

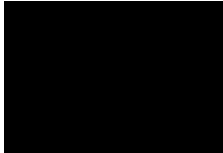
Technical Report

Reference: N&V – R2900

**ASSESSMENT OF NOISE EXPOSURE FOR NORTHERN LINE TRAIN OPERATORS**

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## EXECUTIVE SUMMARY

### INTRODUCTION

Regular assessment of Train Operators exposure to noise have been conducted since 2018. Noise measurements were made in the driving cab of Northern Line rail vehicles during normal travel. The measured data were assessed with respect to the Control of Noise at Work Regulations 2005 (CNAWR).

### MEASUREMENT AND ANALYSIS

Measurements were made in the driving cabs of four vehicles during normal travel between terminals (Morden, Edgware and High Barnet). Repeat measures were conducted over three days: 24 November to 26 November 2020.

Noise measurements were made from a microphone located about 20 cm from the Train Operators left ear. Time Histories of sound pressure were measured using a Class 1 integrating Sound Level Meter (SLM) that was configured to log A-weighted broadband equivalent continuous sound pressure level ( $L_{Aeq}$ ), C-weighted peak sound pressure level and one-third octave band equivalent continuous sound pressure level ( $L_{eq}$ ). The time histories were analysed to determine these values for the end-to-end journey and the separate interstation sections of the route.

The noise data were analysed with respect to The Control of Noise at Work Regulations(2005), specifically: the 'lower exposure action value' (corresponding to a daily personal noise exposure level of 80 dB(A)); the 'upper exposure action value' (corresponding to a daily personal noise exposure level of 85 dB(A)); and the 'exposure limit value' corresponding to a daily personal noise exposure level of 87 dB(A)). The CNAWR specify that the equivalent continuous sound pressure level normalised to an 8-hour working day be used in the assessment of occupational noise exposure. Durations of exposure required to reach the action and limit values have been estimated. Exposure points have been determined for travel and are used to assess against the action and limit values.

### RESULTS AND DISCUSSION

There were 11 end-to-end journeys conducted during the survey. The  $L_{Aeq}$  measured ranged from 78 dB(A) to 82 dB(A). Analysis of interstation noise indicated 11 stations where the noise median levels were above 85 dB(A). Exposure points calculated for the 11 end-to end journeys ranged from 3 points to 7 points. Using exposure points to estimate the daily personal noise exposure level indicate that the 'lower exposure action value' is unlikely to be reached for most duties. Some variation was observed between measurement runs but this is not thought to change the overall assessment of risk. For some duties the 'lower exposure action value' could be reached, if applying a more conservative value to all end-to end journeys during a duty (i.e. the highest value measured during the survey). The 'upper exposure action value' and the 'exposure limit value' is not expected to be reached during normal duty. The data appears consistent with the findings in previous assessments and supports the current provision of hearing protection for all Train Operators. Other recommendations have been made.



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## INTRODUCTION

1. TfL Technical Services were tasked to assess Train Operators exposure to noise during normal travel in the Northern Line rail vehicles. Noise measurements were made over the period 24 - 26 November 2020. The measurements were assessed with respect to current standards and guidelines concerned with human exposure to noise.

2. The effects of exposure to high levels of noise on hearing are widely published and continued exposure to high levels is known to cause hearing damage. The Control of Noise at Work Regulations 2005 (CNAWR) implement the European Commission's Physical Agents Directive on Noise (PA(N)D, 2003). The CNAWR defines several exposure action values at which employers are required to initiate steps to reduce the harmful effects of noise on hearing. The action values are expressed both as an A-weighted daily personal noise exposure level ( $L_{EP,d}$  or weekly,  $L_{EP,w}$ ) and a C-weighted peak sound pressure level ( $L_{Cpk}$ ). The 'daily personal noise exposure' is standardised to an 8-hour period and the 'weekly personal noise exposure' is standardised to a 40-hour working week. In certain circumstances, the CNAWR allow the personal noise exposure to be calculated to a working week: "*Where the exposure of an employee to noise varies markedly from day to day, an employer may use weekly personal noise exposure in place of daily personal noise exposure for the purpose of compliance with these Regulations*". The action values are as follows:

The lower exposure action values (LEAV) are:

$L_{EP,d}$  or  $L_{EP,w}$  of 80 dB(A); and  
 $L_{Cpk}$  of 135 dB(C).

The upper exposure action values (UEAV) are:

$L_{EP,d}$  or  $L_{EP,w}$  of 85 dB(A); and  
 $L_{Cpk}$  of 137 dB(C).

The exposure limit values (ELV) are:

$L_{EP,d}$  or  $L_{EP,w}$  level of 87 dB (A-weighted); and  
 $L_{Cpk}$  of 140 dB(C).

The exposure limit value takes into account the attenuation afforded by any personal hearing protection (PHP). A summary of the standards and guidelines used to assess occupational noise exposure are included in Appendix A.

## EQUIPMENT AND PROCEDURE

### The vehicle

3. The London Underground 1995 Stock is the type of rolling stock in service on the Northern Line. The rail vehicles were manufactured by GEC Alsthom-Metro Cammell and were first brought into service in 1998. Normal formation for 1995 Stock comprises six cars with a maximum full load standing capacity of 662 people. This vehicle is equipped with Thales Transmission Based Train Control (T.B.T.C) for automatic train operation and can be operated manually if required. Automatic train operation is utilised across most of the Northern Line network.



Figure 1. An example driving cab (51618) used during the survey.

### Noise measurements

4. The noise survey was conducted over the period 24 - 26 November 2020. Noise measurements were made in the driving cab of the rail vehicle using a Class 1 integrating Sound Level Meter (01dB Fusion FW 2.49 serial number 12501) with combined ½" condenser microphone (Type 40CD serial number 292570). The microphone was positioned approximately 20 cm from the Train Operator's left ear and any reflecting surfaces using a bespoke mounting that was fixed to a solid panel in the vehicle. Data were acquired for the duration of an end-to-end journey, that is transit from Morden (MOR) terminal to either Edgware (EDG) or High Barnet (HIB) terminals and vice-versa. Measurements were made for a combination of routes via Bank (BAN) and Charing Cross (CAC). Further details of each journey are presented in Table 1; the station codes used throughout the report are listed in the Appendix. The Train Operator controlling the rail vehicle was the same for all surveys. The same rail vehicle was used for the return leg of a journey; a total of four vehicles were used. The TO adjusted the seat according to their normal driving posture and the microphone could be repositioned to ensure it did not restrict movement of the TO. The TO also adjusted the volume control of the radio to a suitable level at the start of each journey.

5. Calibration of the SLM was carried out using an acoustic calibrator (Rion Co. Ltd type NC24 serial number 35236395) which gave a sinusoidal calibration tone of 94 dB at a frequency of 1000 Hz. The field calibration was carried out before and after each survey; the measurements remained stable throughout.

6. The time histories were analysed using 01 dBTrait software (version 6.3.1 build 1) and the following parameters were determined for the end-to-end journey and for interstation transit: the A-weighted equivalent continuous sound pressure level ( $L_{Aeq,T}$ ), the C-weighted peak sound pressure level ( $L_{Cpeak}$ ); and one-third octave band equivalent continuous sound pressure level ( $L_{eqT}$  for centre band frequencies 31.5 Hz to 16,000 Hz).



Table 1. Details of noise survey on the Northern Line 24-26 November 2020 (\* via Kennington Loop)

Date	Journey	Train	Cab	Start	End	Route	Duration (mins)
24 Nov	1	017	51574	MOR	EDG	BAN	66
	2	017	51712	EDG	MOR	BAN	66
	3	102	51618	MOR	HIB	BAN	69
	4	102	51617	HIB	MOR	CHC	65
25 Nov	5	144	51653	MOR	HIB	BAN	68
	6*	144	51652	HIB	HIB	CHC	87
	7	144	51653	HIB	MOR	BAN	68
26 Nov	8	026	51699	MOR	EDG	BAN	68
	9	026	51668	EDG	MOR	BAN	65
	10	026	51699	MOR	EDG	BAN	65
	11	026	51699	EDG	MO	BAN	65

## Analysis

7. Full details about the analysis procedures on the measurement of sound pressure levels and sound exposure levels are shown in Appendix B. The equivalent continuous sound pressure level ( $L_{eq}$ ) is the steady sound pressure level, over a specified period of time, which would produce the same energy equivalent to the actual fluctuating sound. It is described in equation 1 where  $tm$  is the specified period of time,  $P_1$  is the instantaneous sound pressure and  $P_0$  is the reference sound pressure of 20  $\mu$ Pa.

$$L_{eq} \text{ (dB)} = 10 \log_{10} \left[ \frac{1}{tm} \int_0^m \left( \frac{P_1}{P_0} \right)^2 dt \right] \quad (1)$$

8. The A-weighted equivalent continuous sound pressure level ( $L_{Aeq}$ ) can be used to calculate the exposure period required for the noise to reach the 'exposure limit value' (ELV) as specified in CNAWR.

$$T = 8 \times 10^{(0.1(AL - L_{eq}))} \quad (2)$$

where  $T$  is the time (in hours) required to reach the ELV; AL is ELV of 87 dB(A), and  $L_{eq}$  is the measured equivalent continuous sound pressure level. The variable AL in the equation can be replaced by the LEAV or the UEAV to determine the periods required for the noise to reach the different values.

## RESULTS

9. All noise data are presented in Appendix C. The A-weighted equivalent continuous sound pressure levels ( $L_{Aeq}$ ) and the C-weighted peak sound pressure level ( $L_{Cpeak}$ ) obtained for each journey are shown in Table 2. The data presented include



all noise events, such as radio communications, announcements, alarms and whistles, that occurred during the measurement period. The TO reported that the frequency of communications during travel were typical of normal operation.

Table 2 Noise data ( $L_{AeqT}$ ) measured at the Train Operator position of a 1995 Rolling Stock during normal operations on the Northern Line 24-26 November 2020 (\* via Kennington Loop).

Date	Journey	Duration (mins)	$L_{Aeq}$ dB(A)	$L_{Cpeak}$ dB(C)
24 Nov	1	66	80	115
	2	66	79	115
	3	69	82	114
	4	65	78	114
25 Nov	5	68	80	127
	*6	87	81	116
	7	68	79	115
26 Nov	8	68	80	112
	9	65	79	117
	10	65	80	113
	11	65	79	114

10. Noise values ( $L_{Aeq}$ ) obtained for all journeys range from 78 dB(A) (HIB to MOR via CHC, Journey 4) to 82 dB(A) (HIB to MOR via BAN, Journey 3); for  $L_{Cpeak}$  value, a range of 112 dB(C) (MOR to EDG via BAN, Journey 8) to 127 dB(C) (MOR to HIB via BAN, Journey 5) were measured. The high  $L_{Cpeak}$  value obtained during Journey 5 was due to the slamming of the door between the driving cab and the main saloon; this is a rare occurrence, and therefore the  $L_{Cpeak}$  values obtained during the other journeys are deemed to be representative of normal conditions.

11. The  $L_{Aeq}$  measured during transit between stations for north and southbound routes are shown in Figures 2 to 7; the corresponding measurement durations are detailed in Tables C2 to C7 of Appendix C. An indication of the spread between measurements can be seen in Figures C1 to C10 (Appendix C) where the data have been represented with the median  $L_{Aeq}$  values for interstation sections. Some interstation noise levels show a notable difference in  $L_{Aeq}$ ; this is particularly evident in surface sections where noise from other sources such as alarms and radio communications have occurred (for example EDG to BUO in Figure 3 and HIB to TOW in Figures 5 to 7). A difference is also observed in Figures C1 and C2 (Appendix C) where the  $L_{Aeq}$ s for Journey 3 are higher across nearly all interstation sections; except during travel through FIC to WEF (Figure C5) where Journey 5 was higher due to alarms and communications that were recorded during the measurement run.

12. There are 11 interstation sections where the median  $L_{Aeq}$  was equal to or greater than 85 dB(A). The highest median  $L_{Aeq}$  (88 dB(A)) was measured between CAT to EUS on the southbound road; other intersections included KET and CAT, and SOW to MOR. On the northbound road, the highest median  $L_{Aeq}$  (90 dB(A)) was



measured between TOBr and TOBe; median  $L_{Aeq}$  above 85 dB(A) were recorded at five other northbound intersections (CLN to STO, EUS to CAT, WAT to EMB, WAS to EUS, and CAT to KET).

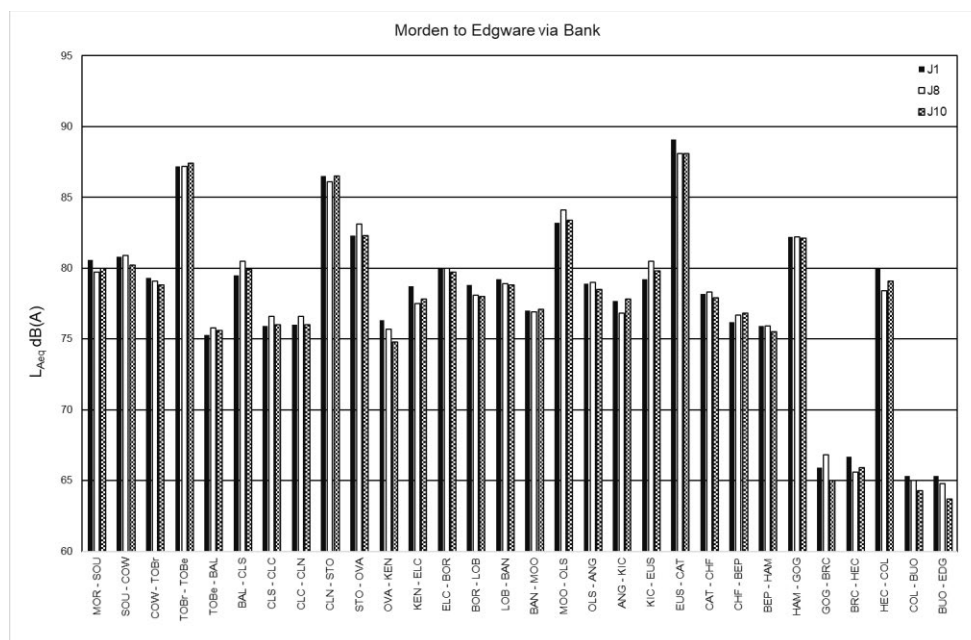


Figure 2 Interstation noise levels ( $L_{Aeq}$  in dB(A)) measured on the northbound road between Morden and Edgware via Bank (Journeys 1, 8 and 10).

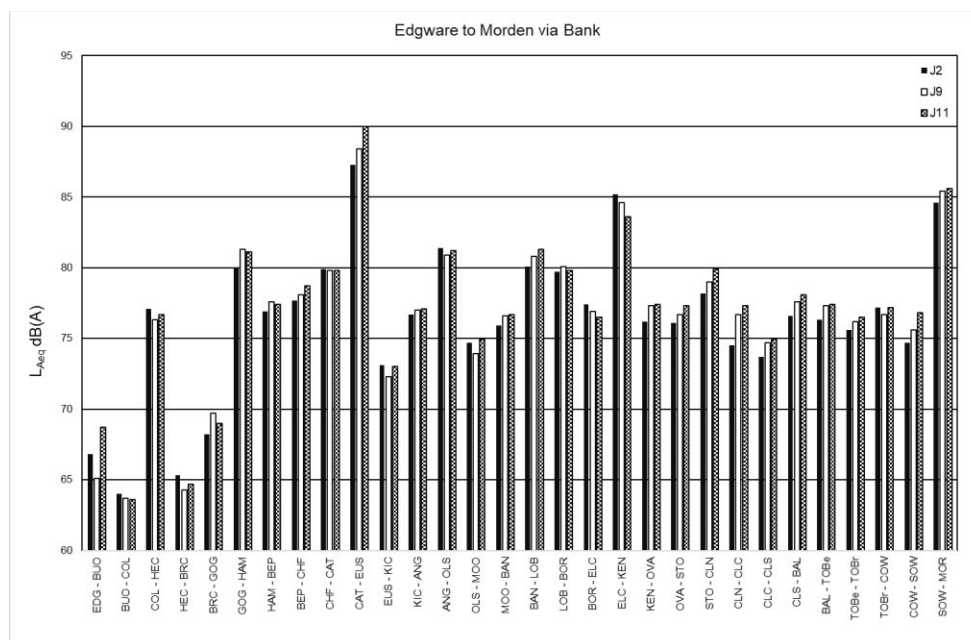


Figure 3 Interstation noise levels ( $L_{Aeq}$  in dB(A)) measured on the southbound road between Edgware and Morden via Bank (Journeys 2, 8 and 11).



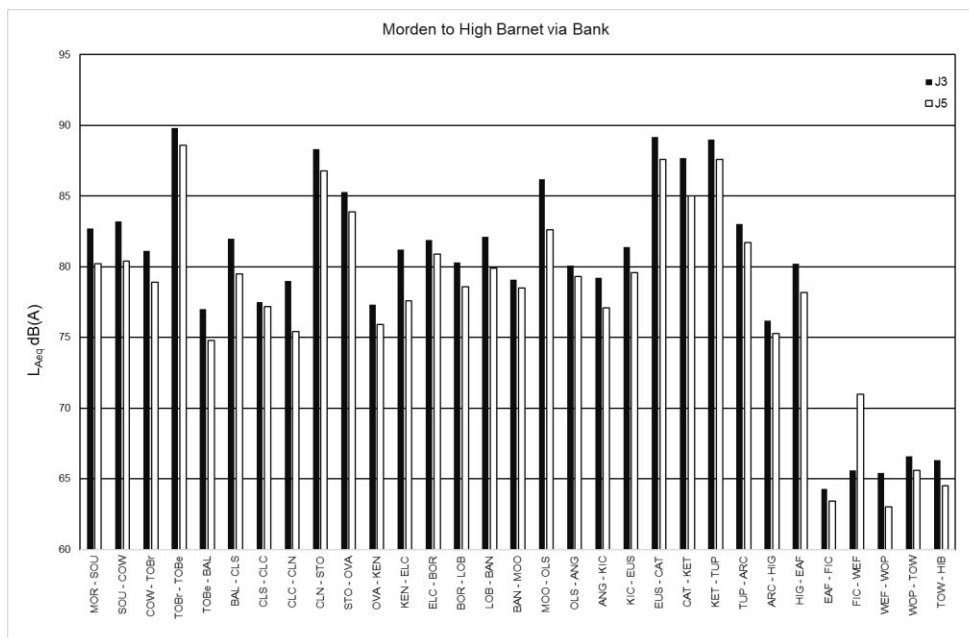


Figure 4 Interstation noise levels ( $L_{Aeq}$  in dB(A)) measured on the northbound road between Morden and High Barnet via Bank (Journeys 3 and 5).

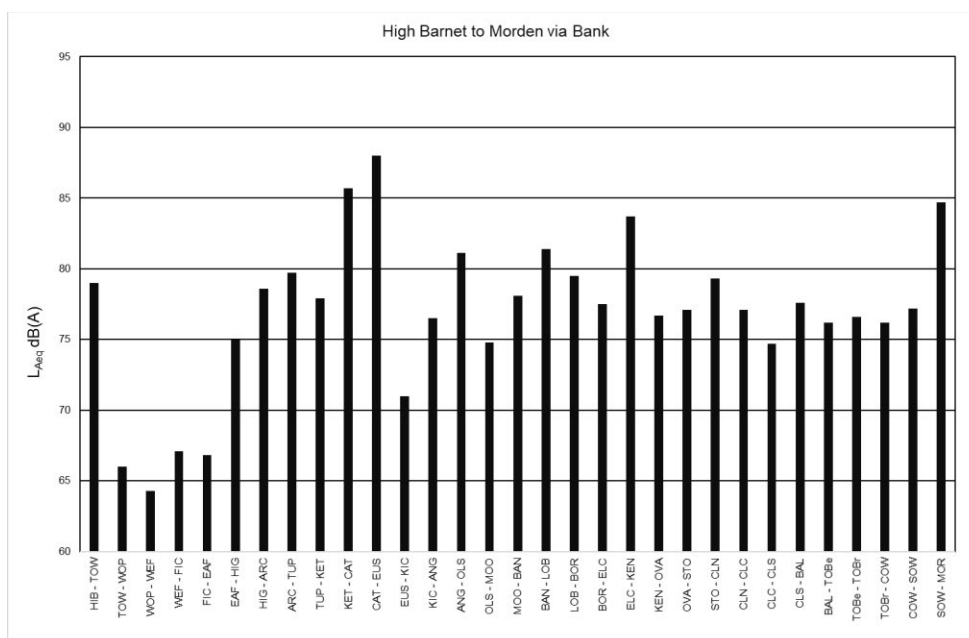


Figure 5 Interstation noise levels ( $L_{Aeq}$  in dB(A)) measured on the southbound road between High Barnet to Morden via Bank (Journey 7).

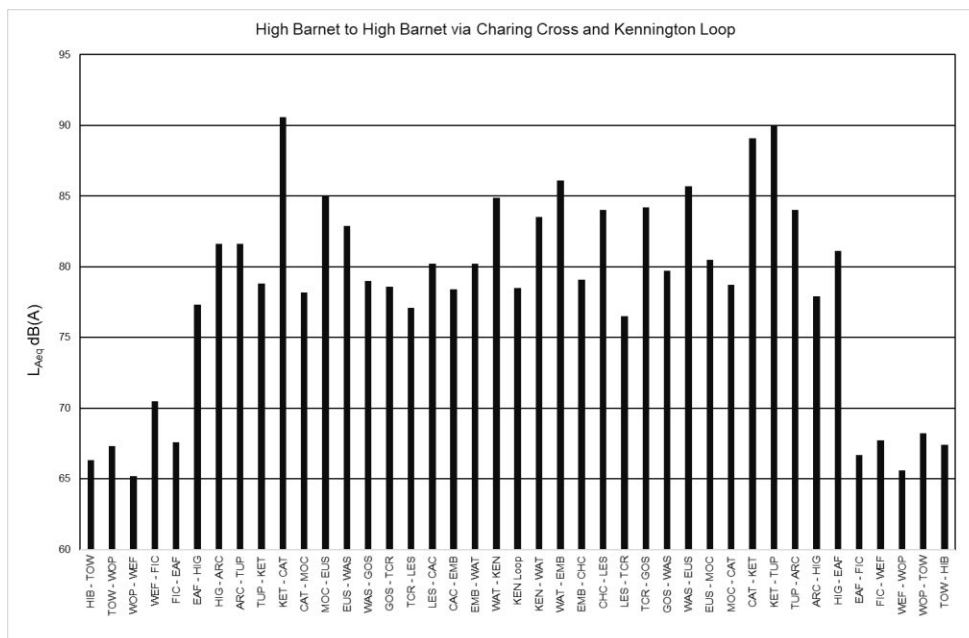


Figure 6 Interstation noise levels ( $L_{Aeq}$  in dB(A)) measured between High Barnet to High Barnet via Charing Cross and Kennington Loop (Journey 6).

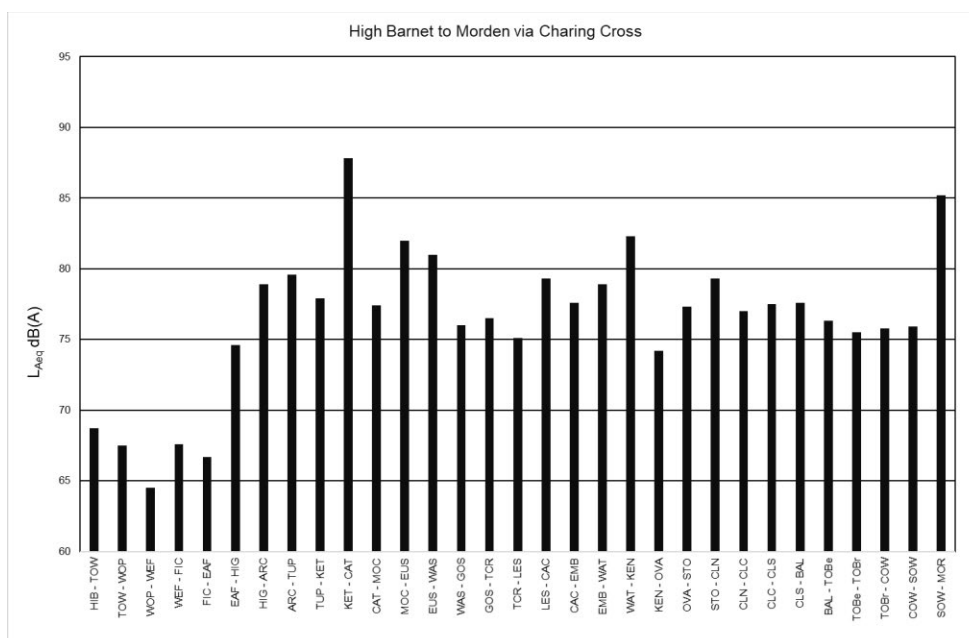


Figure 7 Interstation noise levels ( $L_{Aeq}$  in dB(A)) measured on the northbound road between High Barnet to Morden via Charing Cross (Journey 4).

## DISCUSSION

13. The following subsections cover the estimation of daily exposure using a points-based system and the implications in relation to the regulations. Repeat measures for the tunnel route via Charing Cross station (two in southbound direction and one in northbound direction) were limited, however the values obtained appear to



be consistent with those measured in previous studies. No data were acquired between Mill Hill East and Finchley Central; the previous assessment (Barros, J. 2019) recorded an  $L_{Aeq}$  of 68 dB(A) between these stations.

### Exposure Points System

14. A method of assessment of exposure that is supported by the HSE is by means of an Exposure Points System (EPS). The EPS can be used to determine whether the  $LEP_{,d}$  or  $LEP_{,w}$  is likely to be reached or exceeded. The method assigns exposure points corresponding to a sound level ( $L_{Aeq}$ ) for a particular exposure period; the HSE EPS is shown in Appendix D. The EP and the exposure duration are linearly correlated therefore halving the exposure duration will halve the number of EP. This method can be used to compare against the exposure action values; the exposure points corresponding to these values are:

LEAV	32 points ( $LEP_{,d}$ ) or 160 points $LEP_{,w}$ )
UEAV	100 points ( $LEP_{,d}$ ) or 500 points $LEP_{,w}$
ELV	160 points ( $LEP_{,d}$ ) or 800 points ( $LEP_{,w}$ )

15. Exposure points have been calculated for the different journeys and are presented in Table 3; durations required to reach the various action and limit values have also been calculated using the overall  $L_{Aeq}$  values (to 1 decimal place), for completeness. For example, for Journey 6 the rail vehicle commenced and terminated at High Barnet, travelling via the Kennington Loop and Bank branch stations (in both directions). Based on the total journey time (87 minutes) and the noise level ( $L_{Aeq}$  80.7 dB(A)) the exposure for this journey would be equivalent to 7 points, and the time required to reach the LEAV would be about 6.75 hours. Similarly, for the separate survey days, the total exposure points for Journeys 1 to 4 (24 Nov), Journeys 5 to 7 (25 Nov) and Journeys 8 to 11 (26 Nov) would be 17 points (4+3+7+3), 15 points (4+7+4), and 14 points (4+3+4+3), respectively. Further examples are shown in Appendix D (Tables D2 to D4) where the EPs corresponding to the noise levels and durations obtained during interstation transit have been calculated for Journeys 3, 4 and 6. It can be seen that the total EPs calculated using the intersection noise levels and the durations are comparable with those calculated in Table 3 (i.e. using the overall  $L_{Aeq}$  and duration for the end-to-end journey).

16. A reasonable estimate for the total EPs for a single end-to-end journey, irrespective of the route taken (i.e. via Bank or Charing Cross) would be between 3 points and 7 points. For Journeys 3 and 5 (Morden to High Barnet via Bank Branch) the EP were 7 points and 4 points, respectively, which indicates some variability between runs, however, it is unlikely the variability would alter the overall assessment. Based on the routes with the highest EP (Journeys 3 and 6) it is estimated that journeys could be undertaken around 5 times per day (total EP 35 points) before reaching the LEAV ( $LEP_{,d}$  80 dB(A) or 32 points). However, actual values determined for the three survey days (see paragraph 15) show that a further two end-to-end journeys could be completed without reaching the LEAV.

17. Train Operator schedules are detailed in the Temporary Working Timetable 224 (TWT 224, Establishment Planning, 2020). Actual daily schedules



could comprise a combination of different routes equivalent to four end-to-end journeys and sometimes up to six end-to-end journeys. The  $LEP_{d}$  for some example duties have been estimated using the values presented in Table 3; these are shown in Table 4. The estimated  $LEP_{d}$  indicate daily exposures that are below the LEAV, however it is generally accepted that a more stringent value could be applied to all end-to-end journeys and therefore the LEAV could be reached. The  $LEP_{d}$  for other duties have been estimated in previous assessments (Barros, J. 2019 and 2018) and are consistent with the findings presented in this report.

Table 3 Exposure durations required to reach the action and limit value, and the total exposure points for end-to-end journey (<sup>1</sup> indicates route via Bank and <sup>2</sup> via Charing Cross, \*route via Kennington Loop)

Journey	Route	Dur (mins)	$L_{Aeq}$ dB(A)	Time required to reach			EP
				LEAV	UEAV	ELV	
1	MOR-EDG <sup>1</sup>	66	80	7 h 38 min	24 h 9 min	>24h	4
2	EDG-MOR <sup>1</sup>	66	79	11 h 2 min	>24h	>24h	3
3	MOR-HIB <sup>1</sup>	69	82	5 h 17 min	16 h 42 min	>24h	7
4	HIB-MOR <sup>2</sup>	65	78	12 h 40 min	>24h	>24h	3
5	MOR-HIB <sup>1</sup>	68	80	7 h 27 min	23 h 36 min	>24h	4
*6	HIB-HIB <sup>2</sup>	87	81	6 h 48 min	21 h 31 min	>24h	7
7	HIB-MOR <sup>1</sup>	68	79	10 h 4 min	>24h	>24h	4
8	MOR-EDG <sup>1</sup>	68	80	8 h 34 min	>24h	>24h	4
9	EDG-MOR <sup>1</sup>	65	79	9 h 37 min	>24h	>24h	3
10	MOR-EDG <sup>1</sup>	65	80	8 h 34 min	>24h	>24h	4
11	EDG-MOR <sup>1</sup>	65	79	9 h 37 min	>24h	>24h	3

Table 4 Estimated  $LEP_{d}$  for example Train Operator duties detailed in the Temporary Working Timetable 224 (6 July 2020).

Duty	$LEP_{d}$ in dB(A) (EP)			
	Mon-Thur	Fri	Sat	Sun
612	78 (18)	78 (18)	79 (26)	79 (25)
649	80 (29)	79 (24)	79 (26)	78 (21)
665	80 (29)	79 (26)	79 (26)	79 (26)
680	79 (23)	79 (26)	79 (26)	N/A

18. This study includes all sources of noise (including radio communications, announcements, and alarms) which occurred during the surveys which would contribute to the TO's exposure during normal travel. These exposures should be considered estimates since a working day may comprise other working procedures involving different exposure to other noise sources that have not been assessed as part of this study.

19. It is acknowledged that most duties are unlikely to reach the LEAV. Nevertheless TfL, as a precaution, have implemented measures based on a likelihood of the LEAV being reached or exceeded. This allows for any variability that could be



expected during assessment. Table 5 summarises the assessment against the action and limit values stipulated in the CNAWR.

Table 5 Assessment of TO daily personal noise exposure against the CNAWR.

Could the action or limit values be reached or exceeded?					
LEPd			LCPeak		
LEAV	UEAV	ELV	LEAV	UEAV	ELV
80 dB(A)	85 dB(A)	87 dB(A)	135 dB(C)	137 dB(C)	140 dB(C)
Yes	No	No	No	No	No

20. According to guidance produced by the Health and Safety Executive (HSE, 2005), under Regulation 6 (*Elimination or control of exposure to noise at the workplace*), there is a duty placed on employees “to take action to eliminate risks from noise exposure completely wherever it is reasonably practicable to do so..” and “if it is not reasonably practicable to eliminate the risks completely, to reduce them to as low a level as is reasonably practicable [ALARP]”. Where exposure may reach the UEAV, the control measures “cannot include the provision of personal hearing protection....”. Importantly, the guidance states that “This general duty applies whenever there is a risk from noise and irrespective of whether any exposure action values are exceeded” (HSE, 2005).

21. Noise in cab interiors is largely influenced by the vehicle dynamics. The primary source is the rolling contact noise with other noise exposure arising from radio communications and alarms. There is an ongoing programme of monitoring and maintenance for track and rail vehicles across the underground network which supports continuous measures to minimise noise and vibration both within rail vehicles and within neighbouring commercial and residential buildings.

### Hearing Protection

22. In relation to hearing protection, under Regulation 7 (*Hearing Protection*), HSE guidance states that where exposure falls between the LEAV and the UEAV, the employer has “to provide protectors to employees who ask for them but the Noise Regulations do not make their use compulsory”.

23. Hearing protection is available for use by all Train Operators. There are several types of hearing protection devices (HPD) available in the form of earplug and earmuff style HPDs; these can be requested through the Personal Protective Equipment (PPE) catalogue. The HPD used by the TO during the survey is shown in Figure 8.



Figure 8 The Alpha Solway SONAL1 HPD used by the TO during the survey.

24. There are several methods for estimating the  $L_{Aeq}$  at the ear when different HPDs are worn. The method used would be dependent on the nature of the noise (e.g. frequency content, continuous or impulsive noise) and the type of HPD (e.g. passive, level-dependant, communication). Further guidance on selection of HPD may be found in HSE publication L108 (2005) and BS EN 458 (2016). One of the methods used to estimate attenuation provided by passive HPDs is presented in Appendix E. The interstation sections with median  $L_{Aeq}$  greater than 85 dB(A) (see paragraph 12) have been used to estimate the  $L_{Aeq}$  'at the ear' of the TO whilst using two example HPDs: Alpha Solway SOTA L1 and 3M E.A.R Earplugs EC-01-000 (see Table 6). As attenuation data for the HPD shown in Figure 8 were not available; data for the replacement model (Alpha Solway SONAL1) have been used.

25. HSE guidance states that HPDs “*should aim to provide protection that at least reduces the A-weighted sound pressure level at the wearer’s ear to below 85 dB*” and avoid protectors “*that reduce the level at the ear to below 70 dB*” as ‘over-protection’ could interfere with the TO’s ability to hear radio communication and safety announcements. Table 6 shows that the two HPDs used in the assessment would provide adequate protection for use through interstation sections where high noise values have been recorded. It is important to ensure that TOs adjust the volume control for radio communications to a comfortable level at the start and during each journey.

26. As the attenuation performance of HPDs is often less in the field than the values obtained in the laboratory, it is important to ensure that TO are trained in the correct use of hearing protection and how to maintain and identify impaired performance and any compatibility issues. Information should incorporate more general noise awareness training which covers their daily personal noise exposure level, ways to reduce the risk of damage to hearing and the relevant obligations specified in the CNAWR.



Table 6 Estimated  $L_{Aeq}$  in dB(A) at the ear of the TO for travel through 11 interstation sections where the  $L_{Aeq}$  greater than 85 dB(A).

Direction	Journey	Interstation	SOTA L1	3M E-A-R Caps
North	3	TOBr - TOBe	80	77
	3	CLN - CLC	73	67
	7	WAT - EMB	76	75
	3	WAS - EUS	80	77
	3	EUS - CAT	78	76
	3	CAT - KET	78	75
	3	KET - TUP	80	78
South	6	KET - CAT	80	77
	6	CAT - EUS	77	73
	11	SOW - MOR	80	77

27, With regard to Regulation 9 (*Health Surveillance*), HSE guidance states “*There is strong evidence to show that frequent exposure above the upper exposure action values can pose a risk to health*”, therefore employees who are exposed to noise regularly above the UEAV ( $L_{EP,d}$  85 dB(A) or  $L_{CPeak}$  137 dB(C)) should have their hearing tested as part of the health surveillance program. Where the exposure falls between the LEAV and the UEAV, employers “*should provide health surveillance if you find out that and individual may be particularly sensitive to noise.*”

## CONCLUSIONS

It is concluded that:

- 1 Higher noise levels were measured during travel through tunnel sections compared to surface sections.
- 2 Noise levels greater than 85 dB(A) (Median  $L_{Aeq}$ ) were measured at 11 interstation sections.
- 3 The LEAV ( $L_{EP,d}$  80 dB(A)) could be reached or (marginally) exceeded for some duties.
- 4 Noise exposure for all TO duties are unlikely to reach the UEAV ( $L_{EP,d}$  85 dB(A)) or the ELV ( $L_{EP,d}$  87 dB(A)).
- 5 No peak action or limit would be exceeded during normal operations.



## **RECOMMENDATIONS**

It is recommended that:

- 1 TfL continue to implement measures for all Train Operators based on the likelihood that the LEAV could be reached or exceeded.
- 2 Train Operators are informed of the correct fitting and use of any hearing protection devices supplied and that a programme of maintenance should be implemented.
- 3 General noise awareness training should be provided to Train Operators which includes information regarding their daily personal noise exposure with respect to the CNAWR, their obligations under the regulations and ways to minimise risk of hearing loss.
- 4 Train Operators who may be particularly sensitive to noise (as described in HSE publication L108) should receive regular hearing tests as part of a health surveillance programme.
- 5 Train Operators have access to a quiet recreational room for meal and rest breaks.

## **ACKNOWLEDGEMENTS**

The author gratefully acknowledges the Northern Line Team at the Morden Office for accommodating the noise surveys, particularly the Train Operator for his support over the three days.





## REFERENCES

Alpha Solway (2017) *Alpha SOTA L1 – low attenuation ear defender*. ALPHA-DATA-L1-0617\_1. Alpha Solway Ltd, 2017.

Barros, J. (2019) *Noise at work assessment for Northern Line Train Operators*. TFL Report RP-R2591. TfL Technical Services, 09 May 2019.

Barros, J. (2018) *Noise at work assessment for Northern Line Train Operators*. TFL Report RP-R2311. TfL Technical Services, 25 May 2018.

British Standards Institution (2016) *Hearing Protectors - Recommendations for selection, use, care and maintenance - Guidance document*. BS EN 458:2016. BSI Publications 2016

British Standards Institution (2018) *Acoustics – Hearing protectors Part 1: Subjective method for the measurement of sound attenuation (ISO 4869-1:2018)*. BS EN ISO 4869-1:2018. BSI Publications 2018

British Standards Institution (2018) *Acoustics – Hearing protectors Part 2: Estimation of effective A-weighted sound pressure levels when hearing protectors are worn (ISO 4869-1:2018)*. BS EN ISO 4869-2:2018. BSI Publications 2018

British Standards Institution (2020) *Hearing Protectors - General requirements BS EN 352 (Parts 1 to 3):2020*. BSI Publications 2020

British Standards Institution (2020) *Hearing Protectors - Safety requirements BS EN 352 (Parts 4 to 10):2020*. BSI Publications 2020

Health and Safety Executive (2005). *Controlling noise at work. The Control of Noise at Work Regulations 2005 – Guidance on Regulations*. HSE Books. Crown copyright 2005. ISBN 0 71766164 4

Health and Safety Executive (2008). *Sound Advice. Control of noise at work in music and entertainment*. HSE Books. Crown copyright 2008. ISBN 978 0 71769307 1

Occupational Health Group (2009) *Technical Datasheet E-A-R™ E-A-RCaps™ Earplugs EC-01-000*. CHCAPSDS Iss 1, 3M United Kingdom plc

Temporary Working Timetable 224 (2020) *Morden Duty Book*. Establishment Planning, 06 July 2020.

*The Control of Noise at Work Regulations 2005*. Statutory Instrument 2005 No 1643. HMSO, London. ISBN 0 11 072984 6.



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## APPENDIX A: STANDARDS AND CRITERIA

A1 The Control of Noise at Work Regulations (CNAWR, 2005), define several exposure action values at which employers are required to initiate steps to reduce the harmful effects of noise on hearing. The Regulations stipulate a 'lower exposure action value' (LEAV), an 'upper exposure action value' (UEAV) and an 'exposure limit value' (ELV). The action and limit values are expressed as daily (or weekly) personal noise exposure levels and as peak sound pressure levels. The personal noise exposure levels,  $L_{EP,d}$ , refer to an average noise exposure level that is normalised to an 8-hour period. The peak sound pressure levels,  $L_{Cpeak}$ , correspond to C-weighted values.

A2 The LEAV corresponds to an  $L_{EP,d}$  of 80 dB(A) and  $L_{Cpeak}$  of 135 dB(C). The CNAWR state that:

*"An employer who carries out work which is liable to expose any employees to noise at or above a lower exposure action value shall make a suitable and sufficient assessment of the risk from that noise to the health and safety of those employees ..."*

At this level or above, the employer "... shall make personal hearing protectors available upon request to any employee who is so exposed" and provide information, instruction and training on the harmful effects of noise and that mitigation measures are to be given.

A3 The UEAV corresponds to an  $L_{EP,d}$  of 85 dB(A) and  $L_{Cpeak}$  of 137 dB(C); the Regulations state that:

*"If any employee is likely to be exposed to noise at or above an upper exposure action value, the employer shall reduce exposure to as low a level as is reasonably practicable by establishing and implementing a programme of organisational and technical measures, excluding the provision of personal hearing protectors, which is appropriate to the activity."*

In addition

*"If in any area of the workplace under the control of the employer an employee is likely to be exposed to noise at or above an upper exposure action value for any reason ... the area is designated a Hearing Protection Zone; the area is demarcated and identified by means of a sign specified for the purpose of indicating that ear protection must be worn ... so far as is reasonably practicable that no employee enters that area unless that employee is wearing personal hearing protectors."*

A4 The ELV is set at an  $L_{EP,d}$  of 87 dB(A) and  $L_{Cpeak}$  of 140 dB(C). No personnel are to be exposed above this value; however, the exposure limit value takes into account the attenuation afforded by any personal hearing protection (PHP). In certain circumstances, the CNAWR allow the personal noise exposure to be calculated to a working week:

*"Where the exposure of an employee to noise varies markedly from day to day, an employer may use weekly personal noise exposure in place of daily personal noise"*



*exposure for the purpose of compliance with these Regulations”.*

A5 The CNAWR 2005 also requires the employer to provide an appropriate health surveillance programme to identify early signs and symptoms of hearing loss. The Regulations state that:

*“If the risk assessment indicates that there is a risk to the health of his employees who are, or are liable to be, exposed to noise, the employer shall ensure that such employees are placed under suitable health surveillance, which shall include testing of their hearing”.*

A6 There are a number of Standards applicable to hearing protectors. British Standard BS EN 352 (2020) covers selection and use of hearing protectors. The Standard applies to both earmuffs and earplugs. BS EN 352 (2020) states that the attenuation provided by hearing protectors can be measured according to BS EN ISO 4869-1 (2018). BS EN 458 (2016) also provides recommendations for the selection, use, care and maintenance of the devices.



## APPENDIX B: ANALYSIS OF NOISE DATA

This Appendix shows A-weighted broadband equivalent continuous sound pressure levels and one-third octave band equivalent continuous sound pressure levels (centre frequencies 31.5 Hz to 16,000 Hz). measured in the driving cab of Northern Line rail vehicles (1995 Rolling Stock) during normal operations over the period 24 to 26 November 2020. All measurements were made at head location, near to the Train Operator's left ear.

Table C1 Analysed data for the different end-to-end journeys.

Date	Journey	Train	Cab	Start	End	Route	L <sub>Aeq</sub> dB(A)	Table	Pages
24 Nov	1	017	51574	MOR	EDG	BAN	80.2	C2, C8	21, 27
	2	017	51712	EDG	MOR	BAN	78.6	C3, C9	22, 28
	3	102	51618	MOR	HIB	BAN	81.8	C4, C10	23, 29
	4	102	51617	HIB	MOR	CHC	78.0	C7, C11	26, 30
25 Nov	5	144	51653	MOR	HIB	BAN	80.3	C4, C12	23, 31
	6*	144	51652	HIB	HIB	CHC	80.7	C6, C13	25, 31
	7	144	51653	HIB	MOR	BAN	79.0	C5, C14	24, 32
26 Nov	8	026	51699	MOR	EDG	BAN	79.7	C2, C15	21, 33
	9	026	51668	EDG	MOR	BAN	79.2	C3, C16	22, 34
	10	026	51699	MOR	EDG	BAN	79.7	C2, C17	21, 35
	11	026	51668	EDG	MOR	BAN	79.2	C3, C18	22, 36



Table C2 Interstation LAeq for Morden to Edgware via Bank.

Interstation	Journey 1		Journey 8		Journey 10	
	Duration (s)	LAeq dB(A)	Duration (s)	LAeq dB(A)	Duration (s)	LAeq dB(A)
MOR - SOU	118	80.6	129	79.7	123	80.0
SOU - COW	90	80.8	91	80.9	91	80.2
COW - TOBr	95	79.3	96	79.1	97	78.8
TOBr - TOBe	89	87.2	89	87.2	90	87.4
TOBe - BAL	81	75.3	81	75.8	81	75.6
BAL - CLS	90	79.5	91	80.5	94	79.9
CLS - CLC	105	75.9	106	76.6	106	76.0
CLC - CLN	68	76.0	66	76.6	66	76.0
CLN - STO	67	86.5	66	86.1	66	86.5
STO - OVA	111	82.3	111	83.1	112	82.3
OVA - KEN	79	76.3	80	75.7	83	74.8
KEN - ELC	91	78.7	91	77.5	91	77.8
ELC - BOR	88	80.0	89	80.0	89	79.7
BOR - LOB	72	78.8	72	78.1	72	78.0
LOB - BAN	73	79.2	73	78.9	73	78.8
BAN - MOR	96	77.0	96	76.9	96	77.1
MOR - OLS	59	83.2	58	84.1	58	83.4
OLS - ANG	117	78.9	116	79.0	116	78.5
ANG - KIC	119	77.7	119	76.8	119	77.8
KIC - EUS	64	79.2	63	80.5	65	79.8
EUS - CAT	156	89.1	156	88.1	155	88.1
CAT - CHF	71	78.2	71	78.3	70	77.9
CHF - BEP	89	76.2	90	76.7	89	76.8
BEP - HAM	109	75.9	108	75.9	109	75.5
HAM - GOG	216	82.2	217	82.2	218	82.1
GOG - BRC	137	65.9	124	66.8	138	65.0
BRC - HEC	89	66.7	89	65.6	89	65.9
HEC - COL	149	80.0	150	78.4	153	79.1
COL - BUO	103	65.3	103	65.0	103	64.3
BUO - EDG	139	65.3	136	64.8	136	63.7



Table C3 Interstation LAeq for Edgware to Morden via Bank.

Interstation	Journey 2		Journey 9		Journey 11	
	Duration (s)	LAeq dB(A)	Duration (s)	LAeq dB(A)	Duration (s)	LAeq dB(A)
EDG - BUO	150	66.8	144	65.1	145	68.7
BUO - COL	115	64.0	115	63.7	115	63.6
COL - HEC	153	77.1	147	76.3	146	76.7
HEC - BRC	92	65.3	91	64.3	93	64.7
BRC - GOG	128	68.2	127	69.7	127	69.0
GOG - HAM	177	80.0	177	81.3	176	81.1
HAM - BEP	100	76.9	99	77.6	99	77.4
BEP - CHF	87	77.7	86	78.1	86	78.7
CHF - CAT	76	79.9	76	79.8	73	79.8
CAT - EUS	167	87.3	166	88.4	166	90.0
EUS - KIC	63	73.1	62	72.3	63	73.0
KIC - ANG	117	76.7	117	77.0	116	77.1
ANG - OLS	129	81.4	130	80.9	128	81.2
OLS - MOO	75	74.7	76	73.9	75	74.9
MOO - BAN	96	75.9	97	76.6	97	76.7
BAN - LOB	73	80.1	73	80.8	73	81.3
LOB - BOR	70	79.7	71	80.1	71	79.8
BOR - ELC	97	77.4	99	76.9	99	76.5
ELC - KEN	76	85.2	75	84.6	75	83.6
KEN - OVA	67	76.2	65	77.3	66	77.4
OVA - STO	111	76.1	111	76.7	111	77.3
STO - CLN	67	78.2	68	79.0	67	79.9
CLN - CLC	70	74.5	70	76.7	69	77.3
CLC - CLS	106	73.7	106	74.7	106	74.9
CLS - BAL	93	76.6	93	77.6	93	78.1
BAL - TOBe	83	76.3	81	77.3	82	77.4
TOBe - TOBr	93	75.6	92	76.2	92	76.5
TOBr - COW	98	77.2	98	76.7	98	77.2
COW - SOW	104	74.7	105	75.6	105	76.8
SOW - MOR	131	84.6	148	85.4	148	85.6



Table C4 Interstation L<sub>Aeq</sub> for Morden to High Barnet via Bank.

Interstation	Journey 3		Journey 5	
	Duration (s)	L <sub>Aeq</sub> dB(A)	Duration (s)	L <sub>Aeq</sub> dB(A)
MOR - SOU	118	81.8	118	80.2
SOU - COW	90	83.2	90	80.4
COW - TOBr	96	81.1	97	78.9
TOBr - TOBe	89	89.8	89	88.6
TOBe - BAL	81	77.0	82	74.8
BAL - CLS	91	82.0	90	79.5
CLS - CLC	107	77.5	106	77.2
CLC - CLN	66	79.0	65	75.4
CLN - STO	68	88.3	66	86.8
STO - OVA	111	85.3	111	83.9
OVA - KEN	79	77.3	81	75.9
KEN - ELC	92	81.2	91	77.6
ELC - BOR	90	81.9	90	80.9
BOR - LOB	72	80.3	73	78.6
LOB - BAN	73	82.1	73	79.9
BAN - MOR	96	79.1	96	78.5
MOR - OLS	59	86.2	59	82.6
OLS - ANG	127	80.1	117	79.3
ANG - KIC	120	79.2	120	77.1
KIC - EUS	64	81.4	65	79.6
EUS - CAT	170	89.2	169	87.6
CAT - KET	93	87.7	92	85.0
KET - TUP	70	89.0	71	87.6
TUP - ARC	77	83.0	77	81.7
ARC - HIG	129	76.2	129	75.3
HIG - EAF	115	80.2	114	78.2
EAF - FIC	204	64.3	204	63.4
FIC - WEF	131	65.6	135	71.0
WEF - WOP	83	65.4	83	63.0
WOP - TOW	110	66.6	108	65.6
TOW - HIB	260	66.3	213	64.5



Table C5 Interstation LAeq for High Barnet to Morden via Bank.

Interstation	Journey 7	
	Duration (s)	LAeq dB(A)
HIB - TOW	183	79.0
TOW - WOP	114	66.0
WOP - WEF	98	64.3
WEF - FIC	137	67.1
FIC - EAF	221	66.8
EAF - HIG	132	75.0
HIG - ARC	136	78.6
ARC - TUP	73	79.7
TUP - KET	67	77.9
KET - CAT	104	85.7
CAT - EUS	166	88.0
EUS - KIC	64	71.0
KIC - ANG	118	76.5
ANG - OLS	130	81.1
OLS - MOO	76	74.8
MOO - BAN	97	78.1
BAN - LOB	73	81.4
LOB - BOR	71	79.5
BOR - ELC	98	77.5
ELC - KEN	76	83.7
KEN - OVA	66	76.7
OVA - STO	109	77.1
STO - CLN	67	79.3
CLN - CLC	71	77.1
CLC - CLS	106	74.7
CLS - BAL	93	77.6
BAL - TOBe	83	76.2
TOBe - TOBr	92	76.6
TOBr - COW	99	76.2
COW - SOW	100	77.2
SOW - MOR	139	84.7



Table C6 Interstation LAeq for HIB to HIB via CHC and Kennington Loop.

Interstation	Journey 6	
	Duration (s)	LAeq dB(A)
HIB - TOW	206	66.3
TOW - WOP	110	67.3
WOP - WEF	86	65.2
WEF - FIC	108	70.5
FIC - EAF	203	67.6
EAF - HIG	133	77.3
HIG - ARC	136	81.6
ARC - TUP	73	81.6
TUP - KET	67	78.8
KET - CAT	103	90.6
CAT - MOC	84	78.2
MOC - EUS	76	85.0
EUS - WAS	57	82.9
WAS - GOS	46	79.0
GOS - TCR	57	78.6
TCR - LES	42	77.1
LES - CAC	53	80.2
CAC - EMB	37	78.4
EMB - WAT	57	80.2
WAT - KEN	138	84.9
KEN Loop	298	78.5
KEN - WAT	128	83.5
WAT - EMB	67	86.1
EMB - CHC	38	79.1
CHC - LES	57	84.0
LES - TCR	45	76.5
TCR - GOS	55	84.2
GOS - WAS	47	79.7
WAS - EUS	58	85.7
EUS - MOC	86	80.5
MOC - CAT	82	78.7
CAT - KET	93	89.1
KET - TUP	70	90.0
TUP - ARC	77	84.0
ARC - HIG	129	77.9
HIG - EAF	115	81.1
EAF - FIC	206	66.7
FIC - WEF	133	67.7
WEF - WOP	83	65.6
WOP - TOW	109	68.2
TOW - HIB	247	67.4



Table C7 Interstation LAeq for High Barnet to Morden via Charing Cross.

Interstation	Journey 4	
	Duration (s)	LAeq dB(A)
HIB - TOW	203	68.7
TOW - WOP	110	67.5
WOP - WEF	86	64.5
WEF - FIC	104	67.6
FIC - EAF	203	66.7
EAF - HIG	133	74.6
HIG - ARC	136	78.9
ARC - TUP	73	79.6
TUP - KET	66	77.9
KET - CAT	103	87.8
CAT - MOC	84	77.4
MOC - EUS	111	82.0
EUS - WAS	56	81.0
WAS - GOS	45	76.0
GOS - TCR	57	76.5
TCR - LES	42	75.1
LES - CAC	52	79.3
CAC - EMB	36	77.6
EMB - WAT	58	78.9
WAT - KEN	139	82.3
KEN - OVA	92	74.2
OVA - STO	109	77.3
STO - CLN	67	79.3
CLN - CLC	69	77.0
CLC - CLS	106	77.5
CLS - BAL	93	77.6
BAL - TOBe	82	76.3
TOBe - TOBr	97	75.5
TOBr - COW	98	75.8
COW - SOW	105	75.9
SOW - MOR	144	85.2

Table C8 Noise data for Journey 1 (MOR to EDG via BAN) on 24 November 2020.

Interstation	One third octave band centre frequency (Hz)																											
	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000	12500	16000
MOR - SOU	78.2	73.0	79.4	75.9	77.4	77.5	78.1	72.7	67.3	70.2	74.4	79.2	77.0	73.7	73.1	69.6	66.0	62.2	61.3	60.5	57.8	54.3	53.3	50.9	50.6	49.6	50.8	47.3
SOU - COW	74.7	69.5	78.6	73.4	74.9	75.1	76.4	76.8	71.6	73.9	76.9	80.2	76.2	72.8	72.4	69.9	65.8	61.5	58.9	57.1	53.2	48.4	44.4	41.5	39.7	38.7	39.5	32.2
COW - TOBr	75.0	70.3	79.4	76.4	78.9	78.3	78.0	78.9	73.7	75.1	77.3	78.1	72.7	71.9	69.6	66.8	65.7	61.3	59.2	57.6	53.2	48.1	45.3	41.4	39.5	37.5	40.0	31.0
TOBr - TOBe	73.0	67.8	78.1	70.9	71.0	70.6	70.1	69.0	65.7	69.7	83.7	88.8	75.3	76.6	82.6	72.3	70.0	64.0	61.6	59.2	54.6	49.5	49.7	48.1	43.5	41.4	40.9	34.3
TOBe - BAL	73.4	69.2	78.2	74.3	75.1	74.9	75.8	74.2	67.9	69.3	72.9	73.5	68.2	68.3	66.0	63.9	63.3	58.2	56.3	55.1	50.7	45.4	43.8	40.2	40.3	34.8	32.8	27.6
BAL - CLS	74.5	69.5	78.7	75.7	78.3	79.0	80.5	76.6	70.3	72.6	75.5	78.0	74.9	72.9	70.1	68.2	65.3	61.3	59.5	58.0	54.3	49.3	45.3	41.6	38.2	33.9	32.6	27.3
CLS - CLC	71.4	67.0	77.7	77.1	76.4	75.5	75.8	74.9	68.9	70.8	73.8	73.6	69.5	69.3	66.9	63.8	62.4	58.1	56.2	54.8	50.6	45.7	44.0	42.6	42.3	37.9	37.0	30.4
CLC - CLN	72.4	68.9	76.2	71.2	71.8	71.4	69.3	68.2	64.5	67.4	72.6	75.6	72.8	68.0	67.5	63.1	59.1	55.2	54.9	53.9	48.4	43.1	40.1	35.5	31.1	29.3	29.1	25.4
CLN - STO	71.7	68.9	77.6	71.9	73.1	73.5	73.1	73.9	68.8	71.4	78.7	86.9	79.2	74.8	82.7	73.4	71.2	66.0	65.6	63.0	56.6	50.0	46.9	43.7	39.0	36.2	35.1	30.1
STO - OVA	73.6	69.1	77.9	73.6	74.4	74.1	74.3	73.2	66.6	69.2	73.3	83.2	76.9	73.9	76.2	69.7	65.5	59.8	57.9	56.6	51.1	45.5	42.2	38.2	34.2	32.0	30.9	27.4
OVA - KEN	74.4	72.0	79.1	77.8	77.8	76.0	76.8	75.1	69.3	70.9	72.2	73.5	70.3	70.0	68.3	64.7	63.3	59.9	57.6	56.1	51.2	45.2	42.2	37.5	33.1	30.2	29.5	26.4
KEN - ELC	68.5	65.3	77.6	78.2	74.2	72.6	74.3	71.7	69.1	69.5	75.6	79.3	75.5	70.7	67.3	63.9	61.1	57.4	55.8	54.1	49.2	44.0	42.6	40.1	35.2	33.8	32.6	25.9
ELC - BOR	69.7	69.8	78.6	75.4	75.0	74.0	73.5	72.3	67.3	68.6	75.4	82.2	73.3	70.1	71.2	64.6	62.0	58.1	56.8	55.7	51.3	47.1	46.8	44.3	39.7	36.9	37.0	32.1
BOR - LOB	69.9	66.8	76.2	73.4	74.8	72.4	71.3	71.8	65.3	67.6	71.5	81.1	72.8	67.5	70.0	63.5	61.8	56.7	55.6	53.6	49.0	42.9	41.0	37.2	32.7	30.9	29.9	26.3
LOB - BAN	70.9	69.9	78.0	76.6	77.4	78.3	78.6	79.6	72.7	73.4	76.0	77.5	73.8	72.5	70.1	66.7	65.0	61.8	60.2	59.0	55.4	50.5	48.5	47.2	45.2	42.5	44.2	38.6
BAN - MOO	69.0	70.7	82.6	75.6	74.8	75.2	75.3	75.5	69.0	70.4	71.5	76.3	72.4	67.9	67.7	63.6	61.9	59.0	57.8	64.8	51.3	47.1	47.7	43.9	38.7	36.8	36.9	31.6
MOO - OLS	69.9	67.0	76.4	70.9	71.8	72.3	71.1	70.5	66.5	68.5	77.9	84.9	77.1	74.9	75.8	68.6	65.5	59.6	58.6	56.5	51.1	46.3	45.0	39.9	36.1	34.7	32.0	27.8
OLS - ANG	73.2	69.8	77.2	76.4	76.8	75.6	75.7	75.5	70.5	71.4	74.4	76.9	75.6	72.4	69.5	66.1	65.6	61.0	58.5	62.0	52.8	47.9	45.4	42.1	37.9	35.5	32.7	28.7
ANG - KIC	71.6	69.6	77.4	73.5	75.9	75.8	75.8	73.3	68.2	69.7	72.7	74.5	73.7	70.7	71.5	68.0	63.2	58.5	56.6	55.8	50.9	45.9	42.8	38.9	35.1	31.8	31.2	26.2
KIC - EUS	73.0	70.1	77.3	76.2	80.1	77.0	76.7	77.3	71.5	72.2	74.2	77.9	76.7	72.4	68.9	65.4	62.4	58.6	57.0	55.0	50.5	45.4	44.0	40.2	36.3	34.3	34.7	29.1
EUS - CAT	72.7	68.7	77.1	77.1	77.0	75.8	74.7	73.5	70.2	70.8	79.2	88.6	83.8	80.4	83.6	78.9	75.8	71.6	68.8	66.4	59.9	56.3	52.6	48.4	44.7	42.6	42.1	36.4
CAT - CHF	74.2	71.2	76.5	77.0	80.8	79.1	78.3	76.6	70.4	71.7	74.0	75.4	72.3	71.9	70.4	67.1	65.4	61.5	59.3	58.1	54.1	48.9	46.4	43.4	41.1	37.6	36.3	30.1
CHF - BEP	73.9	68.7	74.7	72.9	75.4	75.3	74.8	74.9	68.8	70.1	72.4	73.8	71.2	70.0	67.3	64.2	63.8	58.6	56.7	56.1	52.1	47.4	47.2	45.3	42.9	37.9	37.3	31.5
BEP - HAM	73.6	69.0	75.4	75.7	77.4	76.2	75.8	73.9	68.6	70.1	72.3	73.1	70.0	69.4	67.4	64.1	63.5	58.7	56.7	57.1	54.9	51.8	49.6	46.0	42.3	38.8	38.2	31.5
HAM - GOG	74.3	71.1	76.9	77.4	80.5	81.6	82.4	78.2	73.8	73.8	75.9	81.6	76.1	73.9	73.7	69.5	67.9	72.1	63.2	59.1	55.2	50.0	47.3	44.0	40.0	37.6	37.4	33.4
GOG - BRC	66.8	64.8	72.0	67.8	66.4	67.2	67.3	65.7	58.5	58.8	65.4	62.2	60.4	59.5	55.9	51.8	52.1	47.1	46.4	46.9	40.9	36.5	33.4	30.0	26.1	24.4	25.2	20.8
BRC - HEC	67.7	65.4	72.8	69.1	67.2	68.1	67.9	64.4	57.0	59.2	61.6	62.7	60.9	60.2	59.6	55.9	54.4	53.9	48.8	47.2	42.1	37.7	34.7	31.5	27.0	25.7	25.5	21.8
HEC - COL	71.6	71.5	75.9	70.5	74.4	77.1	77.0	71.5	66.0	66.5	69.0	72.5	72.1	73.5	73.3	68.3	65.2	74.4	62.6	54.3	51.6	46.5	44.5	43.4	39.8	37.4	37.6	34.4
COL - BUO	67.0	64.9	72.4	66.5	66.6	67.2	67.2	63.8	58.2	58.7	61.0	62.6	60.0	58.1	57.0	53.2	52.6	50.8	46.1	45.4	40.8	35.8	33.7	30.3	25.9	25.2	26.2	22.3
BUO - EDG	69.1	67.0	72.6	68.3	67.3	67.7	67.7	62.7	57.0	57.0	60.4	61.0	59.9	58.1	57.9	55.1	52.5	52.5	47.3	45.5	41.2	36.4	33.9	30.7	26.2	24.7	25.0	21.6



Table C9 Noise data for Journey 2 (EDG to MOR via BAN) on 24 November 2020.

Interstation	One third octave band centre frequency (Hz)																											
	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000	12500	16000
EDG - BUO	72.4	70.1	71.8	69.6	69.5	70.2	68.2	67.6	62.8	64.1	62.9	61.0	58.7	57.8	57.2	56.3	54.5	53.3	50.9	50.2	48.5	47.7	44.9	41.1	38.8	32.8	32.6	29.3
BUO - COL	68.7	68.0	70.9	65.6	66.8	66.0	65.7	63.0	57.8	58.5	60.6	60.4	57.7	57.9	54.9	52.1	52.1	47.2	44.8	44.7	39.9	37.0	38.9	38.3	43.2	32.9	31.2	24.4
COL - HEC	73.8	71.7	74.3	72.5	74.3	72.3	70.9	70.8	68.9	69.8	73.1	74.7	71.5	68.0	68.7	66.3	67.3	63.8	63.2	56.1	51.3	46.7	44.4	42.3	38.5	35.9	38.4	32.3
HEC - BRC	70.8	69.2	71.2	69.1	68.2	67.7	65.7	63.7	59.1	58.9	61.1	61.5	56.3	56.6	56.6	57.7	53.4	53.7	47.0	46.1	42.0	36.6	35.0	31.2	26.3	23.3	23.4	20.6
BRC - GOG	71.8	69.7	72.1	69.0	70.5	69.7	68.3	67.9	67.3	63.8	65.1	65.3	60.9	60.3	57.9	58.2	55.4	53.3	48.1	47.9	44.5	40.3	40.4	36.2	32.8	29.3	29.1	25.2
GOG - HAM	76.9	74.9	77.0	80.8	81.5	78.8	78.6	78.6	76.7	75.7	79.1	78.6	73.3	71.0	69.4	67.9	67.0	63.1	60.4	59.5	55.2	50.1	48.2	44.1	40.0	35.2	34.8	30.2
HAM - BEP	75.3	74.3	75.6	75.2	76.8	74.4	74.7	75.1	73.2	72.7	74.8	75.5	69.9	68.2	66.8	65.3	64.2	61.7	57.8	58.9	54.9	50.4	51.5	46.9	46.8	38.3	38.0	30.7
BEP - CHF	75.0	72.2	73.8	73.1	74.5	73.4	73.7	74.8	73.1	72.7	75.5	76.5	70.3	70.3	68.2	66.0	65.3	61.3	57.9	58.5	53.8	48.9	48.7	45.2	43.6	37.6	38.4	31.4
CHF - CAT	76.3	72.8	76.1	83.5	83.3	81.5	80.5	79.0	75.8	75.2	78.1	77.9	74.4	70.2	70.4	68.9	65.5	60.8	60.3	59.4	55.4	50.8	52.2	48.5	44.6	38.5	39.2	32.1
CAT - EUS	73.4	70.3	74.0	77.0	77.1	77.7	79.0	76.3	78.5	75.6	83.0	88.4	80.5	75.6	79.4	76.9	73.1	68.1	64.6	61.6	55.8	50.5	49.8	44.6	40.0	35.5	34.1	30.0
EUS - KIC	72.4	71.9	74.7	75.1	75.0	71.5	70.0	69.8	67.5	68.6	71.4	71.0	67.7	64.5	61.8	61.6	58.7	56.0	55.4	57.2	54.6	50.9	49.7	45.6	41.1	36.0	35.9	28.5
KIC - ANG	73.0	72.6	74.6	76.7	77.0	73.9	73.2	74.5	72.1	71.5	74.4	76.6	69.7	68.3	66.2	64.2	62.7	58.6	56.6	56.7	51.4	45.6	42.5	37.8	32.3	28.4	26.5	23.4
ANG - OLS	71.2	69.3	73.1	75.1	81.5	75.7	74.1	75.7	71.9	70.6	76.1	83.5	73.8	67.9	74.3	66.7	63.8	59.3	57.9	57.2	52.2	47.5	46.2	41.7	35.8	31.5	32.0	26.3
OLS - MOO	73.2	73.6	76.1	77.6	76.5	73.5	72.6	74.4	71.9	71.0	73.1	72.4	68.5	67.6	64.2	62.4	59.8	56.0	55.6	55.0	49.9	44.9	45.1	41.5	38.0	34.3	35.6	28.2
MOO - BAN	71.3	71.8	74.7	78.2	77.9	73.6	73.4	74.2	69.8	69.5	71.8	78.1	68.4	63.2	64.6	61.3	58.1	55.0	54.8	54.8	49.1	43.3	42.6	37.2	32.1	29.6	29.2	27.5
BAN - LOB	72.4	72.7	78.1	83.7	84.1	80.8	79.9	79.2	77.8	76.0	78.6	79.3	72.7	69.9	69.2	67.2	65.7	62.4	60.8	60.6	55.9	51.6	51.6	46.3	40.3	36.8	35.9	31.5
LOB - BOR	69.3	68.8	75.9	80.2	79.5	79.5	75.5	74.3	75.8	71.7	78.0	81.4	69.8	69.3	70.4	65.8	61.6	57.8	57.0	56.0	51.8	47.0	47.6	41.9	35.8	33.2	34.6	25.3
BOR - ELC	69.0	68.6	71.9	73.2	73.3	71.3	69.5	70.4	68.3	68.3	71.4	80.2	71.7	64.0	66.0	60.8	57.5	53.4	53.5	55.8	48.0	43.3	45.1	38.2	33.2	30.8	30.0	25.9
ELC - KEN	73.0	72.5	75.3	75.5	74.4	71.5	70.5	73.3	72.9	71.6	84.4	88.6	73.8	72.0	71.1	66.7	63.9	59.4	57.7	56.6	51.2	46.2	44.8	39.4	34.1	30.3	30.5	26.4
KEN - OVA	76.9	75.6	76.4	77.8	77.5	75.8	75.1	76.2	73.6	72.8	74.6	74.5	68.8	67.6	65.6	64.4	63.2	60.1	56.7	56.5	52.4	46.5	44.6	40.1	34.8	30.8	28.9	26.3
OVA - STO	75.3	72.4	74.7	76.3	76.8	75.1	74.7	76.1	71.9	72.3	77.2	74.2	67.7	67.1	64.2	63.2	62.1	56.1	54.6	54.5	49.6	44.3	42.7	38.3	34.4	29.8	28.6	25.1
STO - CLN	72.6	70.7	72.2	72.8	76.5	81.6	79.0	74.3	72.3	70.8	73.9	76.2	72.3	70.5	72.3	66.8	63.0	58.3	56.5	56.7	51.4	45.8	44.3	39.5	33.7	30.0	29.4	25.5
CLN - CLC	71.9	74.3	77.7	78.1	77.5	74.5	72.3	74.3	71.8	71.0	74.0	72.7	68.4	65.8	63.3	61.6	59.9	56.0	53.9	54.5	49.4	44.4	42.7	38.1	33.4	29.5	29.3	24.5
CLC - CLS	75.3	71.2	73.3	74.6	75.1	73.4	71.9	71.8	69.3	69.4	72.2	72.2	66.4	66.0	63.0	61.9	61.0	55.4	53.7	54.6	50.3	45.8	45.1	39.8	38.2	30.7	29.1	26.1
CLS - BAL	75.9	72.0	74.0	75.4	75.2	73.2	73.6	74.6	71.7	73.2	75.9	75.8	69.3	68.3	65.9	63.9	62.4	58.3	58.5	56.1	52.3	47.1	45.9	42.4	38.7	33.3	32.2	26.7
BAL - TOBe	76.1	74.2	76.8	77.6	76.6	75.5	75.0	76.0	72.9	72.1	74.8	74.3	69.0	68.0	65.7	65.3	63.8	59.4	57.6	57.2	52.9	48.2	49.6	44.9	41.8	35.9	34.8	28.6
TOBe - TOBr	76.1	72.5	75.1	75.7	75.6	74.0	74.2	75.3	73.0	71.9	74.6	74.3	68.2	66.9	64.6	63.3	62.5	57.9	56.3	55.9	51.4	46.6	45.6	41.9	39.3	33.7	34.3	28.1
TOBr - COW	77.0	73.5	75.7	76.7	76.5	73.9	74.0	75.8	73.8	73.4	76.5	75.7	70.0	69.7	66.5	65.2	63.7	59.2	57.2	56.6	52.6	47.2	44.0	39.7	35.4	31.1	29.3	25.4
COW - SOW	72.4	71.7	73.7	75.7	74.1	72.4	73.0	74.5	72.6	71.8	73.6	72.4	67.6	67.3	63.5	62.7	61.0	57.2	55.5	54.8	51.3	45.3	43.8	39.8	36.1	32.3	31.1	26.8
SOW - MOR	73.7	71.0	73.9	73.5	73.0	72.3	71.7	74.8	74.5	74.3	79.4	86.3	78.1	71.5	77.1	72.0	70.1	66.3	63.3	59.0	53.8	49.0	47.8	44.2	40.0	38.1	38.6	35.7



Table C10 Noise data for Journey 3 (MOR to HIB via BAN) on 24 November 2020.

Interstation	One third octave band centre frequency (Hz)																											
	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000	12500	16000
MOR - SOU	78.4	74.9	76.9	76.5	78.1	78.0	77.6	74.6	74.0	74.8	77.6	82.8	79.2	74.4	73.1	70.2	67.8	63.1	63.0	61.0	56.9	51.6	47.9	43.0	37.6	33.7	31.7	28.8
SOU - COW	80.5	75.7	76.5	74.6	76.5	76.7	76.7	78.6	78.0	79.1	81.5	82.6	78.5	74.0	72.7	71.1	67.5	63.4	61.0	59.6	56.4	50.7	48.0	43.9	40.2	37.5	35.7	30.1
COW - TOBr	79.0	74.9	76.5	76.6	79.1	79.7	77.8	79.6	79.2	79.4	81.7	78.9	72.8	71.3	69.0	68.6	67.1	63.8	62.1	60.0	55.9	49.7	45.6	40.5	35.5	32.1	29.9	27.4
TOBr - TOBe	79.4	72.9	76.2	71.9	73.4	71.3	71.9	71.7	72.0	74.9	89.0	92.1	78.6	78.7	81.6	74.4	71.2	65.9	63.7	61.5	58.1	51.7	48.5	42.9	38.0	36.5	34.4	29.8
TOBe - BAL	78.2	74.5	75.8	75.1	75.9	75.4	76.0	75.4	74.7	74.1	76.2	75.3	69.0	68.3	65.9	64.9	63.9	59.2	57.1	56.8	53.8	48.8	48.0	44.4	40.8	37.7	37.2	31.3
BAL - CLS	80.0	75.1	75.7	77.1	78.8	81.9	81.5	78.7	77.0	77.5	79.5	80.3	76.9	74.7	71.3	71.0	67.5	63.8	62.0	60.8	58.5	53.6	49.4	44.6	39.5	35.7	34.2	29.4
CLS - CLC	76.2	72.5	75.5	77.4	77.1	76.1	76.0	76.0	74.9	75.5	76.6	75.7	70.3	69.3	66.6	64.6	63.9	59.0	56.9	56.6	53.5	48.6	45.5	40.0	34.5	32.1	31.7	27.2
CLC - CLN	76.3	73.2	74.6	73.4	73.3	71.4	71.2	70.4	71.1	71.1	77.3	79.3	76.0	67.8	67.9	64.8	61.0	56.7	57.6	56.9	52.2	46.5	43.4	36.9	31.6	28.4	26.0	21.9
CLN - STO	75.7	74.1	75.6	72.4	73.9	73.1	73.1	76.0	75.1	76.4	84.6	88.8	81.3	75.8	83.0	76.1	73.5	69.6	69.5	65.3	61.1	55.0	51.3	46.6	38.9	35.4	34.3	30.8
STO - OVA	78.9	74.9	76.3	74.5	76.8	76.2	75.5	75.2	72.7	73.7	77.4	87.3	80.1	74.7	76.7	71.3	66.7	60.9	59.2	58.8	54.4	48.4	45.8	40.2	35.1	32.7	31.0	28.1
OVA - KEN	79.3	77.1	79.1	77.4	78.3	77.3	76.6	75.8	74.4	74.5	76.1	75.0	69.6	69.4	67.3	65.3	63.9	60.1	58.4	57.8	53.5	47.5	44.6	38.7	33.4	31.0	30.0	27.6
KEN - ELC	72.8	70.4	75.5	77.3	74.8	72.9	74.0	72.9	75.1	74.4	78.8	82.1	77.9	72.1	67.6	66.1	62.9	58.4	58.0	56.8	52.8	47.2	45.8	41.1	34.7	34.3	33.5	29.1
ELC - BOR	75.4	75.9	78.4	76.0	76.1	75.4	73.8	73.5	73.0	73.3	79.3	83.6	75.3	72.2	72.9	66.0	63.0	58.9	58.9	57.0	53.4	47.4	45.8	41.7	35.0	34.1	35.5	30.2
BOR - LOB	74.3	72.6	73.9	74.6	75.2	73.2	71.7	72.2	70.9	71.1	75.8	82.6	73.9	68.2	71.7	64.0	61.9	57.7	56.9	55.9	52.1	45.5	47.2	41.5	32.0	31.1	30.7	26.3
LOB - BAN	75.7	74.4	77.6	76.1	78.4	79.6	79.5	80.5	78.3	77.8	80.1	81.1	76.5	74.6	71.4	69.2	67.2	64.5	63.7	61.9	58.9	52.6	49.8	44.0	39.1	36.3	36.4	32.0
BAN - MOR	73.8	76.5	83.7	75.2	75.3	76.6	75.2	76.4	74.8	74.8	76.4	79.1	74.6	68.8	67.8	65.0	62.9	60.0	59.5	58.3	54.3	49.1	47.2	42.3	36.2	35.3	35.7	31.1
MOO - OLS	75.6	72.5	73.2	72.2	73.9	72.9	72.3	72.5	71.7	73.7	82.0	88.3	80.7	75.4	77.0	70.3	66.4	61.8	61.4	59.3	54.4	49.3	47.9	39.4	35.7	35.4	31.8	27.6
OLS - ANG	75.0	72.9	74.6	76.4	76.0	75.0	74.9	75.8	75.7	75.3	77.8	78.2	77.1	72.7	67.5	67.8	64.7	61.2	60.5	58.4	55.0	50.0	48.4	43.7	37.5	35.1	32.4	28.9
ANG - KIC	76.7	74.1	75.9	74.5	76.7	76.9	76.0	75.3	73.9	74.2	76.3	77.3	76.3	70.0	68.9	68.7	63.9	59.9	58.4	57.8	54.4	48.8	45.4	39.8	34.7	31.0	29.6	25.5
KIC - EUS	77.4	74.2	76.4	76.4	79.1	78.6	77.4	79.2	76.7	76.3	78.7	80.4	78.3	73.5	69.5	69.0	64.6	61.4	60.5	58.1	54.2	48.4	46.5	41.3	35.1	34.7	34.7	29.3
EUS - CAT	77.1	73.1	76.7	76.7	78.3	76.5	75.9	75.3	76.5	77.3	81.6	88.7	84.4	79.5	82.7	79.3	76.1	72.6	70.9	68.0	61.5	55.1	51.3	46.1	39.7	38.1	38.4	34.1
CAT - KET	77.2	73.5	73.7	71.4	73.9	72.9	71.8	70.4	70.3	74.0	79.9	85.9	83.5	75.5	84.3	76.8	72.3	67.4	65.2	62.1	56.3	50.2	46.0	40.7	34.9	31.6	31.1	27.8
KET - TUP	78.4	74.2	75.8	75.2	78.3	76.1	74.7	73.5	74.1	75.8	80.6	90.3	84.8	77.8	80.6	77.1	73.9	70.0	68.4	65.4	58.9	51.7	46.7	40.8	34.7	31.1	30.0	26.9
TUP - ARC	77.9	74.8	78.5	79.6	84.1	82.6	78.8	77.3	76.0	76.6	78.6	81.7	80.8	72.8	72.3	72.4	68.5	63.7	62.9	61.0	57.3	51.7	47.6	42.3	35.9	32.2	31.6	28.4
ARC - HIG	77.9	74.8	75.0	74.2	76.1	74.8	73.6	72.2	70.5	71.0	73.9	73.4	69.6	68.6	68.2	65.2	63.8	61.3	57.7	57.6	54.5	48.5	44.5	39.7	33.3	30.4	28.8	25.6
HIG - EAF	78.1	77.2	75.9	75.1	76.4	74.8	74.9	73.3	71.9	73.4	76.4	75.3	71.5	75.3	71.6	68.3	69.0	70.2	64.8	59.8	57.0	53.5	51.3	49.8	45.1	45.7	44.5	42.5
EAF - FIC	72.6	69.2	70.6	67.7	70.1	68.1	67.9	63.4	58.2	59.0	61.4	58.9	57.6	57.0	55.4	54.8	51.7	48.0	46.2	46.3	43.1	37.7	34.2	29.7	26.2	23.7	20.8	17.2
FIC - WEF	73.0	68.7	69.6	69.8	71.6	71.0	70.7	65.3	60.8	60.2	61.6	61.4	60.9	59.5	54.1	53.2	50.0	47.5	45.9	46.6	42.6	37.7	35.3	30.3	26.5	24.9	24.8	21.4
WEF - WOP	72.4	68.6	70.4	69.9	70.9	68.9	69.8	64.8	59.0	58.9	60.9	58.7	56.5	57.8	58.1	56.7	51.7	51.8	49.0	47.3	43.5	40.2	35.9	29.2	25.1	24.4	25.3	21.3
WOP - TOW	73.4	70.5	71.1	71.2	73.1	70.5	72.0	66.4	61.0	60.3	62.7	60.5	58.6	58.8	57.4	57.4	53.8	52.9	50.4	47.8	44.8	39.6	36.4	31.5	26.7	25.9	25.7	22.2
TOW - HIB	73.4	71.1	71.0	68.4	70.6	68.8	70.2	66.0	62.3	61.0	61.9	61.3	61.9	57.3	55.4	55.7	51.3	55.0	48.3	46.4	42.6	38.0	35.3	31.7	26.8	24.3	22.8	19.7



Table C11 Noise data for Journey 4 (HIB to MOR via CHC) on 24 November 2020.

Interstation	One third octave band centre frequency (Hz)																											
	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000	12500	16000
HIB - TOW	70.0	69.5	77.5	71.0	72.6	72.2	70.9	71.2	67.8	64.7	64.8	63.5	60.4	61.0	59.1	57.7	55.4	52.6	51.7	51.2	49.8	49.1	47.1	41.9	35.7	32.3	29.4	25.0
TOW - WOP	72.3	71.8	75.8	75.5	74.4	74.0	71.4	70.3	65.0	62.3	64.1	62.7	60.3	58.1	56.5	54.8	53.8	54.3	51.6	47.3	44.0	40.8	38.0	34.8	30.6	27.4	26.5	20.3
WOP - WEF	69.1	67.9	74.9	71.7	71.0	70.2	68.3	68.1	61.5	57.6	61.0	59.1	57.0	55.4	55.7	52.8	51.4	51.3	46.2	44.9	41.0	37.5	36.1	32.3	27.2	23.9	26.6	20.4
WEF - FIC	70.9	69.7	75.3	70.5	71.8	72.9	70.7	72.6	66.2	62.4	64.6	63.8	62.1	57.5	57.3	53.6	52.8	50.2	46.7	45.9	42.6	39.5	37.4	34.9	31.7	28.1	27.1	20.1
FIC - EAF	70.9	70.4	75.5	73.8	71.8	71.3	69.0	68.5	63.7	60.3	62.2	60.4	58.3	57.0	57.5	56.9	52.7	53.5	51.6	51.4	49.1	47.3	47.6	43.2	40.0	35.0	32.2	26.5
EAF - HIG	72.0	70.2	73.8	71.3	71.9	70.9	70.3	71.5	67.7	67.9	73.3	71.1	66.4	65.8	64.2	63.4	66.5	61.2	55.6	55.3	51.4	46.9	48.1	51.9	33.3	29.7	30.8	24.9
HIG - ARC	73.6	73.5	76.4	77.1	76.3	75.3	75.5	77.7	74.8	73.6	77.9	77.8	73.2	69.5	67.8	66.9	64.1	63.5	61.2	58.5	54.6	49.9	47.4	42.9	36.7	32.2	30.4	26.7
ARC - TUP	73.7	71.3	75.6	77.9	79.1	79.4	77.8	78.5	75.0	74.6	78.6	78.1	75.5	68.1	68.2	68.5	65.0	60.6	59.4	57.7	54.0	49.8	49.5	47.9	37.0	33.3	32.4	27.7
TUP - KET	74.1	73.1	74.8	76.7	78.2	78.8	78.5	79.5	74.6	73.5	76.8	74.8	72.5	69.0	66.5	65.4	64.9	60.9	59.3	58.6	55.2	50.3	50.6	48.7	41.1	36.7	34.7	27.4
KET - CAT	73.6	70.7	76.4	75.8	75.1	73.5	73.6	74.8	70.8	70.9	76.6	87.8	84.3	71.6	81.2	78.3	74.7	69.6	67.6	63.7	57.0	50.9	47.1	43.2	35.9	32.1	29.5	26.1
CAT - MOC	72.5	71.0	77.3	82.4	78.3	77.4	77.4	75.9	75.5	74.1	75.8	77.2	72.7	66.5	63.7	63.0	60.7	57.2	55.9	55.3	51.6	46.4	46.2	41.4	35.1	31.4	29.4	25.1
MOC - EUS	76.3	75.2	83.2	86.5	85.0	83.4	82.8	81.7	78.8	78.0	81.6	80.0	74.9	71.4	70.2	70.1	68.0	64.9	64.2	63.0	59.2	55.1	54.8	52.2	44.2	40.9	39.3	35.1
EUS - WAS	73.9	72.8	77.2	83.3	85.1	83.5	79.6	79.2	76.1	74.7	79.0	78.1	79.2	71.6	68.6	67.5	65.2	61.0	60.6	59.5	56.1	52.6	54.7	50.1	43.5	40.7	38.5	33.8
WAS - GOS	73.9	73.1	76.9	78.1	78.4	77.9	77.6	79.1	75.0	72.9	75.0	72.7	68.4	65.1	63.5	63.1	62.9	60.1	58.1	57.7	54.2	49.5	51.4	50.5	39.1	33.6	33.2	27.2
GOS - TCR	73.7	71.9	75.6	76.0	79.2	79.8	79.5	79.1	75.5	73.0	76.3	73.1	68.8	64.7	64.4	63.3	63.5	59.0	56.7	56.0	51.9	47.2	49.0	51.1	35.4	31.9	32.8	26.6
TCR - LES	71.4	69.8	75.7	75.1	78.5	79.6	80.0	79.0	73.4	70.2	73.3	70.8	67.2	63.3	65.1	64.0	62.8	57.2	55.3	55.9	51.3	46.1	44.3	39.7	32.9	29.2	29.3	25.5
LES - CAC	73.5	70.3	72.9	77.2	76.8	75.3	74.8	78.0	76.0	73.8	78.0	78.0	76.7	68.1	66.6	65.1	61.5	58.3	58.2	57.5	53.1	49.3	50.7	49.9	40.4	37.4	37.1	33.6
CAC - EMB	71.0	69.0	73.3	76.7	78.7	78.4	78.2	79.8	74.9	73.2	77.2	75.8	70.5	67.9	66.6	64.7	61.5	59.4	58.8	57.9	54.3	49.4	48.2	45.5	37.0	32.6	30.5	25.2
EMB - WAT	73.1	71.7	74.8	75.3	76.5	76.2	74.7	76.7	75.0	73.6	76.7	78.8	73.2	69.4	68.3	65.6	63.8	62.1	58.6	57.8	54.7	49.5	48.3	45.8	40.0	37.9	37.5	29.9
WAT - KEN	79.0	74.9	78.7	82.6	82.8	80.3	79.5	79.6	77.3	76.3	80.5	82.7	76.1	70.9	71.0	69.2	67.5	64.7	63.5	61.6	58.0	55.0	56.8	50.6	43.8	41.8	40.7	35.6
KEN - OVA	74.6	72.7	75.7	77.0	76.0	76.1	75.0	76.4	72.7	71.2	74.0	70.9	67.7	63.3	61.2	60.7	59.9	58.0	54.6	53.8	49.8	44.3	49.0	48.2	34.0	29.9	30.1	23.4
OVA - STO	75.0	72.9	76.1	77.3	77.9	78.1	77.3	78.7	73.9	73.6	79.1	73.9	68.8	66.1	63.9	63.4	63.8	60.5	57.1	55.5	51.2	46.2	45.2	41.2	35.9	31.5	31.3	27.3
STO - CLN	71.8	68.2	74.0	72.2	75.2	83.8	82.7	76.7	75.3	73.3	76.1	76.6	75.9	70.6	69.7	67.4	64.5	60.0	57.4	55.9	52.1	47.6	46.2	41.2	34.7	30.8	29.7	25.9
CLN - CLC	72.1	72.1	79.9	79.7	78.9	76.8	75.9	76.8	73.8	72.8	76.5	75.6	72.7	67.0	64.5	63.0	61.0	56.9	55.2	54.8	50.5	45.5	46.4	43.7	35.8	32.5	32.1	26.4
CLC - CLS	73.5	70.0	74.3	74.5	75.0	75.1	74.0	74.1	71.0	70.6	74.5	76.6	75.1	66.3	64.5	66.7	63.2	58.5	56.9	55.7	51.6	45.8	44.6	38.8	33.9	30.3	28.4	25.5
CLS - BAL	75.1	72.0	77.5	75.9	76.2	76.3	76.3	77.6	74.9	74.2	77.7	75.7	70.4	67.8	66.1	64.5	63.9	59.3	57.7	56.6	53.5	49.2	49.6	47.1	40.3	36.9	36.0	29.9
BAL - TOBe	73.8	71.8	77.8	76.8	76.5	77.3	77.2	78.0	74.5	72.9	75.8	73.4	69.1	66.1	64.1	64.0	63.6	59.2	57.6	56.8	52.9	48.1	48.2	49.7	39.3	35.1	35.4	28.7
TOBe - TOBr	73.7	70.8	75.0	75.3	75.9	76.9	76.6	77.3	74.8	72.9	75.6	72.8	68.2	64.6	62.6	62.0	61.1	57.2	56.0	55.6	51.5	46.6	44.9	40.3	35.7	31.4	28.5	24.2
TOBr - COW	75.6	71.8	76.8	75.7	75.6	75.3	75.3	76.9	74.0	72.9	76.2	73.3	68.1	64.9	63.7	62.7	62.7	58.6	56.9	55.7	52.0	47.2	45.8	42.3	36.9	32.7	32.4	27.4
COW - SOW	73.1	71.1	77.2	76.1	75.8	75.7	76.3	77.6	75.4	73.8	76.2	72.5	68.6	66.0	63.7	62.6	61.3	57.8	56.6	55.7	52.1	47.5	47.6	43.5	39.8	36.7	36.8	31.3
SOW - MOR	72.7	69.8	74.2	73.6	73.8	74.6	74.2	77.0	76.1	75.3	80.6	85.6	80.6	71.5	78.5	72.9	70.3	67.8	65.0	61.4	55.8	51.2	49.2	45.8	41.3	38.9	38.8	35.1





Table C12 Noise data for Journey 5 (MOR to HIB via BAN) on 25 November 2020.

Interstation	One third octave band centre frequency (Hz)																											
	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000	12500	16000
MOR - SOU	83.1	78.2	78.2	77.7	79.3	77.4	77.8	75.5	71.0	73.4	75.6	78.0	75.2	71.8	72.1	69.1	67.7	64.5	64.2	62.5	60.4	58.3	55.5	53.1	52.0	51.1	50.2	46.2
SOU - COW	77.8	71.8	74.6	74.2	76.9	74.3	76.6	77.4	72.4	77.1	79.3	80.4	73.9	70.2	69.9	69.1	65.6	61.1	57.8	57.7	54.1	48.9	47.2	45.0	42.0	39.5	40.5	33.8
COW - TOBr	76.7	73.0	74.8	77.4	79.4	77.1	77.9	79.3	74.6	78.2	79.2	77.9	70.4	68.8	65.5	64.4	64.4	59.1	56.4	57.2	53.6	48.8	47.4	45.7	43.7	39.1	37.7	33.7
TOBr - TOBe	76.4	70.6	73.2	71.6	73.0	69.3	71.3	71.4	67.3	74.0	86.7	91.8	76.6	75.7	78.5	71.7	70.4	63.6	61.0	60.6	56.5	50.5	48.0	43.5	39.7	39.1	37.9	31.7
TOBe - BAL	74.0	71.2	73.2	74.0	75.5	72.7	74.3	73.9	68.6	72.9	74.1	73.3	66.2	66.0	63.6	62.3	62.1	57.3	55.1	55.8	53.7	46.0	43.8	40.5	35.6	32.4	31.0	26.8
BAL - CLS	76.7	71.8	74.5	77.1	78.8	80.0	81.6	77.9	71.6	75.8	78.0	78.4	73.5	71.1	67.4	67.9	65.4	61.3	58.7	59.2	56.6	51.7	50.3	48.5	43.7	40.4	39.8	33.3
CLS - CLC	74.8	70.1	74.8	78.3	78.6	75.5	77.5	77.5	72.2	75.3	76.2	76.4	69.9	68.3	64.3	63.4	63.2	57.8	54.8	56.2	52.9	48.0	47.1	46.5	39.4	37.6	36.0	29.9
CLC - CLN	72.3	70.0	72.1	72.5	72.2	68.4	69.6	69.9	65.8	68.8	74.6	76.5	70.7	64.1	62.4	61.1	58.1	53.4	53.1	54.0	49.5	44.5	43.7	39.1	31.1	29.1	28.2	25.4
CLN - STO	81.2	78.1	78.5	75.1	76.3	72.8	73.4	76.5	75.9	75.7	80.8	88.6	79.5	73.6	79.4	74.7	72.2	68.2	67.7	64.1	60.4	56.2	52.5	51.2	48.8	46.6	47.0	43.2
STO - OVA	76.5	73.2	75.6	75.5	78.3	74.7	76.5	76.9	72.9	73.6	77.1	86.2	77.8	72.1	75.3	70.7	66.4	59.5	57.9	58.5	53.4	49.8	46.8	42.7	38.3	35.6	34.7	30.5
OVA - KEN	76.1	74.9	78.3	78.1	79.3	75.1	77.3	78.1	74.8	73.4	75.8	72.5	67.3	66.4	64.8	63.6	62.5	58.0	56.2	56.6	52.3	47.2	44.4	39.2	33.8	31.0	30.4	26.5
KEN - ELC	69.6	68.4	75.4	77.8	76.3	71.4	74.9	75.6	74.9	72.0	77.4	77.6	72.9	67.1	63.7	62.7	60.2	54.7	55.1	56.6	52.8	49.9	51.9	45.2	37.9	37.4	36.9	32.7
ELC - BOR	71.7	72.3	78.3	77.2	77.7	74.6	75.6	76.9	73.9	72.7	79.5	82.8	73.4	69.5	70.7	65.2	62.7	57.1	56.5	56.9	52.6	47.5	46.6	43.6	36.8	36.1	33.3	29.8
BOR - LOB	71.9	70.5	73.5	75.2	76.8	70.9	72.4	74.7	70.8	69.3	76.1	80.6	71.7	65.5	69.2	62.7	61.5	55.7	55.2	56.3	53.9	47.9	47.5	42.9	37.4	36.1	36.7	30.5
LOB - BAN	72.3	72.7	76.6	77.1	80.2	77.6	80.6	83.3	78.4	75.5	79.6	77.4	72.6	70.4	67.9	66.3	64.7	61.2	60.7	61.7	58.3	53.5	55.0	55.0	46.1	44.6	44.9	40.2
BAN - MOR	70.7	74.7	83.1	79.2	80.9	76.9	77.8	79.4	76.4	74.1	77.3	77.8	73.8	67.8	65.9	64.0	62.6	57.8	57.8	58.2	55.9	50.0	49.5	44.9	39.5	38.6	38.0	34.1
MOO - OLS	72.2	70.3	73.0	71.5	73.4	69.3	71.4	73.4	71.3	70.4	80.9	84.6	76.5	71.3	72.7	66.4	62.9	57.1	57.1	58.2	53.5	49.9	53.9	53.2	42.8	41.5	40.4	34.3
OLS - ANG	74.9	73.5	75.6	78.3	79.6	74.3	76.6	79.1	77.6	74.3	78.1	77.7	74.6	70.3	67.7	65.8	65.0	60.1	59.4	59.8	56.1	51.9	53.3	48.6	42.0	40.5	39.6	34.3
ANG - KIC	73.8	71.9	75.2	75.5	77.8	75.3	76.4	77.7	73.7	72.0	75.6	74.2	72.7	66.9	67.9	67.3	62.7	57.2	55.7	57.3	52.8	47.9	46.1	42.7	40.2	37.0	36.4	30.3
KIC - EUS	72.2	72.0	75.9	77.0	80.8	76.5	77.8	81.2	77.0	73.9	78.3	78.1	75.2	70.5	67.0	66.4	62.9	58.2	58.7	59.3	55.4	51.8	55.2	52.4	42.0	41.5	40.1	34.2
EUS - CAT	73.8	71.1	76.8	78.1	80.1	74.7	76.2	77.7	76.5	74.0	80.8	86.9	81.8	77.8	81.2	78.4	75.8	70.9	69.4	67.8	61.1	58.6	62.3	48.2	42.5	40.8	39.5	36.1
CAT - KET	74.1	70.8	73.5	72.5	74.5	70.1	72.0	71.9	70.9	71.1	79.2	82.5	79.7	72.9	81.4	75.4	71.9	64.9	63.0	61.6	55.3	49.1	46.0	42.4	36.2	34.4	30.9	27.9
KET - TUP	74.4	70.9	75.4	75.4	79.8	73.9	74.9	75.1	74.8	73.5	79.8	88.4	81.9	77.2	80.8	77.0	73.7	67.6	66.1	64.7	57.9	51.3	47.4	42.6	35.3	31.1	29.1	25.2
TUP - ARC	75.9	73.5	78.3	80.8	85.9	81.3	79.0	79.0	77.0	74.5	78.5	79.5	77.8	71.1	72.5	72.9	67.7	61.9	60.9	60.7	56.4	51.4	48.3	43.8	36.7	32.5	30.6	26.2
ARC - HIG	75.0	72.4	74.4	74.6	77.5	72.3	73.7	74.8	71.6	69.5	73.8	72.1	67.8	66.5	66.9	64.6	63.4	60.2	56.1	57.5	54.0	48.9	45.5	40.1	34.2	30.5	28.5	24.8
HIG - EAF	75.3	74.7	75.3	75.1	77.4	72.9	74.1	74.7	71.2	71.5	75.9	73.1	69.4	71.7	70.2	67.6	67.7	65.9	63.2	59.2	56.1	52.0	48.4	45.1	42.4	41.2	43.0	39.6
EAF - FIC	68.8	67.6	71.6	67.4	69.8	65.4	67.0	64.4	57.8	59.5	60.8	59.3	57.8	51.9	51.6	52.9	52.3	48.5	46.0	45.2	42.0	38.9	34.5	29.8	26.7	25.3	22.5	18.3
FIC - WEF	68.6	66.2	72.3	71.4	73.2	69.2	71.0	65.5	61.4	62.0	63.2	62.8	67.6	65.7	61.3	61.2	58.6	57.3	55.1	51.3	50.1	49.4	46.6	43.5	38.6	34.1	33.0	30.4
WEF - WOP	67.8	67.0	71.6	68.7	70.0	65.0	66.5	63.1	55.5	59.5	60.0	59.0	55.0	53.5	53.5	52.7	50.1	49.8	44.7	44.5	42.7	39.3	33.4	28.9	23.3	20.1	18.5	14.1
WOP - TOW	71.1	70.3	71.9	71.5	73.2	68.2	68.9	65.3	58.4	61.8	62.8	61.5	57.9	57.5	54.7	54.6	53.0	52.1	50.3	46.9	43.5	40.7	37.2	32.6	29.0	26.1	24.8	19.8
TOW - HIB	69.5	67.9	71.2	69.4	70.8	66.2	68.5	65.7	60.4	61.7	62.4	61.0	57.9	56.0	52.7	51.9	50.8	49.1	47.3	44.0	41.1	38.3	35.0	30.5	26.9	24.2	23.5	19.9



Table C13 Noise data for Journey 6 (HIB to HIB via BAN and KEN Loop) on 25 November 2020.

Interstation	One third octave band centre frequency (Hz)																											
	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000	12500	16000
HIB - TOW	73.0	70.4	69.8	71.8	72.5	70.8	70.3	64.6	61.1	62.9	63.1	60.5	60.8	58.2	56.0	54.1	54.9	51.5	47.3	48.6	45.1	41.3	40.8	38.3	32.0	28.6	28.7	22.9
TOW - WOP	76.2	73.0	71.7	75.9	75.0	73.0	71.8	65.5	60.2	63.2	63.5	62.1	59.8	60.1	57.4	55.2	54.7	53.7	50.1	49.5	48.4	44.7	40.7	38.8	34.2	27.6	27.3	23.0
WOP - WEF	73.0	70.5	69.7	71.5	72.9	70.6	68.3	62.4	56.6	59.6	61.3	59.1	57.3	57.6	57.0	54.2	54.2	51.3	47.6	48.1	46.1	41.7	38.3	37.0	29.1	25.2	25.8	21.8
WEF - FIC	73.1	70.4	70.0	72.0	73.1	72.3	71.9	66.0	61.7	63.7	64.8	64.4	63.8	64.4	63.1	62.9	58.7	52.9	49.7	49.2	46.5	43.6	40.6	39.0	37.7	33.3	34.2	30.4
FIC - EAF	73.4	71.9	70.7	74.0	73.1	71.5	70.0	64.0	58.0	62.3	62.7	60.4	59.3	59.5	59.3	56.9	55.4	58.5	51.4	50.8	48.4	43.5	40.1	41.9	36.9	30.4	31.2	28.0
EAF - HIG	76.9	72.6	72.3	74.2	75.2	72.8	72.2	70.5	65.3	71.5	73.4	73.8	69.1	71.6	68.6	66.9	68.4	62.3	57.9	59.4	55.4	49.9	45.0	42.9	41.6	31.4	30.0	26.5
HIG - ARC	78.1	74.2	75.4	78.1	77.8	75.5	75.8	76.6	71.4	76.6	78.5	80.6	74.9	74.5	72.5	70.2	69.4	66.4	62.5	61.8	58.7	53.5	49.2	45.1	40.0	35.8	34.4	29.5
ARC - TUP	79.8	73.7	74.3	78.6	77.5	78.2	78.0	77.1	71.0	76.7	77.5	80.4	76.5	73.3	72.7	71.8	69.2	64.1	61.6	61.0	57.7	52.8	49.1	45.4	41.3	36.7	36.3	30.4
TUP - KET	78.2	72.7	72.9	78.2	79.1	78.0	77.2	77.7	70.3	74.2	75.5	76.2	71.7	73.0	68.9	66.7	67.7	62.6	59.6	60.5	57.1	51.9	47.4	43.9	40.2	35.1	37.5	31.5
KET - CAT	78.6	72.0	74.6	77.2	76.4	73.9	74.2	74.4	68.3	73.6	80.9	89.7	85.4	77.6	85.9	81.4	79.2	71.8	68.0	65.1	60.2	53.9	48.2	44.4	38.3	34.3	34.5	29.7
CAT - MOC	75.0	73.0	76.3	82.4	79.1	77.2	78.2	75.6	72.4	75.6	74.8	77.0	72.0	70.6	67.1	65.3	65.7	61.5	59.0	58.9	56.1	51.3	47.9	45.0	40.7	38.3	36.4	30.3
MOC - EUS	81.3	77.4	82.9	86.3	85.6	84.5	83.0	81.8	75.4	81.0	82.5	83.5	77.4	77.3	75.3	73.5	73.7	69.6	67.4	66.9	64.3	59.5	56.6	53.4	48.5	46.6	46.2	42.2
EUS - WAS	76.7	72.3	75.2	83.4	86.1	83.6	79.5	77.9	72.4	77.5	79.9	80.2	78.0	75.3	73.8	72.1	71.0	66.8	64.6	63.3	60.6	56.3	54.1	51.7	48.8	44.8	45.4	40.3
WAS - GOS	78.6	74.4	76.5	79.7	80.1	78.3	78.2	79.3	72.5	76.1	75.8	75.9	70.9	71.6	68.7	67.4	68.8	64.3	61.3	61.5	58.7	53.0	49.9	45.8	42.9	39.0	40.8	35.0
GOS - TCR	78.8	73.5	74.5	78.0	80.2	79.8	79.0	79.3	72.2	75.1	75.5	76.0	70.7	70.6	69.1	66.8	68.4	62.3	59.0	59.2	56.0	51.0	47.3	43.5	38.5	34.9	35.4	30.1
TCR - LES	75.3	71.4	74.3	77.7	79.7	79.5	79.2	79.4	70.6	72.9	73.4	73.3	68.7	69.6	68.6	66.8	66.4	60.4	57.6	58.2	54.5	49.2	48.1	42.0	35.3	33.1	34.6	28.9
LES - CAC	75.7	72.5	72.6	76.3	77.4	75.5	77.0	78.2	73.2	75.4	77.2	80.2	74.0	72.1	70.5	66.9	65.0	61.2	59.4	60.2	56.8	52.2	51.4	48.3	43.5	41.0	43.0	39.4
CAC - EMB	72.9	70.5	71.5	76.8	78.2	76.6	78.8	79.1	71.2	74.8	75.2	76.0	71.1	72.0	68.5	66.5	65.6	62.5	60.0	60.2	57.1	52.4	50.3	48.4	49.2	40.4	41.2	35.7
EMB - WAT	76.5	72.8	74.4	76.1	77.0	75.4	74.7	76.0	70.5	75.0	75.8	79.6	73.5	73.6	71.6	67.3	68.0	63.6	59.4	60.2	58.0	53.6	52.5	51.9	50.7	46.6	45.7	39.2
WAT - KEN	82.4	76.6	79.0	83.8	84.4	80.8	79.9	79.7	73.8	79.0	80.8	85.3	77.9	76.6	75.5	72.5	72.8	68.8	66.1	65.0	62.6	58.2	54.7	51.0	46.7	45.0	45.7	41.2
KEN Loop	73.4	69.7	71.4	74.2	75.2	71.5	71.9	72.4	67.7	73.0	73.3	74.2	71.8	72.6	68.4	65.4	68.6	65.5	60.6	67.7	58.0	53.1	52.9	48.1	44.1	42.2	44.5	39.8
KEN - WAT	80.0	76.9	77.8	79.5	79.7	78.0	77.8	80.1	73.6	78.7	80.6	82.9	76.6	76.4	73.4	71.5	71.4	67.9	64.5	63.0	60.7	55.3	50.7	47.4	42.2	38.5	37.2	32.6
WAT - EMB	76.6	72.4	77.2	81.3	79.0	79.7	80.1	80.0	72.8	77.8	80.9	86.8	80.0	76.3	79.2	74.5	72.5	66.6	64.2	62.6	59.6	54.1	49.7	45.9	40.8	36.4	35.8	31.1
EMB - CHC	74.6	73.2	78.7	82.4	82.0	79.6	78.5	76.7	70.6	76.4	76.5	76.9	71.6	71.0	70.4	67.6	66.7	62.6	60.3	61.5	57.3	52.5	50.5	48.0	43.3	37.7	38.0	33.5
CHC - LES	76.3	74.7	80.7	81.6	80.2	79.8	80.4	82.0	77.5	81.5	81.9	82.4	77.0	76.4	73.9	72.3	71.7	67.8	65.5	65.4	62.5	58.6	56.6	53.2	48.3	45.8	44.9	41.1
LES - TCR	75.8	71.1	72.9	77.6	79.2	74.0	73.5	73.9	67.5	72.7	73.3	76.4	69.9	67.8	65.8	63.7	64.6	58.2	56.5	57.7	53.6	48.3	44.5	40.1	34.1	30.7	29.8	25.4
TCR - GOS	77.7	73.0	73.8	76.4	76.7	74.9	75.5	77.5	72.6	77.9	82.0	85.8	76.4	74.3	74.1	70.5	69.6	64.6	62.3	60.9	57.4	51.8	48.9	50.9	38.8	35.2	36.8	31.0
GOS - WAS	76.9	72.8	75.7	81.1	81.8	80.6	77.7	76.7	69.7	74.6	76.6	77.7	75.3	72.1	70.3	68.2	67.7	62.3	59.0	59.3	56.2	50.7	47.1	42.2	36.6	32.6	31.5	26.9
WAS - EUS	77.7	77.6	86.5	88.5	84.3	84.7	82.3	79.5	73.8	79.9	80.9	83.1	78.0	78.0	77.9	75.8	75.4	71.6	69.3	68.5	66.3	61.3	57.7	54.3	49.4	46.9	46.8	43.0
EUS - MOC	75.7	71.5	75.4	77.9	78.7	75.4	74.8	75.0	76.4	76.0	76.9	80.5	75.9	73.0	69.5	67.2	65.3	60.9	59.7	58.7	55.2	50.2	47.0	43.4	39.2	38.7	39.5	37.4
MOC - CAT	75.4	74.1	78.5	81.0	79.2	78.0	79.3	79.4	72.2	75.3	75.1	75.6	72.5	71.3	67.8	66.2	67.1	62.4	60.2	62.2	58.9	55.8	59.1	52.6	47.2	44.5	46.2	40.1
CAT - KET	79.1	70.9	71.8	73.9	74.2	72.6	72.0	70.7	66.2	74.4	81.8	86.8	83.1	79.1	85.6	78.7	76.5	70.2	66.3	63.8	58.7	52.5	47.4	43.2	37.9	33.6	32.3	28.2
KET - TUP	78.3	72.1	75.3	76.8	77.7	74.9	73.5	73.5	69.2	75.7	81.1	91.3	82.9	81.1	83.0	78.6	77.3	71.8	67.9	64.5	59.8	53.8	49.1	44.5	39.4	35.7	35.3	30.7
TUP - ARC	79.4	74.1	78.7	81.6	84.7	82.2	79.5	78.3	71.8	77.0	77.5	82.9	80.1	75.5	75.0	74.5	72.2	66.9	64.4	62.9	60.2	55.2	51.4	49.6	42.2	39.1	39.3	33.9
ARC - HIG	77.2	73.5	73.5	75.9	76.9	74.8	73.6	72.9	67.9	72.1	73.3	74.6	70.7	71.2	70.0	66.6	69.4	64.0	58.7	58.6	55.9	50.5	47.0	46.8	41.1	35.2	35.3	31.4
HIG - EAF	77.8	76.1	75.1	77.3	76.7	75.4	73.9	72.9	67.0	73.8	74.6	74.8	71.5	76.2	72.6	68.8	71.6	72.4	68.7	59.8	58.1	53.9	49.0	45.5	41.6	39.6	39.9	36.3
EAF - FIC	70.5	68.1	67.8	69.0	70.2	68.0	67.3	61.6	55.5	59.6	60.6	58.8	57.0	61.0	59.8	58.3	56.0	53.6	49.7	48.0	45.6	43.1	42.4	42.1	35.9	32.6	33.7	29.3
FIC - WEF	71.1	67.0	67.7	72.7	72.5	69.9	71.7	63.6	57.7	61.7	61.2	60.8	61.6	63.0	59.3	58.2	55.1	50.4	47.2	47.5	44.5	40.7	38.6	36.5	32.5	31.3	31.6	28.1
WEF - WOP	71.6	70.2	69.8	71.2	72.3	70.5	68.7	62.7	56.5	60.3	61.0	59.1	57.4	57.1	57.9	55.8	55.4	52.0	46.8	48.7	45.9	41.1	38.7	43.1	33.9	24.9	27.3	19.8
WOP - TOW	73.1	71.4	70.7	75.8	73.8	72.2	70.7	64.2	58.7	62.5	62.9	62.0	64.0	60.2	58.9	57.7	56.8	55.3	51.3	49.6	47.1	43.0	39.1	39.7	32.0	26.9	27.1	20.3
TOW - HIB	73.3	70.3	69.3	73.2	71.9	70.5	70.0	64.2	60.1	63.4	62.8	61.8	62.0	59.9	59.1	55.8	55.4	54.0	51.0	50.5	47.6	42.7	39.5	37.5	32.4	28.4	27.0	22.1

Table C14 Noise data for Journey 7 (HIB to MOR via BAN) on 25 November 2020.



Interstation	One third octave band centre frequency (Hz)																											
	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000	12500	16000
HIB - TOW	73.1	69.9	73.8	75.2	76.9	74.6	75.4	72.9	68.4	72.2	76.1	79.1	73.0	70.0	71.2	66.5	64.6	60.8	56.9	55.9	53.2	48.7	47.6	41.8	38.3	36.4	36.1	32.6
TOW - WOP	71.2	69.9	72.7	71.3	73.2	68.4	69.8	64.6	58.7	62.7	62.5	60.5	60.1	58.0	57.4	53.9	53.2	52.8	48.9	46.6	44.4	42.8	41.1	36.1	33.7	33.1	32.5	29.4
WOP - WEF	68.9	66.4	71.1	66.3	68.6	65.3	66.6	61.4	56.3	60.9	60.6	59.2	59.2	56.9	56.2	52.6	53.0	48.6	46.7	45.6	42.1	41.7	40.4	36.0	33.3	32.8	32.5	29.7
WEF - FIC	69.2	66.1	71.2	67.2	68.1	68.1	70.4	65.7	59.6	62.2	62.5	61.7	61.1	63.0	57.2	56.4	53.7	49.4	46.0	45.9	43.4	41.9	40.5	36.8	34.2	33.1	33.1	29.7
FIC - EAF	69.8	67.9	71.7	68.6	70.6	67.2	69.5	62.8	57.3	61.4	61.5	59.5	58.9	62.5	58.5	57.8	54.9	50.9	47.9	47.0	44.5	43.1	41.2	40.5	39.9	33.2	33.4	30.2
EAF - HIG	73.5	70.3	72.9	70.9	73.5	69.7	71.1	69.0	63.2	69.1	72.5	72.3	67.5	67.9	65.6	63.7	66.9	60.6	54.4	55.5	52.9	47.9	44.7	39.9	35.2	30.7	29.5	26.5
HIG - ARC	74.0	72.6	75.1	75.7	77.1	73.7	75.4	74.8	69.2	73.9	76.9	78.2	72.5	71.4	68.5	65.4	63.6	62.0	58.5	57.5	55.2	50.1	47.2	42.3	36.4	31.6	29.1	25.5
ARC - TUP	75.4	71.7	74.9	77.7	77.8	77.9	77.9	76.6	70.3	75.7	79.0	78.9	74.3	70.5	69.6	67.7	64.7	60.1	57.0	57.6	55.1	50.6	47.8	43.1	36.6	32.7	30.3	25.0
TUP - KET	75.8	71.3	74.7	77.9	79.1	77.4	78.3	76.5	69.7	74.1	76.8	75.1	70.8	71.3	68.2	63.9	64.0	62.4	59.6	59.9	56.7	50.3	47.2	42.6	38.6	35.0	37.2	30.3
KET - CAT	74.2	71.1	74.2	74.1	75.2	71.9	72.9	71.2	65.3	70.9	78.5	85.9	81.7	73.7	79.8	74.8	70.9	64.9	61.6	59.5	54.6	48.8	45.5	40.5	34.1	31.1	33.9	27.1
CAT - EUS	73.9	69.4	75.8	80.8	79.6	79.1	83.2	77.6	76.3	78.4	83.8	88.6	81.6	79.0	80.5	76.5	73.6	68.8	65.4	63.6	59.9	56.1	58.0	48.0	43.0	41.1	39.9	37.3
EUS - KIC	70.8	69.5	72.2	72.6	73.7	69.7	70.0	67.8	62.1	68.3	69.6	69.5	64.5	64.0	60.5	57.7	56.9	53.0	51.4	53.4	50.1	45.3	42.9	40.3	31.1	27.8	28.1	24.2
KIC - ANG	73.5	71.3	74.6	75.2	77.5	74.8	75.2	74.1	68.5	73.3	75.9	76.1	69.2	68.0	65.3	62.4	62.8	58.4	54.4	55.2	52.6	47.6	45.0	40.7	34.4	31.3	28.9	25.4
ANG - OLS	71.9	68.7	72.1	75.7	84.5	77.7	77.4	76.7	70.1	73.9	77.5	82.3	75.7	70.7	72.5	66.4	64.6	60.0	58.3	57.1	54.2	49.3	46.3	41.6	36.4	33.3	30.5	26.2
OLS - MOO	74.4	73.2	78.6	78.2	77.3	73.7	74.5	72.8	67.5	71.5	74.0	73.4	68.0	68.1	63.9	60.7	60.2	56.1	54.1	54.5	51.1	46.1	43.3	36.6	31.7	28.1	25.3	21.9
MOO - BAN	72.1	70.6	75.6	78.1	76.5	72.4	75.1	74.2	67.1	71.1	74.1	81.0	70.0	65.9	65.6	60.5	58.9	54.8	53.4	55.2	52.0	47.2	47.2	40.6	35.4	34.0	33.1	31.5
BAN - LOB	73.0	71.4	79.0	83.3	85.8	82.3	81.1	78.4	76.2	77.7	79.2	80.7	75.9	73.3	71.1	67.3	66.4	62.4	60.2	59.4	57.2	53.8	53.5	49.7	44.5	44.0	41.9	38.1
LOB - BOR	70.1	68.3	75.3	78.8	80.5	81.7	79.2	73.6	71.8	72.8	78.6	79.8	71.6	70.8	71.0	64.1	61.6	57.2	55.1	55.4	59.0	50.9	46.8	41.4	34.9	33.2	32.3	28.5
BOR - ELC	69.9	67.8	72.4	73.7	76.3	72.7	73.1	70.6	65.7	69.9	72.7	80.0	72.6	65.5	65.5	60.2	57.4	53.0	51.3	52.1	48.9	43.3	42.5	35.7	31.6	29.5	30.0	28.4
ELC - KEN	74.0	71.8	75.7	75.4	76.2	72.0	72.7	73.5	69.2	74.5	84.4	83.7	77.1	75.8	74.4	68.5	66.9	62.7	59.5	58.3	55.2	49.7	46.8	41.5	36.4	33.7	32.6	28.9
KEN - OVA	78.1	76.0	78.1	78.0	79.2	76.8	77.3	76.8	70.8	75.0	76.8	74.6	68.9	68.7	65.3	62.6	62.3	59.8	55.6	55.3	53.1	48.2	45.8	41.6	36.2	33.6	31.7	28.2
OVA - STO	76.5	73.3	75.7	77.1	78.8	76.4	77.7	76.7	69.6	74.9	78.2	74.9	69.1	68.7	65.0	62.9	63.1	59.1	54.5	55.0	52.1	46.8	44.1	40.2	35.8	34.0	31.3	28.4
STO - CLN	73.8	69.0	73.1	72.6	76.5	82.8	82.8	74.5	69.3	73.8	76.5	77.9	74.5	72.6	70.0	66.4	63.4	58.9	55.3	55.7	53.3	48.2	44.0	39.0	33.2	30.7	29.6	25.7
CLN - CLC	72.5	73.4	79.7	79.4	79.3	75.6	75.6	75.1	69.5	73.8	76.4	76.0	72.3	69.8	64.6	61.6	60.8	56.8	53.4	54.3	51.6	46.1	43.2	38.0	34.3	32.1	28.9	24.5
CLC - CLS	75.5	70.0	73.6	74.8	76.1	73.5	73.6	71.5	65.6	71.2	73.3	73.3	67.7	67.2	64.5	61.0	61.5	59.1	54.9	57.3	53.9	46.8	42.5	36.8	32.2	28.7	26.5	26.8
CLS - BAL	76.1	71.5	74.7	74.9	77.2	74.4	75.5	74.9	68.7	75.0	77.3	76.6	70.5	69.9	67.1	63.5	63.5	59.5	56.2	55.7	54.3	49.1	45.0	40.2	35.4	31.5	28.1	24.3
BAL - TOBe	75.4	72.6	77.2	76.6	77.4	76.0	76.6	75.7	69.2	73.7	75.2	74.2	68.8	68.2	65.6	63.5	63.4	59.5	55.9	55.8	53.8	48.5	45.3	40.6	36.1	32.8	30.6	25.7
TOBe - TOBr	76.2	72.3	75.9	76.0	77.9	75.8	76.5	75.8	70.0	74.2	76.0	74.8	69.2	68.4	65.4	62.8	64.0	59.6	56.4	56.0	54.1	49.1	45.1	40.4	35.3	31.3	28.2	24.2
TOBr - COW	77.1	72.4	75.2	75.5	77.0	74.0	75.0	74.4	68.8	74.0	75.9	74.7	68.6	67.9	65.1	62.5	63.0	58.9	55.5	55.1	53.4	48.2	44.3	39.5	35.8	32.6	30.4	27.2
COW - SOW	76.3	72.4	76.5	77.4	77.6	75.1	76.8	76.6	71.3	75.3	76.3	75.5	70.2	69.8	66.5	63.7	63.6	59.9	56.3	56.1	53.9	48.7	45.3	40.3	36.8	33.6	32.0	27.2
SOW - MOR	74.3	70.7	73.6	73.2	75.0	73.2	74.1	74.4	70.8	75.7	80.0	85.2	78.4	73.4	79.0	71.6	71.2	69.6	62.9	60.6	56.4	51.1	48.1	44.3	42.4	40.8	42.1	39.4



Table C15 Noise data for Journey 8 (MOR to EDG via BAN) on 26 November 2020.

Interstation	One third octave band centre frequency (Hz)																											
	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000	12500	16000
MOR - SOU	73.2	71.9	74.9	74.6	73.8	74.9	75.5	74.6	69.6	72.1	76.2	79.7	74.5	70.2	72.3	67.0	65.0	61.6	59.4	56.8	52.3	46.5	45.3	41.0	36.1	33.1	32.8	29.6
SOU - COW	77.8	74.0	77.0	74.9	74.4	75.3	76.2	78.4	73.0	76.7	79.3	80.4	76.4	71.4	71.2	67.8	65.3	60.9	58.0	57.2	53.3	47.3	46.4	42.1	37.2	33.5	32.6	28.2
COW - TOBr	77.0	73.5	76.4	77.4	76.5	77.8	76.8	79.7	75.1	77.7	79.3	77.6	72.4	69.7	67.0	63.8	63.4	58.9	56.4	55.8	52.0	45.5	43.7	38.6	33.1	29.6	28.5	25.7
TOBr - TOBe	76.3	71.3	75.0	71.3	71.6	70.4	70.1	71.2	66.6	72.4	86.5	89.2	76.8	76.2	80.1	71.3	69.5	64.0	60.8	59.1	54.8	46.9	45.7	40.2	34.1	31.9	29.3	25.7
TOBe - BAL	76.1	72.8	76.8	76.2	74.5	74.5	75.1	75.6	70.5	72.6	75.2	74.6	68.9	66.9	64.7	62.3	62.2	57.3	54.5	54.7	51.0	45.1	44.3	40.1	35.4	31.3	30.3	26.4
BAL - CLS	76.5	73.3	76.4	77.1	77.3	80.4	81.7	78.3	72.6	75.9	78.7	78.7	76.5	72.8	70.0	67.9	65.3	61.6	59.5	59.1	55.7	49.7	47.9	43.6	38.5	34.5	33.7	29.6
CLS - CLC	75.3	70.9	77.4	78.8	75.8	75.4	75.7	76.8	71.4	74.4	75.8	74.6	70.5	68.9	65.7	62.3	61.8	57.5	55.1	55.3	51.6	46.1	44.9	40.3	35.2	31.7	30.3	26.8
CLC - CLN	73.5	71.3	75.7	73.1	71.7	70.0	69.7	69.8	66.1	69.5	75.3	76.5	74.3	65.5	65.7	60.8	57.5	53.7	52.9	53.9	49.9	44.9	46.0	40.4	33.7	30.4	30.1	26.3
CLN - STO	73.2	72.0	75.3	72.7	72.7	72.7	72.8	75.5	70.8	74.8	81.5	87.3	79.9	74.4	80.4	72.1	70.6	67.0	65.2	62.4	56.3	49.1	47.0	43.0	35.6	32.4	30.8	28.0
STO - OVA	76.0	73.5	76.3	74.2	74.5	75.0	74.2	74.4	68.5	72.5	75.7	84.6	78.0	73.7	76.0	69.0	64.8	59.3	56.8	56.2	51.3	44.7	43.3	38.2	32.3	29.6	28.4	26.3
OVA - KEN	75.7	76.3	77.9	77.5	75.8	75.6	75.2	75.4	70.1	72.5	74.1	73.1	68.8	67.4	68.0	63.1	61.4	58.1	56.8	56.0	52.1	43.9	42.3	36.4	31.5	29.2	28.8	26.1
KEN - ELC	69.5	68.5	75.4	78.4	72.7	71.8	73.6	72.8	69.6	71.7	76.5	77.3	74.7	68.6	64.4	61.0	59.5	55.3	55.0	56.1	51.1	46.1	46.6	41.5	34.9	31.7	31.4	26.9
ELC - BOR	73.0	73.8	77.5	77.0	73.3	74.4	72.7	73.5	68.7	72.1	77.9	81.8	73.3	70.2	70.7	63.2	61.4	57.0	55.3	54.6	50.3	43.7	43.0	38.1	31.1	28.8	27.5	24.3
BOR - LOB	72.7	71.3	75.3	74.9	74.0	71.9	71.2	72.2	66.7	70.0	74.2	80.0	72.5	65.4	70.0	61.6	61.1	55.9	54.3	54.8	49.6	43.1	42.5	36.8	30.9	27.2	25.8	22.3
LOB - BAN	72.0	74.1	76.9	76.7	76.2	77.9	78.1	80.0	73.5	75.7	77.5	76.9	73.4	71.2	68.1	65.1	64.1	61.1	59.4	59.0	55.2	49.2	48.8	44.5	40.0	35.7	35.1	29.8
BAN - MOO	72.3	75.2	81.1	75.2	72.9	74.3	74.3	76.2	70.4	73.5	75.0	76.4	71.9	67.1	65.6	62.5	62.0	58.6	56.9	56.0	52.0	46.6	45.7	40.4	33.8	32.5	31.1	26.8
MOO - OLS	72.3	71.2	74.0	72.1	72.0	71.2	70.9	72.6	67.6	72.1	81.7	85.9	78.2	73.1	75.8	67.9	65.0	60.1	58.9	57.5	52.7	48.9	50.4	44.2	38.2	35.1	34.1	29.4
OLS - ANG	73.7	73.2	76.5	77.9	77.2	75.7	75.4	76.8	72.4	74.3	76.6	77.2	76.1	70.9	68.2	64.6	64.1	59.9	57.6	57.6	54.1	48.8	48.8	44.1	37.5	33.8	32.4	29.3
ANG - KIC	73.9	72.6	75.5	74.5	74.5	75.4	75.1	74.9	69.2	72.4	74.4	74.6	73.9	68.0	66.9	65.1	61.4	57.0	54.8	55.0	51.1	45.2	44.0	40.2	36.6	31.9	31.5	27.4
KIC - EUS	74.7	74.2	77.4	78.4	79.0	78.2	77.0	79.6	73.5	75.4	77.8	79.3	77.8	72.6	68.5	65.5	63.7	59.3	58.4	58.7	55.3	50.4	52.5	48.1	41.9	37.7	38.2	32.9
EUS - CAT	73.9	71.3	76.7	77.5	75.7	75.1	74.4	75.1	71.5	73.7	79.4	87.4	83.6	78.1	82.2	77.7	75.6	71.6	69.0	65.8	59.5	52.3	49.4	44.4	37.4	34.1	33.1	29.5
CAT - CHF	76.0	75.1	76.8	79.2	79.2	78.8	77.9	78.5	72.6	74.9	76.3	76.1	72.3	70.5	68.7	65.8	64.5	60.3	58.2	58.2	55.0	49.3	49.1	45.9	42.5	36.7	35.8	31.3
CHF - BEP	75.0	72.3	75.4	73.6	74.1	74.6	75.0	76.9	71.7	73.0	75.0	74.9	71.5	69.5	66.7	63.4	62.6	58.0	55.3	55.9	52.3	46.3	47.0	42.5	38.7	34.2	33.0	28.7
BEP - HAM	75.6	73.6	75.8	76.7	76.1	75.7	76.0	76.0	70.9	73.0	74.4	73.8	70.1	68.4	66.1	62.1	62.1	57.3	54.8	55.6	52.1	45.6	44.9	41.2	38.1	34.3	33.2	29.0
HAM - GOG	75.0	74.9	76.4	77.5	77.7	81.6	83.6	80.2	75.8	76.9	78.2	81.9	76.7	72.8	73.2	68.0	67.9	66.8	64.1	59.1	55.5	49.6	48.0	43.9	38.4	36.6	37.0	34.5
GOG - BRC	70.6	71.7	73.4	72.2	71.3	69.8	69.2	66.2	60.2	61.5	62.1	62.4	61.1	59.8	60.0	53.9	52.7	53.1	47.9	47.4	43.5	36.7	34.5	30.9	25.9	23.3	23.9	20.6
BRC - HEC	70.4	71.3	72.7	71.7	69.8	69.1	69.4	64.7	58.8	60.0	61.0	61.1	60.0	58.5	57.9	54.3	52.0	50.5	45.9	45.0	41.2	36.2	34.4	30.5	25.6	22.5	22.1	19.0
HEC - COL	72.2	71.3	74.0	71.3	74.0	77.9	77.9	73.1	68.2	69.7	71.7	72.9	73.3	72.5	73.9	67.0	63.9	63.3	60.0	53.6	50.0	44.2	41.8	38.3	34.1	32.7	34.0	32.2
COL - BUO	68.7	70.0	72.8	68.1	70.4	68.4	67.8	64.6	59.1	60.1	60.4	61.2	62.0	56.8	55.6	51.9	49.9	47.8	43.7	43.8	39.3	34.5	32.7	30.6	25.8	24.3	23.8	21.0
BUO - EDG	70.5	71.9	73.6	69.5	69.9	68.7	68.2	63.7	59.3	61.2	60.4	60.3	60.0	57.7	55.5	52.9	51.1	50.3	45.9	43.8	40.6	36.2	34.1	31.4	27.7	24.4	24.2	21.6



Table C16 Noise data for Journey 9 (EDG to MOR via BAN) on 26 November 2020.

Interstation	One third octave band centre frequency (Hz)																											
	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000	12500	16000
EDG - BUO	68.7	66.9	73.1	66.4	64.9	64.8	66.4	63.0	58.4	65.6	63.2	59.5	61.8	55.5	54.6	51.3	50.9	48.7	44.6	43.8	39.4	36.3	36.2	31.4	28.2	25.3	24.5	21.0
BUO - COL	67.9	68.3	71.9	65.1	64.4	63.8	65.7	61.9	55.6	59.0	61.4	58.4	61.4	54.8	54.3	49.9	51.3	46.0	43.9	44.6	38.2	34.9	35.0	30.1	26.1	22.7	21.2	17.7
COL - HEC	73.4	71.0	75.9	73.2	73.2	72.7	72.1	69.7	66.1	70.3	74.3	72.8	72.0	66.8	67.5	65.6	64.2	64.1	61.4	53.9	52.6	48.2	46.1	42.1	38.6	36.5	36.3	33.2
HEC - BRC	67.9	67.9	73.1	65.8	65.0	64.4	64.0	61.1	55.6	59.1	62.8	59.0	57.8	56.1	55.4	55.8	51.7	50.1	46.2	45.8	41.3	37.8	36.5	32.2	28.8	27.1	27.5	27.5
BRC - GOG	70.6	69.7	75.1	68.2	68.4	67.8	68.5	67.0	66.7	65.9	67.2	65.1	63.6	61.5	60.4	58.8	55.1	57.6	56.5	51.0	48.0	41.3	37.9	33.5	29.4	27.0	27.1	23.4
GOG - HAM	77.8	75.2	77.7	80.0	82.0	81.2	81.0	78.9	75.3	77.7	82.0	77.8	76.0	71.6	69.7	68.5	68.9	65.0	62.1	59.8	55.4	51.9	51.2	47.5	43.1	40.2	40.2	34.5
HAM - BEP	75.2	73.5	78.0	75.7	76.9	75.2	75.8	76.3	71.5	74.8	77.1	74.6	71.4	68.4	67.0	65.0	65.8	62.3	58.5	58.7	54.2	52.8	55.1	50.0	47.2	44.0	44.2	36.9
BEP - CHF	76.8	73.0	78.2	73.7	75.0	74.8	74.9	76.1	71.7	74.2	78.3	75.3	71.8	69.3	67.5	65.5	66.3	62.1	58.7	58.3	53.9	50.2	49.7	45.9	43.4	41.4	41.6	35.7
CHF - CAT	75.1	71.4	77.8	80.7	82.5	81.9	80.8	78.0	73.8	76.1	79.3	76.3	75.0	69.7	69.7	67.9	66.5	62.3	60.2	58.3	54.1	50.0	49.0	45.4	40.7	39.6	40.0	34.1
CAT - EUS	74.7	69.3	79.4	77.4	76.6	78.6	81.1	77.4	78.2	78.0	85.2	87.6	83.4	77.0	80.5	78.1	77.5	71.6	68.3	63.9	57.8	53.5	52.3	47.9	41.1	39.2	39.0	34.5
EUS - KIC	71.3	70.2	78.3	74.1	73.6	71.3	70.1	68.7	64.5	68.8	72.5	68.9	67.4	63.3	61.1	60.0	58.5	55.1	54.4	54.5	48.1	44.2	44.2	41.1	34.3	30.7	31.7	26.4
KIC - ANG	74.6	71.6	78.5	77.1	76.9	75.3	74.7	75.2	71.0	73.9	76.8	75.2	71.5	67.2	65.6	63.6	64.4	60.3	57.6	56.7	51.2	47.3	48.4	42.4	37.8	39.7	36.5	32.6
ANG - OLS	71.5	67.6	78.4	75.6	82.6	77.5	76.2	76.2	71.0	72.8	77.5	80.7	76.2	68.3	75.1	66.5	65.7	61.2	59.7	57.8	52.5	50.3	50.0	45.0	40.7	38.1	38.1	32.6
OLS - MOO	73.7	71.2	79.4	77.3	75.4	73.3	72.4	71.6	68.6	71.3	73.6	71.1	68.5	65.7	62.8	60.6	59.7	56.0	55.0	54.4	47.8	43.0	43.5	37.4	31.5	29.2	29.7	24.6
MOO - BAN	71.4	70.6	79.8	79.2	77.8	74.6	73.8	74.1	68.5	71.1	73.9	77.6	71.7	64.7	65.6	61.3	61.6	57.5	55.5	55.6	49.1	45.8	49.0	41.8	36.6	36.7	36.0	33.3
BAN - LOB	73.2	71.8	80.1	84.9	84.6	81.5	80.2	78.4	76.9	77.6	79.6	77.9	75.9	71.1	70.3	67.9	68.2	64.6	62.4	59.9	55.9	53.6	54.9	50.8	45.8	45.2	45.3	41.2
LOB - BOR	70.0	68.8	79.2	82.2	79.3	81.7	78.3	74.7	75.5	73.8	79.9	79.1	74.3	70.3	71.3	66.7	64.7	60.7	59.9	57.7	52.8	49.1	49.8	43.3	38.2	36.1	36.4	32.0
BOR - ELC	71.2	67.8	78.1	75.1	74.7	72.1	71.3	70.0	67.0	69.7	72.8	78.2	73.6	64.0	66.8	60.8	59.0	54.6	53.7	53.0	46.8	42.4	43.7	36.9	33.3	32.3	34.2	31.4
ELC - KEN	73.9	72.3	78.4	76.2	74.6	72.2	71.5	73.1	72.2	74.0	87.1	84.5	77.2	73.9	74.0	68.5	67.2	63.5	60.9	57.7	52.3	48.1	47.2	41.8	36.3	33.4	32.8	28.2
KEN - OVA	78.1	76.3	78.5	78.7	78.0	77.5	76.4	77.1	72.6	75.4	77.6	74.1	70.7	67.4	65.4	63.9	64.9	61.7	57.6	56.6	52.2	47.9	47.2	42.0	36.1	32.6	31.4	27.1
OVA - STO	75.1	71.2	78.1	76.8	76.7	75.4	75.6	76.2	70.2	74.3	79.4	72.8	68.7	66.1	63.7	62.0	62.3	57.2	54.9	54.7	48.7	44.7	44.1	39.0	33.8	30.2	29.9	26.0
STO - CLN	73.6	68.2	77.7	73.1	75.6	83.4	81.6	74.4	71.4	73.2	76.6	76.0	75.0	71.3	70.4	67.1	64.6	60.3	57.6	56.2	50.8	46.9	45.9	41.4	36.4	34.3	32.8	27.8
CLN - CLC	73.1	73.0	80.8	80.1	78.7	76.0	74.3	75.4	71.3	73.8	77.1	73.0	73.1	67.8	64.2	62.1	61.7	57.7	55.2	55.2	49.6	46.4	45.9	40.5	36.8	34.2	34.3	29.3
CLC - CLS	77.4	70.3	77.9	75.9	75.4	74.6	72.9	72.6	68.2	71.4	75.1	72.2	68.7	65.1	63.4	61.5	62.1	57.2	54.3	55.2	49.7	45.7	44.6	39.4	36.6	39.3	34.6	29.5
CLS - BAL	76.2	71.9	77.5	76.1	75.8	74.3	74.2	75.5	70.9	75.1	78.5	75.4	71.1	68.6	66.4	64.0	64.0	59.7	57.0	56.4	51.7	48.1	46.5	42.1	37.7	34.5	33.5	28.2
BAL - TOBe	76.9	73.7	79.9	78.6	77.2	76.9	76.2	77.0	72.2	74.3	77.5	73.5	70.8	68.0	65.9	65.2	65.4	61.5	58.5	57.3	52.8	48.8	47.9	44.3	41.1	34.6	33.4	27.7
TOBe - TOBr	77.1	71.8	78.1	76.2	76.0	75.6	75.2	76.1	71.9	74.0	77.0	73.1	69.4	66.5	63.9	62.7	63.8	59.6	57.0	55.6	50.8	47.2	45.8	40.6	36.4	32.3	31.0	26.4
TOBr - COW	77.6	73.0	77.7	76.4	75.9	74.2	73.8	75.2	71.3	74.1	78.0	73.4	69.7	66.9	64.8	63.7	64.1	59.9	56.9	55.5	51.3	47.5	45.5	40.8	36.6	33.1	32.6	27.9
COW - SOW	73.2	71.7	78.3	76.3	75.3	73.6	73.9	75.2	71.8	74.0	75.8	71.9	69.1	66.7	63.9	62.9	62.7	58.8	56.6	54.8	50.4	46.2	44.8	39.4	35.0	31.4	30.8	26.6
SOW - MOR	74.6	70.4	78.1	73.3	72.5	72.3	72.8	74.8	72.6	75.7	80.9	84.2	79.9	72.1	81.3	72.7	71.7	69.4	66.3	60.8	55.8	51.2	49.5	45.4	39.7	37.8	37.8	34.3



Table C17 Noise data for Journey 10 (MOR to EDG via BAN) on 26 November 2020.

Interstation	One third octave band centre frequency (Hz)																											
	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000	12500	16000
MOR - SOU	75.3	71.7	76.9	76.5	75.6	76.0	77.4	72.3	69.0	71.4	76.1	79.2	77.5	70.9	71.2	67.1	63.0	59.6	58.5	56.7	52.6	46.9	44.8	40.4	35.5	33.5	33.6	31.2
SOU - COW	79.1	73.3	77.9	74.8	75.0	75.0	75.8	77.0	73.9	76.0	79.3	79.0	75.8	70.8	71.4	67.2	63.6	60.3	57.3	56.0	52.2	46.6	45.3	40.4	35.0	31.3	30.2	26.9
COW - TOBr	77.2	73.0	77.8	77.4	77.1	77.5	76.7	78.5	76.0	77.2	79.6	76.6	72.4	69.2	67.8	63.9	62.7	59.0	56.1	55.1	51.4	45.9	44.2	38.8	32.9	29.5	28.9	26.6
TOBr - TOBe	78.3	71.4	76.6	72.0	72.3	70.3	70.6	70.4	68.4	72.9	87.1	88.6	77.4	76.5	81.6	71.6	69.0	64.4	60.9	58.6	54.4	47.5	46.1	40.4	33.9	31.4	29.1	25.7
TOBe - BAL	76.3	72.2	77.3	76.5	75.2	74.3	74.9	74.5	71.8	72.8	75.7	73.6	69.0	66.6	65.2	62.5	61.5	57.3	54.3	54.1	50.8	45.4	45.0	40.0	35.4	30.9	29.7	25.9
BAL - CLS	77.7	72.5	75.9	77.0	77.3	80.0	81.0	76.8	73.0	75.2	78.7	77.5	75.9	72.1	70.3	67.6	63.7	61.1	58.8	57.9	55.1	49.7	47.9	43.7	38.6	34.0	33.2	28.9
CLS - CLC	76.0	70.0	77.0	78.9	76.0	75.2	75.2	75.0	72.1	73.4	75.7	73.6	69.7	67.8	66.4	61.9	60.4	56.9	54.8	54.1	50.9	45.5	44.1	39.8	33.6	29.5	28.0	25.2
CLC - CLN	75.0	70.7	76.0	73.2	72.0	69.4	69.2	68.9	67.0	69.2	75.4	75.7	73.5	64.3	65.6	60.3	55.7	53.1	52.1	52.2	48.4	42.3	41.9	36.5	31.4	27.5	26.6	24.0
CLN - STO	73.7	71.5	77.5	72.9	72.7	72.3	72.6	74.8	72.3	74.6	82.3	86.8	80.1	74.5	82.1	72.4	69.1	66.8	65.7	61.5	56.0	49.4	47.2	42.9	34.9	31.1	29.6	26.9
STO - OVA	75.7	72.3	76.7	73.7	74.1	74.0	73.1	72.8	68.9	72.0	75.4	83.6	78.2	72.2	75.2	68.7	62.9	58.6	56.1	55.0	50.2	44.1	42.8	37.4	31.6	28.5	27.5	25.7
OVA - KEN	75.1	75.0	79.1	77.6	76.1	75.1	75.4	74.3	70.8	72.5	74.3	72.0	68.6	66.8	64.7	61.8	59.8	56.9	54.6	53.4	49.5	43.7	42.4	37.1	31.3	28.5	28.1	25.6
KEN - ELC	70.8	67.9	76.5	78.6	73.5	71.7	73.7	72.0	71.6	72.2	77.4	77.2	75.0	68.5	65.7	61.5	58.4	55.3	54.2	53.8	49.5	44.3	44.8	39.8	33.1	29.5	28.6	24.8
ELC - BOR	72.7	74.3	78.4	76.9	74.0	74.2	72.6	72.4	70.0	71.4	77.7	80.9	73.7	68.8	72.0	63.6	59.9	56.9	54.8	53.5	49.6	43.8	42.9	37.8	31.4	28.3	27.1	24.4
BOR - LOB	73.5	70.7	76.8	75.2	74.4	71.6	71.4	71.3	68.1	69.9	74.5	79.3	73.0	64.8	70.6	62.3	59.4	55.8	54.4	53.9	49.1	43.6	43.2	37.8	31.6	27.3	26.9	23.4
LOB - BAN	72.4	73.3	78.5	77.0	76.7	77.5	78.0	78.9	74.9	75.5	77.7	76.3	73.6	70.6	68.8	65.2	62.9	61.0	59.3	58.8	54.7	49.0	49.1	43.9	39.0	34.0	33.5	27.9
BAN - MOO	73.3	76.3	83.1	76.1	74.2	74.6	74.4	75.7	72.1	73.4	75.6	76.3	72.5	66.7	66.9	63.1	61.1	58.7	57.1	55.8	51.8	46.8	46.3	40.7	33.6	31.6	30.2	26.6
MOO - OLS	73.3	69.7	76.2	72.2	72.1	70.6	70.3	70.8	68.1	71.3	81.6	84.7	77.8	72.2	75.5	67.7	62.9	59.2	57.8	56.2	51.5	47.7	49.2	41.6	35.5	32.8	31.3	27.6
OLS - ANG	73.7	71.5	77.1	77.3	76.5	74.2	74.4	75.0	73.1	73.8	76.4	76.3	75.9	70.4	68.7	64.7	62.4	59.6	57.4	57.0	53.5	48.2	47.4	43.0	36.1	32.5	31.0	28.0
ANG - KIC	75.6	72.2	77.9	75.5	76.0	76.0	75.8	74.7	71.2	73.1	75.8	75.2	75.2	68.3	68.6	66.4	61.3	57.8	55.3	54.8	51.4	45.5	44.1	40.0	35.3	30.6	30.0	26.2
KIC - EUS	75.4	72.9	78.0	77.3	78.3	76.8	75.9	77.8	74.1	74.4	77.2	78.2	77.7	71.5	68.3	65.4	61.5	58.3	56.8	55.4	51.9	46.4	47.1	43.7	36.1	32.6	32.9	29.3
EUS - CAT	74.8	70.9	78.2	77.8	76.1	74.8	74.1	73.9	72.7	74.0	80.4	87.1	83.8	78.0	82.6	78.3	74.4	71.6	68.7	65.5	59.0	52.1	49.3	43.5	35.2	31.8	30.0	27.4
CAT - CHF	76.8	74.4	77.9	79.2	79.7	78.4	77.7	77.0	73.4	74.2	76.4	75.0	72.4	69.9	69.3	65.9	63.0	59.9	58.0	57.3	54.6	49.2	48.2	44.3	39.1	34.3	33.7	29.3
CHF - BEP	76.3	71.9	76.0	73.8	74.8	74.5	74.8	75.8	72.8	73.1	75.5	74.3	71.7	69.2	67.4	63.7	61.9	58.0	55.4	55.7	52.1	46.4	45.8	41.0	36.2	31.9	30.9	26.9
BEP - HAM	75.6	72.7	76.5	76.4	76.2	75.1	75.6	74.6	71.4	72.7	74.6	72.9	69.7	67.6	66.3	62.1	60.6	56.9	54.2	54.8	51.4	46.1	44.5	40.1	35.6	31.4	30.9	27.0
HAM - GOG	76.4	74.6	79.0	78.2	78.8	81.7	83.6	79.4	76.7	77.0	78.8	81.3	77.1	72.7	73.8	68.5	67.4	65.5	64.1	58.9	55.3	49.9	47.7	44.0	38.7	37.3	37.8	36.1
GOG - BRC	68.7	68.2	76.0	68.6	70.5	67.3	68.7	64.3	59.5	60.2	63.6	60.7	59.9	57.6	54.8	51.4	51.0	46.4	44.5	46.0	41.5	36.1	34.3	29.9	26.1	22.4	21.4	18.3
BRC - HEC	69.2	70.1	74.7	73.0	71.8	70.0	69.7	63.6	59.0	60.3	61.7	61.6	60.8	57.5	57.5	55.7	53.0	51.6	46.2	44.6	41.0	36.5	34.6	30.8	26.1	23.5	23.0	20.9
HEC - COL	72.0	70.4	75.9	71.6	74.5	78.3	78.5	72.3	69.2	70.1	72.5	72.3	73.3	72.9	74.2	68.6	65.6	66.6	63.9	53.9	50.8	46.2	44.4	42.2	38.7	38.2	39.8	38.4
COL - BUO	67.9	68.7	74.8	67.6	70.4	68.1	68.1	63.1	59.2	60.2	60.6	60.9	59.9	55.4	55.1	52.3	49.6	47.3	43.4	43.2	39.3	34.4	33.0	30.2	24.3	22.8	22.1	18.6
BUO - EDG	69.0	69.4	75.0	68.3	69.5	67.7	67.6	61.7	56.9	58.5	60.1	59.2	58.9	55.1	54.2	53.0	49.9	50.9	45.1	43.0	39.7	35.1	33.4	31.2	27.0	23.7	23.0	20.4



Table C18 Noise data for Journey 11 (EDG to MOR via BAN) on 26 November 2020.

Interstation	One third octave band centre frequency (Hz)																											
	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000	12500	16000
EDG - BUO	69.7	68.9	75.2	67.1	66.3	65.7	66.2	62.2	58.4	66.1	63.9	59.1	62.9	60.5	57.5	56.8	57.4	56.1	53.0	53.6	55.9	55.4	51.7	50.6	47.6	47.5	48.7	43.9
BUO - COL	67.5	67.8	73.9	64.4	64.5	64.1	65.4	60.7	54.7	59.2	60.9	57.4	61.2	55.4	54.7	49.9	50.6	46.7	44.5	44.9	38.8	36.9	38.2	37.0	34.6	30.4	26.9	22.7
COL - HEC	73.8	71.6	78.0	72.5	73.4	73.2	72.2	69.1	65.3	71.5	75.4	72.3	72.9	66.9	69.3	65.6	63.4	63.1	59.4	54.8	50.7	47.3	46.3	41.5	37.7	35.6	35.0	32.6
HEC - BRC	69.0	68.6	74.4	66.6	66.3	65.9	64.5	61.0	55.5	60.8	63.7	57.9	58.0	54.6	56.5	56.3	52.3	51.3	46.6	46.2	41.4	38.0	36.4	31.9	27.8	25.5	24.9	21.6
BRC - GOG	71.7	71.2	75.7	69.5	69.4	69.1	68.8	66.9	67.1	66.1	68.1	64.5	64.1	60.9	59.2	55.5	55.0	53.3	49.2	48.0	43.7	39.9	38.2	33.6	29.1	26.2	25.2	21.0
GOG - HAM	77.8	76.0	77.4	80.3	81.9	81.3	80.9	77.2	73.7	78.3	82.0	76.3	76.1	71.2	70.9	68.0	68.0	65.1	62.0	60.0	55.1	51.3	50.1	45.9	40.6	37.8	36.5	31.4
HAM - BEP	75.8	74.8	78.5	75.3	76.8	75.3	75.8	74.7	70.2	75.4	77.5	73.3	71.5	67.9	68.3	64.6	64.8	62.3	58.2	58.4	52.6	48.3	46.6	41.8	39.3	35.6	34.9	29.8
BEP - CHF	77.7	73.6	76.8	73.7	75.3	75.4	75.5	75.2	71.1	75.4	79.2	74.8	72.6	69.6	69.6	65.8	66.2	63.1	59.3	59.2	54.1	50.3	49.7	44.7	41.3	38.7	38.4	32.9
CHF - CAT	76.3	72.5	78.1	81.3	83.0	82.6	81.2	76.5	72.5	76.8	79.3	75.2	75.1	69.5	71.4	67.9	66.2	62.9	60.5	59.0	54.1	50.3	50.0	46.8	41.6	40.2	39.1	32.9
CAT - EUS	76.1	70.4	77.9	76.8	76.6	78.9	82.6	77.9	78.7	80.1	87.2	88.6	85.1	79.0	83.3	79.3	78.1	73.6	69.7	66.1	59.1	54.7	52.8	48.5	42.0	38.6	37.4	32.8
EUS - KIC	72.9	71.5	78.9	74.9	74.9	72.4	70.8	68.1	64.4	70.3	72.9	68.9	68.5	63.9	63.4	60.3	58.5	56.1	54.4	55.7	48.1	43.9	43.3	41.3	33.1	27.9	29.6	24.4
KIC - ANG	74.5	72.7	78.9	77.2	77.3	75.7	74.8	73.9	69.9	74.8	77.2	74.0	71.3	67.2	67.5	63.7	63.9	60.7	57.7	57.5	51.0	46.8	45.2	40.6	34.7	31.4	30.8	26.3
ANG - OLS	71.7	68.6	78.7	75.7	83.5	78.4	76.7	75.1	70.1	73.8	78.1	79.5	76.8	68.8	76.7	67.3	65.7	62.0	59.8	58.6	52.0	48.1	46.7	41.3	36.9	33.9	33.0	28.5
OLS - MOO	74.4	73.0	80.1	78.4	76.4	74.4	73.3	71.3	68.5	72.7	74.9	70.6	69.6	66.4	65.9	61.3	60.6	57.4	55.5	56.0	48.4	43.7	43.1	35.5	30.5	27.0	25.5	22.0
MOO - BAN	72.3	72.1	80.1	77.4	75.3	73.0	73.8	73.1	67.7	72.2	74.5	76.8	72.2	65.3	67.6	61.5	60.2	57.1	55.6	56.8	49.2	45.9	46.8	41.0	34.2	32.7	31.3	27.6
BAN - LOB	73.8	73.5	80.9	85.3	85.5	82.6	80.8	77.5	76.3	78.7	80.4	77.3	77.0	71.6	72.0	68.1	67.8	65.3	62.6	60.6	55.7	53.5	53.8	49.2	44.0	42.8	42.3	38.1
LOB - BOR	70.0	69.1	79.6	80.5	78.7	80.8	77.5	72.6	73.1	73.5	80.0	77.8	73.3	70.3	73.4	65.6	63.0	60.1	58.2	57.2	51.4	47.6	47.6	42.2	37.3	34.2	33.6	29.2
BOR - ELC	70.2	68.6	79.9	74.0	74.7	72.7	71.5	69.0	66.5	71.0	73.2	76.8	73.4	64.0	68.2	60.9	58.7	55.0	53.6	53.7	46.5	41.8	42.6	37.0	31.0	28.9	30.0	27.0
ELC - KEN	73.3	72.9	79.0	75.4	74.2	72.0	70.9	71.4	70.5	73.9	86.4	81.8	76.5	73.3	75.2	67.7	66.1	62.8	59.9	57.9	51.5	47.6	46.3	41.0	35.2	31.5	30.9	26.5
KEN - OVA	78.5	77.8	79.9	79.6	78.6	77.6	76.7	75.8	71.8	76.6	78.1	73.1	71.0	67.3	67.1	63.4	64.3	61.7	57.8	57.2	51.9	48.0	46.9	41.4	35.5	31.9	30.4	26.6
OVA - STO	77.6	73.1	79.2	77.2	77.7	76.4	75.9	75.6	69.8	75.4	80.1	72.0	69.7	66.7	65.6	62.4	62.4	58.2	55.5	56.0	49.4	45.9	44.7	39.5	34.7	31.7	30.9	27.0
STO - CLN	74.7	69.5	80.0	73.2	76.5	84.1	82.1	74.1	71.1	74.6	77.7	75.6	76.3	72.0	72.5	67.8	64.7	61.0	58.2	57.3	51.2	47.1	45.8	40.4	35.1	33.2	31.8	27.3
CLN - CLC	73.6	74.4	81.4	80.0	78.7	76.1	74.1	74.1	70.3	75.7	77.8	72.2	72.6	68.0	67.0	64.1	61.7	61.8	58.4	60.2	52.4	46.0	43.9	38.3	33.7	31.2	30.9	26.3
CLC - CLS	77.1	70.9	79.6	75.4	75.6	74.9	72.9	71.3	67.2	72.1	76.1	70.9	69.0	65.0	64.9	61.4	61.6	57.5	54.3	56.0	49.5	45.8	44.7	40.0	37.3	33.0	32.9	28.3
CLS - BAL	76.7	73.1	78.8	75.7	76.3	74.7	74.4	74.4	70.2	76.2	79.0	74.3	71.5	69.1	68.9	64.8	64.2	61.3	58.4	58.7	53.7	49.4	48.0	43.0	40.3	35.7	34.9	28.9
BAL - TOBe	76.8	74.3	80.3	78.4	77.5	77.1	76.2	75.9	71.3	75.3	77.8	72.6	71.0	67.7	67.4	64.9	65.1	62.0	58.8	58.1	52.8	48.7	47.6	43.6	39.0	34.0	32.7	26.7
TOBe - TOBr	77.4	73.0	78.6	76.5	76.9	76.0	75.5	75.2	71.2	74.8	77.5	72.2	70.1	66.4	66.2	63.2	63.5	60.1	57.3	56.7	51.1	48.2	47.8	43.9	41.8	36.3	35.9	29.7
TOBr - COW	77.5	74.0	78.7	76.7	76.7	74.9	74.4	74.6	71.1	75.4	78.4	72.9	70.4	67.3	67.1	63.7	64.0	60.8	57.6	56.9	51.5	47.7	45.9	41.4	39.0	34.3	33.2	28.0
COW - SOW	74.5	73.6	80.0	77.2	76.5	75.0	75.3	75.2	72.1	75.9	77.5	72.2	70.6	67.7	66.8	63.4	63.2	60.3	57.7	56.7	51.7	48.2	49.0	43.7	40.3	36.0	35.4	29.1
SOW - MOR	74.2	71.0	78.9	73.4	73.1	72.8	72.8	73.8	71.8	76.7	81.5	83.5	80.0	72.8	82.2	72.5	71.4	69.4	65.8	61.6	56.5	52.4	51.6	49.7	44.1	41.3	39.7	37.5

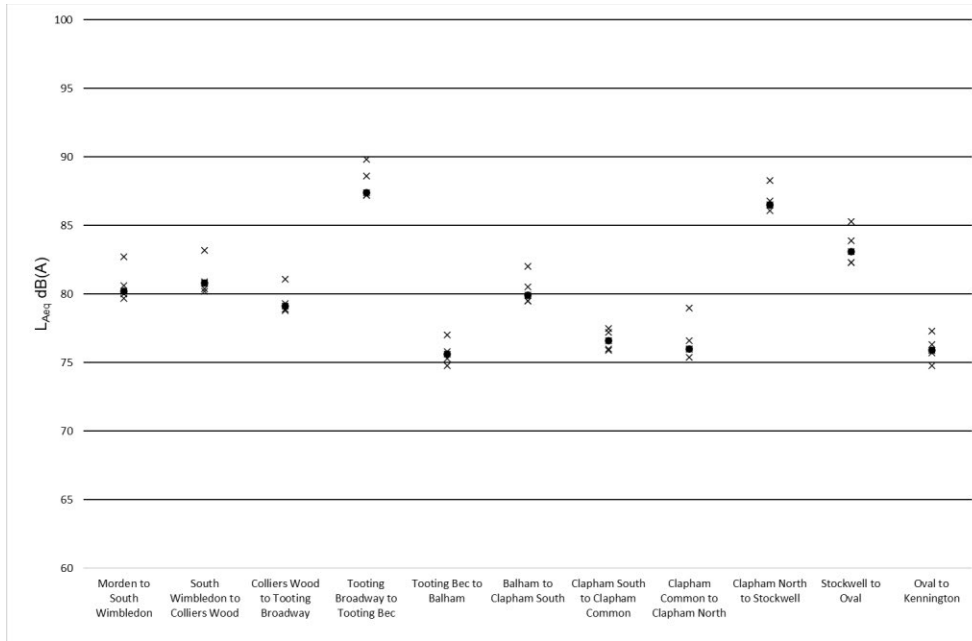


Figure C1 Median LAeq Morden to Kennington (Northbound).

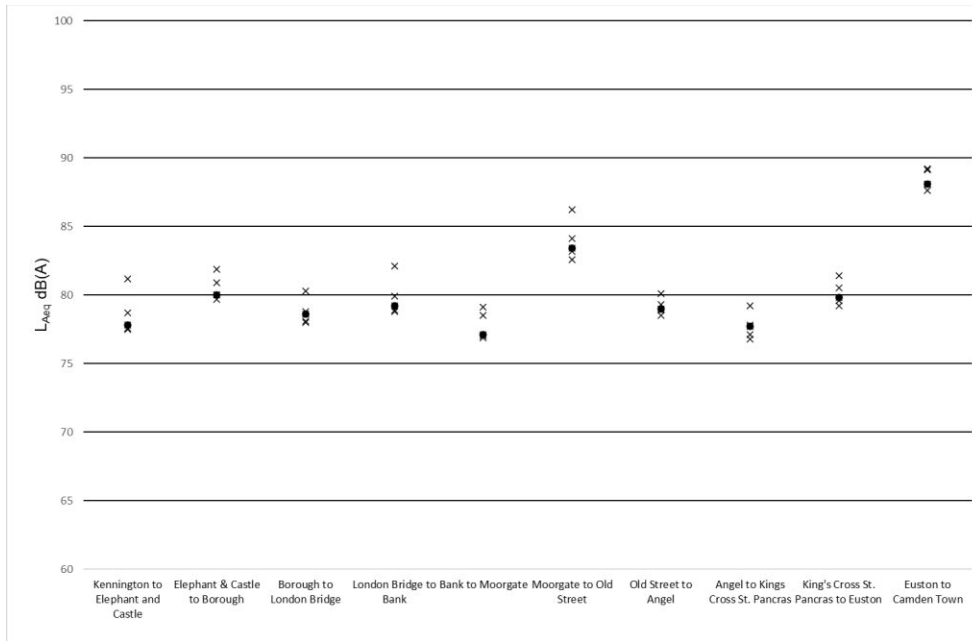


Figure C2 Median LAeq Kennington to Camden Town via Bank (Northbound).



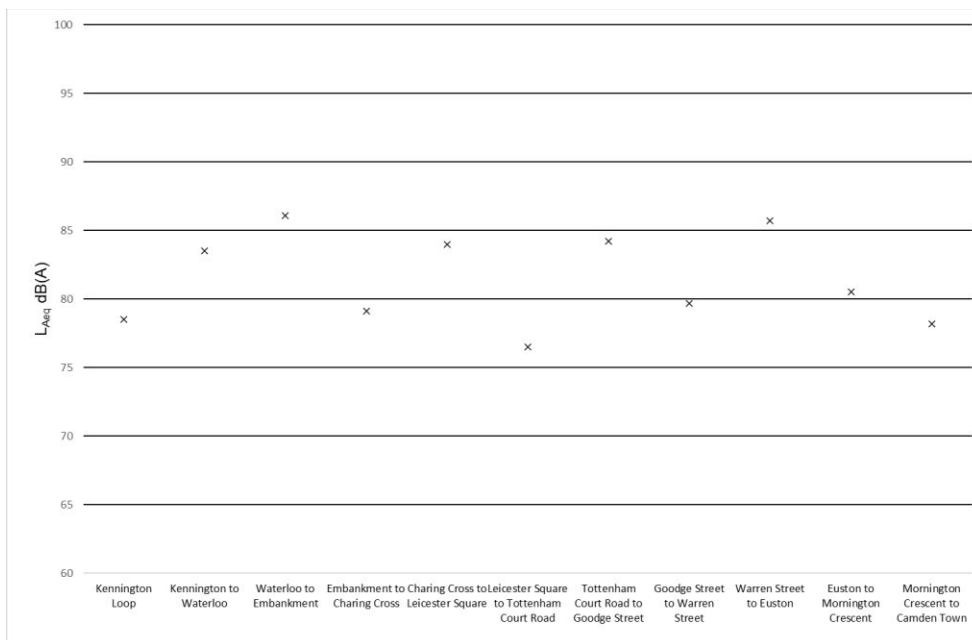


Figure C3 LAeq Kennington to Camden Town via Charing Cross (Northbound).

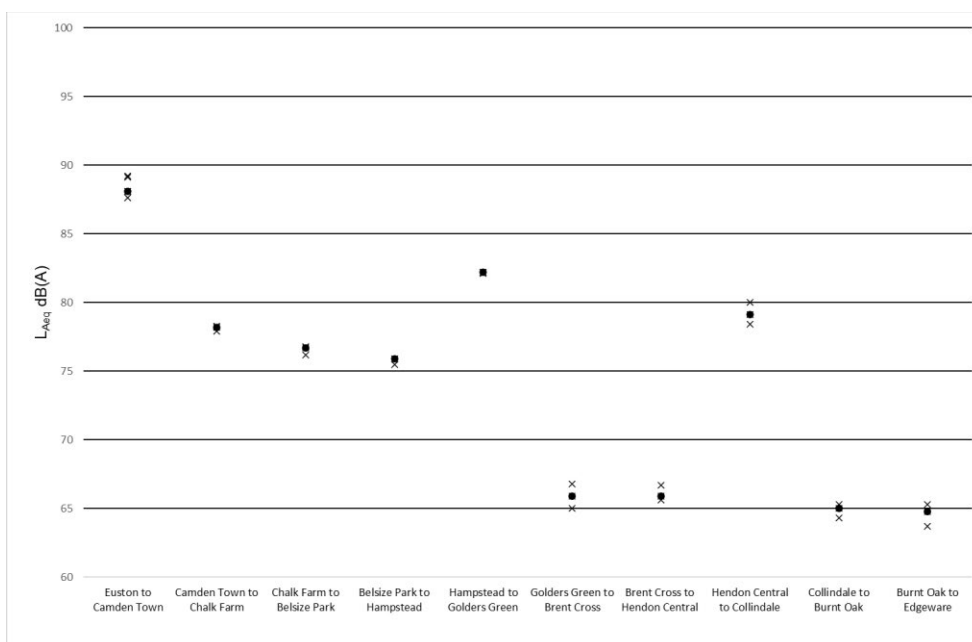


Figure C4 Median LAeq Camden Town to Edgware (Northbound)

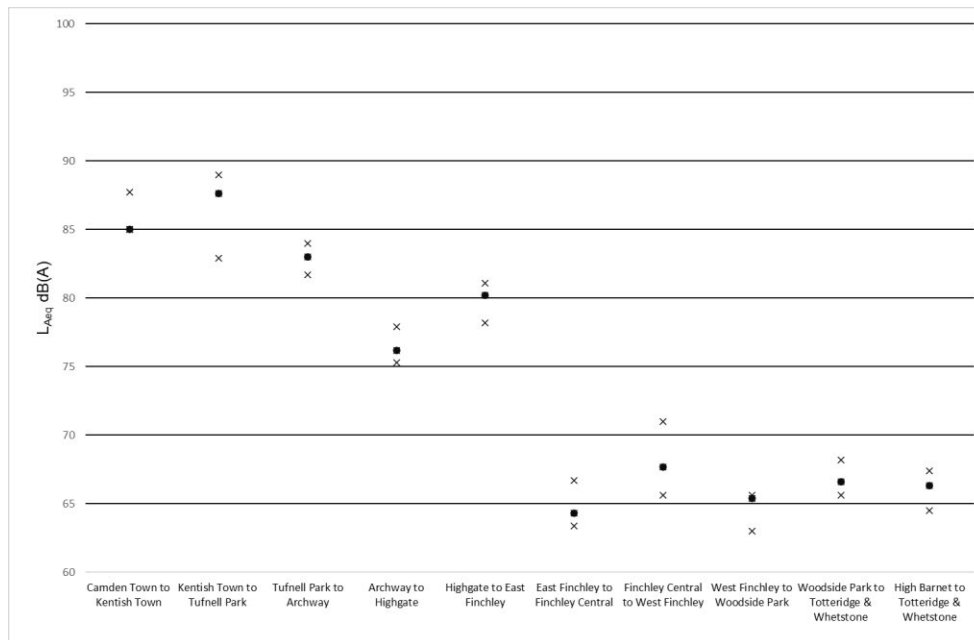


Figure C5 Median LAeq Camden Town to High Barnet (Northbound)

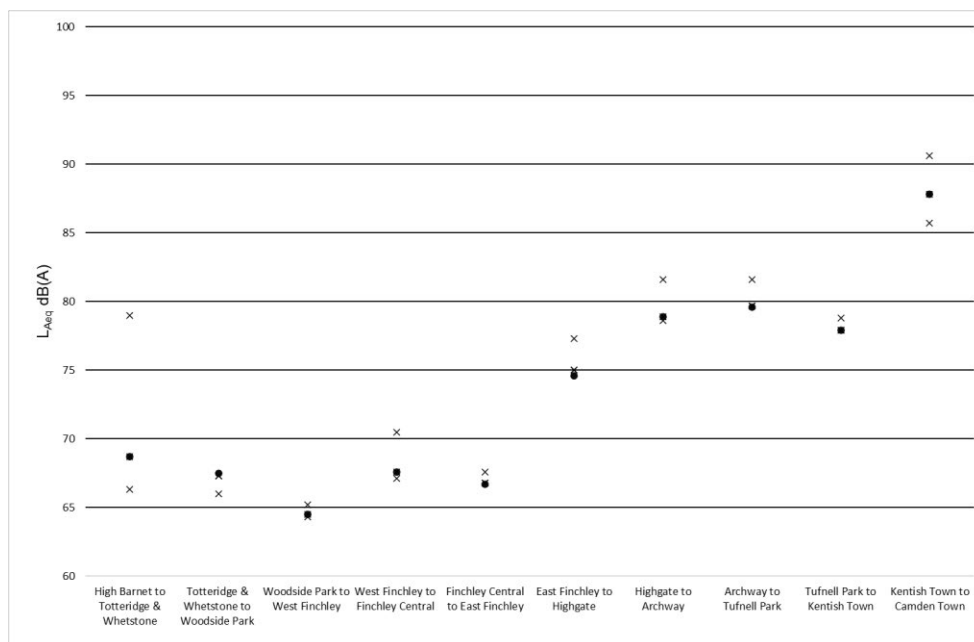


Figure C6 Median LAeq High Barnet to Camden Town (Southbound)

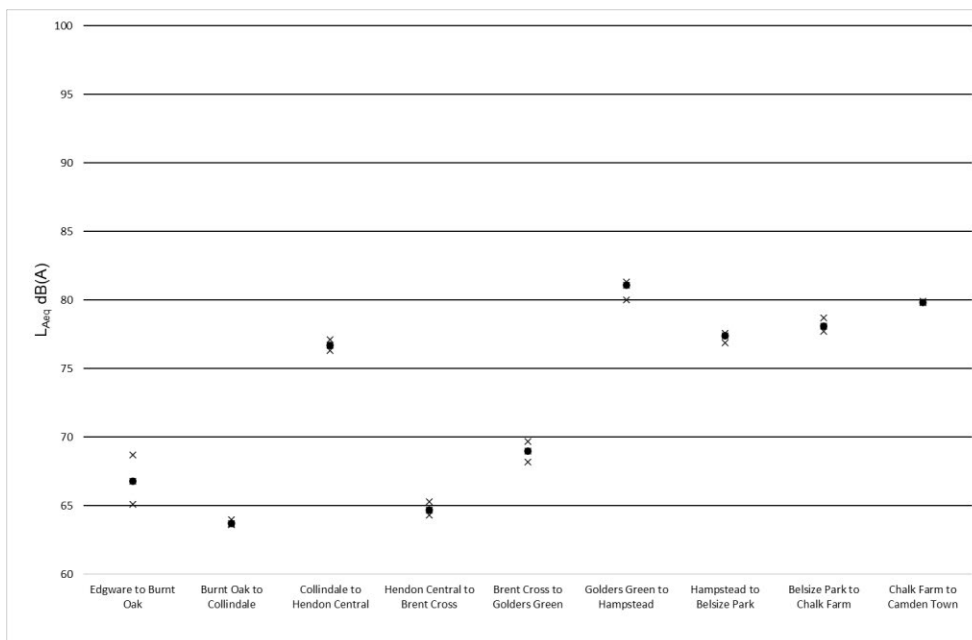


Figure C7 Median LAeq Edgware to Camden Town (Southbound)

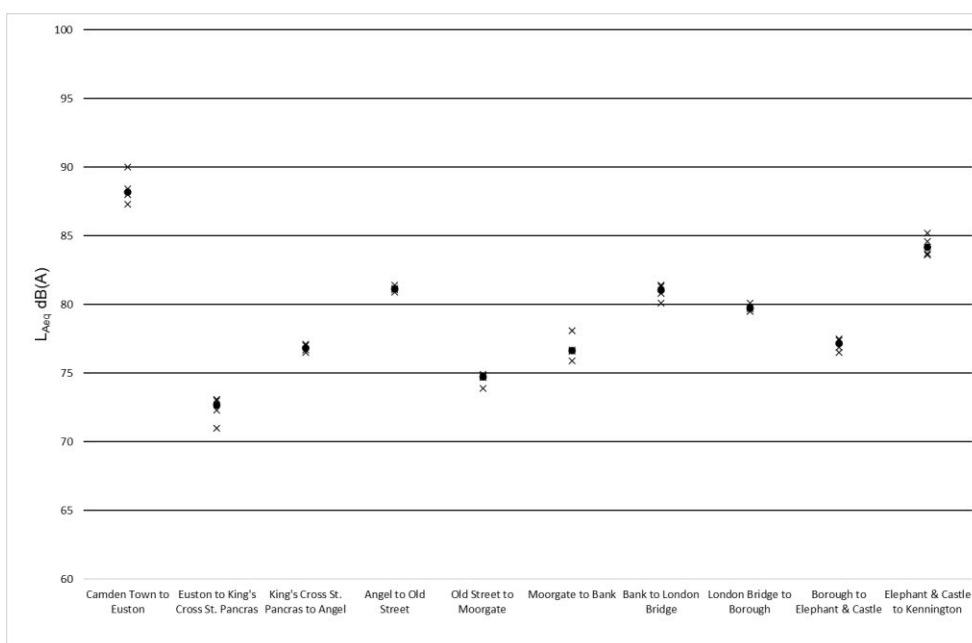


Figure C8 Median LAeq Camden Town to Kennington via Bank (Southbound)

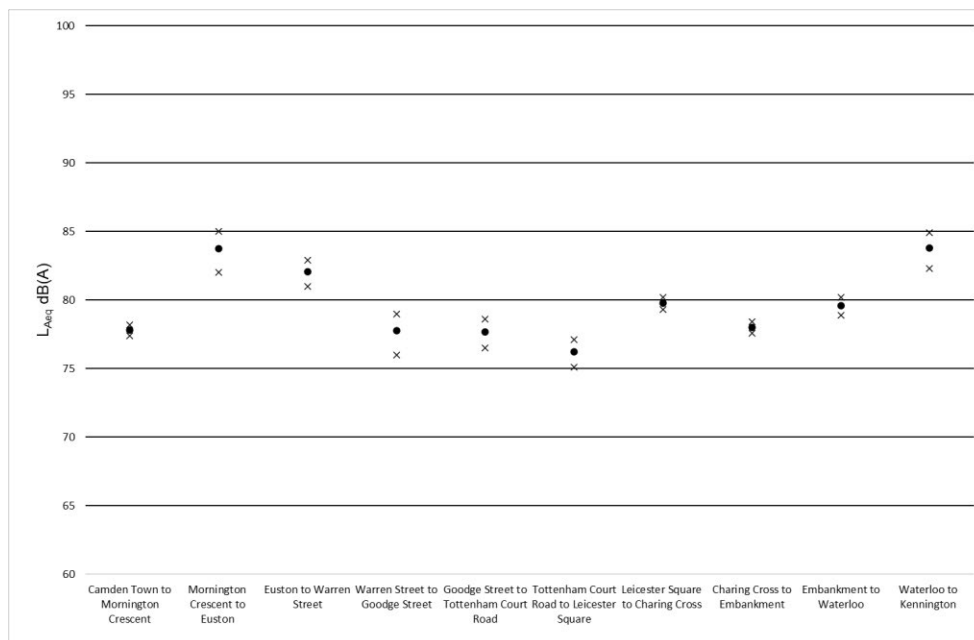


Figure C9 Median LAeq Camden Town to Kennington via Charing Cross (South bound)

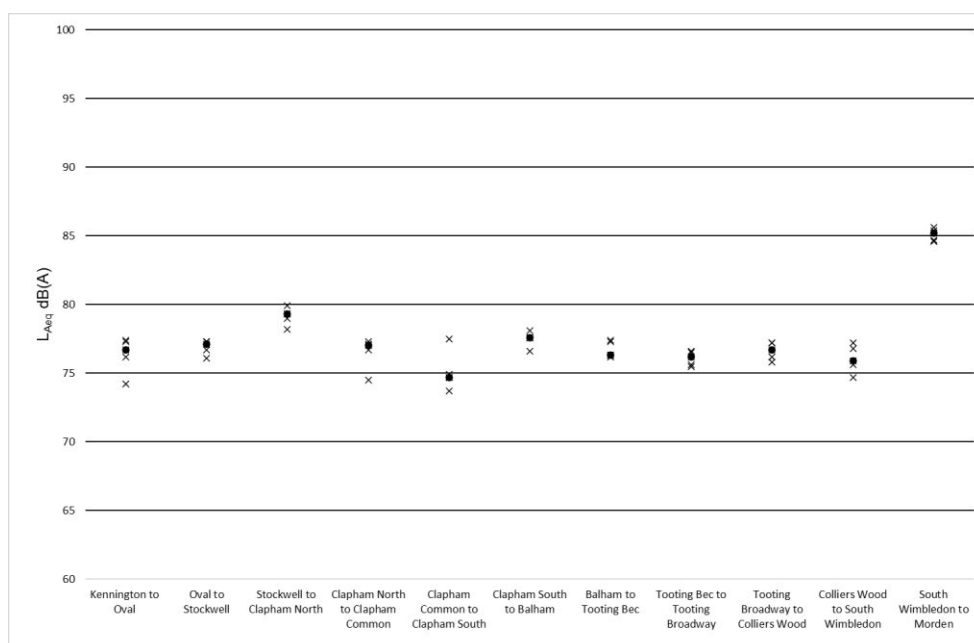


Figure C10 Median LAeq Kennington to Morden (Southbound).



## APPENDIX D: EXPOSURE POINTS SYSTEM



### Noise exposure ready-reckoner (Daily exposure)

Sound pressure level, $L_{Aeq}$ (dB)	Duration of exposure (hours)								Total exposure points	Noise exposure $L_{EP,d}$ (dB)
	¼	½	1	2	4	8	10	12		
105	320	625	1250							
104	250	500	1000							
103	200	400	800							
102	160	320	630	1250						
101	125	250	500	1000						
100	100	200	400	800						
99	80	160	320	630	1250					3200
98	65	125	250	500	1000					2500
97	50	100	200	400	800					2000
96	40	80	160	320	630	1250				1600
95	32	65	125	250	500	1000				1250
94	25	50	100	200	400	800				1000
93	20	40	80	160	320	630				800
92	16	32	65	125	250	500	625			630
91	12	25	50	100	200	400	500	600		500
90	10	20	40	80	160	320	400	470		400
89	8	16	32	65	130	250	310	380		320
88	6	12	25	50	100	200	250	300		250
87	5	10	20	40	80	160	200	240		200
86	4	8	16	32	65	130	160	190		160
85		6	12	25	50	100	125	150		130
84		5	10	20	40	80	100	120		100
83		4	8	16	32	65	80	95		80
82			6	12	25	50	65	75		65
81			5	10	20	40	50	60		50
80			4	8	16	32	40	48		40
79				6	13	25	32	38		32
78				5	10	20	25	30		25
77					8	16	20	24		20
76					6	13	16	20		16
75					5	10	13	15		13

**Instructions:**

- For each task or period of noise exposure in the working day look up in the table on the left the exposure points corresponding to the sound pressure level and duration (e.g. exposure to 93 dB for 1 hour gives 80 exposure points);
- Add up the points for each task or period to give total exposure points for the day;
- Look up in the table on the right the total exposure points to find the corresponding daily noise exposure (e.g. a total exposure points for the day of 280 points gives a daily noise exposure of between 89 and 90 dB).

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Figure D1 The Exposure Points System as shown in HSE publication HSG260



Table D2 Estimated exposure points (EP) for Morden to High Barnet via Bank Branch (Journey 3) based on the interstation  $L_{Aeq}$  and exposure durations; EP for a 1-hour duration are presented for comparison.

Interstation	$L_{Aeq}$ dB(A)	Duration (s)	EP	EP (1-hr)
MOR - SOU	81.8	118	0.2	6
SOU - COW	83.2	90	0.2	8
COW - TOBr	81.1	96	0.1	5
TOBr - TOBe	89.8	89	0.9	38
TOBe - BAL	77.0	81	0.0	2
BAL - CLS	82.0	91	0.2	6
CLS - CLC	77.5	107	0.1	2
CLC - CLN	79.0	66	0.1	3
CLN - STO	88.3	68	0.5	27
STO - OVA	85.3	111	0.4	13
OVA - KEN	77.3	79	0.0	2
KEN - ELC	81.2	92	0.1	5
ELC - BOR	81.9	90	0.2	6
BOR - LOB	80.3	72	0.1	4
LOB - BAN	82.1	73	0.1	6
BAN - MOR	79.1	96	0.1	3
MOR - OLS	86.2	59	0.3	16
OLS - ANG	80.1	127	0.1	4
ANG - KIC	79.2	120	0.1	3
KIC - EUS	81.4	64	0.1	5
EUS - CAT	89.2	170	1.6	33
CAT - KET	87.7	93	0.6	23
KET - TUP	89.0	70	0.6	31
TUP - ARC	83.0	77	0.2	8
ARC - HIG	76.2	129	0.1	2
HIG - EAF	80.2	115	0.1	4
EAF - FIC	64.3	204	0.0	0
FIC - WEF	65.6	131	0.0	0
WEF - WOP	65.4	83	0.0	0
WOP - TOW	66.6	110	0.0	0
TOW - HIB	66.3	260	0.0	0
Total EP for MOR - HIB			7.1	



Table D3 Estimated exposure points (EP) for High Barnet to Morden via Charing Cross (Journey 4) based on the interstation  $L_{Aeq}$  and exposure durations; EP for a 1-hour duration are presented for comparison.

Interstation	$L_{Aeq}$ dB(A)	Duration (s)	EP	EP (1-hr)
HIB - TOW	78.0	203	0.1	2
TOW - WOP	67.5	110	0.0	0
WOP - WEF	64.5	86	0.0	0
WEF - FIC	67.6	104	0.0	0
FIC - EAF	66.7	203	0.0	0
EAF - HIG	74.6	133	0.0	1
HIG - ARC	78.9	136	0.1	3
ARC - TUP	79.6	73	0.1	4
TUP - KET	77.9	66	0.0	2
KET - CAT	87.8	103	0.7	24
CAT - MOC	77.4	84	0.1	2
MOC - EUS	82.0	111	0.2	6
EUS - WAS	81.0	56	0.1	5
WAS - GOS	76.0	45	0.0	2
GOS - TCR	76.5	57	0.0	2
TCR - LES	75.1	42	0.0	1
LES - CAC	79.3	52	0.0	3
CAC - EMB	77.6	36	0.0	2
EMB - WAT	78.9	58	0.0	3
WAT - KEN	82.3	139	0.3	7
KEN - OVA	74.2	92	0.0	1
OVA - STO	77.3	109	0.1	2
STO - CLN	79.3	67	0.1	3
CLN - CLC	77.0	69	0.0	2
CLC - CLS	77.5	106	0.1	2
CLS - BAL	77.6	93	0.1	2
BAL - TOBe	76.3	82	0.0	2
TOBe - TOBr	75.5	97	0.0	1
TOBr - COW	75.8	98	0.0	2
COW - SOW	75.9	105	0.0	2
SOW - MOR	85.2	144	0.5	13
Total EP for HIB - MOR			2.9	



Table D5 Estimated exposure points (EP) for High Barnet to High Barnet via Charing Cross Branch and Kennington Loop (Journey 6). based on the interstation  $L_{Aeq}$  and exposure durations; EP for a 1-hour duration are presented for comparison.

Interstation	$L_{Aeq}$ dB(A)	Duration (s)	EP	EP (1-hr)
HIB - TOW	66.3	206	0.0	0
TOW - WOP	67.3	110	0.0	0
WOP - WEF	65.2	86	0.0	0
WEF - FIC	70.5	108	0.0	0
FIC - EAF	67.6	203	0.0	0
EAF - HIG	77.3	133	0.1	2
HIG - ARC	81.6	136	0.2	6
ARC - TUP	81.6	73	0.1	6
TUP - KET	78.8	67	0.1	3
KET - CAT	90.6	103	1.3	45
CAT - MOC	78.2	84	0.1	3
MOC - EUS	85.0	76	0.3	13
EUS - WAS	82.9	57	0.1	8
WAS - GOS	79.0	46	0.0	3
GOS - TCR	78.6	57	0.0	3
TCR - LES	77.1	42	0.0	2
LES - CAC	80.2	53	0.1	4
CAC - EMB	78.4	37	0.0	3
EMB - WAT	80.2	57	0.1	4
WAT - KEN	84.9	138	0.5	12
KEN Loop	78.5	298	0.2	3
KEN - WAT	83.5	128	0.3	9
WAT - EMB	86.1	67	0.3	16
EMB - CHC	79.1	38	0.0	3
CHC - LES	84.0	57	0.2	10
LES - TCR	76.5	45	0.0	2
TCR - GOS	84.2	55	0.2	10
GOS - WAS	79.7	47	0.0	4
WAS - EUS	85.7	58	0.2	15
EUS - MOC	80.5	86	0.1	4
MOC - CAT	78.7	82	0.1	3
CAT - KET	89.1	93	0.8	32
KET - TUP	90.0	70	0.8	40
TUP - ARC	84.0	77	0.2	10
ARC - HIG	77.9	129	0.1	2
HIG - EAF	81.1	115	0.2	5
EAF - FIC	66.7	206	0.0	0
FIC - WEF	67.7	133	0.0	0
WEF - WOP	65.6	83	0.0	0
WOP - TOW	68.2	109	0.0	0
TOW - HIB	67.4	247	0.0	0
Total EP for HIB to HIB			6.8	





## APPENDIX E: HEARING PROTECTION

E1. The HSE recommends three methods for estimating sound pressure levels using BS EN 4869-2 (1995): Octave band, HML and SNR. All three will provide similar predictions, however the “*HML and SNR methods become less accurate when compared with the octave band method where the noise is dominated by single frequencies, particularly where these are at low frequencies*”. Further information is given in BS EN 458 (2016).

E2. The octave band method for estimating the attenuation provided by passive hearing protection devices involves the following procedure (HSE 2005):

1. convert the measured  $L_{eq}$  from one-third octave band values to one-octave band values;
2. determine the assumed protection value for the hearing protection device (subtract standard deviation from the mean attenuation level);
3. subtract the assumed protection values from the measure one-octave  $L_{eq}$  values;
4. apply A-weighting to value (3) above;
5. calculate total  $L_{eq}$ ;
6. add 4 dB for the real-world factor to  $L_{eq}$  (5) above.

Table F1 Attenuation data (dB) for Alpha Solway SOTA L1

Frequency (Hz)	63	125	250	500	1000	2000	4000	8000
Mean attenuation value	19.6	10.7	7	16.4	22	31.6	33.5	36.3
Standard deviation	4.7	3.1	2.6	2.3	3.1	3.9	4	2.7
Assumed protection value	14.9	7.6	4.4	14.1	18.9	27.7	29.5	33.6

Table F2 Attenuation data (dB) for 3M E.A.R Earplugs EC-01-000

Frequency Hz	63	125	250	500	1000	2000	4000	8000
Mean attenuation value	21	20.2	19.8	19.1	23.2	33.4	41	40.7
Standard deviation	4.1	4.4	4.2	4.3	3.7	4.5	2.9	5.4
Assumed protection value	16.9	15.8	15.6	14.8	19.5	28.9	38.1	35.3



## APPENDIX F: STATION CODES

Table F1 Station codes used in the report.

Interstation	Code	Interstation	Code
Morden	MOR	High Barnet	HIB
South Wimbledon	SOU	Edgware	EDG
Colliers Wood	SOW	Burnt Oak	BUO
Tooting Broadway	TOBr	Collindale	COL
Tooting Bec	TOBe	Hendon Central	HEC
Balham	BAL	Brent Cross	BRC
Clapham South	CLS	Golders Green	GOG
Clapham Common	CLC	Hampstead	HAM
Clapham North	CLN	Belsize Park	BEP
Stockwell	STO	Chalk Farm	CHF
Oval	OVA	Warren Street	WAS
Kennington	KEN	Goodge Street	GOS
Elephant & Castle	ELC	Tottenham Court Road	TCR
Borough	BOR	Leicester Square	LES
London Bridge	LOB	Charing Cross	CHC
Bank	BAN	Embankment	EMB
Moorgate	MOO	Waterloo	WAT
Old Street			
Angel			
King's Cross St. Pancras			
Euston			
Camden Town			
Kentish Town			
Tufnell Park			
Archway			
Highgate			
East Finchley			
Finchley Central			
West Finchley			
Woodside Park			
Totteridge and Whetstone			