCA.

Barn Owls

Barn Owl Trust (2002). *Barn Owls on site: A guide for developers and planners*. Peterborough: English Nature.

Countryside Council for Wales (2005). *Owls in Wales*. Bangor: Countryside Council for Wales.

Royal Society for the Protection of Birds (2007). *Wild Birds and the Law England and Wales: A Plain Guide to Bird Protection Today*. Sandy, Bedfordshire: RSPB.

White-clawed crayfish

Peay, S. (2000). *Guidance on works affecting White-clawed crayfish.* Peterborough: English Nature & Leeds: Environment Agency.

Holdich, D. (2003). *Ecology of the White-clawed Crayfish*. *Conserving Natura 2000 Rivers Ecology Series No.1.* Peterborough: English Nature.

Reptiles

English Nature (2004). *Reptiles: guidelines for developers.* Peterborough: English Nature.

Gent, T. & Gibson, S. (1998) *Herpetofauna Worker's Manual*. Peterborough: JNCC.

Countryside Council for Wales (2001). *Reptiles in Wales.* Bangor: Countryside Council for Wales.

Phase 1 Survey

Nature Conservancy Council (1990). *Handbook for Phase 1 habitat survey*. Peterborough: JNCC

Recommended Survey and Assessment Template for Protected Species

As a guide to what constitutes sufficient information for the planning authority, any submitted survey and report should be based on the following:

1. Executive summary (no more than one side of A4)

2. Introduction

a. Background to development - *justification for why the proposal is necessary*
b. Description of the proposed works; *e.g. building conversion, new build, demolition etc.*
c. Summary of statutory provisions for protected species

3. Survey and Site Assessment

a. Qualifications and experience/competence of surveyor(s) *e.g. details of EPS license number etc. and equipment used (type of bat detectors and data loggers)*
b. Scale plan/map and 6 or 8 figure grid reference
c. Desk top data trawl – *details of information sought and obtained from local records centre*
d. Conclusions of walkover survey
e. Objectives of the detailed survey
f. Field surveys - *details of internal/external inspections, emergence/re-entry surveys, transect surveys, timings (day/evening), dates, weather conditions (wind, rain, temperature tabulated for multiple survey visits)*
g. Survey results – *including: text, tables, photos, maps, illustrations, plans (with raw data appended including sonograms)*
h. Site/habitat - *description of features of value to commuting, foraging and roosting bats*
i. Interpretation/evaluation of results – *estimate of bat numbers and status of site; e.g. presence of hibernation, maternity, feeding roosts, swarming sites and their significance locally / regionally.*

4. Impact Assessment

a. Short term disturbance impacts
b. Long term impacts
    i. Roost modification
    ii. Roost loss
    iii. Fragmentation and isolation of habitat
c. Post development interference impacts e.g. lighting / use of loft space
d. Predicted scale of impacts
e. Land ownership and viability for any proposed mitigation sites

Note: A submitted report must first demonstrate that alternatives have been considered and show why avoidance of negative impacts is not feasible before providing a strategy that details mitigation and compensation proposals.

5. Measures for Mitigation, Compensation and Enhancement

a. Full mitigation, compensation and enhancement plan / strategy
b. Works to be undertaken by an ecologist or suitably qualified person
    i. Capture and exclusion (as an example of possible works)
c. Works to be undertaken by the developer /landowner
    i. In-situ retention of bat roost
    ii. Modification of existing roosts
    iii. New roost creation
    iv. Scaled maps/plans

6. Compliance With Development Plan Policies And Statutory Obligations

a. How biodiversity features will change with development – *a prediction of net loss or gain*
b. How the proposal is in accordance with the relevant policies within the development plan
c. Likelihood of obtaining any necessary Regulation 44 European Protected Species licences

7. Post-development site safeguard

a. Habitat/site management and maintenance where necessary
b. Population monitoring, roost usage etc.
c. Mechanism for ensuring delivery – *planning conditions/obligations and/or Reg. 44 licence*

8. Timetable of works

Evidence that conservation proposals are compatible with the proposed development timetable

4.0 Scoping

INTRODUCTION

4.1 Scoping is the process of identifying the content and extent of the Environmental Information to be submitted to the Competent Authority under the EIA process. Before undertaking a noise impact assessment, it is important that the assessor has a thorough understanding of the project and its context. This involves having an understanding of the nature of the development and identifying the potential sources of noise. It is also important to understand the nature and character of the prevailing noise environment (see Chapter 5). The identification of all the potential new noise sources that will arise from the proposals, during the construction, operation and, if appropriate, de-commissioning needs to be established at the scoping stage. The nature of the new noise sources that will arise from the proposal, including such features as tonal characteristics, intermittency, duration and timing (diurnally and seasonally) needs to be established. It should be noted that the scoping process is not unique to the EIA process. It is relevant to all types of noise assessment and will only differ in its scale and the extent to which consultation is required, either formally or informally.

4.2 The policy context of the proposal, including central and local government policy, relevant international and national guidelines, British Standards etc. should be established at the scoping stage.

CONSULTATION

4.3 Unless there are commercial or other reasons for confidentiality, it is recommended that the competent authority[49] be consulted at an early stage when defining the scope of the baseline study. Consultation with the competent authority (in particular, the authority having responsibility for Environmental Health functions) has the following advantages:

- particular local concerns and receptors can be identified;
- data on existing noise levels may be available;
- specific monitoring or prediction requirements (e.g. noise indicator) can be identified;
- agreeing the spatial and temporal scales for the assessment; and
- assistance with surveys may be provided (e.g. in arranging access or protecting non-secure monitoring sites).

4.4 At the least, it may be possible to agree suitable receptor locations. Furthermore, contact with those living and working in the area also may highlight any local concerns[50].

SELECTION OF RECEPTORS

4.5 Sensitive receptors may include uses other than dwellings, and animals other than human beings. Normally, the objective is to identify those locations most sensitive to or likely to be adversely affected by the proposed development. (It should be noted that not all of these receptors would necessarily have the same degree of sensitivity. This variation would need to be taken into account during the assessment process described in Chapter 6.) Possible receptors that may need to be considered when determining the baseline noise levels include:

- Dwellings;
- Schools/Colleges;
- Hospitals;
- Especially sensitive commercial/industrial installations;
- Commercial premises;
- Community facilities (including libraries, surgeries, health centres);
- Places of worship;
- Retail premises;
- Open air amenities;
- Cemeteries;
- Light industrial sites;
- Farms, kennels;
- Wildlife sites; and
- Vacant land (classify according to potential future use where possible. Consult planning consents, relevant planning strategies and similar local development documents, etc).

4.6 "Open air amenities" covers a wide range of receptors and sensitivities. Sites such as those of special historic interest, nationally recognised footpaths and areas of landscape value should be considered as particularly sensitive[51].

4.7 In circumstances where the development proposal or elements of the scheme are noise-sensitive, it may be necessary to treat them as potential receptors in order to appraise the impacts and effects of noise from existing sources on the scheme itself.

49. Note that although a local authority may have environmental health functions, that body may not be the relevant planning authority.
50. This can be very important, as much time can be spent at Public Inquiry debating the merits or otherwise of specific noise monitoring locations.
51. This category includes both nationally and locally designated sites, but also might include locations that are valued locally, even though they have no formal designation.

5.0 ESTABLISHING THE BASELINE

INTRODUCTION

5.1 This chapter considers the purposes for which baseline noise levels are required, the means of determining them and the factors that influence the method used. It also sets out a systematic approach to presenting the baseline information that is applicable to an Environmental Statement for a major project, or part of a stand-alone noise report forming a planning submission.

5.2 The objective is to enable a practitioner to prepare the baseline information to an appropriate level of detail, proportionate to the development in question and the sensitivity of its proposed location. It also should assist anyone reviewing a baseline study to assess whether it follows good practice[52]. The chapter is structured as follows:

- definition and function of baseline;
- methodology for determination of the baseline; and
- presentation of the baseline information.

5.3 This part of the Guidelines also contains detailed information and advice on the factors that can affect determination of the baseline.

BASELINE: DEFINITION AND FUNCTION

DEFINITION

5.4 Baseline noise refers to the noise environment in an area prior to the construction and/or operation of a proposed (or new) development that may affect it.

5.5 Baseline noise levels may be required for different years. In many cases the year in which the study is carried out will be relevant, and these baseline noise levels may be referred to as existing (or current). However, there may be occasions when baseline data are required for other years (see paragraphs 5.7 and 5.8).

FUNCTION

5.6 Baseline noise levels can serve several purposes in the assessment process:

- They provide context for the noise levels predicted to arise from the proposed development against which they may be appraised;
- They may be required as a formal part of the noise assessment process;
- They may demonstrate that the noise environment is already unsatisfactory.

RELEVANT TIME

5.7 In order for baseline noise levels to fulfil any of these functions, they must be the values expected at the relevant time for the phase of the proposed development being considered. This may be at some future date either because the development will not be operational for several years, or because its noise emissions will change during its operating life.

5.8 For example, an industrial development may take several years to be planned, a year or more to be constructed, and may be designed to have further production lines coming on-stream in the years after it is first operating. In such circumstances, different baseline years may be relevant for the construction and operating phases, and neither of them will be the same as the situation at the time that the assessment is conducted. Although it is possible to measure noise levels at the time an assessment is conducted, this may not be the relevant time for which the baseline noise levels are required. baseline noise levels may be determined by direct measurement, by prediction, or by a combination of these methods. When considering future baseline noise levels it is considered good practice not to include the influence of the scheme itself; although 'organic' changes due to sources that are not associated with the scheme can be taken into account.

TEMPORAL CONSIDERATIONS

5.9 Table 5-1 provides information regarding the temporal aspects of a baseline study.

52. When possible, it is good practice to seek agreement on the proposed methodology with the relevant competent authority in advance.

EIA Quality Mark Article

Guidelines for Environmental Noise Assessment – October 2014

In October 2014 IEMA introduced the Guidelines for Environmental Noise Impact Assessment. The stated purpose of the guidelines is to provide specific support on how noise impact assessment fits within the EIA process.

Noise impact assessments have undergone a degree of change in recent years with the cancelling of tried and tested noise guidance by the introduction of the National Planning Policy Framework (NPPF). Much reliance for assessing the impact of noise had previously been placed on Planning Policy Guidance 24 "Planning and Noise" 1994. The NPPF swept away many pages of subtly nuanced guidance which had been built on many years of experience.

Paragraph 123 of the NPPF states that "planning decisions should aim to avoid noise from giving rise to significant adverse impacts on health and quality of life as a result of new development" but it leaves the definition of "adverse impact" to the Noise Policy Statement for England (NPSE).

NPSE sets out three categories of impact:

NOEL - No observed effect level.
This is the level below which no effect can be detected.

LOAEL - Lowest observed adverse effect level.
This is the level above which adverse effects can be detected.

SOAEL - Significant observed adverse effect level.
This is the level above which significant adverse effects occur.

The Planning Practice Guidance which was introduced in 2014 to support the NPPF expands these effect levels into its Noise Exposure Hierarchy:

Noise Exposure Hierarchy			
Perception	**Examples of Outcomes**	**Increasing Effect Level**	**Action**
Not noticeable	No Effect	No Observed Effect	No specific measures required
Noticeable and not intrusive	Noise can be heard, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed adverse Effect	No specific measures required
		Lowest Observed Adverse Effect Level	
Noticeable and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; closing windows for some of the time because of the noise. Potential for non-awakening sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
		Significant Observed Adverse Effect Level	
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, e.g. having to keep windows closed most of the time, avoiding certain activities during periods of intrusion. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.	Unacceptable Adverse Effect	Prevent

In the Environmental Impact Assessment process it is important to consider the significance of an environmental impact not only by the magnitude of the impact, but also by the sensitivity of the receptor. The following three tables summarise the approach we have adopted, and are offered as a means of applying planning policy and practice guidance to the EIA process.

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Table 1 describes the magnitude of impact of noise. The increasing effect levels in the Noise Exposure Hierarchy are given an equivalent subjective perception rating, which rises from “not noticeable” through intermediate categories to “noticeable and very disruptive”. These perception ratings have been used to derive descriptors for a range of magnitudes of noise impacts. The terms “not noticeable”, “noticeable and not intrusive”, “noticeable and intrusive” and “noticeable and disruptive” in the Noise Exposure Hierarchy equate to “Negligible”, “Small”, “Medium” and “Large” in Table 1:

Table 1 Magnitude of Noise Impact

Descriptor	Description
Large	Impact resulting in a considerable change in baseline environmental conditions predicted either to cause statutory objectives to be significantly exceeded or to result in severe undesirable/desirable consequences on the receiving environment.
Medium	Impact resulting in a discernible change in baseline environmental conditions predicted either to cause statutory objectives to be marginally exceeded or to result in undesirable/desirable consequences on the receiving environment.
Small	Impact resulting in a discernible change in baseline environmental conditions with undesirable/desirable conditions that can be tolerated
Negligible	No discernible change in the baseline environmental conditions, within margins of error of measurement

The sensitivity of the receptor is set out in Table 2:

Table 2 Sensitivity of Receptor

Sensitivity	Receptor Type
High	Receptor/resource has little ability to absorb change without fundamentally altering its present character, or is of international or national importance. For example hospitals, residential care homes, and internationally and nationally designated nature conservation sites which are also known to contain noise sensitive species (i.e. noise may change breeding habits or threaten species in some other way).
Medium	Receptors/resource has moderate capacity to absorb change without significantly altering its present character. For example residential dwellings, offices, schools, and play areas. Locally designated nature conservation sites which are also known to contain noise sensitive species (i.e. noise may change breeding habits or threaten species in some other way).
Low	Receptor/resource is tolerant of change without detriment to its character or is of low or local importance. For example industrial estates.
Negligible	Receptor/ resource is not sensitive to noise.

The significance of the impact of noise is then determined by the interaction of magnitude and sensitivity. The Impact Significance Matrix is set out in Table 3:

Table 3 Impact Significance Matrix

Magnitude	Sensitivity			
	High	Moderate	Low	Negligible
Large	Very Substantial	Substantial	Moderate	None
Medium	Substantial	Substantial	Moderate	None
Small	Moderate	Moderate	Slight	None
Negligible / Beneficial	None	None	None	None

The threshold between insignificant and significant lies between “Moderate” and “substantial”. Moderate impacts might be noticeable and intrusive but may cause a small change in behaviour. Substantial impacts might be noticeable and disruptive, and might cause a material change in behaviour or attitude.

Mark Dawson, Technical Director, Wardell Armstrong, August 2015.

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This Technical Advice Note (TAN) provides guidance which may assist in the technical evaluation of noise assessment.

This publication is available to download in other formats. **MORE**…

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Contents

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Chapter 2: Noise Impact Assessment

2.1 The basic principle of any noise impact assessment is to assess the change in the acoustic environment that will be brought about by the proposed development. It is important to appreciate that the assessment of change can, and should be, both qualitative and quantitative. This Technical Advice Note aims to provide guidance on the assessment of significance of noise impacts for various common situations.

2.2 Where a possible quantitative change in noise level is to be assessed, it is essential to ensure that the most appropriate noise metrics, sampling periods and survey duration are used. For example, it would be inappropriate to assess the level of change in noise likely to occur following the introduction of a bus depot into a suburban area by comparing the predicted $L_{A10,18h}$ with existing $L_{A10,18h}$ noise levels; when the main noise level changes are likely to arise due to large numbers of buses leaving, or returning, to the depot over shorter periods of time outside the standard 0600 to 2400 time period.

2.3 A qualitative noise change may be described in various ways. Typically, a useful qualitative guide when assessing noise impacts is whether or not there are likely to be changes in behaviour as a consequence of the noise generated by, associated with, or potentially impacting upon the proposed development, for example, will changes in the noise climate be such that it causes people to change their behaviour by closing windows, raising their voice or not using their gardens as before. The impacts can also be positive.

2.4 Before undertaking a noise impact assessment, it is important that the person undertaking the assessment has a thorough understanding of the project and its context. This would involve:

- understanding the nature of the development;
- understanding the nature and character of the prevailing noise environment;
- identifying all the potential new noise sources that will arise from the proposal, during the construction, operation and, where relevant, decommissioning phases;
- understanding the nature of the new noise sources that will arise from the proposal, including such features as tonal characteristics, intermittency, duration and timing (diurnally and seasonally)
- Identifying potential noise sensitive receptors.

related to the sensitivity of the receptor so that the significance of the noise level change can be determined. Hence, the significance of the noise impact at a particular receptor can be determined from the magnitude of the noise change and the sensitivity of that receptor to the change in noise. The magnitude of the noise level change can be assessed relative to an absolute threshold level or relative to the pre-existing ambient noise level.

2.6 Issues which may be relevant when considering noise in relation to a development proposal include:

- Type of development and likelihood of significant noise impact;
- Sensitivity of location (e.g. existing land uses, Noise Management Areas, Quiet Areas);
- Existing noise level and predicted change in noise level;
- Character (tonal, impulsivity etc), duration, the number of occurrences and time of day of noise that is likely to be generated; and
- Absolute level and possible dose-response relationships e.g. health effects, if robust data available.

2.7 When noise impact assessments are being prepared, the recommended approach is to consider both the likely level of noise exposure at the time of the application and any increase that may reasonably be expected in the foreseeable future using the most appropriate parameters. The extent to which it is possible to mitigate the adverse effects of noise should also be considered.

Assessment Methodology

2.8 The following sections set out a framework for assessing the noise impact(s) that could potentially arise when either:

- a noise source is planned to be developed or, an existing noise source is to be further developed - referred to as noise generating development (NGD);

or

- a noise sensitive development is planned or, an existing noise sensitive development is to be further developed - referred to as noise sensitive development (NSD).

Overview of Assessment Methodology

2.9 The assessment methodology consists of five stages which can be applied to either type of development described above (Paragraph 2.8). Although the processes within each stage may differ depending on the type of development, the final output from this process will be similar across all developments. Figure 2.1 shows a schematic diagram of the various stages in the assessment procedure.

2.10 ***Stage 1: Initial Process:*** The initial process requires the identification of all noise sensitive receptors (NSR) that may potentially be affected by the development and to prioritise each NSR according to their level of sensitivity. The following steps are then carried out for each NSR

2.11 ***Stage 2: Quantitative Assessment:*** The procedure within a quantitative assessment depends on the type of development i.e.NGD or NSD. The final procedure in this stage is to determine the magnitude of the impact.

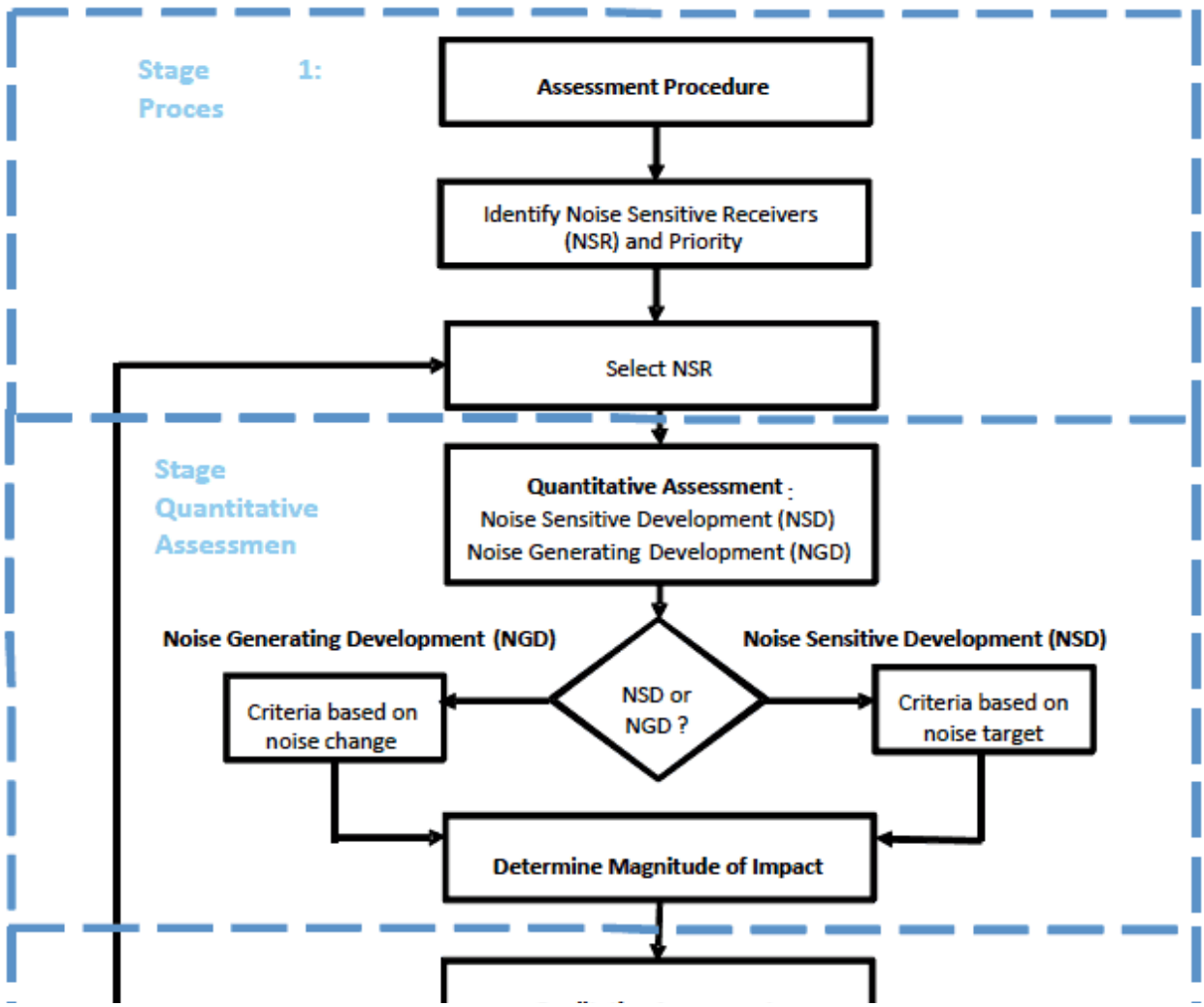
2.12 ***Stage 3: Qualitative Assessment:*** A qualitative assessment allows additional factors to be included in the assessment procedure to augment the quantitative evaluation. The outcome from this process allows the magnitude of impacts determined from the quantitative assessment to be adjusted accordingly.

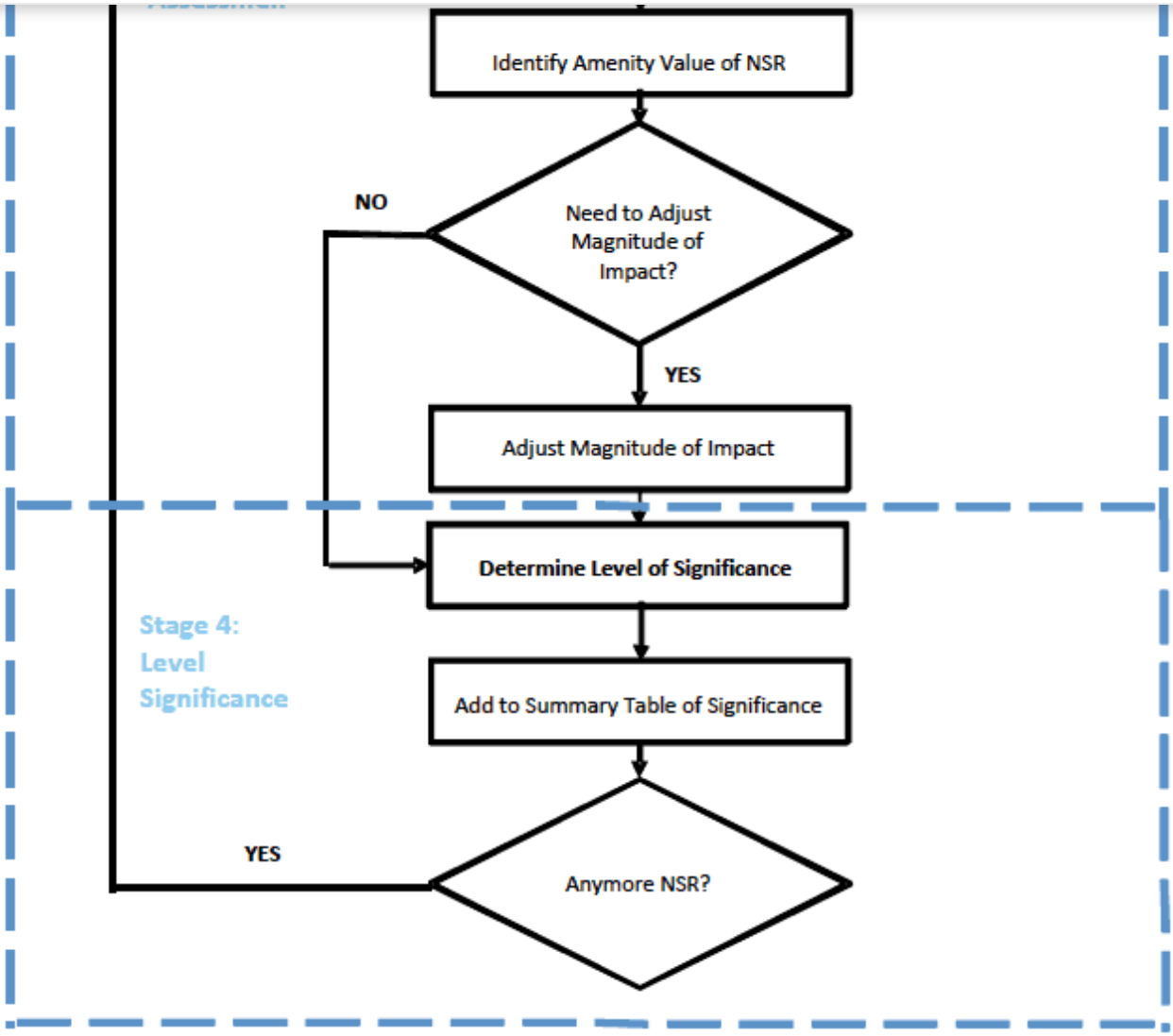
2.13 ***Stage 4: Level of Significance:*** The level of significance of the noise impact at the NSR is obtained through the relationship of the receptor's sensitivity to noise and the magnitude of the noise impact. The result of this process is entered into the Summary Table of Significance of Noise Impacts.

2.14 Stages 2, 3 and 4 are repeated for each NSR.

2.15 ***Stage 5: The Decision Process:*** The number of noise sensitive receptors within each level of significance is totalled to complete the Summary Table of Significance. The Summary Table will normally form only part of the information required to inform the decision process when applying for planning permission.

Figure 2.1: Flow Chart of Assessment Procedure





Details of Assessment Procedure

2.16 The following provides further details of the procedures for each of the stages comprising the assessment procedure.

Stage 1: Initial Process

2.17 The initial process is to identify all noise sensitive receptors which are likely to be adversely affected by the development.

2.18 For noise generating developments (NGD), it may be sufficient to identify the nearest noise sensitive receptors. However, in general, the distance over which a noise source may have a significant impact on NSRs will depend on the magnitude of the noise source, the existing noise level and the influence of site features on sound propagation.

2.19 Generally, in the case of noise sensitive developments (NSD), the noise sensitive receptors will be those associated with the development. Although other noise sensitive receptors may be identified in cases where a noise sensitive development adversely affects existing noise sensitive receptors due, for example, to an increase in traffic associated with a planned large housing development.

2.21 There are three levels of sensitivity 'High', 'Medium' and 'Low'. The ranking is primarily based on the relationship between the amenity associated with a NSR and its susceptibility to noise. NSR's which have amenities associated with low noise levels, such as residential properties, are allocated with a 'High' level of sensitivity, whereas nightclubs would be allocated with a 'Low' level of sensitivity.

2.22 This stage is completed when all NSRs have been allocated a level of sensitivity as illustrated in Table 2.1.

Table 2.1: Level of Sensitivity Associated with Various Examples of NSRs

Sensitivity	Description	Examples of NSR
High	Receptors where people or operations are particularly susceptible to noise	• Residential, including private gardens where appropriate. • Quiet outdoor areas used for recreation • Conference facilities • Theatres/Auditoria/Studios • Schools during the daytime • Hospitals/residential care homes • Places of worship
Medium	Receptors moderately sensitive to noise, where it may cause some distraction or disturbance	• Offices • Bars/Cafes/Restaurants where external noise may be intrusive. • Sports grounds when spectator noise is not a normal part of the event and where quiet conditions are necessary (e.g. tennis, golf, bowls)
Low	Receptors where distraction or disturbance from noise is minimal	• Buildings not occupied during working hours • Factories and working environments with existing high noise levels • Sports grounds when spectator noise is a normal part of the event • Night Clubs

Stage 2: Quantitative Assessment

2.23 The procedure in carrying out a quantitative assessment depends on the type of development.

2.24 In the case of a noise generating development (NGD), a quantitative assessment will be based on the change in noise climate before and after the new noise is introduced.

2.25 For a noise sensitive development (NSD), a quantitative assessment will be based on comparing an absolute noise level with an appropriate noise target.

2.26 Irrespective of which type of development is under consideration, a common method for assessing the magnitude of noise impacts needs to be established.

2.27 To assist in this common approach the following descriptors and the corresponding generic criteria, as shown in Table 2.2, provides a classification of magnitude on noise impacts.

Table 2.2 Classification of Magnitude on Noise Impacts

Descriptors for Magnitude of Impact	Generic Criteria of Descriptor
Major	Loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features or elements (Adverse).
	Large scale or major improvement of resource quality; extensive restoration or enhancement; major improvement of attribute quality (Beneficial).
Moderate	Loss of resource, but not adversely affecting the integrity; partial loss of/damage to key characteristics, features or elements (Adverse).
	Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality (Beneficial).
Minor	Some measurable change in attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements (Adverse).
	Minor benefit to, or addition of, one (maybe more) key characteristics, features or elements; some beneficial impact on attribute or a reduced risk of negative impact occurring (Beneficial).

	elements (Adverse).
	Very minor benefit to or positive addition of one or more characteristics, features or elements (Beneficial).
No change	No loss or alteration of characteristics, features or elements; no observable impact in either direction.

2.28 The following examples illustrate how this process may be applied to either a noise generating development (NGD) or a noise sensitive development (NSD).

Noise Generating Development

2.29 This example deals with the situation where a new road is planned near to residential properties. To assist in developing an appropriate classification of the magnitude of noise impacts, advice from the Highway Agency *Design Manual of Road and Bridges* is sought.

2.30 The classification of the magnitude of noise impacts is shown in Table 2.3 and is based on the change in the noise index $L_{A10,18h}$ dB.

Table 2.3: Example of Associating Changes in Noise Levels with Magnitudes of Impacts for a New Road in a Residential Area.

Change in Noise Level, x $L_{A10,18h}$ dB	**Magnitude of Impact**
x = 5	Major adverse
3 = x < 5	Moderate adverse
1 = x < 3	Minor adverse
0 < x < 1	Negligible adverse
x = 0	No change
-1 < x < 0	Negligible beneficial

-5 < x = -3	Moderate beneficial
x = - 5	Major beneficial

Noise Sensitive Development

2.31 In this example, a housing development is planned where the impact from a nearby road is to be assessed. The impact of the noise from road traffic during the day is to be assessed. A target noise level of 55 $L_{Aeq,16h(07:00 - 23:00)}$ dB (free-field facade level) based on WHO precautionary guideline value for serious noise annoyance has been selected as appropriate.

2.32 Table 2.4 shows the classification of the magnitude of noise impacts based on the difference in noise between the existing noise level and the target noise level.

Table 2.4: Example of Associating Exceedance Noise Levels with Magnitudes of Impacts for a New Residential Area.

(Existing - Target [1]) Noise Level, x $L_{Aeq,16h(07:00-23:00)}$ dB	**Magnitude of Impact**
x = 10	Major adverse
5 = x < 10	Moderate adverse
3 = x < 5	Minor adverse
0= x < 3	Negligible adverse
x < 0	No change

1 In this example the target noise level is 55 $L_{Aeq,16h(07:00-23:00)}$ dB

Stage 3: Qualitative Assessment

2.33 A qualitative assessment is based on perception and how noticeable the noise impact is in

2.34 Where a new noise source is planned, then, the assessment will be based on the effect the new noise climate may have on the amenity value of the existing noise sensitive receptors.

2.35 Where a new noise sensitive receptor is planned the assessment will be based on the effect the existing noise climate may have on the amenity value of the proposed development.

2.36 The aim of the qualitative assessment is to provide additional information which may support the outcome under the quantitative assessment or indicate that the classification of the magnitude of the noise impact needs to be modified.

2.37 To assist in this process it is important to understand the extent to which the noise impact affects the amenities associated with the noise sensitive receptor under consideration. For example, in the case of residential properties, the associated amenities would include qualities which are conducive to:

- undisturbed sleep;
- ability to relax;
- ability to concentrate i.e. reading-listening to radio/ TV;
- able to converse;
- use of outdoor facilities - garden etc

2.38 The initial step in carrying out a qualitative assessment is to understand what impact the noise will have on the amenities associated with the NSR in regard to the perception of noise.

2.39 Table 3.5 shows an example of the relationship between perception and the impact of noise on the amenities associated with residential properties.

2.40 As the noise becomes more noticeable, the level of disruption increases leading to significant changes in behaviour with a subsequent loss in the amenities associated with the NSR.

2.41 In order for a qualitative assessment to assist in supporting or modifying the outcome reached from the quantitative assessment, descriptors for the qualitative impacts that correspond with those used for assessing the magnitude of impacts need to be assigned.

2.42 An example of this process is illustrated in Table 2.5, for the purposes of noise impacts on residential properties.

2.43 A similar process would need to be derived for noise impacts associated with other types of NSRs which may have different types of amenities. For example, a designated area of Special Scientific Interest may have amenities associated with protecting bird populations. To construct a table similar to that shown in Table 2.5 would require advice from relevant specialists.

Table 2.5: Example of Assigning Descriptors for Qualitative Impacts from Noise on Residential Properties.

		for qualitative impact
Noticeable (Very disruptive)	Significant changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm.	Major
Noticeable (Disruptive)	Causes an important change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in character of the area.	Moderate
Noticeable (Mildly intrusive)	Noise can be heard and may cause small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; closing windows more often. Potential for non-awakening sleep disturbance. Can slightly affect the character of the area but not such that there is a perceived change in the quality of life.	Minor
Just Noticeable (Non intrusive)	Noise can be heard, but does not cause any change in behaviour or attitude, e.g. increasing volume of television; speaking more loudly; closing windows. Can slightly affect the character of the area but not such that there is a perceived change in the quality of life.	Negligible
Not noticeable	None	No Impact

2.44 Part of the process in carrying out a qualitative assessment is to ensure that the quantitative assessment has been comprehensively carried out when assessing noise impacts on all the amenities associated with the NSR under consideration.

2.45 Generally, a quantitative assessment, based on a simple change in noise level, in the case of a NGD or comparison with a target noise level for NSD, is not adequate in addressing the noise impact on all the amenities associated with a particular NSR.

2.46 For example, in the case of a NGD such as a new road where an assessment of the noise impacts on residential properties is to be carried out, the magnitude of impact may have been determined as 'minor adverse'. If this assessment is based on the change in the noise index, $L_{A10,18h}$ dB, noise impacts during the night time period would not have been fully addressed.

2.47 If there is insufficient data to carry out a quantitative assessment of night time levels, then a

concerns that the subsequent noise impact may cause sleep disturbance. A qualitative assessment would then consider whether the classification of the magnitude of impact derived from the quantitative assessment was in agreement with the corresponding descriptor associated with the quality impact shown in Table 2.5. If there was sufficient evidence to indicate that the noise impact at night was likely to cause sleep disturbance, then the magnitude of impact derived from the quantitative assessment indicating only a minor adverse impact may need to be changed to 'moderate' or 'major' depending on the judgement of the assessor.

2.48 A qualitative assessment will need to consider several factors that influence the impact of noise on the NSR to supplement the quantitative assessment. These factors, which are both qualitative and quantitative, are listed as follows:

- Averaging time period
- Time of day
- Nature of sound source (intermittency)
- Frequency of occurrence
- Spectral characteristics
- Absolute level
- Influence of noise indicator

2.49 Appendix 2 provides some information on how these factors may influence the modification of the magnitude of impacts derived from the quantitative assessment.

2.50 The outcome from Stage 3 is to establish the magnitude of impact from noise on the NSR under consideration by carrying out a more comprehensive assessment than that based on a simple quantitative assessment.

Stage 4: Level of Significance

2.51 This next stage considers the level of significance the noise impact has on the decision process. Table 2.6 provides a framework in determining the level of significance relating the magnitude of impact with the sensitivity of the receptor.

Table 2.6: Significance of Effects

Magnitude of Impact	**Level of Significance Relative to Sensitivity of Receptor**		
	Low	**Medium**	**High**
Major	Slight/Moderate	Moderate/Large	Large/Very Large

Minor	Neutral/Slight	Slight	Slight/Moderate
Negligible	Neutral/Slight	Neutral/Slight	Slight
No change	Neutral	Neutral	Neutral

2.52 The level of significance and its relevance to the decision making process is explained as follows:

Very Large: These effects represent key factors in the decision-making process. They are generally, but not exclusively, associated with impacts where mitigation is not practical or would be ineffective.

Large: These effects are likely to be important considerations but where mitigation may be effectively employed such that resultant adverse effects are likely to have a Moderate or Slight significance.

Moderate: These effects, if adverse, while important, are not likely to be key decision making issues.

Slight: These effects may be raised but are unlikely to be of importance in the decision making process.

Neutral: No effect, not significant, noise need not be considered as a determining factor in the decision making process.

2.53 At the end of this stage the noise impact on the NSR will be allocated a level of significance which is entered into a Summary Table of Significance as shown Table 2.7.

Table 2.7: Summary Table of Significance

Level of Significance	**Number of NSRs**		
	Low	**Medium**	**High**
Large/Very Large			
Moderate/Large			

Slight/Moderate	
Slight	
Neutral/Slight	
Neutral	

2.54 The procedures described under Stages 2, 3 and 4 are then repeated for all the NSRs under consideration.

Stage 5: The Decision Process

2.55 Part of the decision process will include a completed Summary Table of Significance which provides an overview of the level of significance of the noise impact on all NSRs.

Noise Measurements

2.56 Generally noise measurements will be made in order to characterise the existing noise environment or to determine specific noise levels at one location so that predictions of noise levels likely to be generated at proposed developments can be made. For the former it is necessary to have a clear understanding of the existing environment. This will usually require the measurement of baseline noise levels at times of the day, night, week, season or year when the proposed project is likely to have an impact. Reasonable worst case impacts are normally considered. When undertaking environmental measurements, reference should normally be made to BS 7445-1:2003 *Description and measurement of environmental noise. Guide to quantities and procedures for information in relation to the description and measurement of environmental noise; or* the specific requirements of other guidance where appropriate e.g.BS 4142. For the latter case the level of noise expected to be generated by the different activities associated with the proposed project must be predicted. Where relevant, empirical noise prediction methodologies, such as CRTN[1] and CRN[2], are often employed to predict noise. When using these or other standard empirical prediction methods the guidance within these documents should be followed or, where deviations from the standard have occurred, reasons for, and consequences of, deviating from the standard should be explained, and any subsequent uncertainties in the predictions of noise levels quantified.

Microphone Location and Orientation

2.57 There are two conventions in the presentation of environmental data, one which takes account of the effect of the presence of building facades (known as facade levels), the other does not (the results being known as free-field). Free-field noise levels are equivalent to the levels that

ground). Unless otherwise required by a specific prediction methodology free-field measurements and predictions are preferred.

2.58 Generally, for the determination of ambient noise levels and also for the purposes of prediction, measuring locations should be between 1.2 and 1.5 metres above the ground for a single storey development and between 1.2 to 1.5 metres above the proposed internal floor level for each additional storey. Levels of noise from road and rail traffic are often specified as one metre from a facade, and these facade levels should be assumed to be 2.5 dB(A) higher than levels measured away from the influence of acoustics reflections from buildings etc (i.e., free-field), unless more accurate noise levels are available. For aircraft, the noise levels refer to aircraft noise exposure contour values (summer average $L_{Aeq,16h}$) that are specified at 1.2 metres above the ground and published at 3dB intervals. Because most aircraft noise originates from above, contours include the effects of ground reflection. For aircraft noise the effect of the height of the proposed development is not normally relevant.

Noise Monitoring Locations

2.59 Normally any noise limits associated with a proposed development are chosen to protect the nearest noise sensitive premises exposed to the specific noise source. Therefore, in general, the appropriate noise monitoring location(s) will be outside the sensitive premises. However, this does not mean that the monitoring point should always be adjacent to the most exposed sensitive premises. This is because, usually, any noise limits refer to noise from specific noise sources and not to the total measurable noise level at a particular location that may, for example, be exposed to extraneous transportation noise. In situations where extraneous noise makes monitoring difficult, it may be prudent to select a monitoring location near to the boundary of the site/property, rather than adjacent to the premises most likely to be affected by noise. This approach requires that the proxy monitoring location provides a reliable and representative noise level from the specific noise source which can then be used to calculate the specific noise level at the relevant noise sensitive premises using the appropriate prediction method for the specific noise source. Ideally, noise monitoring locations should be selected such that they are accessible to all parties concerned.

Day and Night-time Periods

2.60 The recommended time periods are 07.00-23.00 for daytime and 23.00-07.00 for night-time.

Instrumentation

2.61 All instrumentation should comply with the current versions:

IEC 61672 - *Electroacoustics - Sound level meters Parts 1, 2 and 3*;

IEC 61260 - *Electroacoustics - Octave-Band and Fractional-Octave-Band Filters*;

IEC 60942 - *Electroacoustics - Sound calibrators*.

Weather Effects

example, greater than about 50 metres). The size of these effects usually increases with distance from a source, but are hard to predict, and so measurements should be made under reasonably stable adverse conditions. A suitable condition is a light wind with a vector component up to 2 m/s from source to receiver; this will increase the noise level by about 2 dB(A) compared with the still conditions. Measurements should also be carried out under dry conditions and, in the case of road traffic, when the road surface is dry.

Noise Indices

2.63 Because noise levels and frequency content may vary over time, many indices have been developed to describe noise levels. The equivalent continuous noise level over a time period T ($L_{Aeq,T}$) has emerged as a good general purpose index for environmental noise. For road traffic noise $L_{A10,18h}$ is still widely used; and to describe background noise the $L_{A90,T}$ is appropriate noise metric. For those noises characterised by definite tonal characteristics the use of Noise Rating (NR) may be applicable. These should not, however, be used to measure noise that is irregular or impulsive in character. To describe the sound insulation of a component of a building envelope (e.g. a window) BSENISO 717-1 *Acoustics Rating the sound insulation in buildings and of building elements. Airborne sound insulation* is appropriate. It is more difficult to specify the insulation of the whole building envelope because the value depends on different insulation values for the various building elements such as windows, walls and roof structure, as well as the type of noise source and its location. All noise metrics are explained in the Glossary to this document. Additional information in relation to units used in the measurement of environmental noise may be found in BS 7445-1:2003: *Description and measurement of environmental noise. Guide to quantities and procedures*.

NEXT
Chapter 3: Appropriate NIA Methodology

PREV
Chapter 1: Introduction

CONTACT

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Appendix C WSP Correspondence

Matthew Barlow

From: Jefferson, Keith <Keith.Jefferson@wsp.com>
Sent: 05 March 2019 14:03
To: Matthew Barlow
Subject: Lake Lothing Third Crossing - Noise at Trinity House

Matthew,

Further to our telephone conversation yesterday, I have set out below a summary of the items that we discussed. Please let me know if you think there are any items that have been missed or misrepresented, or if there are any points that you wish to add.

1. The purpose of me contacting you was to discuss, in principle, an outline methodology for undertaking noise measurements at Trinity House prior to the Scheme construction and after Scheme opening. We noted and discussed a number of practicalities that would need to be discussed in further detail before any kind of detailed methodology could be produced, and hence the notes below only form an outline methodology. The method for assessing the results of the measurements was not discussed in any detail and would need to be agreed at a later date.
2. We agreed that the measurements undertaken within Trinity House should include periods when the building is unoccupied and the building services / ventilation systems are not operational, in order that measurements of external / traffic noise ingress, unaffected by other noise sources, can be undertaken.
3. We also discussed the possibility of undertaking measurements when the building is occupied. We noted that it would be difficult to control the relative influence of human generated noise in the pre-Scheme and post-Scheme scenarios, and also that there is no agreement as to how this data would be used (the method for assessing the results would need to be agreed at a later date). However, we accepted that it is never a bad thing to have too much measurement data and that such measurements could usefully be undertaken if possible.
4. We also discussed the possibility of measurements being undertaken with the building services / ventilation systems on and off. It was agreed that this would provide additional useful data and that it should be measured if possible.
5. We agreed in principle that further measurements could be undertaken externally, but noted the practicalities of getting a microphone position outside the upper storey windows.
6. We agreed that the internal measurements should cover multiple positions within the building.
7. In terms of duration, we agreed that individual measurements as specific measurement positions need be no longer than 1 hour duration. We discussed and agreed that the measurements should be undertaken over, say, two or three evenings (or two or three days) in order to obtain a representative data sample.
8. We agreed that internal measurements should be undertaken following the guidance set out in the ANC Guidelines Noise Measurements in Buildings: Part 2: Noise from External Sources and/or other ANC guidelines that may be applicable (including the guidance on minimum distances from walls and other large reflecting objects etc.).
9. We discussed the need to make sure that the traffic conditions were representative and the possible need to get some traffic counts for the survey period (this might need only be manual traffic counts for the few hours of the survey, noting that the surveys might need to be undertaken over 2 or 3 evenings or days).
10. The items that we discussed only form the outline of a methodology in principle, and there are several practicalities that would need to be considered and agreed at a later time.

As noted above, there are several practicalities that would need to be sorted out. I think the next step would be for me to draft a proposed methodology for discussion / comment – I will aim to do this by the beginning of next week.

Any comments on the above would be gratefully received.

Regards,

Keith Jefferson ***MSc MInstP CPhys MIOA***
Associate Director

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APPENDIX 2 PBA REPORT (MARCH 2019) – ADDITIONAL TRANSPORT/HIGHWAYS RESPONSES ON BEHALF OF NWL

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now part of

Application by Suffolk County Council for an Order Granting Development Consent for the Lake Lothing Third Crossing (Lowestoft)

Development Consent Order 201(…)

Planning Inspectorate Reference TR010023

Additional Transport/Highways Responses on behalf of Northumbrian Water Limited (Deadline 7)

On behalf of **Northumbrian Water Limited**

Project Ref: 42498/001 | Date: March 2019

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Document Control Sheet

Project Name: **Lake Lothing Third Crossing (Lowestoft) DCO**

Project Ref: **42498**

Report Title: **Additional Transport/Highways Responses on behalf of Northumbrian Water Limited (Deadline 7)**

Date: **March 13th 2019**

	Name	Position	Signature	Date
Prepared by:	Nigel Fern	Associate	*N Fern*	13/03/2019
Reviewed by:	Phil Edwards	Principal Engineer	*P Edwards*	13/03/2019
Approved by:	Ron Henry	Director Midlands and East	*R Henry*	13/03/2019
For and on behalf of Peter Brett Associates LLP				

Revision	Date	Description	Prepared	Reviewed	Approved

This report has been prepared by Peter Brett Associates LLP ('PBA') on behalf of its client to whom this report is addressed ('Client') in connection with the project described in this report and takes into account the Client's particular instructions and requirements. This report was prepared in accordance with the professional services appointment under which PBA was appointed by its Client. This report is not intended for and should not be relied on by any third party (i.e. parties other than the Client). PBA accepts no duty or responsibility (including in negligence) to any party other than the Client and disclaims all liability of any nature whatsoever to any such party in respect of this report.

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1 Introduction

1.1 Introduction and Background

1.1.1 This report has been prepared by Peter Brett Associates ("PBA", now part of Stantec) on behalf of Northumbrian Water Limited ("NWL[1]") in relation to the Lake Lothing Third Crossing DCO. It follows a review of the Deadline 4 submission by Suffolk County Council ("SCC" – the Applicant) and subsequent additional information provided by SCC to PBA.

1.1.2 This report provides a summary of the latest position on transport/highways issues (at the time of writing this report) and timeline of events.

1.1.3 The review is based on the following main documents submitted at Deadline 4 by the Applicant:

- Document SCC/LLTC/EX/51: *Applicant's Response to Written Representations and Interested Parties Responses to Written Questions*
- Document SCC/LLTC/EX/69: *Proposed Non-Material Changes to the Application*

1.1.4 The above documents provided a response to Written Representations made by Bryan Cave Leighton Paisner LLP on behalf of NWL, which contained in Appendix 1 a report prepared by PBA entitled '*Transport/Highways Supporting Evidence'* (January 2019). The Applicant prepared a sensitivity test for Deadline 4 to reassess capacity of the proposed Waveney Drive / New Access Road ghost island priority junction.

1.1.5 The review also considers a second sensitivity test undertaken by the Applicant (dated March 6th 2019) in response to PBA's queries to the Deadline 4 sensitivity test. This second sensitivity test has not been formally submitted to the Examining Authority at the time of preparing this report, but is included here at Appendix 3.

1.1.6 This report provides a review and response to the Applicant's Deadline 4 submission material and second sensitivity test. The specific Issue Numbers PBA identified were:

- HT4 - Waveney Drive increase in traffic
- HT5 - Waveney Drive link capacity
- HT6 - New Access Road / Waveney Drive Priority Ghost Island Junction
- HT7 - Rail level crossing on B1531 Victoria Road
- HT8 - Proposed New Access Road / New Canning Road Priority Junction
- HT9 - Junction visibility splays at the Proposed New Access Road / New Canning Road Priority Junction
- HT10 - New Access Road 90 degree bend
- HT11 - Stopping up of Canning Road junction with Riverside Road
- HT12 - Canning Road accessibility

[1] Essex & Suffolk Water is the trading name for NWLs operations in the east of England

- HT13 - Pedestrian crossings on Waveney Drive
- HT14 - Car parking on Riverside Road and Canning Road
- HT15 - HGV impact (during construction)
- HT16 - HGV trip distribution and assignment (during construction)
- HT17 - Abnormal HGV loads

2 Timeline Summary of Events

2.1.1 This section provides a summary timeline of events in respect of transport/highways submissions.

September 2018

Bryan Cave Leighton Paisner LLP on behalf of NWL submitted relevant representations to the application setting out a summary of initial comments and concerns with the Scheme on the operation of Trinity House on 21st September 2018. These representations identified a number of transport and highways concerns.

November 2018

The Applicant provided an initial response to the representations made in September 2018 in Document SCC/LLTC/EX/2: Response to Relevant Representations of 20th November 2018.

January 2019

For Deadline 3 (January 8th 2019), formal Written Representations were made by Bryan Cave Leighton Paisner LLP on behalf of NWL, which contained in Appendix 1 a report prepared by PBA entitled '*Transport/Highways Supporting Evidence'* (January 2019) (standalone report). This report set out identified issues with the Scheme. These specific Issue Numbers PBA identified were:

- HT4 - Waveney Drive increase in traffic
- HT5 - Waveney Drive link capacity
- HT6 - New Access Road / Waveney Drive Priority Ghost Island Junction
- HT7 - Rail level crossing on B1531 Victoria Road
- HT8 - Proposed New Access Road / New Canning Road Priority Junction
- HT9 - Junction visibility splays at the Proposed New Access Road / New Canning Road Priority Junction
- HT10 - New Access Road 90 degree bend
- HT11 - Stopping up of Canning Road junction with Riverside Road
- HT12 - Canning Road accessibility
- HT13 - Pedestrian crossings on Waveney Drive
- HT14 - Car parking on Riverside Road and Canning Road
- HT15 - HGV impact (during construction)
- HT16 - HGV trip distribution and assignment (during construction)
- HT17 - Abnormal HGV loads

It was understood that the Applicant was to submit updated transport/highways assessments at Deadline 3. Although this did occur, it did not contain any specific updated information relating to the issues raised by PBA.

January 2019

For Deadline 4 (January 29th 2019), the Applicant submitted the following relevant documents:

- Document SCC/LLTC/EX/51: Applicant's Response to Written Representations and Interested Parties Responses to Written Questions

- Document SCC/LLTC/EX/69: Proposed Non-Material Changes to the Application

The above documents provided a response to Written Representations made by Bryan Cave Leighton Paisner LLP on behalf of NWL, which contained in Appendix 1 a report prepared by PBA entitled 'Transport/Highways Supporting Evidence' (January 2019) at Deadline 3.

Document SCC/LLTC/EX/51 contained a sensitivity test to reassess the capacity of the proposed New Access Road / Waveney Drive priority ghost island junction.

February 2019

The Deadline 4 sensitivity test did not include the supporting model evidence and information with the submission for PBA to check/interrogate the assessment.

As a result, on February 12th 2019 PBA formally requested from SCC/WSP (Applicant's highways advisors) a list of the required supporting evidence and model technical data/outputs to review.

This evidence/information was supplied by SCC/WSP on February 25th 2019.

As a result, no further technical Written Submission was made by NWL on Deadline 5 (February 22nd 2019) until receipt of this evidence/information.

On February 28th 2019, PBA responded to SCC/WSP outlining further queries on the model evidence/information supplied supporting the sensitivity test. These principally related to the modelling of the proposed Waveney Drive / New Access Road ghost island priority junction.

March 2019

On March 6th 2019, WSP responded with a second sensitivity test Technical Note in response to PBA queries of February 28th 2019. This Technical Note was sent to PBA the day before the Issue Specific Hearing 2 Environmental Matters (March 7th 2019).

The Technical Note sought to address some of the queries raised by PBA. While it had not been possible to review the note in detail for the purposes of the Hearing, some high level points were identified. The Technical Note also raised new issues that the Applicant should review (as verbally outlined at the Hearing). More detailed queries were sent to SCC/WSP by PBA on March 8th 2019.

PBA are currently wait for a response to these queries, and those remaining outstanding from our February 28th 2019 email.

3 Summary of Specific Issues Identified by PBA

3.1 Introduction

3.1.1 This section provides a summary response by PBA to each of the Applicant's responses to the issues raised in the submitted Written Representations by NWL in terms of highways/transport.

3.2 Summary of Responses

3.2.1 PBA's response to each Issue Number is provided in Table 1 below.

3.2.2 Most of the issues raised are now resolved, either by providing further information to clarify PBA's concerns, or through Non-Material Changes to the design.

Table 1 – Summary of PBA responses to each Issue Number

Issue Number	Identified Issue	PBA Response
HT4	Waveney Drive increase in traffic (significant adverse effects on fear and intimidation and severance for pedestrians, and PBA requested a further controlled crossing is provided on Waveney Drive near the New Access Road junction)	The Applicant has stated that they have amended the draft DCO at Deadline 4 to provide for the detailed design of the highway constructed and improved by the Scheme be approved by the County Planning Authority (SCC), and this approval process would include the provision/location/type of crossings. Therefore, this issue should be revisited at the detailed design stage with effective consultation undertaken. PBA would maintain the view that a further controlled crossing of Waveney Drive near the access point is necessary since: i) traffic flow is forecast to double on Waveney Drive with significant severance identified in the ES ii) Waveney Drive is a wide road (>7.3m in width) making it difficult to cross iii) employees are still likely to park in the neighbouring residential area and across Waveney Drive iv) Riverside Business Park has a key sensitive receptor (Riverside Children and Families' Centre) located off Waveney Drive with associated vulnerable users. A suggested controlled crossing on Waveney Drive designed into the New Access Road junction should be achievable and still be within the Order Limits set.

Issue Number	Identified Issue	PBA Response
HT5	Waveney Drive link capacity	Resolved – the Applicant has responded and demonstrated that link capacity on Waveney Drive is within guideline limits. No further comments.
HT6	New Access Road / Waveney Drive Priority Ghost Island Junction	Chapter 4 of this report provides a greater review of this identified issue. Not resolved
HT7	Rail level crossing on B1531 Victoria Road	Resolved – further SATURN model flow difference plots have been provided. No further comments.
HT8	Proposed New Access Road / New Canning Road Priority Junction	Resolved – although PBA would note that the junction visibility envelope has been shown to be outside the Order Limits, on third party land (owned by SCC). No further comments.
HT9	Junction visibility splays at the Proposed New Access Road / New Canning Road Priority Junction	
HT10	New Access Road 90 degree bend	Resolved – Non-Material Change 8 The 90 degree bend has been replaced with a T junction through a Non-Material Change to the design in Deadline 4.
HT11	Stopping up of Canning Road junction with Riverside Road	Resolved – Non-Material Change 1 The Applicant has put forward a proposal for a turning head as part of Non-Material Changes to the Scheme at Deadline 4.
HT12	Canning Road accessibility	Resolved – the Applicant has provided further clarification, in that due to the presence of the bridge structure, it is not possible to retain the current pedestrian/cycle connectivity at ground level on Riverside Road. PBA would still note however that the first pedestrian/cycle access to the Business Park for users travelling from the east is via the 1.8m wide footway next to the Riverside Children and Families' Centre located off Waveney Drive. Pedestrians/cyclists could 'cut-through' Trinity House frontage and car park since this is on their desire line to the Business Park.
HT13	Pedestrian crossings on Waveney Drive	Same comments as HT4 above.

Issue Number	Identified Issue	PBA Response
HT14	Car parking on Riverside Road and Canning Road	Resolved – Non-Material Change 2 The Applicant has brought forward amended parking proposals, including additional on-street parking on Riverside Road and Canning Road. 51 on-street car parking spaces were to be removed. The proposed change will instead result in the retention of 36 spaces, none of which will be subject to time restrictions (15 spaces still lost overall).
HT15	HGV impact (during construction)	Resolved – PBA still believe there is some ambiguity in the wording/numbers of construction-related HGVs. However, this is short-term and temporary in nature, and should be controlled and managed effectively through the Code of Construction Practice which will include traffic management measures.
HT16	HGV trip distribution and assignment (during construction)	
HT17	Abnormal HGV loads	Resolved – No further comments.

3.2.3 With the exception of Issue Number HT6 (considered in detail in the next section), PBA has no further comments to make.

4 Issue Number HT6 – New Access Road / Waveney Drive Priority Ghost Island Junction

4.1 Introduction

4.1.1 This section reviews further sensitivity test technical work submitted by the Applicant as part of Deadline 4 and in response to PBA's queries in relation to the proposed New Access Road / Waveney Drive priority ghost island junction.

4.1.2 The review specifically relates to:

- Deadline 4 – Document SCC/LLTC/EX/51: *Applicant's Response to Written Representations and Interested Parties Responses to Written Questions*

  Appendix H – Sensitivity Test to re-assess capacity of Access Road / Waveney Drive Priority Ghost Island Junction

- A second sensitivity test issued directly to PBA on March 6th 2019 in relation to further queries raised by PBA to the Deadline 4 sensitivity test.

4.1.3 This review provides a summary of both sensitivity tests undertaken, and PBA's review and comments regarding the sensitivity tests.

4.1.4 To date, PBA has raised concerns (Issue Number HT6) that the proposed new access road junction with Waveney Drive (ghost island right turn lane priority T junction) may not be the most appropriate form of junction design (principally for capacity and safety reasons). This new junction will serve all the existing employment sites at Riverside Business Park (including Trinity House), and any future expansion at the Business Park since this will be the only point of vehicular access. The new junction is also intended to accommodate, in part, future growth at the Brooke Peninsula Jeld Wen development site. This new priority junction would have less capacity to accommodate traffic flows than the current signalised crossroads which is being replaced.

4.2 Applicant's First Sensitivity Test (Deadline 4)

Summary of Applicant's Sensitivity Test

4.2.1 The Applicant has undertaken a sensitivity test to assess the capacity of the New Access Road / Waveney Drive priority ghost island junction with updated assumptions regarding development in this area having regard to the progression of developments in the locality.

4.2.2 This involved producing revised traffic flow forecasts for the New Access Road. This more detailed approach to future traffic growth is considered to represent a more accurate forecast of potential flows, rather than applying generic growth derived from TEMPRO.

4.2.3 The revised forecast used the SATURN strategic traffic model and included:

- updated and detailed consideration of the Kirkley Waterfront and Sustainable Urban Neighbourhood site;

- future additional development at Riverside Business Park (including vacant plots).

4.2.4 PBA would note that there is no reference in the sensitivity test to observed traffic flows at the Business Park, and PBA's recorded higher December 2018 traffic count data. In both the AM and PM peak hours, the recorded traffic flows at the Business Park were higher than the July traffic flows supporting the Scheme. The highest recorded one-day had 16% more traffic in the AM peak hour, and 41% more traffic in the PM peak hour – which is significantly higher than the counts relied upon in the application documents.

Kirkley Waterfront and Sustainable Urban Neighbourhood site

4.2.5 The revised forecast flows are based on the following assumed development quanta at this site:

- 2022 – 130 residential dwellings (with 27 dwellings within the Jeld Wen site)

  25% of the Jeld Wen employment occupied (216 jobs)

- 2037 – all development at the redevelopment site

Riverside Business Park (future additional development)

4.2.6 The revised forecast flows are based on four significant sites at the Riverside Business Park as follows:

- Nexen (new office units)
- Waveney District Council office expansion (land adjacent the Registry Office)
- Land owned by Waveney District Council (port-related uses)
- Northumbrian Water Limited (NWL)

4.2.7 The sensitivity test has assumed NWL will double in size, and includes an additional 263 jobs (526 jobs in total).

4.2.8 The revised forecast flows for Riverside Business Park assumed the following additional development:

- 2022 – an additional 241 jobs overall
- 2037 – an additional 964 jobs overall

4.2.9 The sensitivity test states that to avoid double counting, the background traffic growth on the local highway network was adjusted accordingly.

Revised Traffic Flows

4.2.10 The resulting revised traffic flows are summarised in the table below. The observed December 2018 traffic flows on Riverside Road collected by PBA are also summarised in the table for reference and comparison. These are taken from PBA's '*Transport/Highways Supporting Evidence on behalf of Northumbrian Water Limited*' (January 2019) submitted as part of Deadline 3.

Table 2 – Summary of traffic flows entering/exiting New Access Road

Scenario		Traffic Flows (2-way) New Access Road	
		AM Peak Hour	PM Peak Hour
Observed 5th July 2017 (Riverside Road) (inc. Lings)		294	205
Transport Assessment	2022 Do Something	282	183
	2037 Do Something	326	211
Sensitivity Test	2022 Do Something	364	250
	2037 Do Something	611	429
Observed December 2018 (Riverside Road) (inc. Lings)		**Highest 1-day: 342 85th%: 327**	**Highest 1-day: 289 85th%: 259**

4.2.11 In summary, compared to the Applicant's submitted Transport Assessment (June 2018) for the Scheme, the sensitivity test includes:

- in 2022, a further 82 vehicles in the AM peak hour, and 67 vehicles in the PM peak hour
- in 2037, a further 285 vehicles in the AM peak hour, and 218 vehicles in the PM peak hour

4.2.12 PBA would comment that the sensitivity test appears to include significant extra traffic flow on the New Access Road, particularly in 2037.

Revised Junction Capacity Assessment Results

4.2.13 Revised junction capacity assessments of the New Access Road / Waveney Drive priority ghost island junction were carried in 2022 and 2037, as follows:

- 2022 –
  - i) New Access Road as a sole point of access to the Riverside Business Park and part built Jeld Wen site
  - ii) New Access Road with a further access to Waveney Drive from the Jeld Wen site (i.e., assumed to be two points of access)
- 2037 –
  - iii) New Access Road with further accesses to Waveney Drive from the Jeld Wen site

4.2.14 The revised junction capacity assessment model results show in 2022 and 2037 the proposed priority ghost island junction to operate within capacity in both the AM and PM peak hours. In 2037, the average delay per vehicle turning right out of the New Access Road in the PM peak hour is 23 seconds. As a result, the proposed priority ghost island junction arrangement remains unchanged.

4.3 PBA's Review of the First Sensitivity Test (Deadline 4)

4.3.1 PBA would comment that the stated assumptions/estimates of what future development could be occupied by 2022 and 2037 appear reasonable.

4.3.2 In order for PBA to check/interrogate the first sensitivity test, PBA requested sight of the supporting model evidence and information that would support the submission. This was requested by email on February 12th 2019. The email request is included in Appendix 1 for information.

4.3.3 WSP supplied the supporting model evidence on February 25th 2019.

4.3.4 PBA has interrogated the first sensitivity test modelling evidence/information supplied by WSP on February 25th 2019. PBA would make the following comments. All the comments would reduce the capacity of the proposed junction:

Business Park route assignment and turning flow proportions (Select Link Analysis plots)

4.3.5 The entering / exiting traffic flows on the New Access Road between the AM and PM peak hours appear odd and requires further explanation i.e., the predominant flow entering in the AM peak hour exits in the opposite direction (left in, left out). This pattern occurs in both the 2022 opening year model, and 2037 future year model.

4.3.6 In the AM peak hour, the predominant flow (60-70%) arriving to the New Access Road is from Waveney Drive west turning left in (the easiest and least conflicting movement).

4.3.7 In the PM peak hour, the predominant flow (60-70%) departing the New Access Road is to Waveney Drive east turning left out (the easiest and least conflicting movement).

4.3.8 Under normal circumstances, PBA would expect staff to depart in the same direction they arrived i.e., the predominant movement leaving is therefore to turn right out (or vice versa). This is the case with the current Business Park signalised junction, with the predominant flow (60-70%) arriving and departing from/to the Waveney Drive east (right turn in, left turn out).

4.3.9 Furthermore, it is not clear why the SATURN model in the AM peak is assigning significant levels of Business Park traffic entering via Kirkley Run and Colville Road, and not the main A12 Tom Crisp Way. These are residential roads with on-street parking, and do not seem appropriate. In the AM peak, the A12 Tom Crisp Way appears minimally used by the Business Park traffic, but is used as a route in the PM peak.

4.3.10 PBA are of the view that the PICADY assessment capacity model results show the design to be within capacity since these turning flow proportions have been applied – i.e., left in, left out which are the least conflicting movements at a priority junction. Clarity on this observation is required, since it would have a significant impact on the junction capacity assessment results should these turning proportions be different which PBA believe to be the case. This should be tested in PICADY to understand the implications of this to the capacity of the proposed junction. These turning movement proportions do not seem logical or realistic, and are unlikely to happen in reality (particularly based on current movements to and from the Business Park). To PBA, this would indicate issues with the chosen junction form and design.

Heavy Goods Vehicles (HGVs) (PICADY model)

4.3.11 In the PICADY model outputs, the HGV percentages on all turning movements are set at 0%. These should be entered or estimated in the PICADY model to understand the impacts on capacity.

4.3.12 From our December 2018 traffic counts of the Business Park, the existing observed HGV percentages are generally <1% on Riverside Road in AM and PM peak hours. Over a 24 hour period it is around 3%. On Waveney Drive the current HGV percentage is 1.5% over a 24 hour period. These HGV percentages are not considered that significant.

4.3.13 The Kirkley Waterfront and Sustainable Urban Neighbourhood site is a mixed-use development including 7.5 hectares of employment. This is around 30,000sqm of B1 office, B2 industry, B8 warehouse/distribution land use. The employment related development is proposed to be focused on the former Jeld Wen site, therefore accessing (in part) from the New Access Road. Therefore, there will be an element of HGVs generated from Jeld Wen site (B2 and B8 land uses) accessing this new junction which need to be included.

4.3.14 The inclusion of HGV percentages in the junction capacity assessment does have an effect on the capacity (i.e., reduces the capacity), but with these minor HGV percentages it is unlikely to have a significant effect on its own. This is more to ensure it is technically correct. Therefore, on its own, this is unlikely to make a significant difference to the junction capacity assessment results (but could do cumulatively with other changes).

4.3.15 The issue that would have the most significant impact on the junction capacity assessment results is the turning movement proportions (left in, left out) – detailed above.

Visibility from the Minor Road (PICADY model)

4.3.16 The visibility splays left and right from the New Access Road in the PICADY model have been set as:

Left – 10m x 150m

Right – 10m x 77m

4.3.17 PBA would note that the visibility measurement requirements for PICADY are different to the requirements set out in Highways England's DMRB TD 42/95 (*Geometric Design of Major/Minor Priority Junctions*), to which the junction will be designed in accordance with.

4.3.18 In accordance with the PICADY User Guide, the visibility distances for the minor road are measured from points 10m back from the give-way line. PBA would agree with the 'x' distance of 10m applied. However, in accordance with TD 42/95, the visibility requirements for a road subject to a 30mph speed limit is likely to be 4.5m x 90m. This visibility splay is what the junction and positioned highway boundary will be designed to, not the PICADY visibility measurements. In accordance with TD 42/95, providing too much visibility can be detrimental to highway safety.

4.3.19 PBA would need sight of a design drawing illustrating the TD 42/95 visibility splays and proposed location of the highway boundary to confirm if this level of visibility in the PICADY model is achievable and acceptable. PBA consider the visibility splays in the PICADY model are generous and would result in significant grass verge frontage. PBA would consider PICADY visibility splays for this junction to be around 10m x 50m.

Junction Form

4.3.20 Highways England's DMRB TD 42/95 (*Geometric Design of Major/Minor Priority Junctions*) contains guidance on when considering junction form (Figure 2/2).

4.3.21 For single carriageway roads, it shows approximately the various levels of T junction which may be applicable for different combinations of traffic flows. This takes account of geometric and traffic delays, entry and turning traffic flows, and collisions costs.

4.3.22 The figure is reproduced below, with an approximate indication (red cross) of where the New Access Road / Waveney Drive junction would lie, based on estimates made from the sensitivity test. This relates to estimated AADT (Annual Average Daily Traffic) on the major road (Waveney Drive), and the minor road (New Access Road), for the following scenarios:

- 2022 sensitivity test (which includes an element of the Jeld Wen site)
- 2037 sensitivity test (which includes all of the Kirkley Waterfront and Sustainable Urban Neighbourhood – but also a further additional junction to Waveney Drive)

Figure 1 – 2022 Do Something sensitivity test

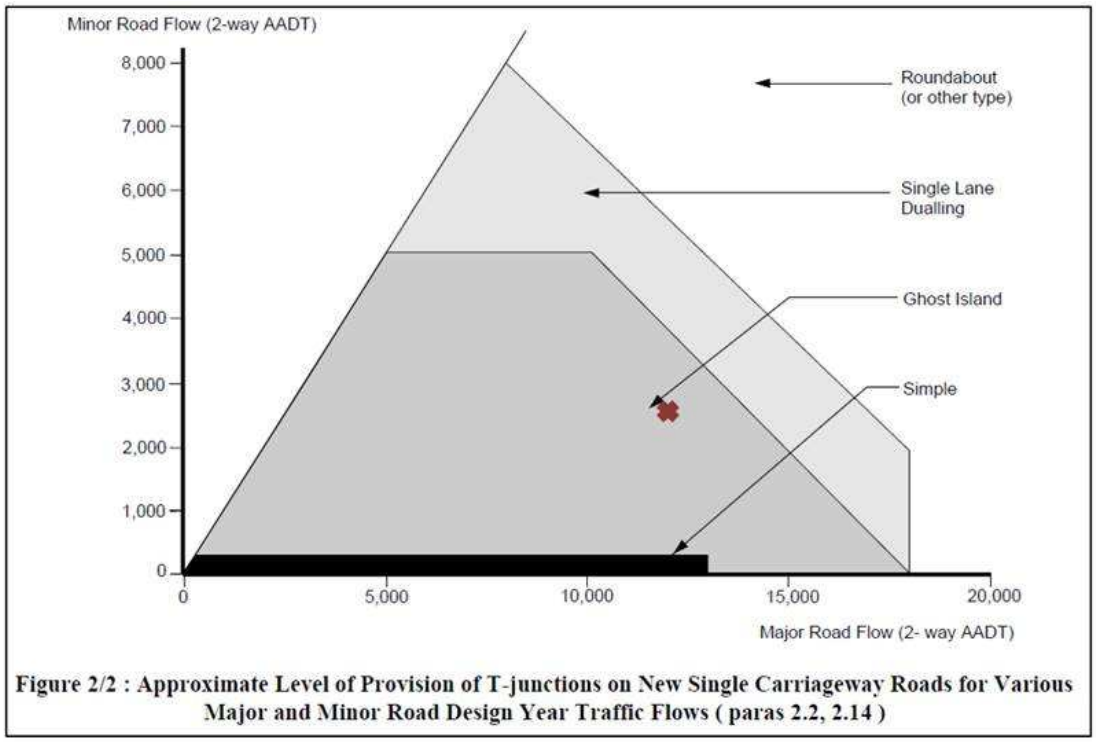
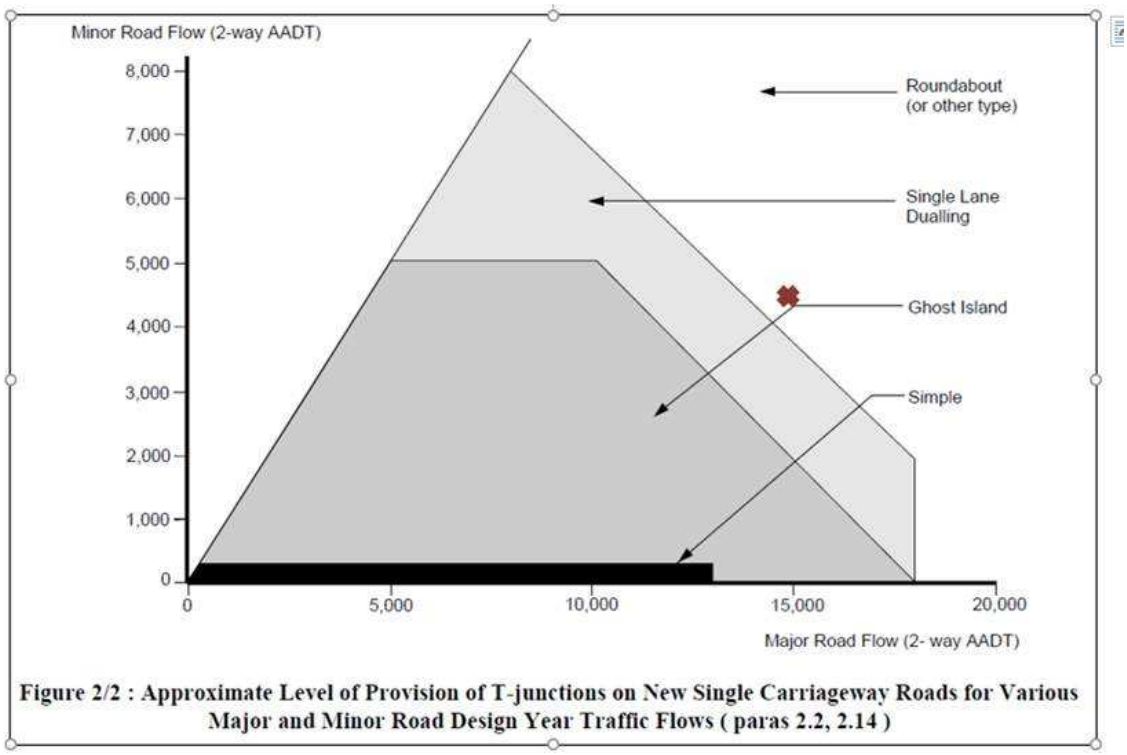


Figure 2/2 : Approximate Level of Provision of T-junctions on New Single Carriageway Roads for Various Major and Minor Road Design Year Traffic Flows (paras 2.2, 2.14)

Major Road flows (Waveney Drive) – 11,700 AADT in 2022 (14,267 from ES less 2,600 on minor arm)
Minor Road flows (New Access Road) – 2,600 AADT in 2022 estimated using ATC factor data

Figure 2 – 2037 Do Something sensitivity test



Major Road flows (Waveney Drive) – 14,280 AADT in 2037 (est. from model flows factored by 6)
Minor Road flows (New Access Road) – 4,420 AADT in 2037 estimated using ATC factor data

4.3.23 PBA would make the following comments:

i) **2022 Opening Year** – Figure 2/2 shows the approximate level of provision of T junction lies within the 'Ghost island' section (i.e. what is currently proposed). The reported junction capacity assessments for 2022 also show the junction performing satisfactorily in the opening year in the sensitivity test with extra traffic flows applied. The junction capacity assessment results are dependent on SCC clarifying the three points PBA have outlined above (including HGV %s, reduced visibility splays, and turning movement proportions). Even with these changes sought, PBA believe the junction form/design in the opening year is likely to be shown to operate within capacity.

Therefore, given the information/evidence PBA has seen (but subject to the queries being resolved), the junction form being proposed is unlikely to pose a capacity risk at the opening year. However, PBA would still state that priority junctions have less capacity than signal control junctions and roundabouts, therefore there will inherently be a worsening of position when compared to the current situation (i.e., this is a backwards step in junction form provision).

ii) **2037 Future Year** – Figure 2/2 shows the approximate level of provision of T junction lies within the 'Roundabout (or other type)' section, and lies far from the 'Ghost Island' section. With this sensitivity test, this demonstrates that a ghost island T junction may not be the most appropriate junction form for the future forecast traffic flows (in this 2037 sensitivity test scenario, the minor road flow has increased, but PBA has estimated that the major road flow on Waveney Drive would decrease from the previous assessment since growth has occurred on the minor arm).

While the 2022 opening year assessment appears reasonable, the issue arises when 15 years' growth is added on Waveney Drive, the Business Park, and the Jeld Wen site.

Although SCC has shown that the junction capacity assessment in 2037 operates within capacity, it is again dependent on SCC clarifying PBA's three points. The turning movement proportions could significantly affect the operation of the junction.

These results emphasise and support the approach put forward about designing the priority ghost island junction so that it can be upgraded to a traffic signal controlled junction in the future.

4.3.24 PBA would also state that as set out in paragraph 2.6 of TD 42/95, the design of the most appropriate type of junction form should be based on a wide range of factors, mainly design year traffic flows, the nature and proportions of large goods and passenger vehicles, geometric and traffic delays, entry and turning stream capacities, and collision costs. It is PBA's view that favourable junction capacity assessment results should not be the only reason for the choice of junction form. It should also be based on a consideration of the particular site characteristics such as the type of development.

4.3.25 Chapter 4 (Safety) states that a major/minor priority junction will usually have a higher collision rate than other junction types – the conversion of priority junctions to traffic signal or roundabout control has been shown to reduce collisions by 30% or more. Traffic signals are also safer for crossing pedestrians and cyclists.

4.3.26 The Applicant has stated that a signalised junction was considered, and not withstanding that it is not required, it was "*discounted due to safety issues in relation to residential property accesses opposite the former Jeld Wen site. Traffic leaving these properties would have become isolated between the signal stop lines and would have been unable to see the signal heads to safely exit. It was also considered to be inappropriate to stop the traffic on Waveney Drive in advance of the new crossing to allow priority to a minor access road (Document reference SCC/LLTC/EX/51).*"

PBA's Further Queries

4.3.27 In light of PBA's review of the first sensitivity test evidence, PBA queried the above four points with SCC/WSP. This was set out in PBA's email of February 28th 2019, and is included in Appendix 2 for information. In summary, these four queries related to the following:

- Business Park route assignment and turning flow proportions in the SATURN model
- Heavy Goods Vehicles (HGVs) inclusion in the PICADY modelling
- Visibility splays from the minor road (New Access Road)
- Junction form with reference to DMRB TD 42/95

4.4 Applicant's Second Sensitivity Test

4.4.1 On March 6th 2019, WSP responded with a second sensitivity test Technical Note SM6 in response to PBA queries of February 28th 2019. This Technical Note was submitted the day before the Issue Specific Hearing 2 Environmental Matters (March 7th 2019). This WSP Technical Note SM6 is included in Appendix 3.

Summary of Applicant's Sensitivity Test

4.4.2 The Applicant has undertaken a further (second) sensitivity test using the strategic SATURN model to discourage traffic flow using Kirkley Run and route via the more appropriate A12 Tom Crisp Way.

4.4.3 This sensitivity test results in a better route assignment and balance of turning movements at the Waveney Drive / New Access Road priority junction i.e. the predominant turning proportion in the AM peak hour is right in, and in the PM peak hour is left out. This also more closely matches existing observed turning movement proportions at the Business Park access.

4.4.4 The sensitivity test also includes HGV proportions to the PICADY modelling.

4.4.5 The PICADY model of the proposed junction was rerun, and the proposed ghost island priority T junction was shown to operate within capacity in 2022 opening year and 2037 future year.

PBA's Review of the Second Sensitivity Test

4.4.6 The second sensitivity test does appear to have resolved PBA's queries relating to the route assignment and turning flow proportions at the new junction, as well as incorporating appropriate levels of HGV proportions.

4.4.7 In terms of the revised junction capacity assessment results, with reference to the reported RFCs (Ratio of Flow to Capacity), PBA would agree that the proposed junction form in both the 2022 opening year and 2037 future year appears to operate within practical capacity (an RFC value of 0.85 represents when a junction is at practical capacity). However, PBA would make the following comments:

- in the 2037 future year there is around ½ minute delay to vehicles turning right out of the New Access Road during the peak hours, with a Level of Service (LoS) of D (Approaching Unstable Flow).

- the second sensitivity test does not appear to take account of PBA's queries on the junction visibility splays, and the observed December 2018 higher traffic counts.

4.4.8 Although the Technical Note addresses some of the queries raised by PBA, there are some outstanding queries remaining (observed traffic counts in December 2018, visibility splays, and junction form).

4.4.9 The second sensitivity test also raises new issues that the Applicant should review. The two sensitivity tests could have potential knock-on effects on other junctions locally, and other wider EIA disciplines (noise, air quality, etc) due to increased levels of traffic flows and different route assignments. In terms of junctions, the following two key junctions are of interest:

- Junction 6 – A12 Tom Crisp Way / A12 Horn Hill / B1531 Waveney Drive / Maconochie Roundabout

- Junction 18 – New Roundabout south of the Lake (Riverside Road / Waveney Drive)

4.4.10 This also includes implications due to potential alterations to the proposed Lings and Nexen access points, via a left in / left out access arrangement to Waveney Drive resulting in u-turning traffic at both roundabouts.

4.4.11 PBA note from the Transport Assessment (SCC/LLTC/EX/24 Revision 1 – January 2019) that Junction 18 above was shown to be over practical capacity (and almost at absolute capacity) in 2037 PM peak hour with an RFC of 0.99 with a queue of 23 PCUs, a maximum delay of 1 minute on the Waveney Drive eastbound entry arm, and a Level of Service (LoS) of F (Forced or Breakdown Flow) (with reference to the ARCADY assessments). PBA are keen to understand the impact of these two sensitivity tests on this junction (and the recorded higher observed traffic counts on Riverside Road in December 2018). PBA also note that the HGV percentages in the ARCADY model are set at 0% again, and should also be included as recently undertaken for the Waveney Drive / New Access Road junction.

4.4.12 These above queries were outlined to SCC/WSP by PBA on March 8th 2019 via email. PBA are currently wait for a response to these queries.

5 Summary and Conclusions

5.1.1 The Applicant has undertaken two sensitivity tests using the strategic SATURN model in light of PBAs comments, as follows:

- First Sensitivity Test – updated and more accurate assumptions regarding development and growth in the local area.
- Second Sensitivity Test – more realistic modelling of the Business Park traffic flow route assignment to and from the Park.

5.1.2 It is acknowledged that the Applicant's second sensitivity test resolves PBA's queries relating to the route assignment and turning flow proportions at the new junction, as well as incorporating appropriate levels of HGV proportions. As a result, the proposed junction form in both 2022 and 2037 appears to operate within practical capacity.

5.1.3 However, there are three outstanding issues that remain unresolved:

i) the second sensitivity test does not appear to refer to the observed traffic flows on Riverside Road in December 2018, which recorded higher observed flows than the Applicant's base survey data. In both the AM and PM peak hours, the recorded traffic flows at the Business Park were higher than the July traffic flows supporting the Scheme. The highest recorded one-day had 16% more traffic in the AM peak hour, and 41% more traffic in the PM peak hour – which is significantly higher than the counts relied upon in the application documents, and is contrary to the oral submissions by the Applicant at the Hearing stating this was not significant.

ii) the second sensitivity test does not appear to take account of PBA's queries on the generous junction visibility splays applied in the PICADY modelling.

iii) the Applicant has not commented upon the chosen junction form in with reference to DMRB's TD 42/95 Figure 2/2 guidance.

5.1.4 In addition, both the first and second sensitivity tests also raises new issues that the Applicant should review. The sensitivity tests have resulted in increased levels of traffic flow on the New Access Road and Waveney Drive. The sensitivity tests could have potential knock-on effects and implications on the following:

- Other junctions locally, mainly two roundabouts on Waveney Drive:
  - Junction 6: A12 Tom Crisp Way / A12 Horn Hill / B1531 Waveney Drive / Maconochie Roundabout
  - Junction 18: New Roundabout south of the Lake (Riverside Road / Waveney Drive)
- Other wider environmental disciplines during the operational phase, mainly:
  - Traffic and transport
  - Noise and vibration
  - Air quality

5.1.5 In terms of the two roundabouts, PBA note from the Transport Assessment (SCC/LLTC/EX/24 Revision 1 – January 2019) the following:

- Junction 6

  This roundabout was shown to be at practical capacity in the 2037 future year PM peak hour with an RFC of 0.89 with a queue of 7 PCUs, and a maximum delay of 21 seconds on the A12 Horn Hill entry arm (with reference to the ARCADY assessments).

- Junction 18

  This new roundabout was shown to be over practical capacity (and almost at absolute capacity) in 2037 future year PM peak hour with an RFC of 0.99 with a queue of 23 PCUs, a maximum delay of 1 minute on the Waveney Drive eastbound entry arm, and a Level of Service (LoS) of F (Forced or Breakdown Flow) (with reference to the ARCADY assessments). The roundabout was also shown to be at practical capacity on the same entry arm in the 2022 opening year with an RFC of 0.85.

  The new roundabout capacity assessment also excluded HGV percentages which should be included.

5.1.6 The Applicant should understand the impact of these two sensitivity tests on these roundabouts since they were shown to operate at capacity before these sensitivity tests were undertaken. These sensitivity tests could result in the roundabouts not operating within capacity.

5.1.7 This also includes implications due to potential alterations to the proposed Lings and Nexen access points, via a left in / left out access arrangement to Waveney Drive resulting in u-turning traffic at both roundabouts.

5.1.8 At this stage, PBA are still of the opinion that a priority ghost island junction form may not be the most appropriate and safest form of access to the Business Park. It may be that with these clarifications and changes, the proposed junction design is still shown to operate within capacity, but there remains a safety aspect to consider (as originally identified in the Road Safety Audit – Problem 1, Document 7.5 Design Report Appendix 8).

5.1.9 This is the only vehicular access to Riverside Business Park (and Trinity House), and therefore needs to provide sufficient resilience and security of access to maintain operational facilities on the Business Park.

5.1.10 It is understood that the principal reason for discounting a signalised T junction was due to safety issues in relation to the private residential property accesses on Waveney Drive opposite the former Jeld Wen site i.e., private drive accesses within the junction arrangement. The Applicant has also stated that they do not want to implement a significantly oversized junction solution in the interim period, and before the new bridge crossing is open.

5.1.11 PBA would comment that similar safety issues would still be present with a priority ghost island junction e.g., with traffic entering these residential properties from the west needing to enter the right turn lane against opposing traffic. Furthermore, the safety issues of traffic to/from around 10 residential properties should be compared against the safety of around 300-400 vehicles trying to exit the New Access Road during a peak hour.

5.1.12 PBA believe the chosen junction form presents the greatest risk to the Business Park i.e. potentially needing to change the junction form in the future when developments come forward. Should the Applicant design the ghost island priority junction with no allowance for signal control (reserving the required surrounding land), fixing the New Access Road alignment, fixing the highway boundary, and land lock the junction, this could restrict a developer the ability to enhance the junction to signals in the future.

Appendix 1 – PBA email request to Applicant of February 12th 2019 for supporting model evidence

Nigel Fern

From: Nigel Fern
Sent: 12 February 2019 10:00
To: steven wood
Cc: Michael Wilks
Subject: Lake Lothing DCO - transport/highways information request

Dear Steven,

I refer to our recent telephone conservation.

As part of Deadline 4 submissions, Suffolk County Council submitted Document SCC/LLTC/EX/51: Applicant's Response to Written Representations and Interested Parties Responses to Written Questions. Contained within this document was Appendix H – 'Sensitivity Test to re-assess capacity of Access Road / Waveney Drive Priority Ghost Island Junction'.

Peter Brett Associates, acting on behalf of Northumbrian Water Limited, are currently reviewing the sensitivity test undertaken. However, it is difficult for PBA to review the sensitivity test, the analysis undertaken, and interpret the results and conclusions since insufficient supporting evidence and information has been provided with the submission i.e., there is no accompanying appendices containing the source data/information.

To aid our review of the submission, we would be most grateful if SCC could supply any of the following information:

- the revised 2022 and 2037 SATURN model strategic-level outputs (Do Something), in particular:
    - Actual Link Flow plots (AM / PM)
    - Delay plots (AM / PM)
    - V/C plots (AM / PM)
    - Select Link Analysis (origin and destination) plots of Riverside Business Park and the Jeld Wen site (AM / PM)
    - Junction turning movement plots for the New Access Road / Waveney Drive junction, and other new junctions on Waveney Drive from the Jeld Wen site (AM / PM)
    - Confirmation of how the New Access Road / Waveney Drive junction has been modelled in SATURN (saturation flows, parameters, etc) and any other new Waveney Drive accesses

- the supporting junction capacity assessment PICADY model outputs (2022 and 2037) for the Waveney Drive / New Access Road ghost island priority junction.

- the highway design drawing of the New Access Road / Waveney Drive ghost island priority junction (showing the visibility splays, and highway boundary) to check the PICADY geometries – if available yet.

The study area of interest is below, mainly Waveney Drive.

Kind regards,

Nigel Fern BSc(Hons) MSc DIC MCIHT
Associate Transport Planner

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Mobile: 07880 242459
nfern@peterbrett.com
Northampton

PBA has joined the Stantec family, find out more at peterbrett.com.

Appendix 2 – PBA email to Applicant of February 28th 2019 outlining queries with the sensitivity test

Nigel Fern

From: Nigel Fern
Sent: 28 February 2019 19:09
To: Johns, Michael; Michael Wilks (Michael.Wilks@suffolk.gov.uk)
Cc: Wood, Steven; Philip Edwards
Subject: RE: Lake Lothing DCO - transport/highways information request

Michael,

Many thanks for providing the model information and data we requested – this is much appreciated and has been most helpful.

We are still going through all the model information, but we have a few queries on the modelling which we would be most grateful for clarification on (set out below). These principally relate to the modelling of the proposed Waveney Drive / New Access Road ghost island priority junction.

Firstly, it is just worth noting that most of the issues PBA has raised are now resolved, either by providing further information to clarify our concerns, or through Non-Material Changes to the general arrangement design.

As mentioned in the request, we are reviewing this data on Northumbrian Water Limited's behalf, who currently have a call centre located at Riverside Business Park.

In terms of our queries, these are as follows based on the SATURN model plots and PICADY model:

1. **Business Park route assignment and turning flow proportions (Select Link Analysis plots)**

   The entering / exiting traffic flows on the New Access Road between the AM and PM peak hours appear odd and requires further explanation i.e., the predominant flow entering in the AM peak hour exits in the opposite direction (left in, left out) This pattern occurs in both the 2022 opening year model, and 2037 future year model.

   In the AM peak hour, the predominant flow (60-70%) arriving to the New Access Road is from Waveney Drive west turning left in (the easiest and least conflicting movement).

   In the PM peak hour, the predominant flow (60-70%) departing the New Access Road is to Waveney Drive east turning left out (the easiest and least conflicting movement).

   Under normal circumstances, PBA would expect staff to depart in the same direction they arrived i.e., the predominant movement leaving is therefore to turn right out (or vice versa). This is the case with the current Business Park signalised junction, with the predominant flow (60-70%) arriving and departing from/to the Waveney Drive east (right turn in, left turn out).

   Furthermore, it is not clear why the SATURN model in the AM peak is assigning significant levels of Business Park traffic entering via Kirkley Run and Colville Road, and not the main A12 Tom Crisp Way. These are residential roads with on-street parking, and do not seem appropriate. In the AM peak, the A12 Tom Crisp Way appears minimally used by the Business Park traffic, but is used as a route in the PM peak.

   PBA are of the view that the PICADY assessment capacity model results show the design to be within capacity since these turning flow proportions have been applied – i.e., left in, left out which are the least conflicting movements at a priority junction. Clarity on this observation is required, since it would have a significant impact on the junction capacity assessment results should these turning proportions be different which PBA believe to be the case. This should be tested in PICADY to understand the implications of this to the capacity of the proposed junction. These turning movement proportions do not seem logical or realistic, and are unlikely to happen in reality (particularly based on current movements to and from the Business Park). To PBA, this would indicate issues with the chosen junction form and design.

2. **Heavy Goods Vehicles (HGVs) (PICADY model)**

   In the PICADY model outputs, the HGV percentages on all turning movements are set at 0%. These should be entered or estimated in the PICADY model to understand the impacts on capacity.

3. Visibility from the Minor Road (PICADY model)

The visibility splays left and right from the New Access Road in the PICADY model have been set as:

Left – 10m x 150m

Right – 10m x 77m

PBA would note that the visibility measurement requirements for PICADY are different to the requirements set out in Highways England's DMRB TD 42/95 (*Geometric Design of Major/Minor Priority Junctions*), to which the junction will be designed in accordance with.

In accordance with the PICADY User Guide, the visibility distances for the minor road are measured from points 10m back from the give-way line. PBA would agree with the 'x' distance of 10m applied. However, in accordance with TD 42/95, the visibility requirements for a road subject to a 30mph speed limit is likely to be 4.5m x 90m. This visibility splay is what the junction and positioned highway boundary will be designed to, not the PICADY visibility measurements. In accordance with TD 42/95, providing too much visibility can be detrimental to highway safety.

PBA would need sight of a design drawing illustrating the TD 42/95 visibility splays and proposed location of the highway boundary to confirm if this level of visibility in the PICADY model is achievable and acceptable. PBA consider the visibility splays in the PICADY model are generous and would result in significant grass verge frontage. PBA would consider PICADY visibility splays for this junction to be around 10m x 50m. We would be grateful for clarification on this.

Junction Form

Based on point 1 above, PBA would make further comment regarding the chosen junction form with reference to Highways England's DMRB TD 42/95 (*Geometric Design of Major/Minor Priority Junctions*) guidance on when considering junction form (Figure 2/2). We would be grateful for the Applicant's views on this.

For single carriageway roads, it shows approximately the various levels of T junction which may be applicable for different combinations of traffic flows. This takes account of geometric and traffic delays, entry and turning traffic flows, and collisions costs.

The figure is reproduced below, with an approximate indication (red cross) of where the New Access Road / Waveney Drive junction would lie, based on the reported 2037 major road daily traffic flows (AADT – Annual Average Daily Traffic) on Waveney Drive, and the estimated daily traffic flows for the minor road on the New Access Road.

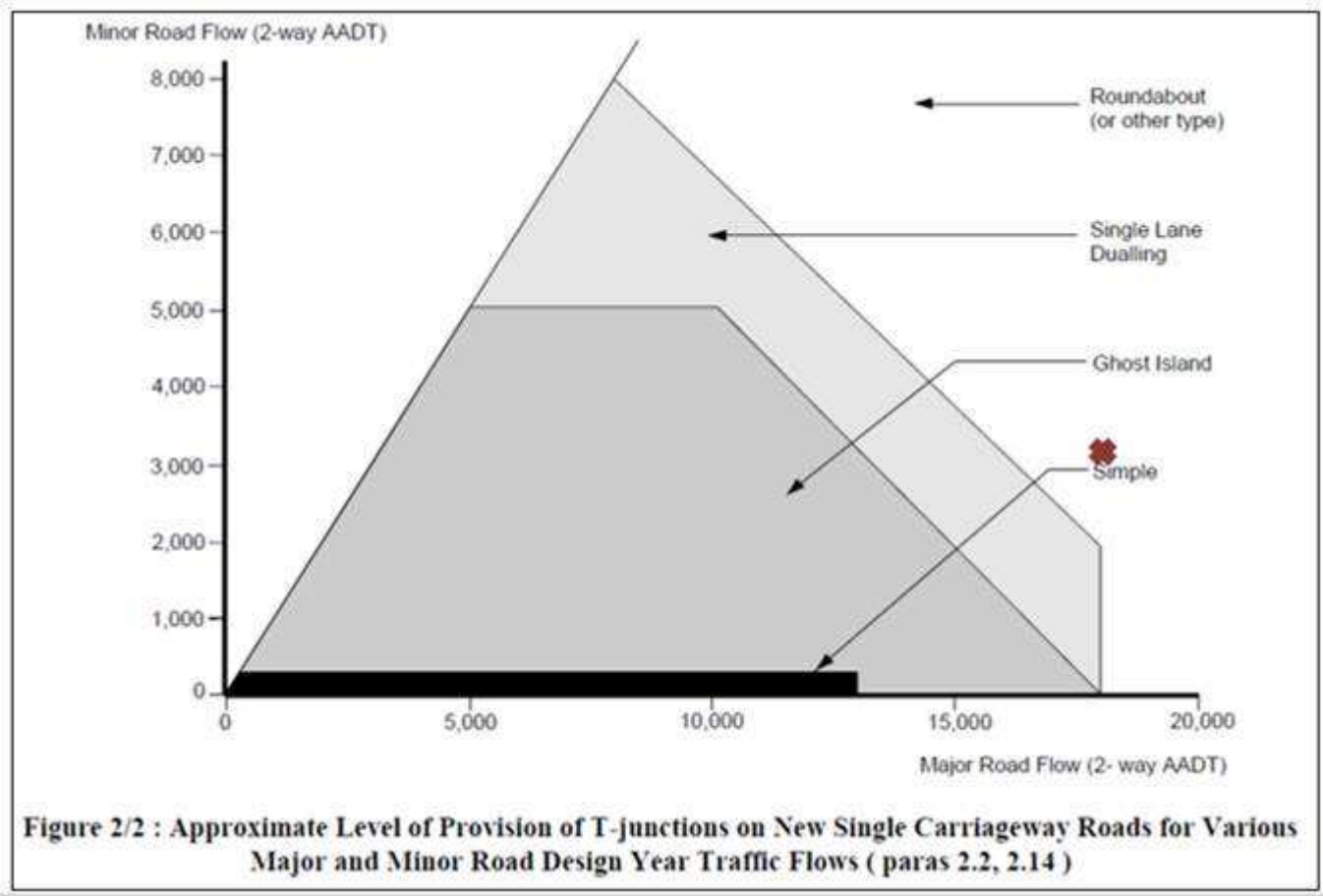

Figure 2/2 : Approximate Level of Provision of T-junctions on New Single Carriageway Roads for Various Major and Minor Road Design Year Traffic Flows (paras 2.2, 2.14)

Major Road flows (Waveney Drive) – 18,100 AADT in 2037 (ES and TA)

Minor Road flows (New Access Road) – 2,500-3,000 AADT in 2037 estimated. Noting that a December 2018 traffic count on Riverside Road recorded an average AADT of 2,300 vehicles currently.

With the reported 2037 traffic flows, the approximate level of provision of T junction comfortably lies within the 'Roundabout (or other type)' section, and lies far from the 'Ghost Island' section. This demonstrates that a ghost island T junction may not be the most appropriate junction form for the forecast traffic flows.

As set out in paragraph 2.6 of TD 42/95, the design of the most appropriate type of junction form should be based on a wide range of factors, mainly design year traffic flows, the nature and proportions of large goods and passenger vehicles, geometric and traffic delays, entry and turning stream capacities, and collision costs. PBA would consider that the junction capacity assessment results should not be the only reason for the choice of junction form. It should also be based on a consideration of the particular site characteristics such as the type of development.

Chapter 4 (Safety) states that a major/minor priority junction will usually have a higher collision rate than other junction types – the conversion of priority junctions to traffic signal or roundabout control has been shown to reduce collisions by 30% or more. Traffic signals are also safer for crossing pedestrians and cyclists.

Depending upon the outcome of the above clarifications, PBA are still of the opinion that a priority ghost island junction form may not be the most appropriate and safe form of access to the Business Park (this was also highlighted in the Road Safety Audit – Problem 1). It is understood that the principal reason for discounting a signalised T junction was due to safety issues in relation to the private residential property accesses on Waveney Dive opposite the former Jeld Wen site i.e., private drive accesses within the junction arrangement. Also that SCC do not want to implement a significantly oversized junction solution in the interim period, and before the new bridge crossing is open.

PBA would comment that similar safety issues would still be present with a priority ghost island junction e.g., with traffic entering these residential properties from the west needing to enter the right turn lane against opposing traffic. Furthermore, the safety aspects of traffic to/from around 10 residential properties should be compared against the safety of around 300-400 vehicles trying to exit the New Access Road during a peak hour.

I am happy to chat through any of the above and discuss these matters further.

Kind regards,

Nigel Fern BSc(Hons) MSc DIC MCIHT
Associate Transport Planner

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From: Johns, Michael [mailto:Michael.Johns@wsp.com]
Sent: 25 February 2019 09:56
To: Nigel Fern <nfern@peterbrett.com>
Cc: Wood, Steven <Steven.Wood2@wsp.com>; Michael Wilks (Michael.Wilks@suffolk.gov.uk) <Michael.Wilks@suffolk.gov.uk>
Subject: RE: Lake Lothing DCO - transport/highways information request

Nigel

I am involved in the strategic modelling which has been undertaken in relation to Lake Lothing Third Crossing. It has been requested that I provide you with further information on the analysis which was undertaken for Appendix H – 'Sensitivity Test to re-assess capacity of Access Road / Waveney Drive Priority Ghost Island Junction'. This Appendix was contained within document SCC/LLTC/EX/51: Applicant's Response to Written Representations and Interested Parties Responses to Written Questions, submitted by Suffolk County Council as part of the Deadline 4 submissions.

Please see details below of the information which has been requested in relation to the following:

1. Actual Link Flow, Delay and V/C plots for the AM peak (0800-0900) and PM peak (1700-1800)
2. Select link analysis to/from Riverside Business Park and the Jeld Wen site
3. Junction turning movements for New Access Road / Waveney Drive and additional Jeld Wen access / Waveney Drive junction
4. Parameters used for Waveney Drive junctions
5. Junction model output report from PICADY model used for New Access Road / Waveney Drive assessment
6. Highway drawing of the New Access Road / Waveney Drive junction

1. **Actual Link Flow, Delay and V/C plots**
   You will receive an invitation to log into Suffolk Transport View - https://suffolk.wspdigital.co.uk/login?next=/

   This will enable you to view the 2022 and 2037 AM & PM peak assignments which underpin the sensitivity tests, and toggle between Volume / Capacity, Delay and Actual Flow

2. **Select link analysis**
   Please find attached a zip file containing pdfs which show the two-way select link flows for the Jeld Wen site and Riverside Business Park. Note the Jeld Wen site has had the employment and housing modelled in two separate zones, but the select link captures traffic to/from both zones.

3. **Junction turning movements**
   Junction turning movements in pcus/hr are in the attached zip file, these have been provided for the following junctions:
   - New Access Road / Waveney Drive (2022 & 2037)
   - Western Jeld Wen access junction / Waveney Drive (2037 only)

4. **Parameters used for New Access Road / Waveney Drive**
   Please find attached a zip file which contains node graphics which detail the saturation flows (pcu/hr) for the following junctions:
   - New Access Road / Waveney Drive
   - Western Jeld Wen access junction / Waveney Drive

   The assumed gap time is 1.5 seconds for these priority junctions.

5. **Junction model output for New Access Road / Waveney Drive**
   The junction model outputs are split into the following:
   - *22 Waveney Dr-Riverside Rd priority KW RBP SingleAccess_Junctions 8 Report_MAIN.pdf*
     - 2022 junction performance assuming New Access Road / Waveney Drive is the sole point of access for Riverside Business Park and Jeld Wen
   - *22 Waveney Dr-Riverside Rd priority KW RBP_Junctions 8 Report_MAIN.pdf*
     - 2022 junction performance assuming two access points on Waveney Drive access for Riverside Business Park and Jeld Wen
     - 2037 junction performance

6. **Highway drawing of New Access Road / Waveney Drive**
   The attached junction drawing "Geometry dwgs for issue - 008 Junction 22.pdf" gives details of assumed road widths and lengths

Regards

Michael Johns
Associate

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From: Nigel Fern [mailto:nfern@peterbrett.com]
Sent: 12 February 2019 10:00
To: Wood, Steven
Cc: Michael Wilks
Subject: Lake Lothing DCO - transport/highways information request

Dear Steven,

I refer to our recent telephone conservation.

As part of Deadline 4 submissions, Suffolk County Council submitted Document SCC/LLTC/EX/51: Applicant's Response to Written Representations and Interested Parties Responses to Written Questions. Contained within this document was Appendix H – 'Sensitivity Test to re-assess capacity of Access Road / Waveney Drive Priority Ghost Island Junction'.

Peter Brett Associates, acting on behalf of Northumbrian Water Limited, are currently reviewing the sensitivity test undertaken. However, it is difficult for PBA to review the sensitivity test, the analysis undertaken, and interpret the results and conclusions since insufficient supporting evidence and information has been provided with the submission i.e., there is no accompanying appendices containing the source data/information.

To aid our review of the submission, we would be most grateful if SCC could supply any of the following information:

- the revised 2022 and 2037 SATURN model strategic-level outputs (Do Something), in particular:

    - Actual Link Flow plots (AM / PM)
    - Delay plots (AM / PM)
    - V/C plots (AM / PM)
    - Select Link Analysis (origin and destination) plots of Riverside Business Park and the Jeld Wen site (AM / PM)
    - Junction turning movement plots for the New Access Road / Waveney Drive junction, and other new junctions on Waveney Drive from the Jeld Wen site (AM / PM)
    - Confirmation of how the New Access Road / Waveney Drive junction has been modelled in SATURN (saturation flows, parameters, etc) and any other new Waveney Drive accesses

- the supporting junction capacity assessment PICADY model outputs (2022 and 2037) for the Waveney Drive / New Access Road ghost island priority junction.

- the highway design drawing of the New Access Road / Waveney Drive ghost island priority junction (showing the visibility splays, and highway boundary) to check the PICADY geometries – if available yet.

The study area of interest is below, mainly Waveney Drive.

Kind regards,

Nigel Fern BSc(Hons) MSc DIC MCIHT
Associate Transport Planner

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Northampton

PBA has joined the Stantec family, find out more at peterbrett.com.

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Appendix 3 – WSP Technical Note SM6 March 6th 2019 (sensitivity test 2)

TECHNICAL NOTE: LAKE LOTHING THIRD CROSSING DCO SUBMISSION – STRATEGIC TRAFFIC MODELLING

TECHNICAL NOTE SM6 – SENSITIVITY TEST FOR MODELLING OF PROPOSED WAVENEY DRIVE / NEW ACCESS ROAD GHOST ISLAND PRIORITY JUNCTION

QM

Job Number	Date	Version	Author	Checked	Authorised
62240712	06/03/2019	1.0	Michael Johns	Steven Wood	

BACKGROUND

WHY THIS NOTE HAS BEEN PRODUCED

This note has been produced focusing on the New Access Road / Waveney Drive Ghost Island Priority Junction which is associated with the Lake Lothing Third Crossing (LLTC). In response to written representation from Northumbrian Water, WSP undertook sensitivity testing using the SATURN model which included revised future housing and employment growth assumptions associated with the Kirkley Waterfront Sustainable Urban Neighbourhood (SUN) and Riverside Business Park. Outputs from the SATURN model was used to inform a PICADY model of the new junction.

This sensitivity test modelling was reported in Appendix H – 'Sensitivity to re-assess capacity of Access Road / Waveney Drive Priority Ghost Island Junction.' This Appendix was contained within document SCC/LLTC/EX/51 – 'Applicants Response to Written Representations and Interested Parties Responses to Written Questions' submitted by Suffolk County Council (SCC) at Deadline 4 on 29th January 2019.

Subsequent to this submission, PBA acting on behalf of Northumbria Water Limited, requested further information in relation to the sensitivity test modelling. WSP provided this additional information to PBA on 25th February 2019.

PBA provided an email on 28th February 2019 which raised a query in relation to the SATURN select link analysis which was issued on 25th February 2019. This select link analysis provided information on the routing of traffic to and from Riverside Business Park. In particular, PBA queried the routing of business park traffic via Kirkley Run / Colville Road which resulted in a small proportion of traffic opting to use the A12 Tom Crisp Way particularly in the AM peak and the resultant balance of turning movements at the New Access Road / Waveney Drive junction.

WSP have undertaken a further sensitivity test constraining the capacity of Kirkley Run in the SATURN model. This sensitivity test has been undertaken as it is acknowledged the SATURN model is assuming free flow conditions along Kirkley Run which could result in this road being more attractive to development traffic than it would otherwise be if an

appropriate capacity constraint were applied. Kirkley Run in reality is a residential fronted road where certain sections are restricted in terms of its capacity due to cars parked on both sides of the road, effectively leading to traffic having to pull over to allow oncoming traffic to pass in some instances. The example in Figure 1 taken from Google Street View illustrates where this occurs on a specific section of Kirkley Run.

Figure 1 – Kirkley Run (between Edgerton Road and Birds Lane), facing south-east bound (Source: Google Street View)

Alternatively, other sections of Kirkley Run allow cars in opposite directions to travel past one another without one vehicle required to stop, but would still result in one direction having to cross the centre line to keep a safe distance from parked vehicles. This would result in traffic slowing down and reduce capacity. Figure 2 taken from Google Street View an example of where this occurs on Kirkley Run.

Figure 2 – Kirkley Run (between Notley Road and Victoria Road), facing north-east bound (Source: Google Street View)

The additional sensitivity test has been undertaken to constrain the capacity along Kirkley Run to reflect the impact of parked cars and the general nature of Kirkley Run to ensure the SATURN model does not show a free flow situation

along this local road. This has resulted in traffic re-routing away from Kirkley Run, affecting the direction which traffic from Riverside Business Park opts to access the New Access Road via Waveney Drive. These revised turning movements at the New Access Road / Waveney Drive junction have been utilised to re-run the PICADY model.

In summary this note sets out the following:
— 2016 base year validation performance on Kirkley Run
— Revised flows on Kirkley Run following a further sensitivity test which has been carried out
— Revised turning flows at the New Access Road / Waveney Drive junction
— PICADY model results

2016 BASE YEAR MODE VALIDATION

The base year validation on Kirkley Run is presented in order to demonstrate the underlying base year model which underpins all forecasting associated the LLTC provides an appropriate level of fit on this key local road.

KIRKLEY RUN 2016 VALIDATION

The underlying 2016 base year model which informs the forecasting being undertaken for the LLTC includes an Automatic Traffic Count (ATC) on Kirkley Run. The validation of the SATURN model at this location is presented by direction for all time periods in Table 1. This shows that in terms of GEH and flow validation, (as required within DfT TAG), the base year model matches closely between observed and modelled flow on Kirkley Run.

Table 1 – Kirkley Run traffic count – 2016 base year validation by direction and time period

Time Period	Direction	Observed flow (vehicles per hour)	Modelled flow (vehicles per hour)	GEH	Flow Pass
AM peak	North-westbound	161	162	**0.086**	**Yes**
AM peak	South-eastbound	93	91	**0.216**	**Yes**
Inter peak	North-westbound	133	133	**0.016**	**Yes**
Inter peak	South-eastbound	110	109	**0.085**	**Yes**
PM peak	North-westbound	218	218	**0.028**	**Yes**
PM peak	South-eastbound	182	179	**0.209**	**Yes**

The level of fit between observed and modelled flow shows the SATURN model provides a suitable basis from which to forecast future levels of traffic growth on Kirkley Run.

KIRKLEY RUN TRAFFIC GROWTH

COMPARISON BETWEEN SENSITIVITY TESTS

Kirkley Run was previously modelled as a 40kmph link with no link capacity restraint which is typical for strategic modelling in an urban environment where junction capacity is considered the main constraint on traffic. Link capacity constraints are typically applied in the SATURN model for rural links over 1km in length. In the revised sensitivity test, a speed flow curve was applied which restricted speeds to 34kmph and link capacity to a maximum of 600 pcus per hour. This has been applied to reduce the attractiveness of Kirkley Run which as previously acknowledged shows free flow conditions in the SATURN model. It is considered this change will better reflect the likely routing of strategic traffic which opts to use alternative links such as the A12 Tom Crisp Way rather than Kirkley Run, particularly development traffic to/from Riverside Business Park.

Table 2 shows the change in two-way flow on Kirkley Run between the latest model run and the previously reported sensitivity test in Appendix H of document SCC/LLTC/EX/51. This shows a significant reduction in the level of traffic which opts to route via Kirkley Run as a result of the capacity restraint which has been applied.

Table 2 – Comparison of revised traffic flows on Kirkley Run

Time Period	Forecast Year	Latest Modelled Flow – Two Way (pcu/hr)	Previous Modelled Flow – Two Way (pcu/hr)	Absolute change in Flow – Two Way (pcu/hr)	% change in Flow – Two Way (pcu/hr)
AM peak	2022	395	597	-202	-34%
AM peak	2037	521	906	-385	-42%
PM peak	2022	437	634	-197	-31%
PM peak	2037	524	905	-381	-42%

REVISED TURNING FLOW MOVEMENTS

Table 3 to Table 6 presents a comparison of the change in the balance of turning movements to/from the New Access Road between the previous sensitivity test and the latest test with the Kirkley Run capacity adjustment.

Cells highlighted in bold represent the right turning movements at the junction. This comparison shows the relative balance of right turn movements at the New Access Road / Waveney Drive junction has increased, with this becoming the more dominant movement compared to the left turn movements. The split of movements between trips arriving at Riverside Business Park in the AM peak, and leaving in the PM peak is also shown to be a closer match. It should be noted that as the SATURN peak hour assignments are independent of each other, this will naturally result in a difference in the balance of flows between the AM and PM peak.

Table 3 – AM 2022 revised split in turning movements to/from New Access Road

Arm to/from New Access Road	2022 AM - Sensitivity Test		2022 AM - Sensitivity Test Update	
	Arrivals	Departures	Arrivals	Departures
Waveney Drive W	68%	30%	38%	30%
Waveney Drive E	32%	70%	62%	70%

Table 4 – PM 2022 revised split in turning movements to/from New Access Road

Arm to/from New Access Road	2022 PM - Sensitivity Test		2022 PM – Sensitivity Test Update	
	Arrivals	Dep	Arrivals	Dep
Waveney Drive W	45%	48%	45%	42%
Waveney Drive E	55%	52%	55%	58%

Table 5 – AM 2037 revised split in turning movements to/from New Access Road

Arm to/from New Access Road	2037 AM - Sensitivity Test		2037 AM - Sensitivity Test Update	
	Arrivals	Dep	Arrivals	Dep
Waveney Drive W	55%	14%	36%	13%
Waveney Drive E	45%	86%	64%	87%

Table 6 – PM 2037 revised split in turning movements to/from New Access Road

Arm to/from New Access Road	2037 PM - Sensitivity Test		2037 AM - Sensitivity Test Update	
	Arrivals	Dep	Arrivals	Dep
Waveney Drive W	21%	36%	18%	30%
Waveney Drive E	79%	64%	83%	70%

Appendix A contains a comparison of turning movement matrices between the original sensitivity test and revised model run, also showing the absolute change in flow between the two sets of turning flow matrices.

It is considered the revised turning movement matrices provide an appropriate basis from which to further test the capacity of the New Access Road / Waveney Drive junction.

JUNCTION MODELLING RESULTS

The revised turning movements were applied to the PICADY model. HGV percentages were allocated by turning movement within the PICADY model based on the proportion of HGVs in pcus within the SATURN assignment. Table 7 shows the HGV percentages which were applied in the AM and PM 2022 junction models

Table 7 – AM 2022 and PM 2022 HGV percentages applied in revised PICADY model

		To		
		A	B	C
From	A	0.0	0.0	4.3
	B	0.0	0.0	0.0
	C	2.8	0.0	0.0

		To		
		A	B	C
From	A	0.0	0.0	2.4
	B	1.1	0.0	1.6
	C	0.5	0.0	0.0

Table 8 presents the HGV percentages applied within the AM and PM 2037 junction models

Table 8 – AM 2037 and PM 2037 HGV percentages applied in revised PICADY model

		To		
		A	B	C
From	A	0.0	0.0	3.6
	B	0.0	0.0	0.0
	C	2.8	0.0	0.0

		To		
		A	B	C
From	A	0.0	0.0	2.0
	B	1.0	0.0	0.9
	C	0.3	0.0	0.0

Table 9 details the results from the PICADY junction model for both 2022 and 2037. The junction modelling shows the priority junction continues to operate within capacity in both forecast years.

Table 9 – PM 2037 revised split in turning movements to/from New Access Road

	AM				PM			
	Queue (PCU)	Delay (s)	RFC	LOS	Queue (PCU)	Delay (s)	RFC	LOS
	KW RBP - 2022 DS							
New Access left turn	0.09	6.78	0.08	A	0.28	7.42	0.21	A
New Access right turn	0.07	12.74	0.07	B	0.33	12.23	0.25	B
Waveney Drive WB right turn	0.55	9.63	0.36	A	0.03	5.32	0.03	A
	KW RBP - 2037 DS							
New Access left turn	0.49	11.09	0.33	B	0.83	11.62	0.45	B
New Access right turn	0.16	25.77	0.14	D	0.67	22.02	0.41	C
Waveney Drive WB right turn	2.08	22.17	0.68	C	0.20	6.49	0.16	A

CONCLUSIONS

The analysis within this note presents the results from an adjustment to the SATURN model, recognising the level of traffic to/from Riverside Business Park routing via Kirkley Run should be adjusted. The subsequent revised sensitivity test has resulted in an increase in the number of right turning movements at the New Access Road / Waveney Drive priority junction. The turning movements from the SATURN model have been applied in a PICADY model including HGV proportions. The results of this analysis show the junction operates within capacity in both the scheme opening year for LLTC (2022) and future forecast year (2037). It is considered this analysis demonstrated it is appropriate for the New Access Road / Waveney Drive junction to be specified as a Ghost Island Priority Junction.

Appendix A

2022 AM - Sensitivity Test

		A	B	C	Total
Waveney Drive W	A	0	206	519	725
New Access Road	B	18	0	43	61
Waveney Drive E	C	262	98	0	360
	Total	280	304	562	1146

2022 AM - Sensitivity Test Update

	A	B	C	Total
A	0	115	556	671
B	18	0	43	61
C	253	189	0	442
Total	271	304	599	1174

2022 AM - Diff

	A	B	C	Total
A	0	-91	37	-54
B	0	0	0	0
C	-9	91	0	82
Total	-9	0	37	28

2022 PM - Sensitivity Test

		A	B	C	Total
Waveney Drive W	A	0	17	305	322
New Access Road	B	101	0	110	211
Waveney Drive E	C	664	21	0	685
	Total	765	38	415	1218

2022 PM - Sensitivity Test Update

	A	B	C	Total
A	0	17	289	306
B	89	0	122	211
C	650	21	0	671
Total	739	38	411	1188

2022 AM - Diff

	A	B	C	Total
A	0	0	-16	-16
B	-12	0	12	0
C	-14	0	0	-14
Total	-26	0	-4	-30

2037 AM - Sensitivity Test

		A	B	C	Total
Waveney Drive W	A	0	253	787	1040
New Access Road	B	21	0	129	150
Waveney Drive E	C	329	208	0	537
	Total	350	461	916	1727

2037 AM - Sensitivity Test Update

	A	B	C	Total
A	0	166	799	965
B	21	0	146	167
C	316	297	0	613
Total	337	463	945	1745

2037 AM - Diff

	A	B	C	Total
A	0	-87	12	-75
B	0	0	17	17
C	-13	89	0	76
Total	-13	2	29	18

2037 PM - Sensitivity Test

		A	B	C	Total
Waveney Drive W	A	0	21	406	427
New Access Road	B	118	0	213	331
Waveney Drive E	C	858	77	0	935
	Total	976	98	619	1693

2037 PM - Sensitivity Test Update

	A	B	C	Total
A	0	21	396	417
B	102	0	235	337
C	866	99	0	965
Total	968	120	631	1719

2037 AM - Diff

	A	B	C	Total
A	0	0	-10	-10
B	-16	0	22	6
C	8	22	0	30
Total	-8	22	12	26

Getting in touch

Please don't hesitate to get in touch if you would like to discuss anything covered or raised within this document.

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