

Appendix A9.2

Noise and Vibration Surveys

Table A9.2.1: Baseline Noise Monitoring Locations, Dates and Instrumentation

Reference	Survey Location	Survey Dates	Details	Sound Level Meter Type / Serial Number	Microphone Type / Serial Number	Field Calibrator Type / Serial Number
N1	10 King William Street	31.10.13 to 09.11.13, and 15.11.13 to 26.11.13	Roof-top façade location at the corner of Nicolas Lane and King William Street.	Rion NL-52 00620960	UC-59 03878	Rion NC-74 35125828 / 34625646
N2	Daiwa Offices, 5 King William Street	31.10.13 to 14.11.13	Balcony of 4 th floor, Abchurch Lane façade.	Rion NL-52 00732147	UC-59 05339	Rion NC-74 35125828
N4	10 Arthur Street	04.11.13 to 18.11.13	Balcony of 3 rd floor, Arthur Street façade.	Rion NL-52 00231666	UC-59 04711	Rion NC-74 35125828
N5	10 Arthur Street (representative of 6 Martin Lane)	04.11.13 to 18.11.13	Balcony of 3 rd floor, Martin Lane façade.	Rion NL-52 00610203	UC-59 02545	Rion NC-74 35125828
N6	1, Abchurch Yard	26.11.13 to 04.12.13	Abchurch Yard façade (2 nd floor) of 131-133 Cannon Street.	Rion NL-52 00620960	UC-59 03878	Rion NC-74 34625646 / 34304643
N7	St Mary Abchurch	07.11.13, and 10.11.13	Street level short-term attended noise survey at south-east facade of church. Morning (1-hour), afternoon (1-hour), evening (1-hour) and Sunday (1-hour).	Rion NL-52 01021281	UC-59 04337	Rion NC-74 34425537 / 35173436
N8	Travelodge, Sherbourne Lane	07.11.13, and 08.11.13	Street level short-term attended noise survey at Sherbourne Lane façade of hotel. Morning (1-hour), afternoon (1-hour), evening (1-	Rion NL-52 01021283 / 01021281	UC-59 04339 / 04337	Rion NC-74 35173436 / 34304647

Reference	Survey Location	Survey Dates	Details	Sound Level Meter Type / Serial Number	Microphone Type / Serial Number	Field Calibrator Type / Serial Number
			hour) and night-time (2-hour).			
N9	Fishmonger's Hall, Upper Thames Street	26.11.13	Street level short-term attended noise survey at Upper Thames Street façade. Morning (1-hour), afternoon (1-hour), evening (1-hour) and night-time (2-hour).	Rion NL-52 01021267 / 01021278	UC-59 03275 / 04333	Rion NC-74 35173436 / 34304647
N10	Laurence Pountney Lane	25.11.13 and 26.11.13	Street level short-term attended noise survey at façade, adjacent to 6 Laurence Pountney Lane. Morning (1-hour), afternoon (1-hour), evening (1-hour) and night-time (2-hour).	Rion NL-52 01021267	UC-59 03275	Rion NC-74 34425537
N11	15 Abchurch Lane	31.03.14	Street level short-term attended noise survey at façade, adjacent to 15 Abchurch Lane. Afternoon (3 hours).	Norsonic 140 1403078	1225 – 91977	B&K 14 3005455
N12	81 King William Street	31.03.14	Street level short-term attended noise survey at façade, adjacent to 81 King William Street. Morning (1 hour), afternoon (1 hour).	NL 32 01172390	35173436	NC 74 35173436
N13	18 Nicholas Lane	31.03.14	Street level short-term attended noise survey at façade, adjacent to 18 Nicholas Lane. Morning (1 hour), afternoon (1 hour).	Norsonic 140 1403078	1225 – 91977	B&K 14 3005455
N14	110 Cannon Street	31.03.14	Street level short-term attended noise survey at façade, adjacent to 110 Cannon Street/ Morning (1 hour), afternoon (1 hour).	NL 32 01172390	35173436	NC 74 35173436

Reference	Survey Location	Survey Dates	Details	Sound Level Meter Type / Serial Number	Microphone Type / Serial Number	Field Calibrator Type / Serial Number
N15	12 Arthur Street	31.03.14	Street level short-term attended noise survey at façade, adjacent to 12 Arthur Street. Morning (1 hour), afternoon (2 hour).	Norsonic 140 1403078 NL 32 01172390	1225 – 91977 35173436	B&K 14 3005455 NC 74 35173436
N16	The Walbrook Building, Walbrook	08.02.06	Street level short-term attended noise survey at southern end of Walbrook (5x15min measurements between 09:35 and 15:55).	B&K 2238	–	Nor 1251
N17	St Stephen's Church, Walbrook	06.06.14	Street level short-term attended noise survey at façade, adjacent to north west corner of building. Afternoon (15 min only due to interference from existing Bloomberg building site)	Rion NL-52 00420767	UC-59 03275	NC 74 35173436
N18	Mansion House (western façade)	06.06.14 and 10.06.14	Street level short-term attended noise survey at western façade of Mansion House. Morning (1 hour), night-time (0.5 hour).	Rion NL-52 00420766 (day and night)	UC-59 03575 (day and night)	NC 74 34304647 (day) and NC 74 35173436 (night)
N19	1-6 Lombard Street	06.06.14	Street level short-term attended noise survey at northern façade, Afternoon (1 hour).	Rion NL-52 00420767	UC-59 03275	NC 74 35173436
N20	Mansion House (north east corner)	06.06.14 and 10.06.14	Street level short-term attended façade noise survey at north east corner of Mansion House.	Rion NL-52 00420766 (day) and Rion NL-52	UC-59 03575 and UC-59 03275 (night)	NC 74 34304647 (day and night)

Reference	Survey Location	Survey Dates	Details	Sound Level Meter Type / Serial Number	Microphone Type / Serial Number	Field Calibrator Type / Serial Number
			Afternoon (1 hour), night-time (0.5 hour).	00420767 (night)		

Table A9.2.2: Baseline Vibration Monitoring Locations, Dates and Instrumentation

Reference	Survey Location	Survey Dates / Times	Details	Recorder Type / Serial Number	Accelerometer Type / Serial Number
V2	1-6 St Swithin's Lane	20.11.13 to 21.11.13 / 22:18 to 00:18	Located on concrete floor in north-east corner of the cleaners store by external wall.	RION DA-20 00260254	Dytran 3233A 879
V4	St Mary Abchurch	13.11.13 to 14.11.13 / 15:44 to 13:44	Located on stone floor in north-east corner of church by external wall..	RION DA-20 00260254	Dytran 3233A 879
V5	St. Clement's Church	12.11.13 to 13.11.13 / 22:00 to 00:00	Located on stone floor in entrance foyer of church.	RION DA-20 00260254	Dytran 3233A 879
V6	8-10 Mansion House Place	19.11.13 to 20.11.13 / 22:04 to 00:04	Located on concrete floor in corridor adjacent to cold water tank room.	RION DA-20 00260254	Dytran 3233A 879
V7	Mansion House	21.11.13 to 22.11.13 / 22:00 to 00:00	Located on concrete floor in the basement in the southern half of the building.	RION DA-20 00260254	Dytran 3233A 879

Table A9.2.3: Groundborne Noise and Vibration Monitoring Locations, Dates and Instrumentation

Ref.	Survey Location	Survey Dates / Times	Details	Recorder Type / Serial Number	Accelerometer Type / Serial Number	Microphone Type / Serial Number	Calibrator Type / Serial Number
V1	7 Prince's Street	17.12.13 to 18.12.13 / 20:30 to 00:00	Located on concrete floor in basement elevator corridor.	01dB Harmonie 4451	Dytran 3233A 400	N/A	N/A
V3	Adelaide House	11.02.14 to 12.02.14 / 21:00 to 00:00	Located on vinyl floor in basement cafeteria area	01dB Harmonie 4451	Dytran 3233A 400	N/A	N/A
V5	St. Clement's Church	11.12.13 to 12.12.13 / 17:45 to 10:00	Located on stone floor in entrance foyer of church.	01dB Symphonie 01704	Wilcoxon 731A 4453	01dB MCE 212 67260	Rion NC-74 34304643
V7	Mansion House	21.11.13 to 22.11.13 / 22:00 to 00:00	Located on concrete floor in the basement in the southern half of the building.	01dB Symphonie 01704	Wilcoxon 731A 4453	01dB MCE 212 39855	Rion NC-74 34304643

Meteorological Conditions

- Weather conditions were monitored throughout the duration of the noise survey periods, by a combination of direct observation and available internet sources.
- Primarily, data was sourced from www.wunderground.com, IENGLAND274, Angel/Farringdon, London. However, to provide further assurance regarding the representativeness of the weather station used, data from others (ILONDONL28, Bermondsey and IENGLAND499, Newham) were analysed to ensure there were no significant differences in the weather data recorded.
- Conditions were directly noted during set-up and collection dates of the longer-term surveys, and throughout all attended monitoring.
- Noise measurement data gathered during periods when unacceptable weather conditions were identified i.e. prolonged showers, periods of heavy rain or wind speeds in excess of 5 m/s, have been excluded from analysis.
- Days of acceptable weather conditions during monitoring at location N1 have been determined as: 1st to 2nd November, 7th November, 16th to 19th November and 21st to 25th November.
- Days of acceptable weather conditions during monitoring at location N2 have been determined as: 1st to 2nd November, 7th November, 10th November and 12th to 13th November.
- During the monitoring at location N6, acceptable weather conditions were noted between 27th November and 3rd December.
- Weather conditions at locations N7 to N20 were noted as acceptable throughout the measurement periods.

Measurement Protocol

Baseline Noise

- The baseline noise surveys have been undertaken in accordance with *BS 7445: Description and Measurement of Environmental Noise* (BSI, 2003).
- The calibration level of all noise instrumentation was checked both prior to and immediately following each survey period. No significant drift (+/- 0.3dB) was noted.
- Measured parameters including the L_{Aeq} , L_{A90} and L_{AFmax} were logged in 1-second and 5-minute intervals.
- The long term noise monitoring equipment was protected within weather proof environmental cases, and the microphones with appropriate windshields.
- The attended noise measurements were undertaken at 1.5m above ground level with the microphone protected by appropriate windshields.

Baseline Vibration

- In terms of the vibration measurements, continuous raw acceleration data was captured, enabling the calculation of VDV and ppv levels.
- The calibration deviation for the complete vibration monitoring system was checked (by Anderson Acoustics) by recording calibration tones at 2.5m/s^2 at both 80Hz and 160Hz using a laboratory shaker table at AV Calibration and the percentage error calculated in all three axes. The calibration deviation calculated from the measured tones ranged from 0.4 to 3.6 per cent. In the absence of any international or British Standard, specifically applicable to this instrument, a calibration deviation of less than or equal to 3.6 per cent is deemed acceptable as it is within the range of +/- 10 per cent deviation adopted as an acceptable benchmark by a number of UK Calibration Laboratories.
- Full details regarding the long-term baseline surveys including instrumentation calibration certificates, time history charts, and photographs are located in Anderson Acoustics 'Baseline Noise and Vibration' Report, found as Appendix A9.3.
- A summary of the measured baseline vibration levels from each location is provided as Table A9.2.4.

Table A9.2.4: Groundborne Noise and Vibration Monitoring Locations, Dates and Instrumentation

Ref.	Survey Location	Train Event Vertical Vibration Dose Value, $\text{ms}^{-1.75}$			
		Northern Line Northbound	Northern Line Southbound	Central Line Eastbound	Central Line Westbound
V1	7 Prince's Street	0.001	0.001	0.001	0.001
V2	1-6 St Swithin's Lane	0.001	0.001	-	-
V3	Adelaide House	0.001	0.001	-	-
V4	St Mary Abchurch	0.003	0.003	-	-
V5	St Clement's Church	0.004	0.004	-	-
V6	8-10 Mansion House Place	0.002	0.002	-	-
V7	Mansion House	0.002	0.002	0.001	0.001

Groundborne Noise and Vibration

- With regard to the measurements undertaken by Anderson Acoustics, the accelerometer was mounted on a heavy plate (conforming to DIN standards). The microphone was fixed to a tripod approximately 1.2m above ground/floor level.
- All noise measurement instrumentation was calibrated prior to and immediately following each survey period. No calibration drifts occurred.
- Full details regarding the groundborne noise and vibration surveys undertaken by Anderson Acoustics, including instrumentation calibration certificates, time history charts, and photographs are located in Anderson Acoustics 'Groundborne Noise and Vibration' Report, can be located within Appendix A9.3.