Luton Airport Public Inquiry

Rebuttal to Noise Evidence

for LADACAN

Seth Roberts, Hayes McKenzie Partnership Ltd

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Contents

1. INTRODUCTION

1.1 In relation to the Luton Airport Public Inquiry (**PINS ref: APP/B0230/V/22/3296455**), Mr. Holcombe is an expert witness acting for the Local Authority and Mr. Thornley-Taylor is an expert witness acting for the Applicant. Both experts have submitted Proofs of Evidence to the Planning inspectorate on the subject of noise (LPA-W2.1 and APP-W1.1). I have also submitted a Proof of Evidence on the subject of noise, and this does not align with reports produced by Mr. Holcombe and Mr. Thornley-Taylor. This Rebuttal Proof has been prepared to address areas of disagreement apparent on the face of these main Proofs of Evidence.

1.2 There are three main areas of disagreement as follows:

- The baseline assumed for the assessment
- The assessment methodology only considers change in L_{Aeq}
- Recalibration of the noise model

1.3 I address each of these three areas in separate sections below.

2. EXECUTIVE SUMMARY

2.1 The LPA and Applicant's noise experts have submitted Proofs of Evidence which do not align with my own and I consider that the three key areas of disparity that I have identified are of significance to the determination of the Public Inquiry.

2.2 I rebut both experts' acceptance of the assumed baseline which has been used for the purposes of the noise assessment. I do not consider the assumed baseline to be in accordance with the Town and Country Planning (Environmental Impact Assessment) Regulations 2017 ("the 2017 EIA Regulations") or that it gives a fair benchmark against which noise impacts of the proposed development can be accurately assessed.

2.3 I rebut both experts' acceptance of the assessment methodology presented by the Applicant which has been used for the purposes of the determination of significant effects. I do not consider the assessment methodology is in accordance with the 2017 EIA Regulations as it provides insufficient information and does not represent best practice.

2.4 I rebut Mr. Holcombe's assertion that the noise modelling carried out for the purposes of the ES noise assessment complies with CAP 2091. I do not consider that the required standards for noise modelling at an airport of this size have been met and the resulting discrepancy has the potential to result in predicted noise levels which are inaccurate. This is of particular significance

since the accuracy of the noise modelling is brought into question which potentially undermines the whole noise assessment.

3. ASSUMED BASELINE

3.1 As discussed at paragraph 3.8 of my Proof of Evidence, the only correct baseline presented in the ES is the 2028 12.5mppa operation that was forecast to exist (within the 2012 planning application) in a without development scenario. I will refer to this as the "12.5mppa set" for the purposes of describing what I consider to be the correct way of assessing the noise impact.

3.2 The 2014 Permission granted a set of conditions for a with development scenario which I will refer to as the "18mpa set".

3.3 The current S73 Application seeks retrospective permission to develop according to an alternative "19mppa set".

3.4 It is my opinion that the noise assessment presented within the ES for the current S73 application should involve comparing both the 18mppa set and the 19mppa set with the baseline (12.5mppa set) in order to determine the magnitude of effects and the resulting impacts. These calculated impacts of the 19mppa set can then be compared to the calculated impacts of the 18mppa set.

3.5 The ES addendum presents the most recent noise assessment which sets out an assessment methodology that assesses the change in L_{Aeq} between the 18mppa set and the 19mppa set. Missing out the first step of comparison with the baseline (12.5mppa set) means that the magnitude of the effects is underestimated (as discussed at paragraph 6.1 of my Proof of Evidence), and the resulting impacts cannot be determined.

Position of LPA and Applicant's Experts

3.6 Mr Thornley-Taylor's Proof of Evidence responds to LADACAN's contention that the baseline used in the ES is incorrect, by simply referring to the assumptions set out in Appendix 1 to Andy Hunt's proof of Evidence (APP-W2.1). This implies that he does not see any problems with these assumptions and considers the assessment to have been carried out correctly.

3.7 Mr. Holcombe sets out quite clearly that he believes the baseline that has been used in the ES is correct stating at paragraph 7.4 of his report:

'Turning to what is the relevant 'baseline', the acid test of any ES noise assessment is to identify how much additional (or less) noise will be generated by full capacity operations with the application approved (19mppa "with development") as compared to full capacity operations if it is denied (18mppa "without development").'

My Position and Reasons for Rebuttal

3.8 As noted at paragraph 3.9 of my Proof of Evidence, the 2017 EIA Regulations state that a baseline must be representative of a scenario: '*without implementation of the development*'. Since this is a S73 application for variation of conditions pertaining to a development that was approved in 2014, the baseline scenario to be considered must be one that could be reasonably expected to pertain without implementation of that development.

3.9 In relation to this, it should also be noted that it was the significance and magnitude of impacts assessed against a without development baseline (12.5mppa set) which necessitated the passenger cap (18mppa) and the current condition 10 noise contour area limits. Therefore, any proposed change to the passenger cap and noise contour area limits must logically be assessed against a without development baseline in the same way.

3.10 Even if we assume that the 18mppa set (see paragraph 3.2) is a suitable baseline, the impacts of the 18mppa set were calculated in 2012 under very different operating conditions:

- the forecasts were produced 10 years ago
- the fleet then comprised smaller aircraft (many more A319s)
- none of the fleet had been modernised and timeframes were uncertain
- the in-service noise benefits of modernisation were not known, so assumptions were made

3.11 Realistically, if the Condition 10 noise contour area limits were redefined based on the current noise model and up to date ATM forecasts, the area limits would be likely to change and could be smaller. This would have the effect of reducing the baseline noise predictions relative to the development case and showing greater change in L_{Aeq} for the purposes of the noise assessment.

3.12 In my opinion using the current condition 10 limit as a baseline is an incorrect approach: firstly, for the reasons indicated above, and secondly because this limit on the area of the noise contours was set to ensure that appropriate levels of mitigation were implemented. Reaching "full capacity" operations at the Airport under its existing or proposed noise control conditions is always dependent on achieving the required mitigation afforded by fleet modernisation so that the movements scheduled by airlines to transport the passengers can be operated within the noise contour limit and the quota count limit. If the level of fleet modernisation is not sufficient to allow the Airport to operate within these limits during the appropriate assessment period, then the limits serve indirectly to limit throughput and that is why they were imposed.

3.13 Furthermore, in the case of conditions 9(iii)(b), 9(vi) and 10, there is an obligation to reduce these limits over time and it should be borne in mind that this obligation reflects an expectation that the Airport would gradually become quieter with or without the development. Whilst condition 10 does partially reflect this expected reduction by including a longer term reduced noise contour area limit from 2028 onwards, this is based on a forecast from 2012 and is accordingly also based on an assumption of the reductions to the 'without development' baseline that were expected at that time. It stands to reason that if the expectations for a 'without development' baseline were to change, that the condition 10 noise contour area limit would also change based on what is considered acceptable and this interdependence upon the baseline has not been explored or addressed at all within the ES.

3.14 The inherent obligation to reduce noise output also means that the impacts of both the 18mppa set and the impacts of the 19mppa set must be evidenced as complying with those reductions. This is of particular importance since the Airport does not have direct control over fleet modernisation and the whole reason for the S73 application is related to a mismanagement of the Airport such that too many slots were released before the fleet had been sufficiently modernised. I do not find evidence in the ES demonstrating a clear plan of how to address and manage either the level of fleet modernisation or the overall numbers of ATMs at the Airport. I therefore conclude that without reference to a true 'without development' baseline, the noise assessment presented is unreliable.

4. ASSESSMENT METHODOLOGY

4.1 In addition to the fact that I consider the assumed baseline to be incorrect, the assessment methodology set out in section 8.8 of the updated ES chapter (CD4.06) is not set out clearly and I do not consider it to conform with the requirements of the EIA regulations or to represent best practice.

4.2 Paragraph 8.81 of the updated ES chapter (CD4.06), states that:

'The generic approach of comparing the Proposed Scheme with a baseline has informed this noise assessment. However, the identification of receptor sensitivity and magnitude is unnecessary as there exists in NPSE the framework for identifying significant effects on health, albeit the level by which this occurs is a matter of professional judgment.'

4.3 At paragraph 8.8.5, the document goes on to state:

'Following government policy terminology, adverse effects can be detected from calculated noise at a residential receptor when between LOAEL and SOAEL, and significant adverse effects occur when above SOAEL'

4.4 At paragraph 8.8.17, the document goes on to state, in relation to assessing change in predicted L_{Aeq} noise levels at residential properties, that:

'Where predicted aviation noise levels at residences exceed the LOAEL or SOAEL there is the potential for adverse or significant adverse effects, respectively. A notable exceedance of criteria is deemed to occur if aviation noise exceeds the LOAEL by at least 3.0 dB and the SOAEL by at least 1.0 dB.'

4.5 At paragraph 8.8.18, the document provides different criteria for change in predicted L_{Aeq} noise levels non-residential properties, stating:

'For non-residential receptors, any increase of at least 1 dB where the noise level is above the threshold criteria would be considered a significant effect.'

4.6 In terms of assessment of effects at residential properties, section 8.8 of the document uses the terms 'adverse' and 'significant adverse' as defined by the LOAEL and SOAEL thresholds and this indicates that only predicted absolute noise levels above the SOAEL would be considered significant in terms of the EIA Regulations (although this is not explicitly stated). The wording of the criteria indicates that noise levels exceeding the LOAEL by 3 dB would be 'notable' but it is unclear how this has been used as a criterion for assessing the significance of effect.

4.7 Although paragraph 8.9.2 of the document refers to change criteria of '*3 dB or more between the LOAEL or SOAEL*' and '*1 dB or more within the SOAEL*' for residential properties, there is no indication of how these criteria relate to the overall assessment of the significance of effect.

4.8 Furthermore, paragraph 8.9.2 notes that the assessment identifies '*change in number of receptors exposed within the SOAEL contour*' but there are no criteria given to relate the magnitude of any change to a significant effect of the purposes of the EIA regulations.

4.9 Chapter 7 of the ES Addendum (CD1.16) provides an assessment of the health effects of the development which relies heavily on the outcome of the noise assessment in chapter 6 of the document. This chapter presents judgements on the magnitude of health effects referring to changes in noise levels as part of the rationale. Since the noise chapter does not provide any criteria for determining the magnitude of effect but instead refers to '*professional judgement*' (see paragraph 4.2 above) it is not clear how the significance of health effects has been determined.

Position of LPA and Applicant's Experts

4.10 Mr. Holcombe states at paragraph 8.3 of his Proof of Evidence that:

'Noise level increases from airborne aircraft in the day and night-time are not significant, being under a 1 dB increase in every assessment year, which is not perceptible and is in line with local plan policy of no material increase in noise.'

4.11 He goes on to state at paragraph 8.4 that:

As a result of the application, an additional 322 dwellings are expected to experience a significant effect, being above the SOAEL during the night-time.

4.12 Mr. Thornley-Taylor's Proof of Evidence makes similar observations about the significance of effect and although he provides some additional analysis beyond what is stated by Mr. Holcombe. He analyses the numbers of dwellings at which residents are likely to be highly annoyed (for the 18mppa set and 19mppa set) along with changes in numbers of overflights. In relation to his additional analysis, he concludes at paragraph 8.5.15 that:

'these population totals do not have much meaning, because, for any particular resident of the dwellings concerned there will only be a negligible difference in the loudness or frequency of occurrence of aircraft noise events when the change in L_{Aeq} level is less than 1dB which will not be noticeable.'

4.13 It is clear to me that Mr. Thornley-Taylor considers the additional 322 dwellings experiencing noise levels above the SOAEL to not be a significant effect and that this is due to the magnitude of noise change (between the 18mppa set and 19mppa set) presented in the noise assessment.

My Position and Reasons for Rebuttal

4.14 Regulation 18.4(b) of the 2017 IEA Regulations states that within their Environmental Statement, an applicant must:

'include the information reasonably required for reaching a reasoned conclusion on the significant effects of the development on the environment, taking into account current knowledge and methods of assessment;'

4.15 I do not consider that all the information that is reasonably required for determining the significance of effect has been included in the revised ES chapter or the ES Addendum. Most notably, there is no quantification of the magnitude of effects as would usually be expected for an ES. Additionally, there are no clear criteria provided in these documents for determining what is considered to be a significant effect in terms of the change of noise level at residential properties or the number of properties affected.

4.16 The method of assessment does not align with best practice and in this respect, I do not believe it can be described as '*taking into account current knowledge and methods of assessment*' as required by the 2017 EIA Regulations. In relation to best practice, I would expect the assessment methodology to set out clear criteria for determining the magnitude of effect (usually described using the following terms: **Negligible**, **Minor**, **Moderate**, **Major** and **Substantial**). I would expect these criteria to include, as a minimum, objective ratings of: the primary L_{Aeq} metric; expected changes to the primary metric (as a result of the development); numbers of dwellings affected. I would also expect to see some objective criteria for assessing secondary metrics which would typically include thresholds of significance for numbers of dwellings within the **NA60**, **NA65** and $\mathbf{L_{max}}$ contours along with thresholds of significance for change in the L_{max} metric at specific locations. Examples of best practice which could be expected for the assessment methodology can be found in Preliminary Environmental Information Reports (PEIR) prepared for the Heathrow third runway and Gatwick North Runway DCO application. Extracts of these PEIR documents covering the relevant assessment methodology are included at Appendix 1 of this report.

4.17 The criteria that are presented in the methodology relate only to change in the primary L_{Aeq} metric and do not acknowledge the limitations of this stated at paragraph 4.7 of my Proof of Evidence.

4.18 Furthermore, since I consider that an incorrect baseline has been used (as discussed at section 2.1 above), I do not think that the change in noise level due to the development has been correctly determined and the assertions about a change of less than 1 dB being insignificant are founded on a flawed methodology. This point is set out at paragraph 6.1 of my main Proof of Evidence.

4.19 There is also a clear importance attached to noise in the 2014 permission emphasised in the reasons and the justifications for the conditions as restated in the 2017 permission for condition 10:

'To safeguard residential amenity. To accord with the objectives of Policy LP1 and LLA1 of the Luton Local Plan and the National Planning Policy Framework.'

and for Condition 8:

'To enable the Local Planning Authority to exercise proper control over the development, in the interests of securing a satisfactory operation of the development and to safeguard the amenities of the surrounding area. To accord with the objectives of Policy LP1 of the Luton Local Plan and the National Planning Policy Framework.'

4.20 It is clear to me that any noise assessment should consider the importance of the limits that are already in place. By merely assessing the change in L_{Aeq} against these upper limits of what is

acceptable, the assessment gives no weight to the original assessment or the importance of the existing limits.

5. CALIBRATION OF THE NOISE MODEL

5.1 Both Mr. Holcombe and Mr. Thornley-Taylor have failed to highlight the importance of a document detailing noise measurements used for calibration of the noise model (CD8.06) and how this might relate to the outcome of the noise assessment. This is discussed briefly within my Proof of Evidence at paragraph 3.14 and I discuss below how this relates to, and does not align with, evidence presented by the two experts.

Position of LPA and Applicant's Experts

5.2 In response to LADACAN's assertion that the noise modelling has not been 'fully calibrated', Mr. Thornley-Taylor states:

'In the noise model source terms for each aircraft type have been aligned with data measured at the Airport.'

5.3 In commenting on LADACAN's Statement of Case and in response to concerns about the calibration of the noise model, Mr Holcombe states in paragraph 7.11 of his report:

'CAP 2091 (CAA Policy on Minimum Standards for Noise Modelling, 2021), sets out the modelling requirements for varying airport sizes. Luton Airport is in category C and complies with CAP 2091.'

My Position and Reasons for Rebuttal

5.4 I concur that CAP 2091 applies to Luton Airport, since the Applicant has supplied airspace change data to the CAA, for example during the airspace change process to introduce RNAV in 2015 and the subsequent Post Implementation Review[1]. However, I do not necessarily agree that Luton Airport complies with the requirements of CAP 2091

5.5 Chapter 4 of CAP 2091 "*Minimum standards for noise modelling*" reiterates in 4.1 that *"… the CAA has applied a **proportionality principle** to its requirements"* which differentiates according to the number of people exposed to noise. It goes on to define in Tables 4.1 and 4.2 thresholds based on numbers of people exposed to day and night noise contour areas.

[1] CD8.11 'CAP 1882 - Report of the CAA's Post Implementation Review of London Luton Airport's Airspace Change Proposal - Runway 26 Brookmans Park RNAV-1 Standard Instrument Departure Procedures, CAA, Mar 2020

5.6 In 4.3, however, CAP 2091[2] make clear there are "some further criteria to ensure that airports do not reduce their noise modelling sophistication from their methodology today" which is later expanded in 4.10:

'This policy defines minimum requirements for noise modelling. Some airports may already be providing noise modelling at a higher Category than the minimum required here. We would expect these arrangements to persist and so no airport (or other stakeholder) should do less in terms of its noise modelling than it did on or before January 2020, when we first consulted on this policy, or 8 February 2021, when it comes into force.'

5.7 The capabilities expected at each threshold level are set out Table 2.1 of Section 2.14, which is reproduced here at Figure 1:

2.14 A summary of the Categories is shown in Table 2.1. We would consider that a stakeholder's noise modelling can only be declared to be in a particular Category if it meets ***all*** the criteria in the table for that Category.

Table 2.1: Summary of Noise Modelling Categories

Category	Aircraft noise		Aircraft tracks (arrival and departure routes)		
	Noise data	Flight profiles	Centreline (mean track)	Dispersion (variation around centreline)	Usage (allocation of traffic to routes)
A	ICAO dataset modified for local noise monitor data for all aircraft types.	Local track-keeping data	Local track-keeping data	Local track-keeping data	Local track-keeping data
B	ICAO dataset validated by local noise monitor data for major aircraft types	Local track-keeping data	Local track-keeping data	Local track-keeping data	Local track-keeping data
C	ICAO dataset	Local track-keeping data for major aircraft types	Local track-keeping data	Local track-keeping data	Local track-keeping data
D *	ICAO dataset	ICAO dataset	Local data from airport	ECAC guidance or data from airport	Local data from airport
E	ICAO dataset	ICAO dataset	Local data from airport	ECAC guidance or data from airport	Local data from airport

* the CAA is currently consulting on a new definition for Category D.

Figure 1: Table 2.1 from CAP2091

5.8 The ES3 revised noise chapter contains a query by the LPA's noise expert regarding why the standard INM dispersal of aircraft around the track centreline had apparently been used in the noise model, and Wood's response states *"The modelled departure track centrelines and*

[2] CD13.50 'CAP 2091 Minimum Standards for Noise Modelling', CAA, Jan 2021

dispersed sub tracks are based on an analysis of radar data and information provided by the airport." [3]

5.9 I have reviewed the Applicant's Log[4] of requests by LADACAN for disclosure of relevant data provided to BAP and the responses provided. In response to a request for disclosure of relevant radar data the Log states:

'The radar data is provided to LLAOL under a commercial contract between LLAOL and NATS. The data belongs to NATS and cannot be shared.'

5.10 This tallies with my understanding that a NATS radar feed is a service provided on commercial terms which preclude sharing of data and cannot be waived. BAP has confirmed this limitation with an early exception:

'When BAP took over the modelling [from Bureau Veritas] we undertook a review, including of the routes. This involved comparison with radar data which found the routes in the model were representative … For the introduction of the RNAV route, track density plots were used to inform the modelled route.'

5.11 In my opinion track density plots do not provide profile information, and I find no mention in the BAP noise contour calibration documents[5] of using radar data, so it appears that radar data (ie local track keeping data as per the CAA Table above) is not used at the Airport to deduce departure profiles. Similarly, the only mention of use of altitude appears to be in the explanatory document on processing noise results provided by BAP where it states:

'One of the parameters recorded by the NTK system is the "Distance to NMT", this is a combination of an aircraft's altitude and lateral distance from the NMT, as measured by the track keeping system at the time of the Lmax. Aircraft that are recorded as relatively distant from the NMTs are excluded from the validation.'[6]

5.12 Comparing the noise modelling practices at Luton Airport with this Table, based on the descriptions in the BAP noise contour calibration documents referred to above and in the

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3 CD4.06 'ES Chapter 8 Noise – Revised', Wood, May 2021, Section 8D1 Table 4.1. PDF p79

4 'LADACAN information requests tracker dated 18.8.22.xlsx', Julia Krause, Herbert Smith Freehills, cell K3

5 CD8.06, CD13.17, CD13.16 'Noise contouring methodology updates' BAP, 2015, 2018, 2019

6 CD13.23 'A11060 N69 DR_1.0 Processing of NMT Results', BAP, Jul 2022

disclosed noise measurement data and the lack of use of radar data as indicated above, I conclude:

- Category A is not a match for Noise data, since the standard dataset is not modified for local noise monitor data for all aircraft types
- Category B is a match for Noise data, since the standard dataset is modified by local noise monitor data for major aircraft types; but is not a match for Flight Profiles if (as appears the case) the CAA requires all flight profiles for Category B to be set by local track-keeping data, rather than just for major aircraft types, and also that the Flight Profiles are to be set from track keeping data rather than just by acoustic data.
- Category C is a match for Noise data but with greater capability, since Luton meets the Category B criterion; but is not a match for Flight profiles since although the profiles have been modified for major aircraft types as the BAP report on the contour recalibration in 2015 shows[7], this was done on the basis of acoustic data only and did not benefit even from altitude data let alone the use of radar data.

5.13 I therefore disagree with both of Mr Holcombe's assertions in the statement "*Luton Airport is in category C and complies with CAP 2091".* The evidence suggests it would be correct to say instead that:

'Luton Airport partly meets the requirements of category C, exceeding them by adjusting Noise data for major aircraft types, a requirement of category B; however, it does not meet the requirements of Categories A, B or C to adjust Flight Profiles using local track keeping data, since only acoustic data has been used.'

5.14 Based on the assumption that its contours enclose more people than the Category D threshold (otherwise the Airport would have been classified as Category D), it would therefore appear incorrect to say that Luton Airport complies with CAP 2091. This also suggests that the level of accuracy of the noise modelling is not proportionate to the size of the airport and that a greater level of precision should have been employed when modelling noise from Luton Airport.

Additional Information Relating to the Results of the South Luton Monitoring Used for Calibration of the Noise Model

5.15 Working from adequate and representative data samples is another key part of ensuring accurate results when measuring aircraft noise for calibration of the noise model.

[7] CD8.06 'BAP contouring methodology update', BAP, Aug 2015

5.16 Mr Lambourne's Proof identified the relatively small sample sizes of data gathered during apparently one short monitoring exercise in South Luton. The requests to and responses from the Application mentioned in footnote 4 above indicate that no other South Luton monitoring was conducted for this purpose and the BAP contour methodology update reports only mention that one instance.

5.17 I have since reviewed the noise monitoring performed before, during and after the RNAV trials which were the subject of the CAA CAP 1882 report referenced in footnote 1. This was published by the Applicant as part of the consultation material following the trials. Page 41 of 59 of this document[8] has been included as Appendix 2 and this shows the results of a number of other monitoring exercises in Ludlow Avenue, South Luton. By zooming in on the images and measuring the position of the centre of the confidence intervals relative to the horizontal lines, it was possible to deduce the average measurement results for various aircraft types under the various operating conditions, many of which were using conventional navigation (which pertained before 2015) and others post-RNAV.

5.18 In addition to the consultation document, CAP1882 presents average maximum noise levels measured in South Luton and wood have supplied raw data[9] from the applicant which details the average maximum noise levels measured in South Luton as part of the noise model validation exercise. For the departures of the A320 aircraft, the values of the average L_{Amax} are presented at Table 1 below with the values used for calibration highlighted as bold text and the values taken from CAP 1882 highlighted with grey shading.

Table 1: Summary of L_{Amax} Results Presented in Consultation Document, CAP 1882 and Raw Data

Aircraft Type	**Average L_{Amax} results**							
	RNAV pre Oct 2012 LLAOL	RNAV 210 Mar 2013 LLA/BAP	Conv 210 May 2013 LLA/BAP	RNAV 210 May 2013 LLA/BAP	CAP 1882 Mar 2013 LLAOL	Conv post Jul 2013 LLAOL	**Dec 2014 - Jan 2015 Raw Data**	CAP 1882 Mar 2017 LLAOL
A320	77.3	79.5	80.3	81.1	78.5	78.9	**77.5**	78.4

8 RNAV Stakeholder consultation document, LLAOL, April 2014 - Appendix C: *Detailed Noise Monitoring Results*

9 CD8.49 disclosed RAW data from the applicant, Wood

5.19 This shows that the period of South Luton monitoring used for contour calibration (and to justify a significant reduction in SEL values from the modelled profiles), yielded a noise measurement among the very lowest measured in this location. This perhaps uncharacteristically low measurement might explain the significant reductions in predicted noise levels for the major aircraft types that were concluded to be necessary.

5.20 In my opinion, it is difficult to see how that monitoring exercise could be held to be representative, yet despite the other data being available to the Applicant and to BAP, this alone exercise was chosen to be used for the recalibration which reduced the 48dB $L_{Aeq\ 8h}$ night noise contour values by 6%[10], an adjustment which has persisted thereafter.

Additional Implications of Recalibrating the Noise Model

5.21 The alteration of the departure profiles (following the calibration of the noise model) results in changes to predicted noise levels both with and without the development. Therefore, any comparison against a baseline would need to apply the same changes to the baseline noise predictions as to the predictions for the proposed development in order to make a fair, like for like comparison.

5.22 By using the condition 10 noise contour area limit as an alternative to the 'without development' baseline, the effect of the recalibration of the noise model on the true baseline has been totally bypassed. Given that the recalibration of the model introduces a reduction of 4 dB to one of the major aircraft types, when applied to the noise contours produced for the 2012 application, this would be likely to have the effect of significantly reducing the noise contour area limits that are represented by the current condition 10.

5.23 Without looking at the effect of the recalibration on the noise contours produced for the 2012 application, it cannot be stated with any certainty that the differences between the assumed baseline and the proposed development are representative of changes between with and without development scenarios.

[10] CD8.06 'BAP contouring methodology update', BAP, Aug 2015

Appendix 1:

Excerpts from Heathrow and Gatwick PEIR Documents

based on noise and flight track data collected by the Gatwick Noise and Track Keeping (NTK) system. In recent years, 32 locations have been used with typically eight in use at any one time. In April 2019, the system was upgraded to improve functionality and ease of access for the public online. In December 2020 the following 23 sites were live with others at various stages of planning and installation: Rusper, Russ Hill, Orltons, Oaklands Farm, Faygate, South Holmwood, Newdigate, Charlwood, Ifold, Alfold, Slinfold, Ruckmans, Kingsfold (all to the west), Moat House, Bellwood (Burstow), Outwood, Lingfield, Cowden, Hever Castle, Chiddingstone, Withyham (Crowborough) and Rusthall (all to the east) and Slinfold (to the north). The NTK data are used by GAL to respond to complaints, and to engage with the public over noise and track performance.

Site-Specific Surveys

14.4.20 For the ground noise assessment, baseline noise level measurements were conducted in August 2016 at 16 locations, 12 of which are considered to be relevant to the Project (see Figure 14.4.1). Measurements were conducted continuously over a two week period. Overall baseline noise levels are not likely to have changed significantly between mid-2016 and spring 2020 when the Covid pandemic began.

14.4.21 On-airport (airside) noise measurements to verify taxi noise levels were carried out in March and April 2019. The results of these measurements were used to determine more up to date source noise data to improve the accuracy of the modelling and to allow next generation aircraft to be taken into account within the changing fleet. See Appendix 14.9.3 for more details.

14.4.22 For road traffic noise, baseline conditions were modelled using the Predictor noise model. Calibration surveys were carried out in the Riverside Garden Park in May 2019 (see Appendix 14.9.4). For construction noise, the ground noise baseline survey results have been used, as similar areas and receptors are likely to be affected.

Assessment Criteria and Assignment of Significance

Methodology for Identifying Significant Effects

Overview

14.4.23 This section sets out the approach to identifying the significance of noise effects, beneficial and adverse, that are likely to arise from the Project. The methodology uses the following overarching concepts, explained in this section, as follows:

- significant effects, adverse and beneficial (due to noise levels and noise change resulting from the Project), including effects on health and quality of life;
- combined noise effects (due to the various Project noise sources); and
- cumulative noise effects (due to noise from the Project together with other proposed developments).

Effects on Health and Quality of Life

14.4.24 As described in 14.2, the Airports NPS (paragraph 5.68) states that: ‘Development consent should not be granted unless the Secretary of State is satisfied that the proposals will meet the following aims for the effective management and control of noise, within the context of Government policy on sustainable development:

- Avoid significant adverse impacts on health and quality of life from noise;

- Mitigate and minimise adverse impacts on health and quality of life from noise; and
- Where possible, contribute to improvements to health and quality of life.'

14.4.25 The approach to assessing noise effects from the Project therefore firstly identifies the potential for significant adverse effects on health and quality of life that may arise where noise at a receptor newly exceeds the SOAEL, and it identifies mitigation measures to avoid these. Secondly, the assessment identifies adverse effects that may arise above the LOAEL but below the SOAEL and identifies mitigation measures to minimise these as far as practicable. Thirdly, opportunities to reduce noise levels from the base case so as to improve health and quality of life have been explored.

Environmental Significant Effects

14.4.26 In addition to effects that exceed the SOAEL and result in significant adverse impacts on health and quality of life from noise that should be avoided, other likely significant environmental noise effects have been identified.

14.4.27 In line with the Airports NPS and the NPSE, the above approach is adopted for construction noise, air noise, ground noise, and road traffic noise, as explained in the following four sections. For each of the four types of noise, LOAELs and SOAELs are identified, and additional factors are described that inform the likely significance of an environmental effect, including effects where the noise level would be between the LOAEL and the SOAEL or where there would be a change in noise level. Methods used to predict levels are also summarised and metrics used to describe noise levels are also explained.

14.4.28 This PEIR chapter presents the preliminary findings of the assessment. As such, the conclusions presented here are preliminary and may be refined by further work throughout the EIA process and reported in the ES following consultation. Consequently, the assessment method may also develop further from that used in the PEIR. For example, consultation may reveal noise or vibration sensitive receptors with particular sensitivities requiring specific attention.

Combined Effects

14.4.29 Combined effects are those arising from the combination of different types of noise arising from the Project. As there is no reliable means of quantitatively assessing the overall noise effect resulting from different noise sources, this PEIR considers the overall effect of noise from combined sources qualitatively. This approach will also be used within the ES. Section 14.11 considers potential combined effects due to various types of noise.

Cumulative Effects

14.4.30 Cumulative effects that may arise as a result of the Project, when considered together with other proposed developments are considered in Section 14.11.

Inter-Related Effects

14.4.31 Section 14.11.17 provides noise impact information for the assessment of inter-related effects from noise, landscape and visual, historic environment and ecological/biodiversity impacts. The methodology used to assess effects on landscape, townscape and visually sensitive receptors, on receptors of historic importance and on ecological receptors is described in Chapters 7, 8, and 9 of this PEIR.

Construction Noise

Metrics

14.4.32 Construction noise has been assessed using BS5228-1:2009+A1:2014 (Code of practice for noise and vibration control on construction and open sites – noise) (BSI, 2014a). The metric used for construction noise assessment is the L_{Aeq}.

Noise Criteria

14.4.33 Construction noise has been assessed with reference to the 'ABC method' described in BS5228-1:2009+A1:2014. The ABC method defines the thresholds at building facades on the basis of existing noise levels as set out in Table 14.4.3.

14.4.34 Where the forecast construction noise exceeds the relevant threshold, this is an indicator of a potentially significant effect, ie where the level of impact is sufficient that it may lead to a likely significant effect once other aspects are considered.

14.4.35 For daytime, the widely used threshold of 75 dB L_{Aeq} (category C) being exceeded for one month or more has been taken to be the SOAEL for construction noise. The threshold was originally set to avoid interference with normal speech indoors, with windows closed (Wilson, 1963). The daytime SOAEL and the corresponding SOAELs for the evening and night periods (shown in Table 14.4.3) indicate likely significant effects on heath and quality of life at a receptor, assuming construction noise is dominant and of sufficient duration, as discussed below.

14.4.36 Also shown are the category A and B noise criteria, which are applied as the LOAEL assessment criteria from BS 5228 depending on the existing noise levels, as noted in Table 14.4.3.

Table 14.4.3: Airborne Sound from Construction – Impact Criteria at Residential Receptors (construction noise only)

Period	Assessment Category dB $L_{Aeq, T}$		
	A (LOAEL)	B (LOAEL)	C (SOAEL)
Day: T=12hr, Weekdays, 07:00-19:00, T=6hr, Saturday, 07:00-13:00	>65	>70	>75
Evenings and weekends: T=1hr, Weekdays 19:00–23:00, Saturdays 13:00-23:00, Sundays 07:00-23:00	>55	>60	>65
Night: T=1hr, Every day 23:00-06:00	>45	>50	>55

Notes:
All sound levels are defined at the façade of the receptor.
Assessment Category A: impact criteria to use when baseline ambient sound levels (rounded to the nearest 5 dB) are less than these values.
Assessment Category B: impact criteria to use when baseline ambient sound levels (rounded to the nearest 5 dB) are the same as category A values.
Assessment Category C: impact criteria to use when baseline ambient sound levels (rounded to the nearest 5 dB) are higher than category A values.

Significance of Effects

14.4.37 When predicted noise levels are above LOAEL thresholds, but below the SOAEL, other factors have been taken into account in determining whether the effect could be significant, such as the

number of people affected, and the duration of the activity causing the noise impact in determining the significance of the noise effects.

14.4.38 Taking account of these and considering any additional factors, the following ratings have been used to describe the significance of the predicted noise effects.

- **Negligible**: Below LOAEL or of short duration <1 month.
- **Minor**: Below SOAEL but above LOAEL with low noise exceedances (1-2 dB) or affecting low population size.
- **Moderate**: Above LOAEL with noise exceedances (>2 dB), or affecting high population size, but at levels not at SOAEL.
- **Major**: Above SOAEL, or above LOAEL affecting high population size.
- **Substantial**: Above SOAEL affecting high population size.

14.4.39 For the purposes of this assessment, effects of moderate significance and above are considered significant in terms of the EIA Regulations.

Air Noise

Air Noise Modelling

14.4.40 Air noise has been modelled using the CAA's ANCON v2.4 model, as used to produce Gatwick's noise exposure contours annually, and validated for Gatwick on an annual basis. The summer season contours for 2019 form the baseline, as reported below. Air traffic has been modelled for the four operational forecast years as described elsewhere in this report: 2029, 2032, 2038 and 2047. For the 2029, 2032, 2038 and 2047 scenarios, base case (do-minimum) and with Project noise modelling has been undertaken to allow comparisons between with and without Project cases in these years.

14.4.41 The basis of these models is the 2019 ANCON model. For current aircraft types, ANCON uses source noise levels, climb rates and dispersion within Noise Preferential Routes (NPRs) based on those measured in the NTK system at Gatwick. Noise emission levels from future aircraft types have been taken from the CAA's latest estimates and reported in the noise assessment, along with all other relevant input data. Further details are provided in Appendix 14.9.2. The noise modelling of all future cases, ie 2029, 2032, 2038 and 2047, is based on forecasts of air traffic movements and fleets expected to operate, so is unavoidably approximate albeit based on best available information at this stage. At the current time, as the aviation industry has been impacted by the Covid pandemic, there is some uncertainty as to how airlines will invest in new quieter aircraft in the future. To address this uncertainty a range of future fleets have been considered in the air noise modelling. The 'central case' fleet represents the transition envisaged from current generation to next generation, quieter, aircraft. The 'slower transition fleet' case represents a delayed transition leading to higher noise levels in the future, in both the future baseline and Project cases. Section 14.5 and Appendix 14.9.5 provide further details.

Primary and Secondary Noise Metrics

14.4.42 The following noise metrics are used to assess air noise in accordance with CAP 1616 (CAA, 2018).

14.4.43 Primary Noise Metrics:

- $L_{eq,\ 16\ hour}$ day 51 to 72 dB; and

- $L_{eq, 8\ hour}$ night 45 to 72 dB.

14.4.44 Secondary Noise Metrics:

- N65 day 20, 50, 100, 200, 500; and
- N60 night 10, 20, 50, 100.

14.4.45 N65 day refers to the number of aircraft during an average summer day above L_{max} 65 dB, while N60 night refers to the number of aircraft during an average summer night above L_{max} 60 dB. Thus, for example, an N65 day 20 contour plots the locations at which twenty noise events above L_{max} 65 dB occur on an average summer day.

14.4.46 Secondary Non-Noise Metric:

- Overflight (<7,000 feet) >48.5 degrees to the horizontal[3] (see Appendix 14.9.2 Section 3).

14.4.47 Flight paths above 7,000 feet would not be affected by the Project.

14.4.48 These noise metrics relate to the 92 day summer period from 16 June to 15 September, as used conventionally in the UK because it represents the busiest, and hence noisiest, season. A description of the noise metrics is presented in the glossary at Section 14.15.

14.4.49 $L_{eq, 16\ hour}$ day and $L_{eq, 8\ hour}$ night have been used as the primary metrics to quantify impacts in terms of the areas and population within the various 3 dB noise contour bands in the ranges above. Noise difference contours have also been used to show areas where noise levels are expected to increase and decrease.

14.4.50 In addition annual average L_{den} and L_{night} noise contours have been produced to illustrate the changes in noise levels averaged over the whole year.

Lmax Levels at Representative Community Locations

14.4.51 In addition to noise contours, more detail has been provided on the changes to be expected at a selection of specific locations that represent communities most affected:

- Rusper Primary School
- Charlwood Village Infant School
- Lingfield Primary School
- Chiddingstone Church of England School
- Capel Pre School
- Willow Tree Pre-school, Ifield; and
- Barnfield Care Home, Horley.

14.4.52 At these seven Community Representative Locations, the changes in noise to be expected as a result of the Project have been described in terms of changes in day and night noise levels ($L_{eq, 16\ hour}$ day and $L_{eq, 8\ hour}$ night), and in terms of numbers of aircraft above the day L_{max} 65 dB and night L_{max} 60 dB levels, for easterly and westerly operations. This is to provide greater detail as to the noise changes that affected communities can expect in terms of peak noise levels as well as accumulated noise levels.

[3] As defined in CAP 1498 Definition of Overflight (CAA 2017).

14.4.53 In addition to assessing impacts on residential properties, and those receptors listed above, air noise has been modelled and assessed at schools, hospitals, community buildings and places of worship.

Lmax Contours

14.4.54 The noise modelling assumes aircraft would fly along already used flight paths. Flight paths to and from the main runway would not be affected. Only departures would routinely use the northern runway (other than during maintenance of the main runway when arrivals and departures may use it as is the case now). These would fly straight ahead until they turn onto the relevant Standard Instrument Departure (SID) Route within the Noise Preferential Route generally 5 to 16 km from the end of the runway. These flight paths would be 210 metres north of the equivalent flight paths from the main runway. Thus, areas to the north of the existing extended runway centreline, to the east and to the west of the airport up to about 5 to 16 km from the runway ends, would experience more aircraft closer to them every day. The changes in noise from individual aircraft taking off on the northern runway compared to the main runway have been illustrated using L_{max} 60 dB contours.

Overflights

14.4.55 The methodologies for assessing airspace change (CAP 1616) adopted for the EIA process require an assessment of a new metric called overflight, and to consider overflights in two areas as follows.

- Air Noise – 'Overflight' as defined by CAP 1498 (CAA, 2017).
- Tranquillity – CAP 1616 requires consideration of increased overflights affecting particular areas, such as AONBs and National Parks.

14.4.56 This secondary non-noise metric, 'overflights' has been computed within a Geographic Information System, as described in Appendix 14.9.2, Section 3. Three-dimensional radar tracks from 128,000 aircraft flying to and from Gatwick and other airports within 35 miles of Gatwick were analysed to count overflights below 7,000 feet in accordance with the CAA guidance. The results are used to illustrate how the numbers of overflights would change with the Project.

Noise Criteria

14.4.57 In order to follow the approach required in the NPSE, it is necessary to define the LOAEL and SOAEL for aircraft noise.

14.4.58 LOAELs are provided in the Consultation Response on UK Airspace Policy: A Framework for Balanced Decisions on the Design and Use of Airspace (Department for Transport, 2017b), as described in paragraph 14.2.27.

14.4.59 SOAELs are defined with reference to Government expectations of compensation and noise insulation schemes specified in the Aviation Policy Framework (2013). For daytime, the SOAEL is set at $L_{eq,\ 16\ hour}$ 63 dB. This represents the exposure level at which the most recent UK annoyance survey (CAA, 2014) indicates that 23% of the population would be highly annoyed. The SOAEL value for night-time is taken from the interim target of the WHO Night Noise Guidelines 2009 at $L_{eq,\ 8\ hour}$ 55 dB, which is described in those guidelines as the level above which *'Adverse health effects occur frequently, a sizeable proportion of the population is highly annoyed and sleep-disturbed.'* (WHO, 2009).

14.4.60 The LOAELs and SOAELs for air noise are summarised in Table 14.4.4.

Table 14.4.4: Air Noise LOAELs and SOAELs

Issue	LOAEL	SOAEL
Day	$L_{eq,\ 16\ hour}$ day 51 dB	$L_{eq,\ 16\ hour}$ day 63 dB
Night	$L_{eq,\ 8\ hour}$ night 45 dB	$L_{eq,\ 8\ hour}$ night 55 dB

Significance of Effects

14.4.61 The evaluation of significant air noise effects has been undertaken in two stages.

- If the level is newly above SOAEL as a result of the Project – a significant effect on health and quality of life that should be avoided is likely, subject to consideration of any additional factors present.
- If the level is below SOAEL but above LOAEL as a result of the Project, then the following have been considered:

  - How large is the noise change?
  - How large is the population affected?
  - How close is the noise level to SOAEL?

14.4.62 In the first stage, a significant effect is likely if the noise level is or would be below SOAEL in the base case but rises above it as a result of the Project. A significant effect can arise at a single property or at a group of properties. Additional factors that could affect this include the use and nature of the receptors, other noise sources and the duration of the effect.

14.4.63 In the second stage assessment where the predicted noise level is below SOAEL but above LOAEL, the first consideration is the extent of noise change; increases leading to adverse impacts, decreases leading to beneficial impacts. CAP 1616 (paragraph 1.31) can be used to give the following L_{eq} ranges.

- Negligible <1 dB
- Low 1-2 dB
- Medium 3-5 dB
- High 6-9 dB
- Very High >9 dB

14.4.64 The second consideration is how many people are affected by the noise increase. The following ranges have been drawn from Institute of Environmental Management and Assessment (IEMA) Guidance on Environmental Noise Assessment (IEMA, 2014). It is noted that these ranges have also been used in the PEIR produced for the third runway at Heathrow, with reference to that project's Noise Expert Review Group.

- Very Low 10-99
- Low 100-399
- Medium 400-699
- High 700-1000
- Very High >1,000

14.4.65 The third consideration is how close the predicted noise level is to the SOAEL, with noise levels closer to SOAEL more likely to give rise to significant effects.

14.4.66 Noise assessment takes account of the difference in the sensitivity of different NSRs by applying different LOAEL and SOAEL values to different types of buildings, if necessary, to assess impacts. This assessment considers residential buildings, which are sensitive during the day and night. All residential buildings are assumed to be similarly sensitive, unless they have noise insulation, as discussed below. The LOAELs and SOAELs given above are for residential buildings. The assessment also considers hospitals, which are sensitive during the day and night, and it considers schools, places of worship and community buildings that are sensitive to noise in the daytime and evening only. For non-residential buildings, sensitivity to noise tends to depend not just on the building use, but also its construction and other factors. For non-residential buildings specific noise assessment criteria are used where significant noise increases are expected, with reference to their particular use, design and circumstances.

14.4.67 Noise insulation forms part of the noise control measures relied upon to avoid significant adverse effects on health and quality of life in line with Government policy (Department for Transport, 2018a).

14.4.68 Taking account of these additional factors, the following noise effect ratings have been used to describe the significance of the predicted noise effects.

- **Negligible**: Below LOAEL, or above LOAEL negligible noise change (<1 dB) affecting high or very high population size, or high noise change affecting low population size.
- **Minor**: Below SOAEL but above LOAEL with low noise changes (1-2 dB), or affecting low population size, or at levels not near SOAEL.
- **Moderate**: Above SOAEL. Or above LOAEL with noise changes of medium or above (>3 dB), or affecting high population size, but at levels not close to SOAEL.
- **Major**: Above SOAEL. Or above LOAEL with noise changes above medium, or affecting high population size, near SOAEL.
- **Substantial**: Above SOAEL by a margin affecting high population size.

14.4.69 The assessment of significance is based primarily on the predicted levels and changes in the primary noise metrics, but additional noise metrics (the secondary noise metrics) are used to provide more detail on the changes that would arise.

14.4.70 For the purposes of this assessment, effects of moderate significance and above are considered significant in terms of the EIA Regulations.

Ground Noise

Metrics

14.4.71 The assessment of aircraft ground noise has been carried out by comparing the predicted noise levels against benchmark criteria for the LOAEL and SOAEL, defined for the night-time and daytime hours separately, and by comparing the predicted change in noise levels arising at receptors around the airport against the baseline noise levels.

14.4.72 Ground noise has been assessed using a methodology closely aligned with air noise and, for this reason, similar metrics are used. The primary metric used for assessment is the L_{Aeq} as defined over the 16 hour daytime period (07:00-23:00) and the 8 hour night-time period (23:00-07:00) and

1. A review of modelled aircraft flight-related performance, namely the altitude and speed of aircraft departing and arriving at Heathrow (using Heathrow's ANOMS data)
2. Modification of Noise-Power-Distance (NPD) data for the majority of aircraft types operating in 2017 to better reflect measured levels at Heathrow's fixed and temporary monitoring terminals. This has included the network of additional noise monitors installed from 2016
3. Where insufficient data has been available to validate an aircraft type, a 'best fit' of any data available has been used against default information held within AEDT.

17.7.9 Further information on the validation is available in **Appendix 17.1, Annex B**.

17.7.10 The validation of the AEDT modelling has been undertaken using an approach accepted by the CAA based on comparisons of $L_{Aeq,16h}$ contours produced using AEDT and ANCON for 2017 and 2035 with the DCO Project.

17.7.11 In modelling future scenarios, a range of assumptions have been made relating to future aircraft and airspace and these are set out in **Appendix 17.1, Annex B**.

Methodology for identifying significant effects

Overview

17.7.12 This section sets out the approach to identifying the significance of noise effects, positive and negative, that arise from the DCO Project.

17.7.13 The overarching concepts covered in this section are as follows:

1. Significant effects on health and quality of life (due to noise levels that result from the DCO Project)
2. Environmental likely significant effects, both adverse and beneficial (due noise change resulting from the DCO Project)
3. Combined noise effects (due to multiple DCO Project noise sources)
4. Cumulative noise effects (due to noise from the DCO Project and other developments)

Significant effects on health and quality of life

17.7.14 The requirement of the ANPS (paragraph 5.68) and the NN NPS (paragraph 5.195), is that the

"Development consent should not be granted unless the Secretary of State is satisfied that the proposals will meet the following aims for the effective management and control of noise, within the context of Government policy on sustainable development:

- *Avoid significant adverse impacts on health and quality of life from noise;*
- *Mitigate and minimise adverse impacts on health and quality of life from noise; and*
- *Where possible, contribute to improvements to health and quality of life."*

17.7.15 In line with the first aim of Government noise policy[30], significant effects on health and quality of life have been identified where the forecast noise from the DCO Project at a receptor newly exceeds the relevant SOAEL value. SOAEL values are defined in **Table 17.14**. The means to avoid such significant effects includes both noise control measures embedded into the DCO Project and compensatory measures (usually noise insulation) provided at the receptor.

17.7.16 In line with the second and third aims of Government noise policy, the assessment also identifies: adverse effects on health and quality of life (i.e. where exposure from the DCO Project is forecast to exceed the relevant LOAEL but is below the relevant SOAEL); how noise control measures have mitigated and minimised such adverse effects; and where the DCO Project contributes to the improvement of health and quality of life (due to noise).

Likely significant effects (adverse and beneficial)

17.7.17 The EIA Regulations require the identification of likely significant effects and envisaged mitigation to avoid or reduce the significant effects.

17.7.18 Likely significant effects in line with the EIA Regulations are identified separately from, and in addition to, significant effects on health and quality of life that are identified in line with government noise policy as described earlier in this section.

17.7.19 Likely significant effects are identified by reference to Primary Factors and Additional Factors. The Primary Factors considered (in combination) in the identification of likely significant effects (adverse and beneficial) are:

1. the calculated change in noise level for the source being considered
2. the calculated noise exposure compared to the relevant LOAEL and SOAEL values
3. the population (number of people) in an area exposed to the calculated noise level and change in noise level.

[30] In this context, Government noise policy refers to the Airports National Policy Statement (ANPS) which is the primary basis for decision making for the project. The same aims are also contained in similar terms the NPSE and the NPSNN.

17.7.20 Likely significant effects (adverse and beneficial) are only identified when considering the three Primary Factors in combination. The combinations of the three Primary Factors that identify likely significant effects are set out later in this section.

17.7.21 The Primary Factors are supported by a number of Additional Factors (discussed below and in more detail in **Appendix 17.1, Annex D**) that take into account the local context of the receiving environment and the features of the noise arising from the DCO Project. Additional Factors are only ever considered after a potential likely significant effect has been identified using the Primary Factors. The Additional Factors therefore confirm whether a potential significant effect identified using the Primary Factors is actually a likely significant effect (or not). Additional Factors would not identify likely significant effects over and above those identified by the Primary Factors. The Additional Factors are therefore only applied after the Primary Factors.

17.7.22 Likely significant effects are identified in this Chapter for each DCO Project noise source using only the Primary Factors. In the ES, the likely significant effects will be reported taking into account both the Primary the Additional Factors. **Appendix 17.1, Annex D** sets out how the Additional Factors would be applied for the ES and provides a number of worked examples.

Combined effects

17.7.23 The combined effects are those that arise from a receptor being exposed to noise from different sources associated with the DCO Project.

17.7.24 As there is no reliable means of quantitatively assessing the overall noise effect resulting from different noise source, this PEIR (and the subsequent ES) will consider the overall effect noise from combined sources qualitatively. For the PEIR assessment this is reported in **Section 17.11.**

17.7.25 In-combination effects are those that arise from interactions of different types of effect from the DCO Project, for example, air quality, noise and vibration, landscape and visual amenity, on a single receptor. These are reported in **Chapter 22: In-combination effects.**

17.7.26 As there is no reliable means of quantitatively assessing the overall noise effect resulting from different noise source, this PEIR (and the subsequent ES) will consider the overall effect noise from combined sources qualitatively. This will take account of matters such as:

1. Whether the effects from the different sources would occur at the same time
2. The duration of any combined effects

3. Whether the effects might be additive or whether one effect could dominate over others
4. Whether the effects on the receptor are similar in nature (e.g. effecting the same façade of a property) or different in nature (e.g. affecting different facades).

Cumulative effects

17.7.27 Cumulative noise and vibration effects resulting from the combination of effects from the DCO Project and other developments has been assessed in accordance with the approach set out in **Chapter 5: Section 8, Cumulative effects assessment**.

In-combination effects

17.7.28 In-combination effects would arise by the interaction of effects from different environmental aspects (e.g. noise, air quality, visual). These are reported in **Chapter 22: In combination effects**.

Assessment of residential receptors

Overall framework

17.7.29 **Table 17.13** is based on the noise exposure hierarchy presented in Planning Practice Guidance- Noise (PPGN)[31], which is consistent with the ANPS[32] and the NPPF and presents the overall framework for identifying significant effects for residential receptors.

[31] DCLG, 2014.
[32] DfT, 2017a.

Table 17.13: Illustration of LOAEL and SOAEL in the context of identifying likely significant effects on residential receptors applicable for all noise sources (the interaction between government noise policy and the EIA requirements based on noise hierarchy table presented in the PPG-Noise[33]

	PPG – Noise Noise Hierarchy (in line with ANPS 5.67 and NPPF)			EIA Identification of LSE		Noise Mitigation (ANPS 5.60 – 5.65)	Community Compensation (ANPS 5.244 – 5.246) (ANG 4.47 + Annex D)	
	Perception	**Effect**	**Action**	**Assessment**	**Effect**			
Increasing exposure of noise and vibration	Not noticeable	No effect	No specific measures required	None	Adverse effect unlikely	By exception only*	None	
	Noticeable and not intrusive	No observed adverse effect	No specific measures required					
	Lowest Observed Adverse Effect Level – LOAEL							
	Noticeable and intrusive	Observed adverse effect increasingly likely	Mitigate and minimise	Noise exposure + Change in noise exposure + Population + Additional factors **Refer to** Graphic 17.9	Change in exposure (increase or decrease) may cause adverse or beneficial effect on acoustic character of an area. May be identified as an EIA **LSE** (adverse or beneficial) on an area basis (i.e. on a risk basis taking account of factors such as exposure, change and population exposed)	Mitigate and minimise adverse impacts on HQL, within the context of Government policy on sustainable development	Voluntary Noise Insulation offer for aircraft noise	Community Compensation Fund
	Significant Observed Adverse Effect Level – SOAEL							
	Intrusive and disruptive	Observed Significant adverse effect	Avoid	Noise exposure + Change in noise exposure + Additional factors **Refer to** Graphic 17.9	1) Significant adverse effect on health and quality of life on each receptor where newly exposed 2) May be identified as an EIA **likely significant effect** (adverse or beneficial) on each receptor where exposure currently exceeds SOAEL and the DCO Project changes exposure	Mitigate and minimise adverse impacts on Health and Quality of Life (HQL), within the context of Government policy on sustainable development	Noise Insulation Assist with costs of moving[34]	Community Compensation Fund
	Intrusive and very disruptive	Unacceptable adverse effect	Prevent			Mitigate to prevent if possible	Seek powers to install noise insulation & assist with costs of moving	

[33] DCLG, 2014.
[34] There are several factors to take into consideration in relation to 'assist with costs of moving'. a) In terms of temporary rehousing, BS5528: Construction Part 1 Annex E provides example thresholds for providing temporary rehousing or reasonable costs thereof, in relation to construction noise. The Noise and Insulation Regulations 1975 and Noise Insulation (Amendment) Regulations 1988 provide discretionary powers with regard to providing temporary rehousing with regard to the construction of new or altered railways or new or altered roads. b) In terms of permanent rehousing, para 2.48 of the 'Consultation response on UK Airspace Policy' specifies that 'the government continues to expect airport operators to offer households exposed to 69dB $L_{Aeq,16h}$ or more assistance with the costs of moving' and requires an offer of full insulation to be paid for by the airport for homes within the 69dB $L_{Aeq,16h}$ or greater contour, where home owners do not want to move. Further, Heathrow have set out a Wider Property Offer Zone (WPOZ) for eligible homeowners who live close to the boundary of the expanded airport but outside the Compulsory Purchase Zone, which provides assurance for owner-occupiers of eligible properties. If owners sign up to Heathrow's bond they will receive the unaffected market value of their home and a 25% Home Loss Payment as well as their normal legal fees, moving costs and an equivalent stamp duty amount.
* By exception cases would occur where a receptor a within or immediately adjacent to a designated Quiet Area or Green Space and the designation defines requires control of noise below LOAEL.

Significance criteria

17.7.30 **Graphic 17.9** presents the Primary Factors and Additional Factors used in the assessment of all noise sources. The graphic has been updated since the publishing of the Scoping Report in two ways:

1. WebTAG is no longer listed as an Additional Factor. Rather WebTAG has been integrated into the initial assessment in three ways:
2. First, in assessing wider health effects (refer to **Section 17.10**)
    a. Second, in supporting the definition Primary Factor combinations that are used to indicate likely significant effects (as described later in this section)
    b. Thirdly, as part of the evaluation of noise mitigation measures to establish whether they should be embedded in the DCO Project (refer to **Section 17.9**)
3. Noise insulation is no longer considered an Additional Factor, as it forms part of the noise control measures relied on to avoid significant adverse effects on health and quality in line with Government Policy (the ANPS) (refer to **Section 17.9**).

Graphic 17.9 Significance evaluation criteria for residential receptors for all noise sources

Evaluation 1

Government noise policy; identification of significant adverse effects on health and quality of life due to noise arising from the DCO Project.
Identified on a receptor-by-receptor and source-by-source basis:

- **Primary Factor**: **Noise exposure.** A significant adverse effect on health and quality of life is identified where noise from the DCO Project newly exceeds[a] the relevant SOAEL value (refer to Table 17.14) evaluated using $L_{Aeq,16h}$ and $L_{Aeq,8h}$ metrics[b,c] and taking account of mitigation and compensation measures (see Section 17.9)

- **Additional Factors:** (that in the ES could reduce significant effects identified based on the primary factor alone): **Additional metrics**; e.g. based on Heathrow's ongoing community research (refer to Appendix 17.1 Annex D) better evaluate how significant adverse effects on health and quality of life are reduced or avoided by predictable and valued respite provided by the runway alternation already considered with Primary Factors.

Evaluation 2

EIA Regulations; identification of likely significant effects (adverse and beneficial) due to noise change arising from the DCO Project.
Identified source-be-source having taken account of all noise control measures (**refer to Section 17.9**).

- **Primary Factors**: Likely significant effects are identified on areas (e.g. communities, or parts of communities including their private and public external amenity space) by considering in combination (refer to Graphic 17.3):

P1 **Noise change[d]:** day or night and beneficial (decrease) or adverse (increase) changes evaluated using $L_{Aeq,16h}$ and $L_{Aeq,8h}$ metrics[b,c]; and

P2 **Noise level:** day or night, evaluated using $L_{Aeq,16h}$ and $L_{Aeq,8h}$ metrics[b,c] compared to the relevant LOAEL, SOAEL and UAEL values (refer to Table 17.14); and

P3 **Population:** The population in the area that is exposed to the calculated noise change and noise exposure.

- **Additional factors:** (that would reduce significant effects identified based on primary factors alone) (in no order):

A1 **Change in overall noise:** This is the change n the overall noise in an area taking account of both new/changed noise caused by the DCO Project and noise from other sources not altered by the DCO Project. Overall change is considered day and night using $L_{Aeq,16h}$ and $L_{Aeq,8h}$ metrics[b,c] i

A2 **Additional metrics**: e.g. i) consider 100% mode L_{Aeq} metrics to better evaluate how adverse likely significant effects are reduced by predictable and valued respite through runway alternation; and ii) use Nabove metrics to confirm adverse likely significant effects taking account of the noise level from each aircraft and number aircraft. For aircraft, additional metrics from ANG17, CAP1616 and Airports Commission.

A3 **Other relevant qualitative information**: for example, non-acoustic factors that could change people's response to noise or the duration of the exposure for construction noise

Notes:
a - Resulting from an increase of at least 1 dB
b - Summer 92-day average for aircraft and ground noise and Annual Average Weekday for road traffic noise.
c - Change in noise level for construction noise is accounted for using the 'ABC' method 2 from Annex E of BS5228 Part 1 2008 + A1: 2014 using day (12hr), evening (4hr) and night-time (1hr) L_{Aeq} noise metrics.
d - Greater weight will be given to change in exposure, even slight changes on a small number of dwellings, if the area is already exposed to existing levels of noise that exceed the relevant SOAEL values to reflect the increasing risk of health effects at these levels of exposure.

Thresholds of potential effects in terms of government policy

17.7.31 The assessment has made use of Lowest Observed Adverse Effect Levels (LOAELs) and Significant Observed Adverse Effect Levels (SOAEL), as set out in the Scoping Report. Since the Scoping Report was published and in response to the Scoping Opinion (refer to **Table 17.5**), Unacceptable Adverse Effect Levels (UAEL) have been added to the assessment methodology.

17.7.32 These effect level values are shown in **Table 17.14** for each noise source, along with references to the source of these values.

17.7.33 The LOAEL, SOAEL and UAEL values have been identified following a review of policy, precedent set by previous projects, guidance, and the research evidence base for different phases (construction, operation), types of noise source (aircraft noise; railway noise; road traffic noise; construction noise; ground-borne noise and vibration; airfield static noise), and type of effect.

17.7.34 The selection of LOAEL, SOAEL and UAEL values for the assessment prioritises policy and legislative requirements, as well as standards over suggestions for LOAEL, SOAEL and UAEL values from other sources. The assessment aligns SOAEL values with noise insulation requirements, where available.

17.7.35 For further detail on the evidence base used to identify the LOAEL, SOAEL and UAEL values, see **Appendix 17.1, Annex F**.

Table 17.14: LOAEL SOAEL and UAEL levels to be used in the assessment for residential receptors

Source	Period	LOAEL, SOAEL and UAEL criteria (outdoors, free-field[n])	
		Period noise level	Maximum noise level
Construction			
Site/Construction including borrow pits	Daytime 0700 – 1900	LOAEL 65dB $L_{Aeq,12h}$[a] SOAEL 75dB $L_{Aeq,12h}$[a] UAEL 85dB $L_{Aeq,12h}$[b]	
	Evening 1900 – 2300 / Weekends	LOAEL 55dB $L_{Aeq,4h}$[a] SOAEL 65dB $L_{Aeq,4h}$[a] UAEL 75dB $L_{Aeq,4h}$[b]	
	Night-time 2300-0700	LOAEL 45dB $L_{Aeq,8h}$[a] SOAEL 55dB $L_{Aeq,8h}$[a] UAEL 65dB $L_{Aeq,8h}$[b]	[c]
Operation			
Other noise sources (fixed noise sources) e.g. Airfield static sources	Day/Night-time Avoid LSE by setting noise constraints in line with BS 4142.[d]		
Aircraft noise / Aircraft ground noise	Daytime	LOAEL 51dB $L_{Aeq,16h}$[e] SOAEL 63dB $L_{Aeq,16h}$[f] UAEL 71dB $L_{Aeq,16h}$[g]	
	Night-time	LOAEL 45dB $L_{Aeq,8h}$[e] SOAEL 55dB $L_{Aeq,8h}$[h] UAEL 66dB $L_{Aeq,8h}$[g]	Supplementary SOAEL: newly experiencing one additional awakening due to aircraft noise (year average)
Road	Daytime	LOAEL 50dB $L_{Aeq,16h}$[j] SOAEL 63dB $L_{Aeq,16h}$[k] UAEL 71dB $L_{Aeq,16h}$[g]	
	Night-time	LOAEL 40dB $L_{Aeq,8h}$[h] SOAEL 55dB $L_{Aeq,8h}$[h] UAEL 66dB $L_{Aeq,8h}$[g]	
Railway	Daytime	LOAEL 50dB $L_{Aeq,16h}$[j] SOAEL 65dB $L_{Aeq,16h}$[l] UAEL 71dB $L_{Aeq,16h}$[g]	
	Night-time	LOAEL 40dB $L_{Aeq,8h}$[j] SOAEL 55dB $L_{Aeq,8h}$[h] UAEL 66dB $L_{Aeq,8h}$[g]	LOAEL L_{Amax}, 60 dB (any event)[m] SOAEL L_{Amax}, 80dB (>20 pass-bys per night) or 85dB (< 20 pass-bys per night[m]

Notes:
a. BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites - Part 1: Noise. The LOAEL and SOAEL correspond to Category A and Category C of the 'ABC method' respectively.
b. BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites - Part 1: Noise. The UAEL value aligns with the trigger value for temporary rehousing.
c. L_{max} levels are not provided for construction noise. Construction noise is calculated in accordance with BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites - Part 1: Noise., which calculates L_{Aeq}, T values. There is no developed methodology linking construction noise L_{max} levels to health/quality of life.
d. For airfield static noise, no LOAEL, SOAEL or UAEL values are specified at this stage of the Project as airfield static noise is managed through the application of BS4142 after the DCO process, when the design elements are specified, and background noise can be assessed.
e. UK Airspace Policy, DfT, February 2017 and Consultation Response, DfT, October 2017
f. Department for Transport, Aviation Policy Framework, 2013
g. London Borough of Richmond Supplementary Planning Guidance/ProPG/BS8233
h. WHO, Night Noise Guidelines for Europe, 2009
i. Research on objective sleep disturbance suggests that, on average, there should be less than one additional awakening induced by aircraft noise per night (Basner et al, 2006).
j. WHO, Guidelines for Community Noise, 1999
k. Statutory Instrument No. 1763 (1974), The Noise Insulation Regulations 1975
l. Statutory Instrument 1996 No. 428. The Noise Insulation (Railways and Other Guided Transport Systems) Regulations 1996
m. HS2 Phase 2a Information Paper E9: Control of Airborne Noise
n. The noise level evaluated over relevant assessment period, outdoors at the façade of a noise sensitive receptor and measured in the absence of façade reflections. When sound radiates from an object, it can either travel directly to the receiver in a straight-line or be reflected from other surfaces in the environment. Free-field is a situation where no reflections occur and only the direct sound is observed.

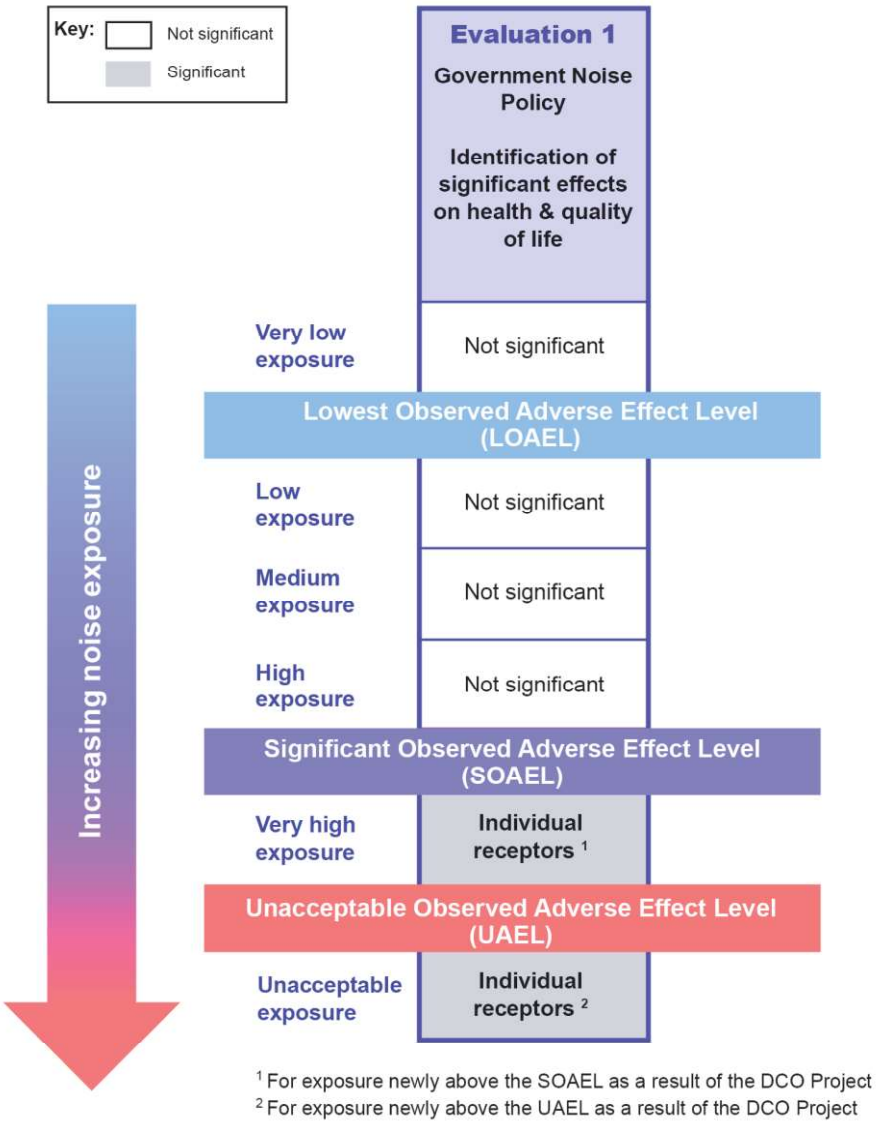
Evaluation 1 - Significant adverse effects on health and quality of life

17.7.36 In line with Government policy (the NPSE), where the calculated 'end state' exposure newly exceeds the SOAEL, and all noise control measures have been taken into account, then there is a potential for a significant adverse effect on health and quality of life to be identified for each receptor affected. Where exposure newly exceeds the UAEL there is a potential for an unacceptable adverse effect on health and quality of life to be identified for each receptor affected.

17.7.37 The Primary Factor for Evaluation 1 is therefore end state noise exposure compared to the relevant SOAEL and UAEL value for the time period and noise source in question (see **Table 17.14**).

17.7.38 **Graphic 17.10** shows how a potential for significant adverse effect on health and quality of life is identified for each receptor newly exposed above the relevant SOAEL.

Graphic 17.10 Evaluation 1 framework



17.7.39 For Evaluation 1 there is a single Additional Factor (that would reduce significant effects identified based on the primary factor alone): additional metrics. These will be used in the ES to better evaluate, for example, how the significant adverse effects on health and quality of life identified using the Primary Factor are reduced or avoided by predictable and valued respite provided by runway alternation. This example would be supported by the results of community research currently being undertaken by Heathrow. For further information on this Additional Factor and related respite research, see **Appendix 17.1, Annex D**. For this PEIR, the assessment is based on the Primary Factors, that provide a precautionary assessment, and a qualitative description of how the Additional Factor may change the assessment outcome in the ES.

Assessment of significant effects on health and quality of life | objective sleep disturbance

17.7.40 For the ES an assessment of objective sleep disturbance will be undertaken in addition to the assessment of wider self-reported sleep disturbance presented in this preliminary assessment.

17.7.41 Sleep disturbance can be quantified either by subjective means e.g. asking people how they slept in a questionnaire or by objective means e.g. monitoring physiological or behavioural awakenings during the night. It is important to recognise that people are not conscious of their own bodies when asleep and studies have reported inconsistencies between the physiological effects of noise exposure (objective measures) and the subjects' perceived disturbance[35,36]. Self-reported sleep disturbance is often considered to be a poor indicator of actual sleep disturbance and associated health effects. Nonetheless, self-reported sleep disturbance is an important indicator of community perception of night noise effects (in many respects an indicator of night-time annoyance). Self-reported sleep disturbance is reasonably related to the $L_{Aeq,8h}$ metric (refer to **Appendix 17.1, Annexes E and F).**

17.7.42 Sleep disturbance can also be measured objectively electrophysiologically, using polysomnography (PSG) i.e. the simultaneous recording of the electroencephalogram (EEG), the electrooculogram (EOG), the electromyogram (EMG) and other physiological variables. This is referred to as objective sleep disturbance and can be measured by quantifying the number of 'additional awakenings' induced by a noise source. It is important to note that awakenings measured using PSG are often either too short to be remembered the next day or relate to a change of sleep state that is no longer recuperative but is not 'awake'[37].

17.7.43 Evidence for noise effects on objective sleep disturbance (in terms of additional awakenings) is demonstrated using L_{Amax} levels for individual noise events. Additional assessment metrics, such as L_{Amax}, will therefore be employed at ES stage to include objective sleep disturbance in the assessment.

17.7.44 For aircraft noise the Scoping Report set out:

1. night-time LOAEL and SOAEL values defined using the $L_{Aeq,8h}$ metric, which describe self-reported sleep disturbance, and in addition
2. 'L_{Amax} and number of events and a risk assessment of objective sleep disturbance' would also be considered.

[35] U. Moehler & L. Greven (2005), Community response to railway and road traffic noise - a review on German field studies. Internoise 2005
[36] M. Basner, U. Müller, E-M. Elmenhorst (2011), Single and combined effects of air, road and rail traffic noise on sleep and recuperation, SLEEP
37 Basner and McGuire, 2018. WHO Environmental Noise Guidelines for the European Region: A systematic review on environmental noise and effects on sleep. International Journal of Environmental Research and Public Health, 15(3), 519.

17.7.45 The Scoping Opinion requested clarification on this second point (see **Table 17.5**)

17.7.46 For aviation, research on objective sleep disturbance suggests that, on average, to protect health, bearing in mind that a healthy adult briefly awakens around 20 times during an 8-hour night period in environments without external stressors, there should be less than one additional awakening induced by aircraft noise per night[38].

17.7.47 However, one additional awakening for aircraft noise might be associated with a wide-variety of combinations of L_{Amax} levels / number of events such as a small number of events with high L_{Amax} levels or by a high number of events with lower L_{Amax} levels[39]. This makes setting a SOAEL value for aviation noise based on L_{Amax} levels / number of events challenging and unlikely to identify all significant effects on health and quality of life. This contrasts with other noise sources, such as railway noise, where there are regular repeating events both in noise levels and geography (i.e. the train has a similar noise exposure and is in the same place in relation to the receptor), which enables LOAEL and SOAEL values to be set using L_{Amax} levels / number of events.

17.7.48 For aircraft noise the assessment at ES will therefore use a supplementary SOAEL value of newly experiencing one additional awakening (per night but taken as an average over a year). A risk assessment will therefore be undertaken using the methodologies defined by Basner as part of Evaluation 1. This will estimate the number of additional awakenings for aircraft noise in relation to all combinations of L_{Amax} levels and number of events for the night-time period (23.00 – 07.00) during operation.

17.7.49 If the result of the assessment shows that, on average, there will be less than one additional awakening induced by aircraft noise per night, then it will be assumed that there is no significant effect on health for objective sleep disturbance. If the assessment shows that a receptor will newly experience more than one additional awakening by aircraft noise (>=one additional awakening), then this will contribute to a significant effect on health for objective sleep disturbance (i.e. there would be a significant adverse effect on health and quality of life due to additional awakening, as well as self-reported sleep disturbance for each receptor newly exposed above the SOAEL).

38 Basner et al 2006. Aircraft noise effect on sleep: application of the results of a large polysomnographic field study. The Journal of the Acoustical Society of America, 119(5), 2772-2784
39 Basner et al 2006. Aircraft noise effect on sleep: application of the results of a large polysomnographic field study. The Journal of the Acoustical Society of America, 119(5), 2772-2784

Evaluation 2 - Likely Significant Effects (adverse and beneficial)

17.7.50 Where exposure lies above the relevant LOAEL value, then there is the potential for likely significant effects (adverse or beneficial) to be identified primarily due to noise change brought about by the DCO Project. The Primary Factors and Additional Factors (described and further outlined in the following sections) are used to determine whether a likely significant effect is identified, having taken into account embedded and all other noise control measures.

Primary factors

17.7.51 The three Primary Factors identified in **Graphic 17.9** Significance evaluation criteria for residential receptors for all noise sources

17.7.52 have been considered together in the assessment and are not considered in isolation. None of the factors on their own would indicate a likely significant effect.

17.7.53 When the exposure falls above the relevant LOAEL value a likely significant effect (adverse or beneficial) is identified in terms of the EIA Regulations in according to a grading structure for each area where, at extremes:

1. A large population is subject to small noise change (increase or decrease)
2. A small population is subject to a large noise change (increase or decrease)
3. Greater weight is given to a small change in exposure, where the exposure approaches the relevant SOAEL, and less weight will be given to a large population where the exposure is just above the relevant LOAEL.

Primary Factor P1 – noise change

1.1.1 When combining the primary factors to identify likely significant effects (adverse and beneficial), greater weight will be given to changes in noise exposure of greater magnitude (increases and decreases) according to the change categories in **Table 17.15**.

1.1.2 The change categories for aircraft noise have been informed by guidance from the Civil Aviation Authority (CAP1616a Para 1.31 et seq). For road traffic noise the change categories have been informed by the noise change classification for short-term criteria (as a worst-case) from the Design Manual for Roads and Bridges (DMRB). There are only three change classifications above negligible in DMRB (referred to as minor, moderate and major), so the long-term ‘major’ noise change category has been used for the Very High road noise change category.

Table 17.15: Noise change categories

Noise change category	Aircraft and ground noise	Road noise
Negligible	<1 dB	<1 dB
Low	1 - 2 dB	1 – 2 dB
Medium	3 – 5 dB	3 – 4 dB
High	6 – 9 dB	5 – 10 dB
Very High	>9 dB	>10 dB

Primary Factor P2 – noise level

17.7.54 When combining the primary factors to identify likely significant effects (adverse and beneficial), greater weight will be given to exposures at higher noise levels according to the exposure categories in **Table 17.16**.

Table 17.16: Noise exposure categories

Exposure category	Aircraft and ground noise, daytime	Aircraft and ground noise, night-time	Road noise, daytime	Road noise, night-time
Very Low	<51 $dBL_{Aeq,16h}$	<45 $dBL_{Aeq,8h}$	<50 $dBL_{Aeq,16h}$	<40 $dBL_{Aeq,8h}$
LOAEL				
Low	51 – 53 $dBL_{Aeq,16h}$	45 – 47 $dBL_{Aeq,8h}$	50 – 53 $dBL_{Aeq,16h}$	40 – 44 $dBL_{Aeq,8h}$
Medium	54 – 56 $dBL_{Aeq,16h}$	48 – 50 $dBL_{Aeq,8h}$	54 – 56 $dBL_{Aeq,16h}$	45 – 49 $dBL_{Aeq,8h}$
High	57 – 62 $dBL_{Aeq,16h}$	51 – 54 $dBL_{Aeq,8h}$	57 – 62 $dBL_{Aeq,16h}$	50 – 54 $dBL_{Aeq,8h}$
SOAEL				
Very High	>63 $dBL_{Aeq,16h}$	>54 $dBL_{Aeq,8h}$	>63 $dBL_{Aeq,16h}$	>55 $dBL_{Aeq,8h}$
UAEL				
Unacceptable	>71$dBL_{Aeq,16h}$	>66$dBL_{Aeq,8h}$	>71$dBL_{Aeq,16h}$	>66$dBL_{Aeq,8h}$

Primary Factor P3 – population

17.7.55 When combining the primary factors to identify likely significant effects (adverse and beneficial), greater weight will be given to effects on greater population within an assessment area according to the population categories in **Table 17.17**.

17.7.56 As noted earlier the specific combination of Primary Factors that lead to likely significant effects (adverse or beneficial) are based on a grading structure. Where possible, the grading structure has been taken from relevant standards and guidance (for example the noise change categories set out in CAP1616a) and has also taken into account response to the Scoping Report consultation. The grading

structure **- particularly the grades for population -** has been further informed by professional judgement (see the IEMA Guidelines for Environmental Noise Assessment 2014) and has been refined through application to specific assessment areas for the DCO Project and through engagement and review with the Noise Expert Review Group. Finally, the monetised value of the combination of exposure, change and population have been considered using WebTAG to finalise the grading structure and combinations.

17.7.57 The difference in the population counts used to define the grades for aircraft compared to ground noise sources is justified because ground noise levels reduce more quickly with distance than aircraft noise because of ground absorption bur more importantly because of screening from natural topography, the built environment and noise barriers.

Table 17.17: Population categories

Population category	Aircraft noise	Aircraft ground noise and road noise
Very Low	10 – 99	1 - 9
Low	100 – 399	10 – 39
Medium	400 – 699	40 – 69
High	700 – 1000	70 – 100
Very High	>1000	>100

Framework for the combination of Primary Factors for Evaluation 2

17.7.58 **Graphic 17.11** shows how the categories of Primary Factors are brought together to identify likely significant effects (adverse and beneficial). Where combinations that lead to likely significant effects are possible (indicated by grey shaded cells), the text in the cell shows **the range of population** categories (for that change and exposure) that would lead to the identification of a likely significant effect. For example:

1. A likely significant effect would be identified on an area basis for a low change (see **Table 17.15**) and low exposure (see **Table 17.16**) if the population is very high (see **Table 17.17**); and by contrast
2. A likely significant effect would be identified on an area basis for a very high change and a high exposure if the population is low, medium, high or very high.

Graphic 17.11 Evaluation 2 framework

Key: Not significant; Significant

VL Very Low
L Low
M Medium
H High
VH Very High

Evaluation 2

Environmental Impact Assessment
Identification of likely significant effects (adverse and beneficial)

Increasing magnitude of change (increases and decreases)

Increasing noise exposure

	Negligible change	Low change	Medium change	High change	Very high change
Very low exposure	Not significant	Not significant	Not significant	Not significant	Not significant
Lowest Observed Adverse Effect Level (LOAEL)					
Low exposure	Not significant	VH population[1]	M, H & VH population[1]	L, M, H & VH population[1]	L, M, H & VH population[1]
Medium exposure	Not significant	VH population	M, H & VH population	L, M, H & VH population	L, M, H & VH population
High exposure	Not significant	VH population	L, M, H & VH population	L, M, H & VH population	L, M, H & VH population
Significant Observed Adverse Effect Level (SOAEL)					
Very high exposure	Not significant	VL, L, M, H & VH population	VL, L, M, H & VH population	VL, L, M, H & VH population	VL, L, M, H & VH population
Unacceptable Observed Adverse Effect Level (UAEL)					
Unacceptable exposure	Not significant	Individual receptors	Individual receptors	Individual receptors	Individual receptors

[1] Beneficial likely significant effects may be identified due to noise decreases that bring exposure from above the LOAEL without the DCO Project to below the LOAEL with the DCO Project.

Additional factors

17.7.59 As set out **Graphic 17.9** the identification of likely significant effects will be supported by a number of Additional Factors. Whilst the Additional Factors have not been fully applied for the PEIR assessment they are described in more detail in **Appendix 17.1, Annex D**, with worked examples to explain how they will be used in the ES.

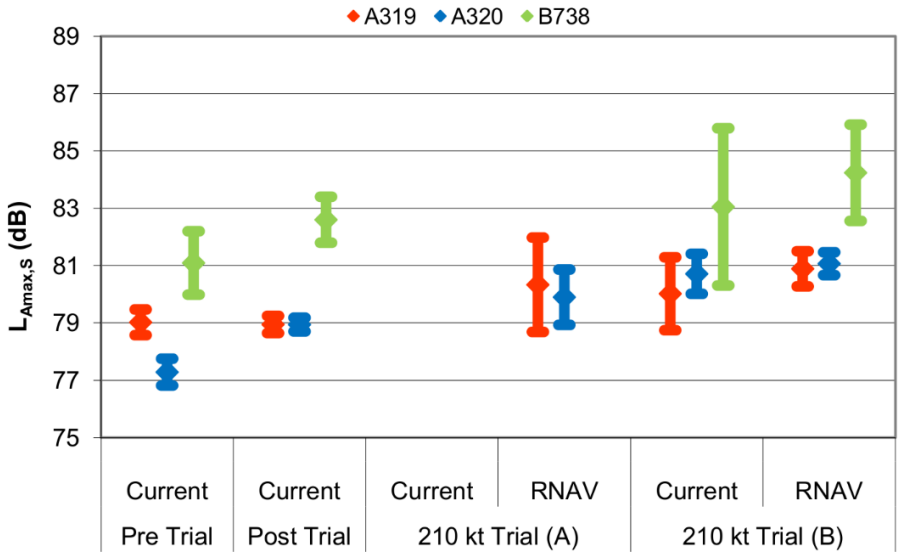
17.7.60 For this PEIR, the assessment is based on Primary Factors and, where relevant, a qualitative description of how the Additional Factors may change the assessment outcome is provided. At ES the assessment will be based on the Primary Factors and the Additional Factors.

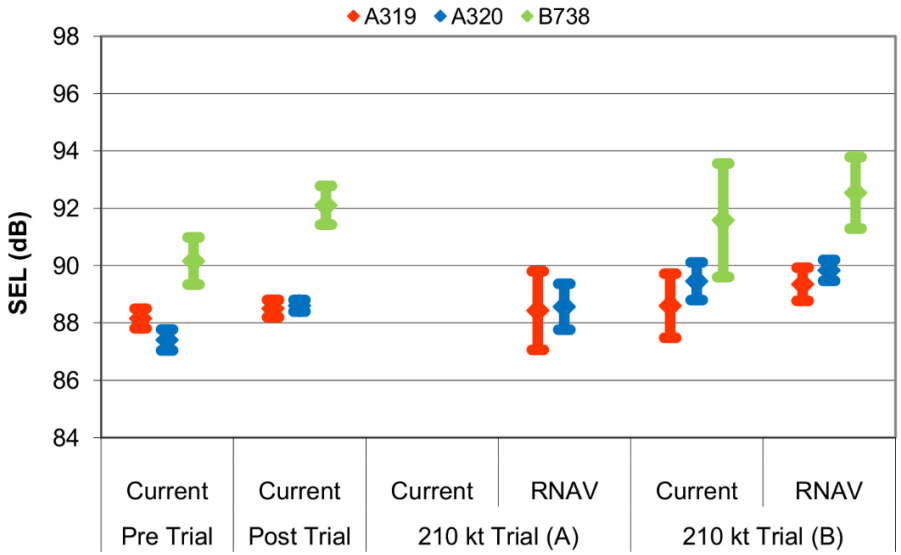
Appendix 2:

Excerpt from Consultation Document

South Luton Monitoring

Location:	Ludlow Avenue, Luton, LU1 3RW		
Survey Dates			
Pre Trial	26/10/2012 – 01/11/2012		
210 knots trial	07/03/2013 – 13/03/2013	&	30/05/2013 – 06/06/2013 (revisited)
220 knots trial	-		
Post Trial	25/07/2013 – 31/07/2013		





Current: Aircraft flying current procedures using conventional navigation technology

RNAV: Aircraft flight the RNAV1 trial procedures