

SILVERTOWN TUNNEL

**Environmental  
Statement Appendix 14D  
(6.3.14.4)**

**Southern Portal Tunnel  
Noise Assessment**

April 2016

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## List of Abbreviations

|     |                           |
|-----|---------------------------|
| NML | Noise Monitoring Location |
|-----|---------------------------|

## Glossary of Terms

|                               |  |
|-------------------------------|--|
| Ambient noise                 | Totally encompassing noise in a given situation at a given time, usually composed of noise from many sources near and far  |
| Ambient noise level (LAeq)    | Equivalent continuous A-weighted noise pressure level of the totally encompassing noise in a given situation at a given time, usually from many sources near and far, at the assessment location over a given time interval  |
| Background noise level (LA90) | A-weighted noise pressure level that is exceeded by the residual noise at the assessment location for 90% of a given time interval, T, measured using fast time weighting and quoted to the nearest whole number of decibels |
| Rating level                  | Specific noise level plus any adjustment for the characteristic features of the noise  |
| Residual noise                | Ambient noise remaining at the assessment location when the specific noise source is suppressed to such a degree that it does not contribute to the ambient noise  |
| Specific noise level          | Equivalent continuous A-weighted noise pressure level produced by the specific noise source at the assessment location over a given reference time interval  |
| Specific noise source (LAeq)  | Noise source being assessed  |

# 1. INTRODUCTION

- 1.1.1 This Appendix presents the findings of the Noise and Vibration Assessment for the tunnel ventilation system at the southern portal of the proposed Silvertown Tunnel located within the Royal Borough of Greenwich. It identifies the methodology used to establish existing background noise levels, identifies the closest receptors potentially affected and an assessment of the impact of the new noise source in accordance with BS4142: 2014 '*Methods for rating and assessing industrial and commercial noise*'<sup>1</sup>.

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<sup>1</sup> British Standard Institution (2014), BS4142: 2014 '*Methods for rating and assessing industrial and commercial noise*'.

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## 2. GUIDANCE

### 2.1 **BS4142 Methods for Rating and Assessing Industrial and Commercial Noise**

2.1.1 British Standard BS 4142:2014 '*Methods for Rating and Assessing Industrial and Commercial Noise*' is used to determine the impacts of noise upon residential dwellings. The guidance provided within BS 4142 provides a method whereby the likelihood of a significant impact due to noise from industrial sources can be assessed.

2.1.2 The standard advises that the existing background noise levels outside noise sensitive premises are compared with the rating noise levels from any nearby industrial activities.

#### **Background Noise Level**

2.1.3 The background noise level (LA90) is the noise level that is exceeded for 90% of the monitoring period at the assessment location.

#### **Specific Noise Level**

2.1.4 The specific noise level is the LAeq produced by the noise source under investigation, for the purposes of the assessment noise levels have been predicted using manufacturer's data.

#### **Rating Level**

2.1.5 The rating level is the specific noise level plus any adjustments for the acoustic characteristics of the noise as specified in clause 9.0 of BS4142.

2.1.6 Certain acoustic features can increase the significance of impact over that expected from a basic comparison between the specific noise level and the background noise level.

2.1.7 The rating level should include corrections for any acoustic character to the noise that makes it more readily discernible to a listener. The subjective corrections which may be applied are presented in Table 2-1.

**Table 2-1 Subjective Acoustic Feature Corrections Provided in BS4142**

| <b>Acoustic Feature</b>            | <b>Correction</b>   |
|------------------------------------|---|
| <b>Tonality</b>                    | 2 dB for a tone which is just perceptible   |
|                                    | 4 dB where it is clearly perceptible  |
|                                    | 6 dB where it is highly perceptible   |
| <b>Impulsivity</b>                 | 3 dB for impulsivity which is just perceptible  |
|                                    | 6 dB where it is clearly perceptible  |
|                                    | 9 dB where it is highly perceptible   |
| <b>Intermittency</b>               | If the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied   |
| <b>Other noise characteristics</b> | Where the specific noise features characteristics that are neither tonal nor impulsive, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied. |

2.1.8 Where tonal and impulsive characteristics are present in the specific noise within the same reference period then these two corrections can both be taken into account.

## **2.2 Assessment of Impacts**

2.2.1 An assessment of the likely impacts is undertaken by subtracting the measured background noise level from the rating level, and considers the following:

- A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.
- A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.
- The lower the rating level is relative to the measured background noise level, the less likely it is that the specific noise source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background noise level, this is an indication of the specific noise source having a low impact, depending on the context.

### 3. METHODOLOGY

#### 3.1 Sensitive Receptors Considered

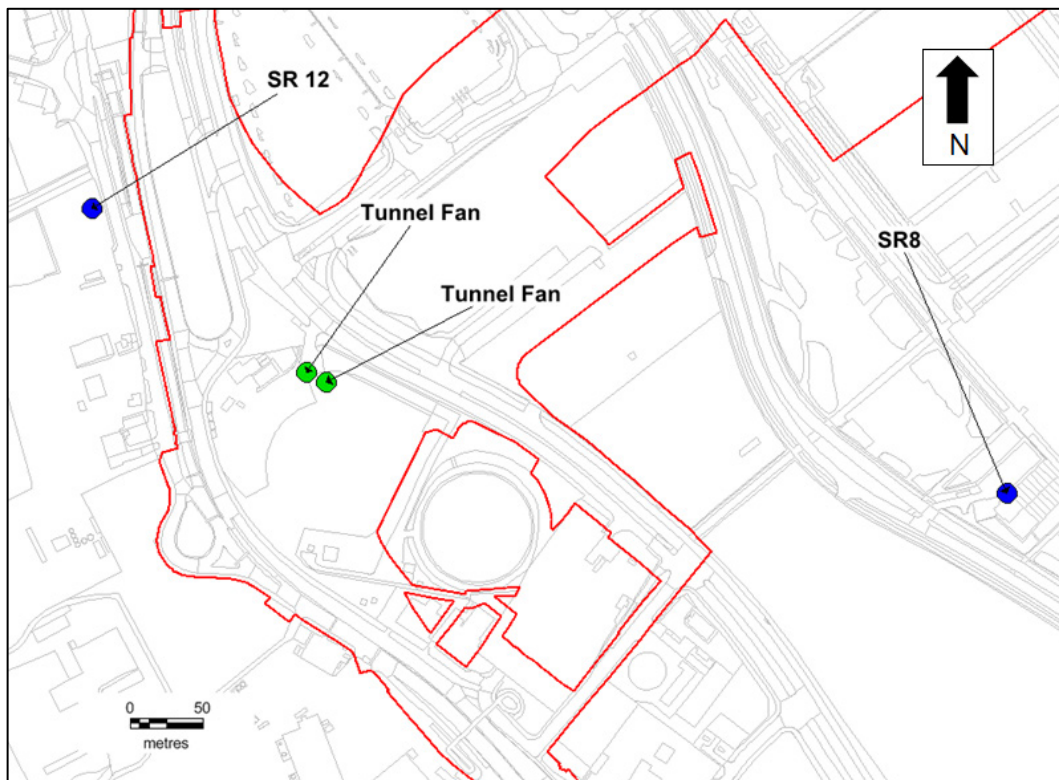
3.1.1 The proposed site is located on the south of the River Thames within the Royal Borough of Greenwich.

3.1.2 The nearest residential dwellings and the approximate distance to the ventilation stack are presented in Table 3-1 and in Figure 3-1 Identified Sensitive Receptor Locations.

**Table 3-1 Identified Sensitive Receptor Locations**

| Receptor ID | Description                                | Distance from Scheme in metres | OS Grid Reference |
|-------------|--|--------------------------------|-------------------|
| SR8         | River way                                  | 470                            | 539640,179395     |
| SR12        | Greenwich Peninsula Masterplan Development | 175                            | 539006,179593     |

**Figure 3-1 Identified Sensitive Receptor Locations**



### 3.2 Background Noise Level Survey

3.2.1 Background noise surveys were undertaken at two monitoring locations within the vicinity of the tunnel portal. The locations of each survey position are presented in Figure 3-2.

3.2.2 The measurement locations were chosen to be representative of the nearest residential dwellings to the tunnel ventilation buildings and tunnel portals.

**Figure 3-2 Survey Locations**



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3.2.3 The background noise level surveys at Noise Monitoring Location (NML) B were undertaken for a period of 24 hours during on 14 March 2016 to 15 March 2016.

3.2.4 The background noise level surveys at NML G were undertaken for a period of 5 days from 24 March 2016 to 28 March 2016.

3.2.5 Table 3-2 presents details of the equipment used for the noise level survey.

**Table 3-2 Details of Noise Level Survey Equipment**

| <b>Equipment</b>  | <b>Manufacturer</b> | <b>Model</b> | <b>Serial Number</b> |
|-------------------|---------------------|--------------|----------------------|
| Noise Level Meter | Rion                | NL-52        | 00410085             |
| Noise Calibrator  | Rion                | 4231         | 3002998              |
| Microphone        | Rion                | UC-59        | 02436                |
| Pre Amplifier     | Rion                | NH-25        | 10078                |

### 3.3 Noise Propagation Model

- 3.3.1 Noise predictions have been carried out using International Standard ISO 9613, '*Acoustics – Attenuation of Noise during Propagation Outdoors*'<sup>2</sup>. The propagation model described in Part 2 of this standard provides for the prediction of noise pressure levels based on either short-term downwind (i.e. worst case) conditions or long-term overall averages. Only the downwind condition has been considered in this assessment, that is, for wind blowing from the application site towards the nearby houses. When the wind is blowing in the opposite direction noise levels may be significantly lower, especially if there is any shielding between the application site and the houses.
- 3.3.2 This assessment has used published values of 'α' (atmospheric absorption) from ISO 9613 Part 1<sup>3</sup> corresponding to a temperature of 10 °C and a relative humidity of 70% which give relatively low levels of atmospheric attenuation, and subsequently worst case noise predictions.
- 3.3.3 The calculations undertaken within this assessment have been conducted using a computer based prediction program IMMI (produced by Wölfel Meßsysteme). The software package follows the procedures given in ISO 9613.
- 3.3.4 The noise source data provided by the design team for the jet fans at the portal of the tunnel used in the prediction of specific noise levels in the assessment are provided in Table 3-3

<sup>2</sup> International Organization for Standardization (1996), ISO 9613-2:1996 Acoustics - Attenuation of noise during propagation outdoors

<sup>3</sup> International Organization for Standardization (1993), ISO 9613-1:1993 Acoustics - Attenuation of noise during propagation outdoors Part 1: Calculation of the absorption of noise by the atmosphere

**Table 3-3 Noise Pressure Data used in Assessment**

|                                       | Octave Band Centre Frequency [Hz]<br>Noise Pressure Level, dB |     |     |     |    |    |    |    | Noise Pressure Level, dBA |
|---------------------------------------|---|-----|-----|-----|----|----|----|----|---------------------------|
|                                       | 63  | 125 | 250 | 500 | 1k | 2k | 4k | 8k |                           |
| <b>SPL of Jet fan noise at portal</b> | 79  | 79  | 82  | 69  | 67 | 68 | 61 | 45 | 76                        |

### 3.4 Rating Noise Level Correction

3.4.1 A rating penalty for the specific noise from the operation of the tunnel ventilation system has been based on a subjective assessment of its characteristics. Table 3-4 present the subjective acoustic corrections which have been applied in the assessment.

**Table 3-4 Subjective Acoustic Feature Corrections Applied**

| Acoustic Feature             | Correction  |
|------------------------------|-------------|
| Tonality                     | +6dB        |
| Impulsivity                  | Zero        |
| Intermittency                | Zero        |
| Other noise characteristics  | +3dB        |
| <b>Total Penalty Applied</b> | <b>+9dB</b> |

3.4.2 The following acoustic feature corrections have been assumed when considering the specific noise from the tunnel ventilation jet fans.

- a +6 dB penalty has been applied based upon the possibility of a tone being present from the ventilation fans;
- no penalty has been applied for impulsivity; the operation of the ventilation system would not give rise to rapid fluctuations in overall noise level at identified sensitive receptors;
- no penalty has been applied for intermittency: the operation of the ventilation system would be continuous, operating 24 hours a day; and
- a penalty of +3 dB has been applied for other noise characteristics. This penalty has been applied as the operation of the tunnel ventilation system could possibly be readily distinctive against the residual acoustic environment.

- 3.4.3 Overall a total penalty of +9dB has been added to the specific noise level, to obtain the rating noise level.

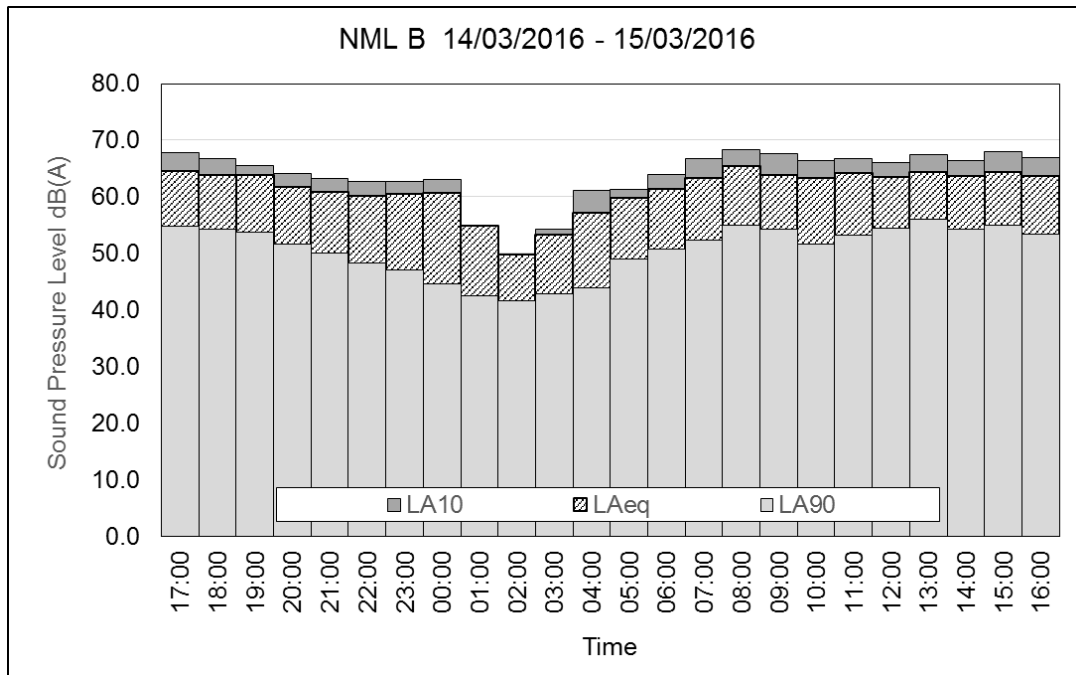
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## 4. SURVEY RESULTS

### 4.1 Background Noise Level

4.1.1 A time history of the measured noise levels at location NML B during the survey is presented in Figure 4-1.

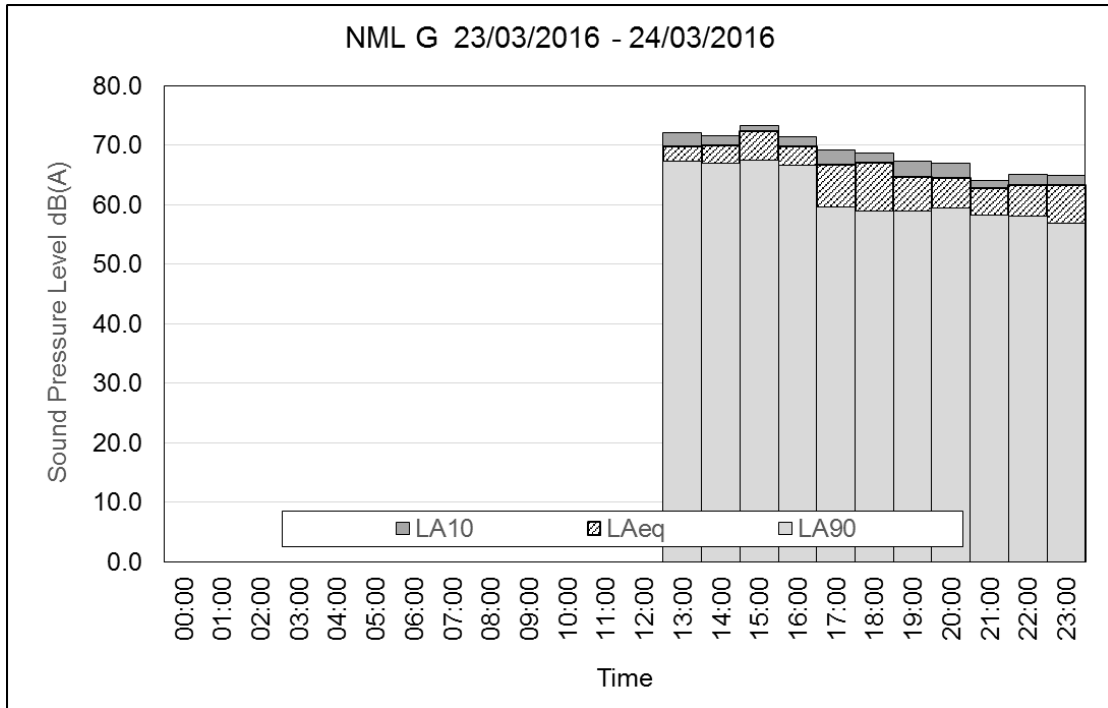


**Figure 4-1 Time History during Daytime Survey at NML B**

4.1.2 Daytime levels at NML B ranged from 56 dB  $L_{Aeq}$  1 hour to 65 dB  $L_{Aeq}$  1 hour during the survey. Background noise levels ranged from 50 dB  $L_{A90}$  1 hour to 56 dB  $L_{A90}$  1 hour.

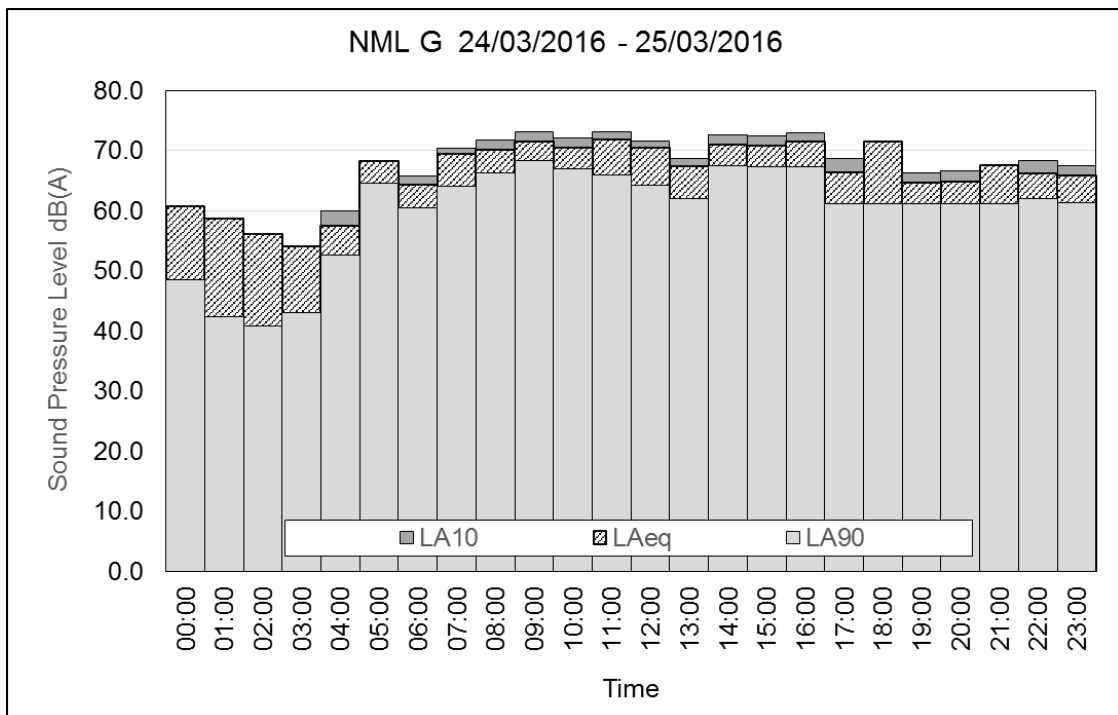
4.1.3 Night-time levels at NML B ranged from 61 dB  $L_{Aeq}$  1 hour to 50 dB  $L_{Aeq}$  1 hour during the survey. Background noise levels ranged from 42 dB  $L_{A90}$  1 hour to 49 dB  $L_{A90}$  1 hour.

4.1.4 A time history of the measured noise levels at location NML G during the survey is presented in Figure 4-2 to Figure 4-7.

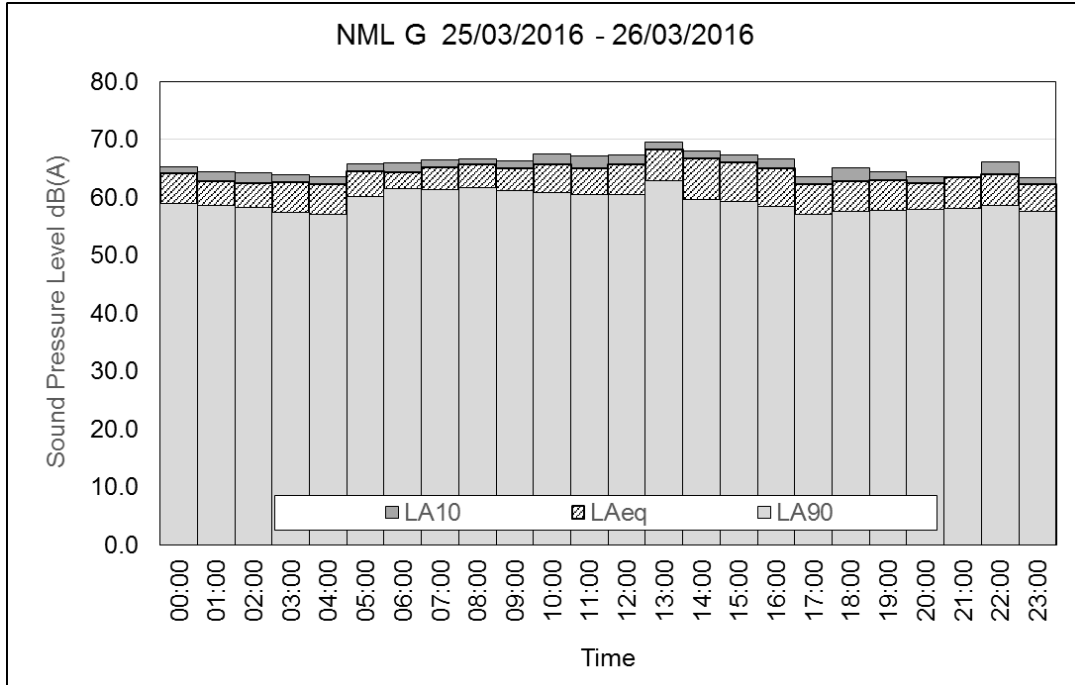


**Figure 4-2 Time History during Daytime Survey at NML G**

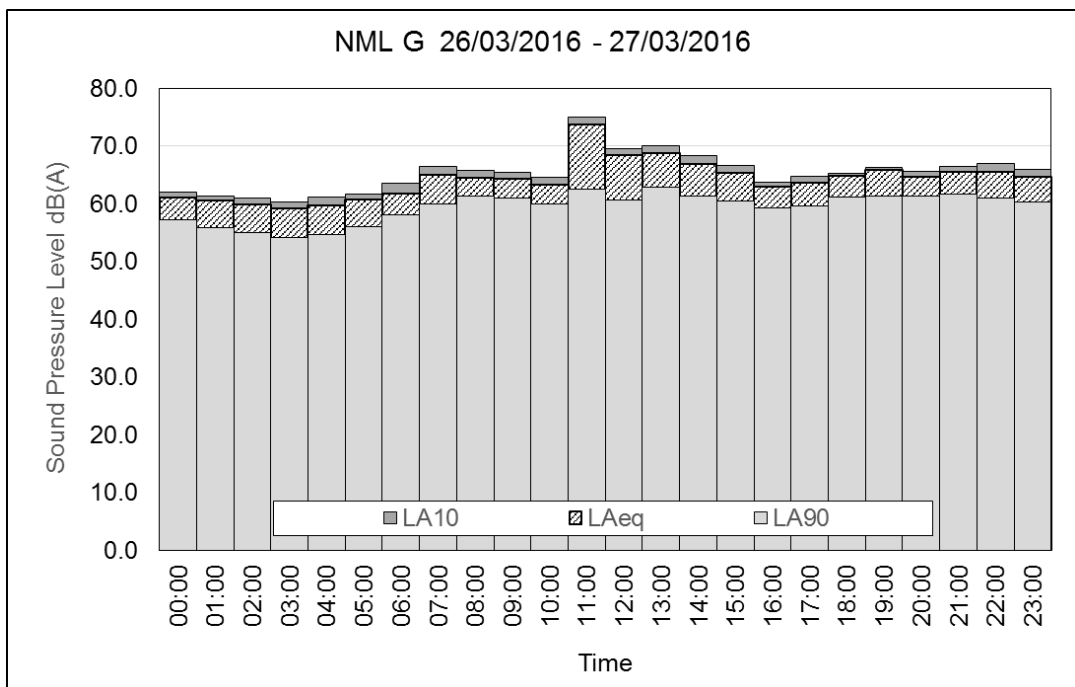
**Figure 4-3 Time History during Daytime Survey at NML G.**



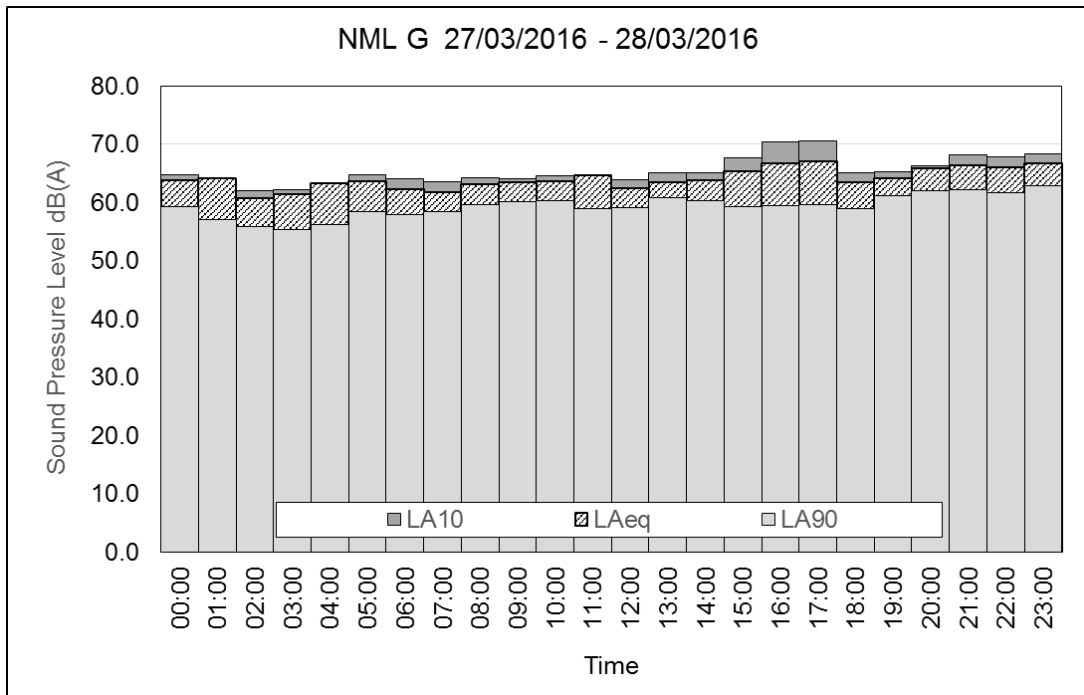
**Figure 4-4 Time History during Daytime Survey at NML G**



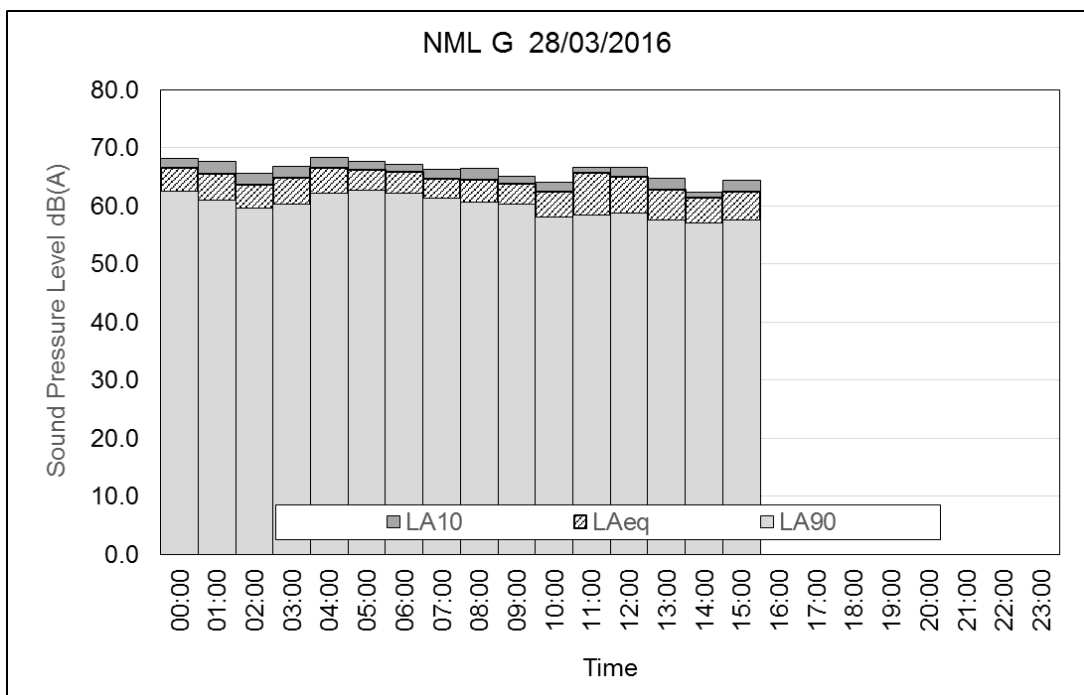
**Figure 4-5 Time History during Daytime Survey at NML G**



**Figure 4-6 Time History during Daytime Survey at NML G**



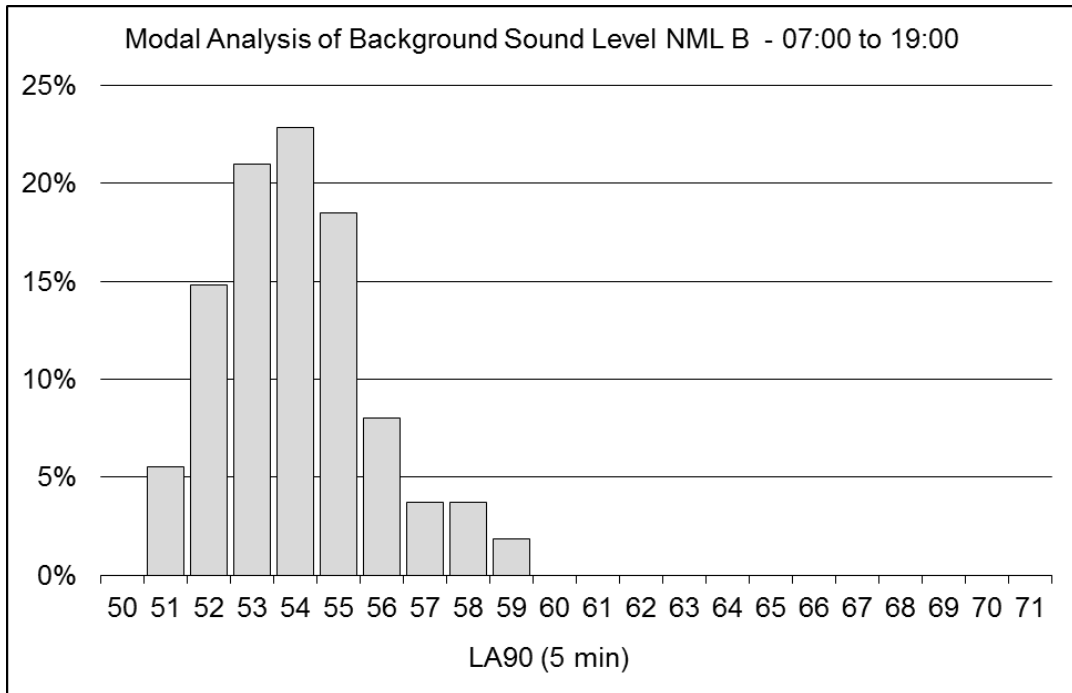
**Figure 4-7 Time History during Daytime Survey at NML G**



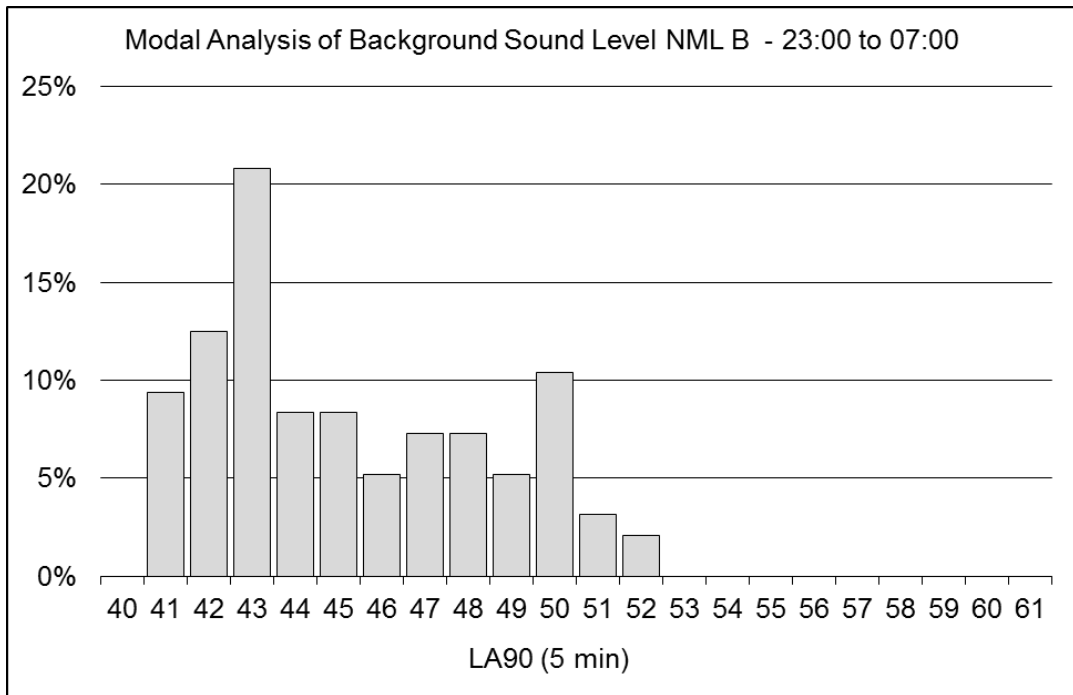
**4.2 Modal Analysis of Background Levels**

4.2.1 The following graphs present a modal analysis of the measured background noise levels monitored during the surveys at locations NML B and NML G for daytime and night time periods.

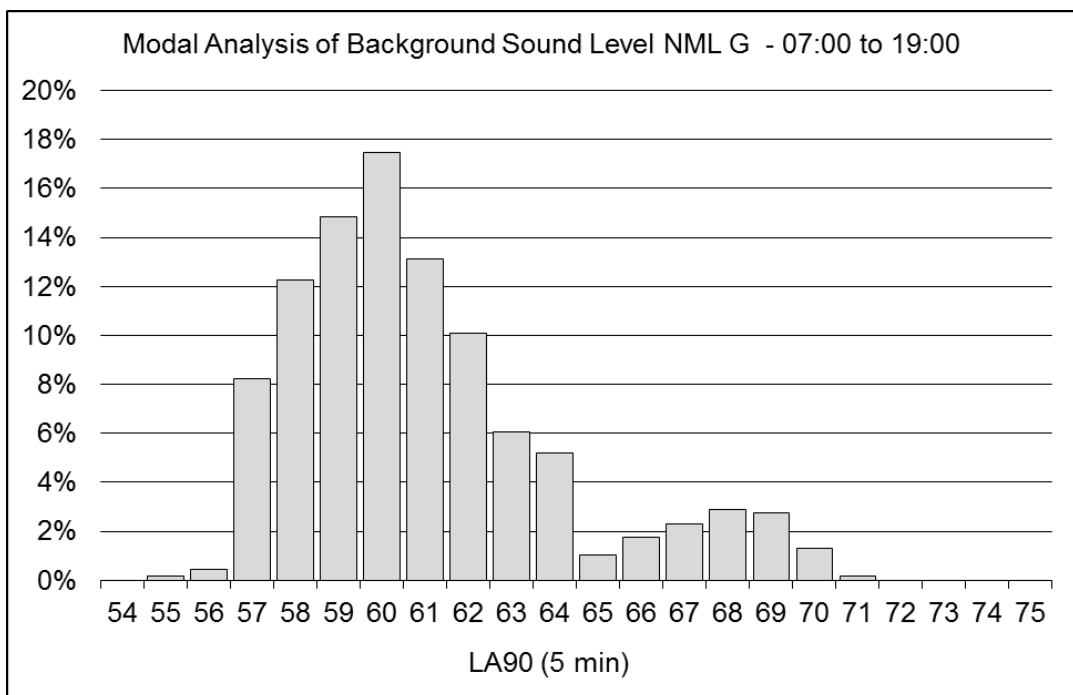
**Figure 4-8 Daytime modal analysis at NML B**



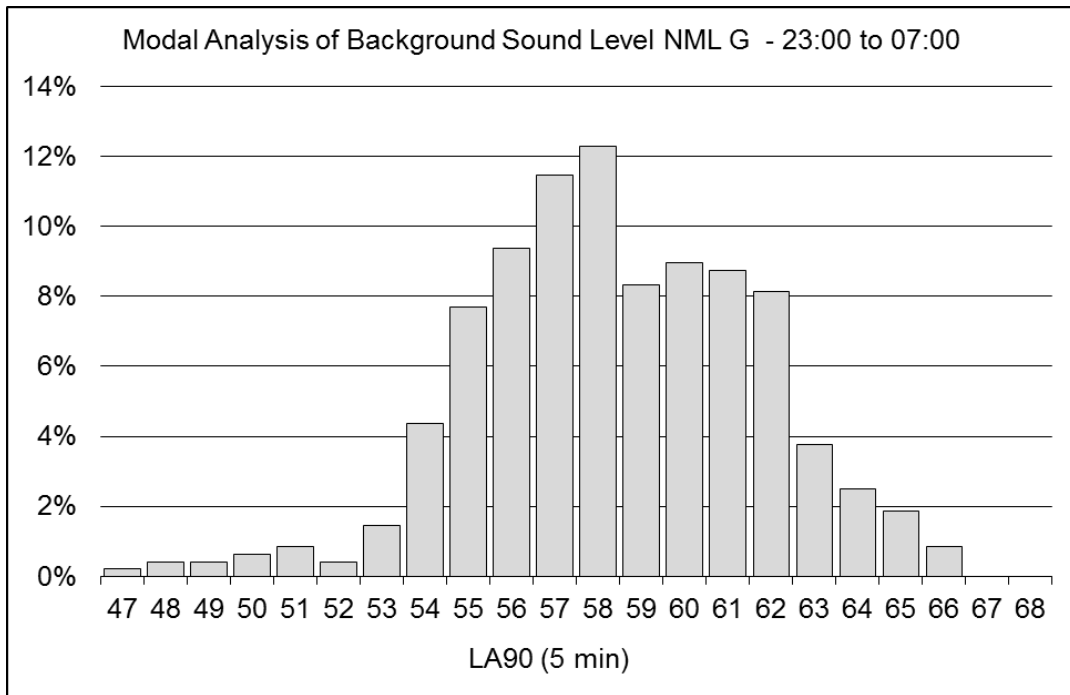
**Figure 4-9 Night-time modal analysis at NLM B**



**Figure 4-10 Daytime modal analysis at NML G**



**Figure 4-11 Night-time modal analysis at NML G**



4.2.2 The results from the modal analysis indicate at a typical background noise level of 54dB  $L_{A90\ 5\text{minute}}$  during the daytime and 43dB  $L_{A90\ 5\text{minute}}$  during the night time at NML B.

4.2.3 At NML G the modal analysis indicates a typical daytime background noise level of 60dB  $L_{A90\ 5\text{minute}}$  during the daytime and 58dB  $L_{A90\ 5\text{minute}}$  during the night time.

**4.3 Predicted Specific Noise Levels**

4.3.1 The predicted specific noise levels from the tunnel ventilation fans are presented in Table 4-1.

**Table 4-1 Specific Noise Levels**

| Noise Source | Description  | Predicted Noise Pressure Level dB(A) |
|--------------|--|--------------------------------------|
| SR 8         | River Way  | 7                                    |
| SR 12        | Nearest residential element for Greenwich Peninsula Masterplan | 20                                   |

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## 5. BS4142 ASSESSMENT

5.1.1 Table 5-1 present the results of the assessment in accordance with BS4142 for daytime and night-time periods. In accordance with BS4142 all rounding has been done on the basis that a value of 0.5 is rounded up.

**Table 5-1 BS4142 Tunnel ventilation noise assessment**

| Receptor ID | Receptor description  | Background noise level dB LA90 |       | Predicted Sound Pressure Level dB(A) | Rating level dB(A) | Excess over/under background level |       |
|-------------|---|--------------------------------|-------|--------------------------------------|--------------------|------------------------------------|-------|
|             |   | Day                            | Night |                                      |                    | Day                                | Night |
| SR8         | River Way   | 54                             | 43    | 7                                    | 16                 | -38                                | -27   |
| SR12        | Nearest Residential Element of Greenwich Peninsula Masterplan | 60                             | 58    | 20                                   | 29                 | -31                                | -29   |

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## 6. DISCUSSION

- 6.1.1 All of the sensitive receptors considered are predicted to be below the measured background noise level by a minimum of 27dB or more.
- 6.1.2 The results from the assessment in accordance with BS 4142 indicate that the rating noise level does not exceed the background noise level at any identified residential receptor, which provides a positive indication of the specific noise source from the jet fans having a negligible effect upon the local ambient noise environment.

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## 7. CONCLUSION

- 7.1.1 An operational noise assessment has been undertaken for tunnel ventilation system for the proposed Silvertown Tunnel at the southern portal located in the Royal Borough of Greenwich.
- 7.1.2 Noise predictions indicate that noise levels from the ventilation system would be below existing background noise levels at all identified residential dwellings.
- 7.1.3 BS4142 states:
- 'The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background noise level, this is an indication of the specific noise source having a low impact'.*
- 7.1.4 It is therefore concluded that the predicted low noise levels and resultant rating noise level provide a positive indication that noise from the proposed tunnel ventilation system would have a negligible impact upon the local area and that existing noise-sensitive receptors within the vicinity of The Scheme will be protected from any potentially intrusive noise.

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