ArupAcoustics

Appendix 7.1

Noise Measurement Survey

Contents

A7.1 INTRODUCTION

As part of the Waterfront proposal assessment study, Arup Acoustics conducted a noise measurement survey at various locations on and surrounding the Temple Quay North site in Bristol. These were in the form of both attended, short term sampled measurements and continuous long term monitoring. Measurements were taken in order to establish the typical ambient noise climate and character at locations representative of existing noise sensitive properties. Measurements were also taken upon the proposed development site, at locations representative of the frontages of outline building footprints to assess the suitability of the noise climate for residential use.

Site Description

The western perimeter of the site lies on the bank of the River Avon, whilst its southern edge is approximately 100m north of Bristol Temple Meads railway station. It is bounded to the northern side by Avon Street. Avon Street itself runs north-west to south-east, joining the A420 to Feeder Road. The closest residential properties lie approximately 150m to the north and east of the site, whilst commercial premises are in close proximity to the immediate north-west corner and over to the west on the opposite side of the River Avon. The noise measurement locations were situated both on the proposed development site itself, and at strategic locations within residential areas close to and surrounding the site. These measurement positions are described in more detail below.

The main sources of noise are road traffic, both local and distant. The A4044, otherwise known as Kingsland Road, runs north-south approximately 250m to the west of the development site. A plan of the site showing the measurement locations is presented in Figure 1.

At the time of surveying, construction works were taking place on the opposite side of Avon Street. Therefore, to obtain typical ambient noise level data representative of the area surrounding the development site, it was necessary to take measurements during periods of minimal activity at the current construction site. This was enabled by measuring during the lunchtime period, and during late afternoon as site operations were shutting down for the day.

A7.2 NOISE SURVEY

Continuous monitoring was conducted at Location 2 from 19:30hrs through to 07:30hrs and at Location 1 from 01:00hrs through to 07:30hrs, between the 15th and 16th of March 2007. Short term sampled measurements were made at satellite locations 3, 4 and 5, during the evening between 20:30hrs and 21:30hrs, and at night-time, between 23:00hrs and 00:00hrs on the 15th of March 2007. Additional daytime measurements were made on the 22nd of March 2007 at locations 1 and 2, to obtain the representative daytime noise data during the periods discussed above during minimal activities on the current building site. These were in the form of half hour sampled measurements made during inter-peak times, 13:00hrs and 14:00hrs, and during afternoon peak times, 17:30hrs and 18:30hrs.

These surveys were carried out by Daniel Howells of Arup Acoustics.

For each noise measurement period, pertinent data such as description of the noise character, wind speed and direction, in addition to the measured noise levels, were recorded. These results are reported below.

Measurement Procedure

Instrumentation

The instrumentation used to carry out the noise survey was as follows:

- Brüel & Kjær 2260 type 1 precision sound level meter (SLM)
- Brüel & Kjær 2236 type 1 precision sound level meter (SLM)
- RION NL-32 type 1 precision sound level meter (SLM)
- Brüel & Kjær Type 4231 Sound Pressure Calibrator (SPL)
- Kestrel 1000 Anemometer
- Compass

Immediately before and after each series of measurements was carried out, each one of the Sound Level Meter's (SLM) calibration was checked using the Sound Pressure Level (SPL) calibrator.

Each of the SLM's were mounted onto tripods, with the microphone set approximately 1.2-1.5m above ground level. A windshield was fitted to each microphone at all times, to minimise the effects of wind induced noise across the microphone diaphragm.

All noise measuring instrumentation owned and used by Arup Acoustics is checked for correct calibration to traceable national and international standards on an annual basis. Routine 'in-house' spot checks are also conducted as part of Arup Acoustics' QA policy.

All measurements were taken in an acoustically 'Free Field' condition, at least 3.5m away from any vertical reflective surfaces. The measurement locations were chosen at strategic locations, to provide a representative indication of the typical ambient noise level at noise sensitive receivers surrounding the area proposed for development, as well as to provide an indication of the noise encroaching onto the development site itself. The continuous unmanned measurements undertaken, were required to provide essential information on both the variation of the noise climate, as well as the lowest noise level likely to occur, upon the site.

Unmanned Measurements

Continuous measurements were made at locations 1 and 2, situated at either end of the proposed development site. Continuous five minute logging intervals were measured over the following periods:

- Location 1 – 01:00hrs to 07:30hrs, on the 16th of March 2007
- Location 2 – 19:30hrs, on the 15th ,to 07:30hrs, on the 16th of March 2007

These locations were chosen to provide indicative noise data, representative of each end of the proposed development site, at the edges of the outlined building footprints for plots ND2 and ND5, as shown in Figure 1. From these datasets, the intervening noise levels across the whole site could be estimated.

Manned Measurements

Manned measurements were made at Locations 1 to 5 on the following dates:

- Location 1 – hour long sampled night-time measurements were made on the 15th and 16th of March 2007. Further half hour sampled daytime measurements were made on the 22nd of March 2007 during the periods of 13:00hrs to 14:00hrs and 17:30hrs to 18:30hrs.
- Location 2 - half hour sampled daytime measurements were made on the 22nd of March 2007, between the periods of 13:00hrs to 14:00hrs and 17:30hrs to 18:30hrs.
- Locations 3, 4 and 5 – Attended 10 minute sampled measurements were made between 20:30hrs and 21:30hrs, and 23:00hrs to 00:00hrs, on the 15th of March 2007.
- Locations 3, 4 and 5 were chosen at the closest residential properties to the site, and were considered to be representative of typical noise levels in these areas.

Weather

- 15th and 16th of March 2007 - winds generally from the south-east were measured between 1 and 2 ms-1. Conditions were overcast with some light drizzle at night leading to damp roads, although this was not considered sufficient to adversely affect the noise measurements.
- 22nd March 2007 – conditions were overcast but dry throughout with very little wind.

Measurement Location Descriptions

Location 1 - NW site boundary

To the immediate north-west of the site is the Royal Bank of Scotland building. The SLM was sited at the boundary between this building and the development site approximately 20m south-west of Avon Street.

Daytime background noise was dominated by distant traffic noise. Traffic on Avon Street proved a significant source during daytime hours. It should be noted that due to construction work being conducted on the opposite side of Avon Street, HGV activity was most likely higher than could be considered typical. Frequent trains accessing Bristol Temple Meads Station were also audible throughout.

During late evening and night time measurements distant traffic remained the dominant background noise source. Traffic levels on local roads were reduced at these times and trains became less frequent.

Location 2 – SE site boundary

The south-east side of the development site is bounded by a viaduct which carries a number of rail tracks serving Temple Meads station. The SLM was placed within the site boundary approximately 15m from the railway viaduct. This position was chosen as being representative of the eastern section of the site, as well as the closest point of plot ND5 to the railway viaduct.

During daytime measurements, road traffic was the main noise source, with distant traffic dominating the noise character and climate. As already mentioned above, construction work on the north side of Avon Street meant an increase in HGV movements on local roads. Generators serving this site ran throughout and added to the background noise level.

Regular passenger train services were also a significant noise source. These became less regular during the late evening hours, and appeared to cease between the hours of 00:00 and 05:00hrs.

During the late evening and night-time periods plant noise from the construction site generators become more significant as the number of vehicle movements on local roads reduced. However, more distant road traffic remained the dominant background noise source.

Location 3 – Corner of Tyler Street and Barton Road

Approximately 150m to the north-east of the development site is a series of residential properties. The SLM was sited on the junction of Tyler Street and Barton Road. From this point, there is still a line of sight across the present construction site to the proposed development site.

Distant traffic dominated the background noise at this location. Occasional trains accessing Temple Mead station remained audible although they became less regular during the later evening and into the night.

Location 4 – New Kingsley Road

100m to the north of the development site on New Kingsley Road was a residential complex, Kingsley House. The SLM was sited on the kerb at the entrance to this complex.

Distant traffic noise remained the dominant noise source at this location. Generators on the construction site were also a significant background noise source particularly as traffic levels fell. Trains traversing through Temple Meads Station remained audible at this location.

Location 5 – Avon Street

Measurements were made at the boundary of the development site with Avon Street approximately 75m from the north-west corner of the site.

Distant traffic noise remained the dominant noise source although due to this location's proximity to the active construction site opposite, the site generators were a more significant continuous noise source.

A7.3 BASELINE NOISE SURVEY RESULTS

Date	Time		Wind		Noise Level, dB (A)				Comments
	Start	Finish	Speed (ms^{-1})	Dir	L_{90}	L_{10}	L_{max}	L_{eq}	
15.03.07	2148	2248	calm	-	41	54	69	51	Distant traffic noise dominates background. Light drizzle throughout period leads to damp roads. Low level broadband noise appearing to emanate from rooftop plant of RBS building. Occasional traffic on Avon Street. Trains approaching Temple Meads Station audible, as are platform announcements.
	0010	0110	calm	-	41	50	66	48	Roads quieter than before. No trains.
22.03.07	1343	1413	calm	-	51	62	82	59	Traffic noise dominant. Considerable HGV activity due to construction works. Very minor site activity continues – occasional hammering, impact type noises. Train events along mainline to and from Temple Meads Station are audible but not significant.
	1748	1818	1-1.5	N	52	63	86	61	As above but with no site activity. Reduced HGV movements along Avon Street now that nearby construction site is inactive.

Table 1: Measurements made at Location 1 - NW site boundary

Date	Time		Wind		Noise Level, dB (A)				Comments
	Start	Finish	Speed (ms^{-1})	Dir	L_{90}	L_{10}	L_{max}	L_{eq}	
22.03.07	1303	1333	calm	-	51	58	72	56	Local and distant road traffic noise dominant. Notable noise from other local activities included minor site activities, although these subsided within first few minutes of measurement period. Also considerable HGV movements associated with construction site. Some hammering and occasional grinding continued but remained infrequent. Construction site generators audible. Warning horns from trains clearly audible. Train pass-bys noted approximately every 2 to 4 minutes.
22.03.07	1709	1739	0.5-1	N	51	57	70	55	Local and distant road traffic noise dominant Some minor site activity audible for first 10 minutes of measurement, including use of plant pressure washing facility. Train pass-by events remained regular at every 2 to 4mins. Reduced HGV movements now that site activities have ceased for the day.

Table 2: Measurements made at Location 2 - SE site boundary

Date	Time		Wind		Noise Level, dB (A)				Comments
	Start	Finish	Speed (ms^{-1})	Dir	L_{90}	L_{10}	L_{max}	L_{eq}	
15.03.07	2048	2058	1.5-2	SE	44	53	65	50	Distant traffic dominant noise source. Very occasional traffic on local roads, mainly slow moving. Occasional train pass-bys. Church bells audible during some of measurement period. Public Address announcements audible from Temple Meads Station. 1 freight train pass-by observed, very slow moving but relatively loud.
15.03.07	2259	2309	calm	-	39	48	64	46	Distant traffic remains dominant continuous noise source, although less busy. Local road traffic: 3 cars on Barton Rd. Trains pass-bys: 3

Table 3: Measurements made at Location 3 - Corner of Tyler Street and Barton Road

Date	Time		Wind		Noise Level, dB (A)				Comments
	Start	Finish	Speed (ms^{-1})	Dir	L_{90}	L_{10}	L_{max}	L_{eq}	
15.03.07	2108	2118	1.5-2	E	45	53	77	55	Distant traffic dominates background. 3 train pass-bys. Very little traffic on New Kingsley Road and other nearby local roads. Occasional PA use audible from Temple Meads Station. Car horn on Bread St affected L_{max}
15.03.07	2318	2328	0.5-1	SE	43	50	68	49	Distant traffic dominates background. Generators on adjacent site are audible, which become significant noise source when roads are quiet. Train and very occasional traffic on Avon Street. Car pass-by on New Kingsley Road resulted in logged L_{max}

Table 4: Measurements made at Location 4 - New Kingsley Road

Date	Time		Wind		Noise Level, dB (A)				Comments
	Start	Finish	Speed (ms^{-1})	Dir	L_{90}	L_{10}	L_{max}	L_{eq}	
15.03.07	2122	2132	calm	-	47	64	79	61	Distant traffic noise dominates background. Very occasional traffic on Avon Street. Local cars: 15. 6 train passbys.. Plant running on building site – constant broadband noise, generators likely for site security lighting. Temple Mead Station p.a. announcements remain audible.
15.03.07	2331	2341	0.5	S	44	60	77	59	Construction site generator noise much more dominant now roads are quieter. Very occasional traffic on Avon St. Local cars: 7. Trains passbys: 3.

Table 5: Measurements made at Location 5 - Avon Street

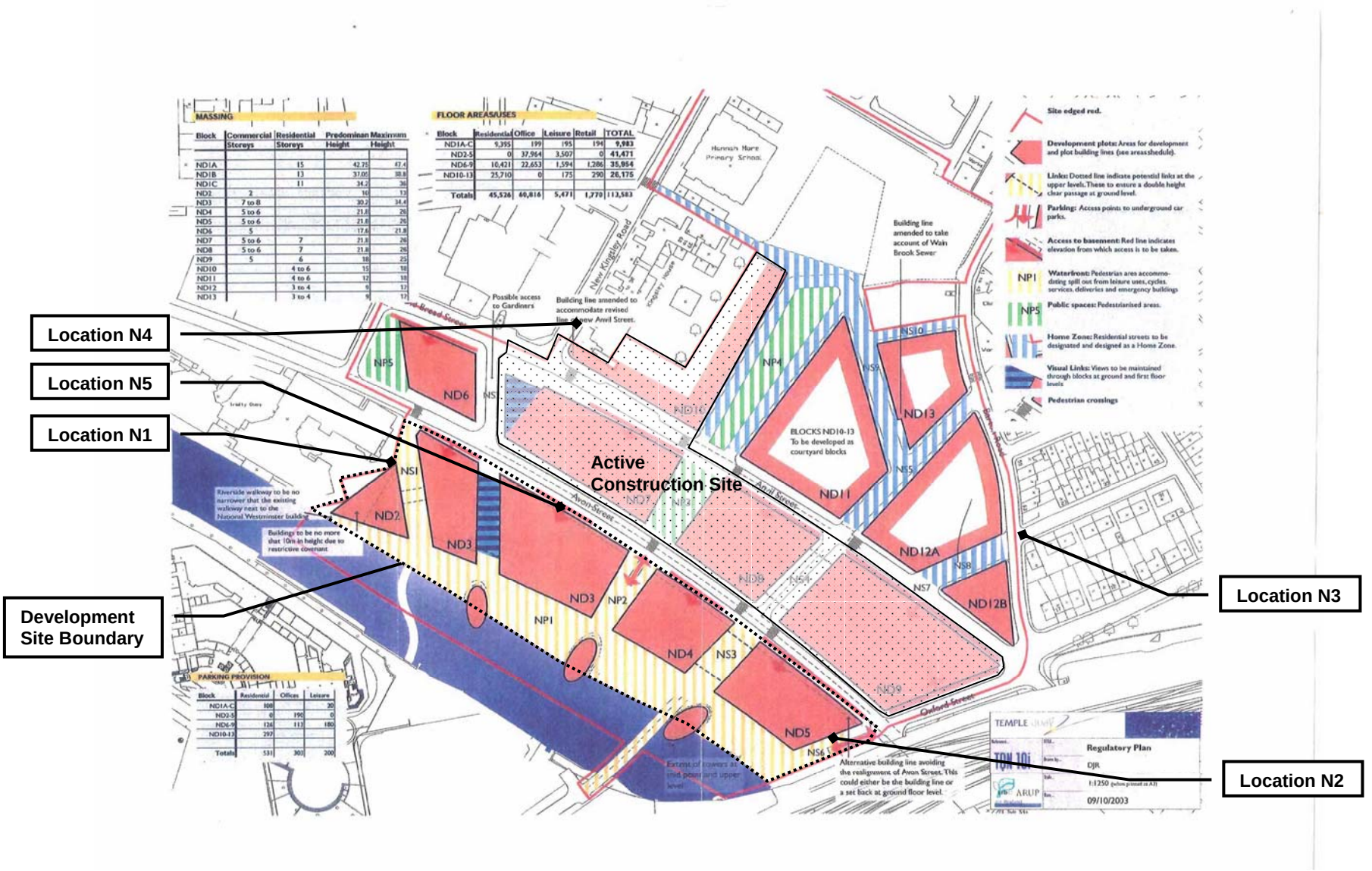

Figure 1: Noise measurement locations and site boundaries