

SILVERTOWN TUNNEL

**Preliminary  
Environmental  
Information Report:  
Appendix 14.D**

**Southern Portal  
Tunnel Ventilation  
Noise Assessment**

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**BIBLIOGRAPHY**

## LIST OF ABBREVIATIONS

TfL	Transport for London
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## GLOSSARY OF TERMS

Rating level	Specific sound level plus any adjustment for the characteristic features of the sound
Residual sound	Ambient sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound
Specific sound level	Equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval
Specific sound source (LAeq)	Sound source being assessed
Ambient sound	Totally encompassing sound in a given situation at a given time, usually composed of sound from many sources near and far
Ambient sound level (LAeq)	Equivalent continuous A-weighted sound pressure level of the totally encompassing sound 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 sound level (LA90)	A-weighted sound pressure level that is exceeded by the residual sound 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

## 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. It identifies the methodology used to establish existing background noise levels, identifies receptors potentially affected and an assessment of the impact of the new sound source in accordance with BS4142: 2014 '*Methods for rating and assessing industrial and commercial sound*'<sup>1</sup>.
- 1.1.2 This Appendix should be read in conjunction with Drawing 14.2.

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

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## 2. GUIDANCE

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

2.1.1 British Standard BS 4142:2014 'Methods for Rating and Assessing Industrial and Commercial Sound' 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 Sound Level**

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

#### **Specific Sound Level**

2.1.4 The specific sound 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 sound 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 sound level and the background sound 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 1.

**Table 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 sound characteristics</b>	Where the specific sound 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 sound 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 sound 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 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 sound level, this is an indication of the specific sound source having a low impact, depending on the context.



### 3. METHODOLOGY

#### 3.1 Background Sound Level Survey

3.1.1 Background sound level surveys were undertaken for 3 hours during the daytime on 27 July 2015 at 2 locations between 10:30 and 17:00 and during the Night time on 3 August and 10 August 2015 between 01:00 and 04:00 at the measurement locations presented in Drawing 14.3. The measurement location was agreed with Nick Marks of Greenwich Council's Environmental Health Department.

3.1.2 The measurement location was chosen to be representative of the nearest residential dwellings to the tunnel ventilation buildings and tunnel portals. The night time measurements were undertaken between 01:00 and 04:00 on a Monday morning as this was considered to be the quietest night time period.

3.1.3 Table 2 presents details of the equipment used for the sound level survey.

**Table 2 Details of Sound Level Survey Equipment**

Equipment	Manufacturer	Model	Serial Number
Sound Level Meter	Rion	NL-52	00410085
Sound Calibrator	Rion	4231	3002998
Microphone	Rion	UC-59	02436
Pre Amplifier	Rion	NH-25	10078

#### 3.2 Sound Propagation Model

3.2.1 Noise predictions have been carried out using International Standard ISO 9613, '*Acoustics – Attenuation of Sound during Propagation Outdoors*'<sup>2</sup>. The propagation model described in Part 2 of this standard provides for the prediction of sound 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

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

significantly lower, especially if there is any shielding between the application site and the houses.

3.2.2 This assessment has used published values of ‘ $\alpha$ ’ (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.

3.2.3 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.

3.2.4 The source data used for the prediction in the assessment are provided in Table 3.

**Table 3 Sound Pressure Data used in Assessment**

	Octave Band Centre Frequency [Hz]								Sound Pressure Level, dBA
	Sound Pressure Level, dB								
	63	125	250	500	1k	2k	4k	8k	
<b>SPL at exhaust stack</b>	83	81	63	41	41	43	60	59	68
<b>SPL of Jet fan noise at portal</b>	82	82	82	69	67	68	64	57	77

### 3.3 Sensitive Receptors Considered

3.3.1 The proposed site is located on the south of the River Thames within a predominantly residential area.

3.3.2 The nearest residential dwellings and the approximate distance to the ventilation stack are presented in Table 4 and in Drawing 14-X.

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

**Table 4 Identified Sensitive Receptors Considered in Assessment**

Receptor ID	Description	Distance from Scheme in metres	OS Grid Reference
SR8	River way	440	TQ 39622 79394
SR12	Greenwich Peninsula Masterplan Development	50	TQ 39290 79588

### 3.4 Rating Sound Level Correction

3.4.1 A rating penalty for the specific sound from the operation of the tunnel ventilation system has been based on a subjective assessment of its characteristics. Table 5 present the subjective acoustic corrections which have been applied in the assessment.

**Table 5 Subjective Acoustic Feature Corrections Applied**

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

3.4.2 A +6 dB penalty has been applied based upon the possibility of a tone being present from the ventilation fans.

3.4.3 No penalty has been applied for impulsivity; the operation of the ventilation system would not give rise to rapid fluctuations in overall sound level at identified sensitive receptors.

3.4.4 No penalty has been applied for intermittency: the operation of the ventilation system would be continuous, operating 24 hours a day.

3.4.5 A penalty of +3 dB has been applied for other sound characteristics. This penalty has been applied as the operation of the tunnel ventilation system could possibly be readily distinctive against the residual acoustic environment.

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

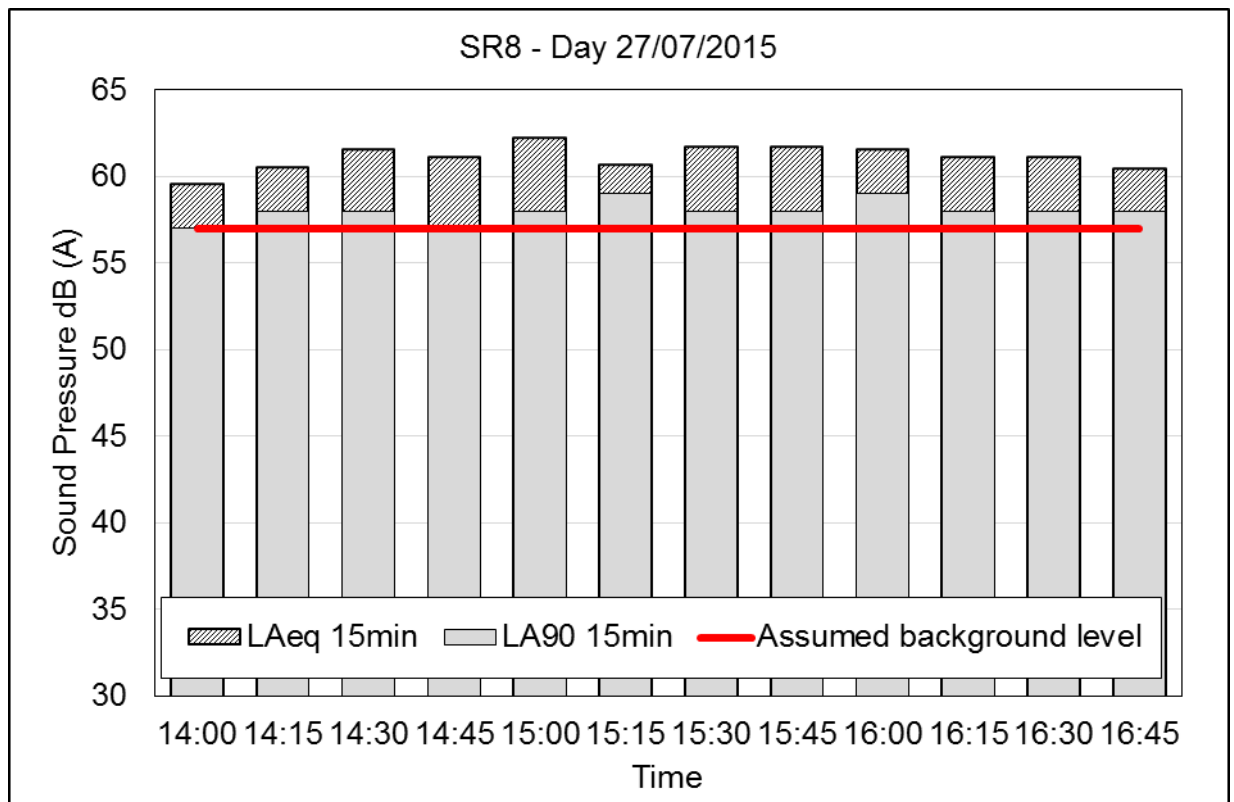


## 4. SURVEY RESULTS

### 4.1 Background Sound Level

4.1.1 A time history of the measured sound levels at location SR1 during the daytime survey is presented in Graph 1.

**Graph- 1 Time History during Daytime Survey at SR8**

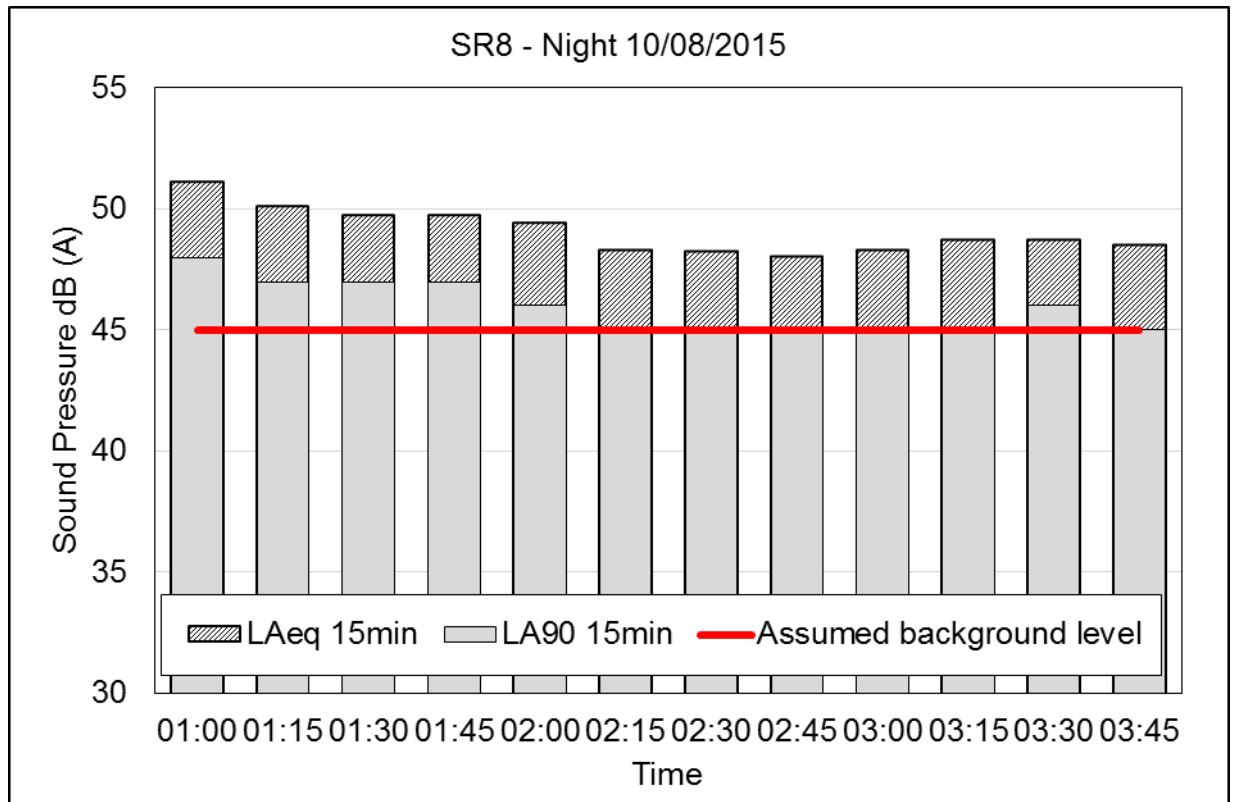


4.1.2 Daytime levels at SR8 ranged from 59 dB LAeq 15 minute to 62 dB LAeq 15 minute during the 3 hour survey. Background sound levels ranged from 56 dB LA90 15 minute to 59 dB LAeq 15 minute.

4.1.3 Using professional judgement a typical background sound level of 57 dB LA90 15 minute during the daytime has been assumed. Assuming a background sound level of 57 dB LAeq 15 minute provides a cautious approach with the majority of the measured LA90 values monitored during the daytime survey being above this level.

4.1.4 A time history of the measured sound levels during the night time survey at SR8 is presented in Graph 2.

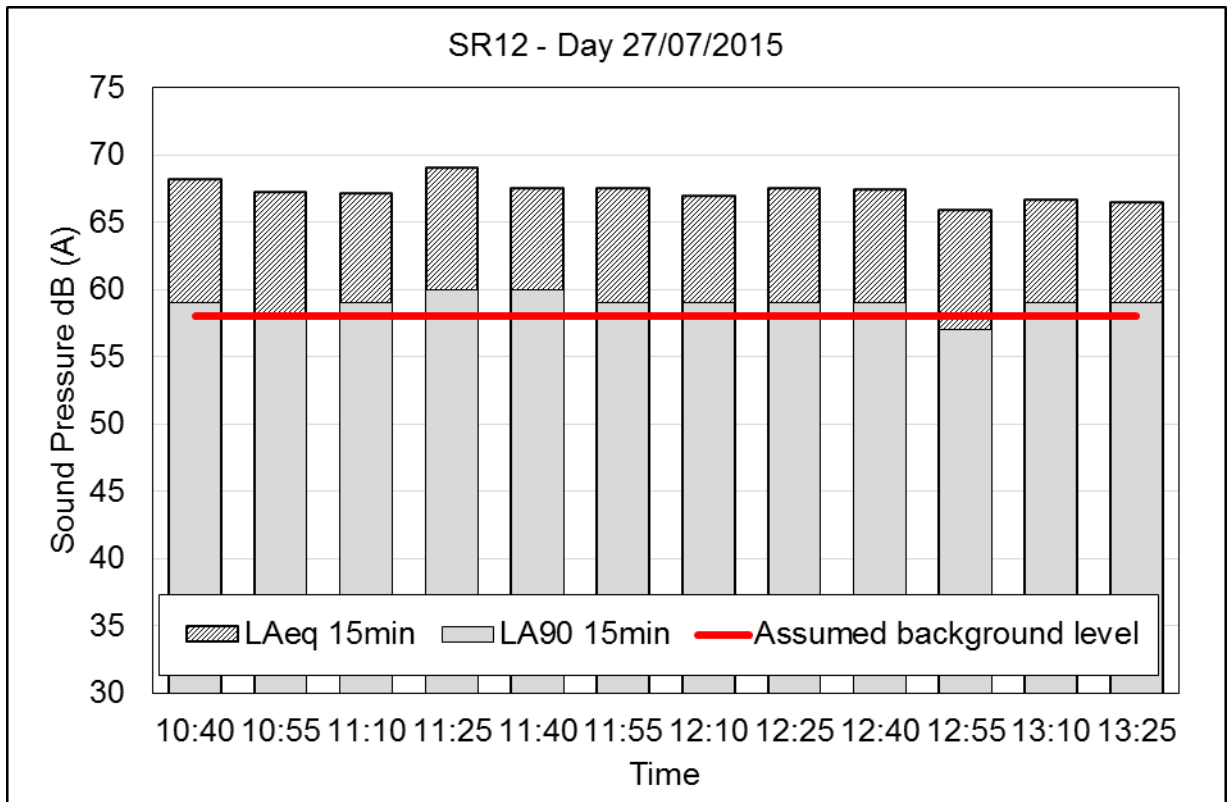
**Graph- 2 Time History during Night-time Survey at SR8**



4.1.5 Using professional judgement a typical background sound level of 45 dB LA90 15 minute during the night-time has been assumed. Assuming a background sound level of 42 dB LA90 15 minute provides a cautious approach with the majority of the measured LA90 values monitored during the night-time survey being above this level.

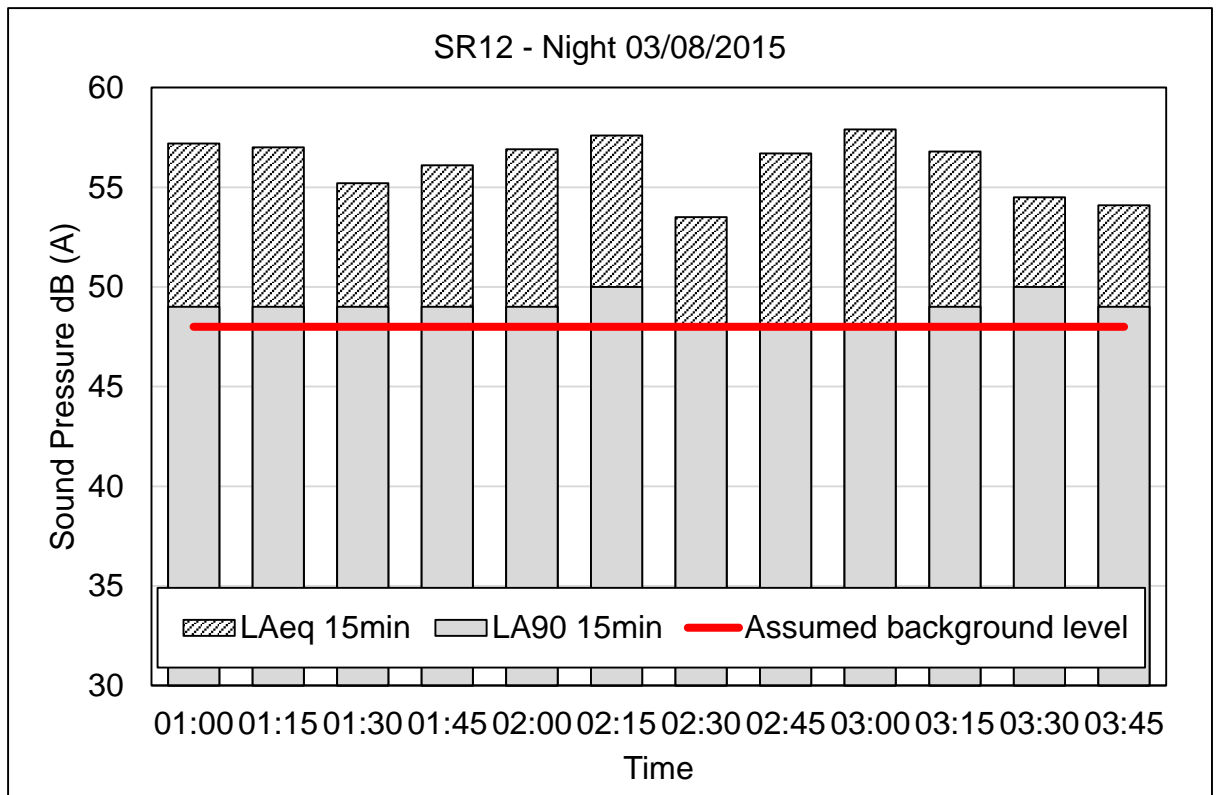
4.1.6 A time history of the measured sound levels at location SR12 during the daytime survey is presented in Graph 3.

**Graph- 3 Time History during Daytime Survey at SR12**



- 4.1.7 Daytime levels at SR2 ranged from 65 dB LAeq 15 minute to 69 dB LAeq 15 minute during the 3 hour survey. Background sound levels ranged from 57 dB LA90 15 minute to 60 dB LA90 15 minute.
- 4.1.8 Using professional judgement a typical background sound level of 58 dB LA90 15 minute during the daytime has been assumed. Assuming a background sound level of 58 dB LA90 15 minute provides a cautious approach with the majority of the measured LA90 values monitored during the daytime survey being above this level.
- 4.1.9 A time history of the measured sound levels during the night time survey at SR12 is presented in Graph 4.

**Graph- 4 Time History during Night-time Survey at SR12**



4.1.10 Using professional judgement a typical background sound level of 48 dB LA90 15 minute during the night-time has been assumed. Assuming a background sound level of 48 dB LA90 15 minute provides a cautious approach with the majority of the measured LA90 values monitored during the night-time survey being above this level.

**4.2 Predicted Specific Sound Levels**

4.2.1 The predicted specific sound levels from the Scheme are presented in Table 6.

**Table 6 Predicted Specific Sound Level with Mitigation**

Noise Source	Description	Predicted Sound Pressure Level dB(A)
SR 8	River Way	24
SR 12	Nearest residential element for Greenwich Peninsula Masterplan	14



## 5. BS4142 ASSESSMENT

- 5.1.1 The following tables 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 7 BS4142 Daytime Assessment at SR 8**

<b>Sensitive Receptor – SR8: River Way</b>		<b>Relevant clause</b>	<b>Commentary</b>
<b>Measured ambient sound level</b>	$L_{Aeq} 3 \text{ hour} = 67$	7.3.1	specific sound source not operational
<b>Residual sound level</b>	N/A	7.3.3	specific sound source not operational
<b>Background sound level (daytime)</b>	$L_{A90} 15 \text{ minute} = 59$	8.3	
<b>Assessment made during the daytime. The reference time interval is 1 h</b>	N/A	7.2	specific sound source will operate continuously
<b>Specific sound level</b>	24	7.3.4	
<b>Acoustic feature correction</b>	+9	9.2	
<b>Rating level</b>	33	9.2	
<b>Background sound level</b>	$L_{A90} 15 \text{ minute} = 59$	8	
<b>Excess of rating over background sound level</b>	-25	11	
<b>Rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact</b>		11	
<b>Uncertainty of the assessment</b>		10	The measurements were taken under repeatable conditions with predicted low rating level. The uncertainty in the result will be low

**Table 8 BS4142 Night-time Assessment at SR 8**

<b>Sensitive Receptor – SR8: River Way</b>		<b>Relevant clause</b>	<b>Commentary</b>
<b>Measured ambient sound level</b>	$L_{Aeq\ 3\ hour} = 56$	7.3.1	specific sound source not operational
<b>Residual sound level</b>	N/A	7.3.3	specific sound source not operational
<b>Background sound level (daytime)</b>	$L_{A90\ 15\ minute} = 49$	8.3	
<b>Assessment made during the daytime. The reference time interval is 1 h</b>	N/A	7.2	specific sound source will operate continuously
<b>Specific sound level</b>	24	7.3.4	
<b>Acoustic feature correction</b>	+9	9.2	6dB tonal penalty and 3 dB other sound characteristics penalty
<b>Rating level</b>	33	9.2	
<b>Background sound level</b>	$L_{A90\ 15\ minute} = 49$	8	
<b>Excess of rating over background sound level</b>	-15	11	
<b>Rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact</b>		11	
<b>Uncertainty of the assessment</b>		10	The measurements were taken under repeatable conditions with predicted low rating level. The uncertainty in the result will be low

**Table 9 BS4142 Daytime Assessment at SR 12**

<b>Sensitive Receptor – SR12: Greenwich Peninsula Masterplan</b>		<b>Relevant clause</b>	<b>Commentary</b>
<b>Measured ambient sound level</b>	L <sub>Aeq</sub> 3 hour = 61	7.3.1	specific sound source not operational
<b>Residual sound level</b>	N/A	7.3.3	specific sound source not operational
<b>Background sound level (daytime)</b>	L <sub>A90</sub> 15 minute = 58	8.3	
<b>Assessment made during the daytime. The reference time interval is 1 h</b>	N/A	7.2	specific sound source will operate continuously
<b>Specific sound level</b>	14	7.3.4	
<b>Acoustic feature correction</b>	+9	9.2	6dB tonal penalty and 3 dB other sound characteristics penalty
<b>Rating level</b>	23	9.2	
<b>Background sound level</b>	L <sub>A90</sub> 15 minute = 58	8	
<b>Excess of rating over background sound level</b>	-34	11	
<b>Rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact</b>		11	
<b>Uncertainty of the assessment</b>		10	The measurements were taken under repeatable conditions with predicted low rating level. The uncertainty in the result will be low

**Table 10 BS4142 Night-time Assessment at SR 12**

<b>Sensitive Receptor – SR12: Greenwich Peninsula Masterplan</b>		<b>Relevant clause</b>	<b>Commentary</b>
<b>Measured ambient sound level</b>	$L_{Aeq} 3 \text{ hour} = 49$	7.3.1	specific sound source not operational
<b>Residual sound level</b>	N/A	7.3.3	specific sound source not operational
<b>Background sound level (daytime)</b>	$L_{A90} 15 \text{ minute} = 46$	8.3	
<b>Assessment made during the daytime. The reference time interval is 1 h</b>	N/A	7.2	specific sound source will operate continuously
<b>Specific sound level</b>	14	7.3.4	
<b>Acoustic feature correction</b>	+9	9.2	6dB tonal penalty and 3 dB other sound characteristics penalty
<b>Rating level</b>	23	9.2	
<b>Background sound level</b>	$L_{A90} 15 \text{ minute} = 46$	8	
<b>Excess of rating over background sound level</b>	-22	11	
<b>Rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact</b>		11	
<b>Uncertainty of the assessment</b>		10	The measurements were taken under repeatable conditions with predicted low rating level. The uncertainty in the result will be low

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## 6. DISCUSSION

- 6.1.1 The results from the assessment in accordance with BS 4142 indicate that the rating sound level does not exceed the background sound level, which is an indication of the specific sound source having a low impact.
- 6.1.2 All of the sensitive receptors considered are predicted to be below the measured background sound level by a minimum of 15dB or more.

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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 London Borough of Greenwich.
- 7.1.2 Noise predictions indicate that noise levels from the ventilation system would be below existing background sound levels at all identified residential dwellings.
- 7.1.3 BS4142 states 'Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact'.
- 7.1.4 It is therefore concluded that the predicted low noise levels 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.