Twickenham Station, Twickenham

Noise Modelling of Twickenham Station and Vicinity

Pre and Post Redevelopment Scenario Modelling

December 2011

1. Introduction and Background

1.1 A Noise and Vibration EIA chapter and addendum were prepared in 2011 for the proposed redevelopment of Twickenham Station. The Noise Assessment comprised a series of short-term noise monitoring exercises covering both day and night-time periods, and a 48-hour continuous monitoring session. The results of the monitoring showed the site to lie mostly within Noise Exposure Category (NEC) B for daytime cases, and mostly within NEC C for night-time cases (see Table 1). It was also concluded that the noise generated by crowds using Twickenham Station after Twickenham Stadium events was not so severe as to change the NEC categories for the site.

Table 1 Recommended Noise Exposure Categories for New Dwellings Near Existing Noise Sources

Noise Levels Corresponding to the Noise Exposure Categories for New Dwellings $L_{(A)Eq,T}$, dB				
Noise Source	**Noise Exposure Category**			
	A	**B**	**C**	**D**
Mixed Sources				
07:00 - 23:00 hours	<55 dB	55 – 63 dB	63 – 72 dB	>72 dB
23:00 - 07:00 hours	<45 dB	45 – 57 dB	57 – 66 dB	>66 dB

1.2 The Noise and Vibration EIA chapter also concluded that the proposed redevelopment in service should not have significant noise and vibration impacts on the nearest residential receivers, subject to appropriate treatment of external ventilation and climate control features.

1.3 Further to public consultation, local community concern was apparent regarding noise impacts after redevelopment. In order to improve the quality of the prediction of impacts at the nearest residential receivers, London Borough of Richmond-upon Thames (LBRuT) requested that noise modelling work be carried out for Twickenham Station and vicinity.

1.4 The London Borough of Richmond Upon Thames (LBRuT) requested that "*A noise model shall be provided which includes horizontal and vertical grid noise contours to demonstrate the effect of transportation noise on new and existing residential receivers with and without the proposed development in place*".

1.5 This report provides information on the model used, the modelled scenarios, outputs and results generated from the noise modelling of the Twickenham Station redevelopment.

2. Model Requirements

2.1 The first requirement was that the noise model should be reputable and be appropriate for the proposed use. On this basis, two available models appeared suitable, including the Bruel & Kjaer Predictor noise model. As LBRuT presently uses Bruel & Kjaer Predictor noise modelling software, it was felt that compatibility with the LBRuT software would be advantageous.

2.2 The Bruel & Kjaer Predictor noise model was selected for this project. See Predictor software details in Appendix A.

3. Methodology

3.1 The extent of the area to be modelled was established based on the need to include the noise sources likely to affect the site and all the receivers likely to be affected by noise from the site. A suggested set of model boundaries was submitted to LBRuT for approval and the Council's approval was received on 8 September 2011.

3.2 The modelling method used was the Harmonoise method (suitable for road traffic, railway, construction and building operational noise).

3.3 The DXF (digitised) Ordnance Survey mapping was obtained for the area to be modelled. Aerial oblique and street level digital photography was used in conjunction with terrestrial level data to enable the buildings, building locations and building profiles (horizontal and vertical) to be plotted in the model. Buildings were assigned a unique name and description within the model. Reflection factors for building surfaces were entered into the model (generally the default value of 0.8 given in the model). The grid height for noise output contour plots was set at 1.5 m and 4.5 m.

3.4 Roads, using bifurcated flow lines for the main road over the railway (part of London Road) and single flow lines for the side roads, were plotted in the model. The individual roads were assigned a unique name and description within the model.

3.5 Traffic census data (flows and average velocities) for the highways within the model boundaries was obtained from the LBRuT and the breakdown into vehicle types was derived from Department for Transport (DfT) data. Average vehicle widths (required for the model) were derived from on-site observations and measurements. Model default values were used for vehicle accelerations.

3.6 Traffic flows and velocities for light and heavy vehicles, for both day and night-time periods, were entered into the model for each of the roads. Daytime is defined as 07:00 hours – 23:00 hours and night-time is defined as 23:00 hours – 07:00 hours.

3.7 Noise source heights used in the model were 0.01 m (tyre noise), 0.3 m (exhaust noise) and 0.75 m (engine noise). Tyre road noise is corrected for the air temperature (Tatn).

3.8 The individual railway lines were assigned unique names and descriptions within the model. The ground levels at the railway lines were input into the model. The source height for the railway (trains) was assumed at 0.5 m (wheel and traction motor noise) for most train types. The support correction option chosen was concrete sleepers (based on observations at the site).

3.9 The balance and mixture of train flows, types and train velocities (stopping and not stopping) were derived from the published timetables for the railway passing through Twickenham Station for both the day and night-time periods.

3.10 The two scenarios modelled are detailed below in Table 2.

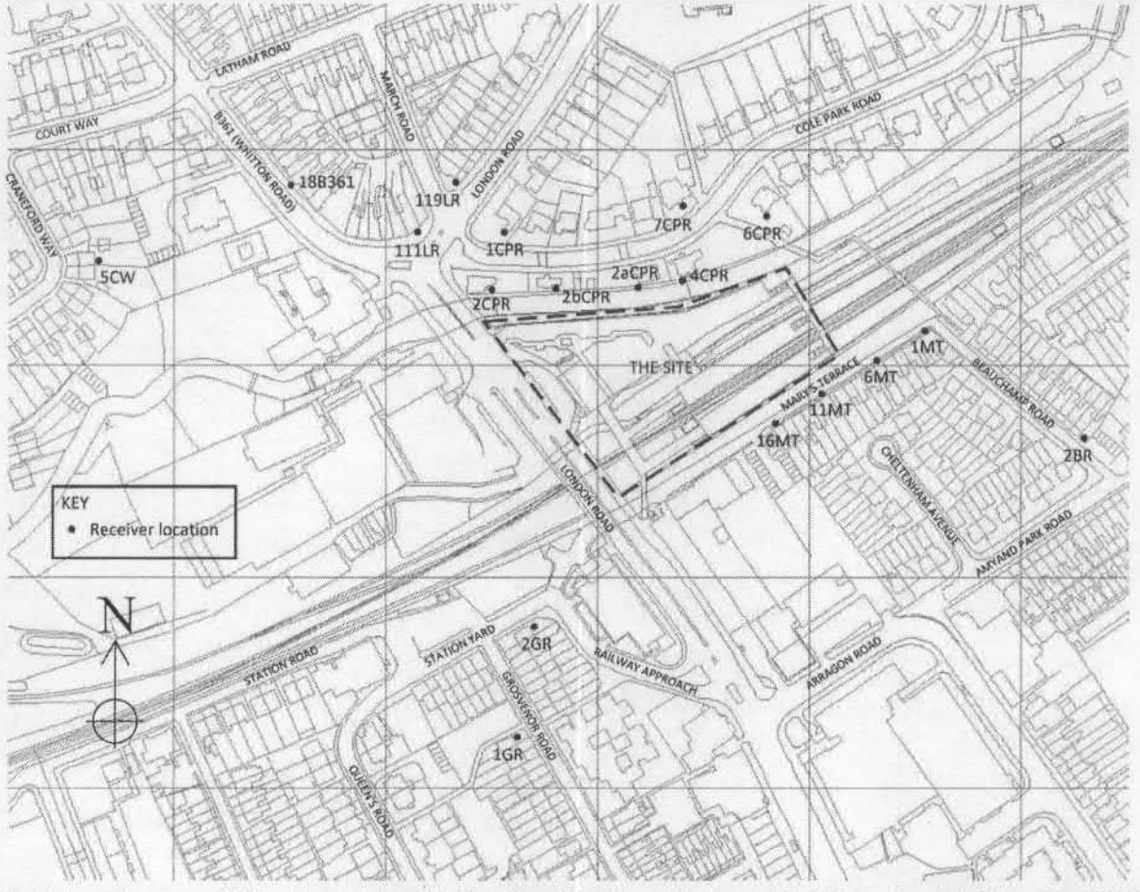
Table 2 Modelling scenarios

Scenario	Description
Pre-redevelopment	Site and surroundings as existing, but including the new Travelodge building at Regal House
Post redevelopment	Site with proposed redevelopment completed, construction phase hoarding removed and no operational noise

3.11 It is recognised that some noise will be generated from within the development and from ventilation systems etc. The proposals for this are not yet complete and we understand that any resulting noise will be limited by planning conditions. These sources have therefore not been included in the analysis at this stage.

3.12 Noise impacts arising from the construction of the project will be temporary only and are covered by a separate analysis.

3.13 The receivers used in the model included those nearest residences to the site most likely to be impacted by noise from the proposed redevelopment, and a number of residences at locations spread across the modelled area. See Figure 1 for off-site receiver location plan and Table 3 for list of receivers used in the model.



Based on Ordnance Survey map (2011) with permission of the Controller of Her Majesty's Stationary office © Crown Copyright. Licence No. 100005508

Fig. 1 OFF-SITE RECEIVER LOCATION PLAN

December 2011 Not to Scale

Table 3 List of off-site receivers used in the model (receivers located 1 m from façade)

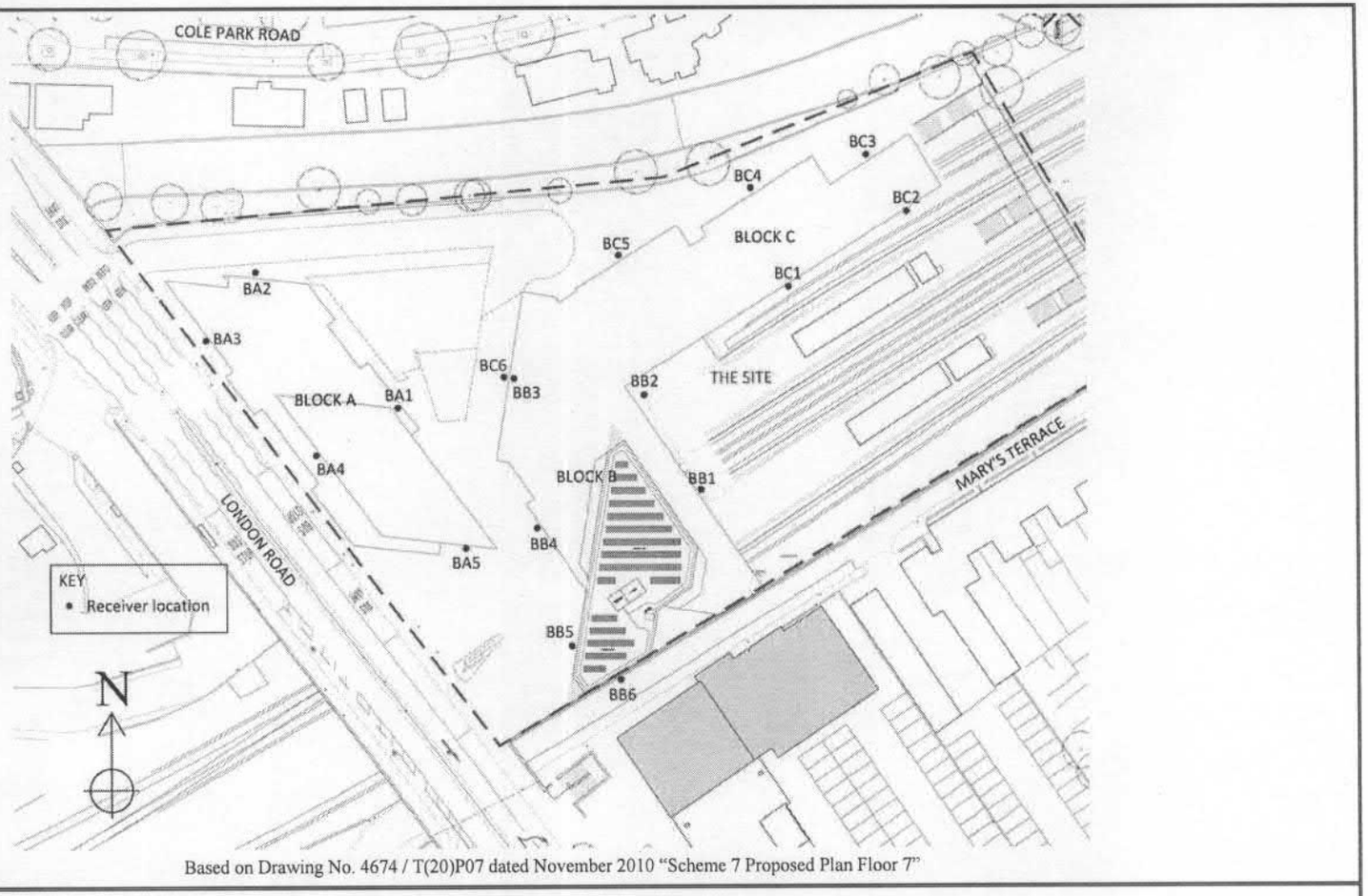
Receiver description	Height above ground level	Model code
18 B361 (Whitton Road) (receiver)	1.5 m & 4.5 m	18B361
2 Beauchamp Road (receiver)	1.5 m & 4.5 m	2 BR
1 Cole Park Road (receiver)	1.5 m & 4.5 m	1CPR
2 Cole Park Road (receiver)	1.5 m & 4.5 m	2CPR
2a Cole Park road (receiver)	1.5 m & 4.5 m	2aCPR
2b Cole Park Road (receiver)	1.5 m & 4.5 m	2bCPR
4 Cole Park Road (receiver)	1.5 m & 4.5 m	4CPR
6 Cole Park Road (receiver)	1.5 m & 4.5 m	6CPR
7 Cole Park road (receiver)	1.5 m & 4.5 m	7CPR
5 Craneford Way (receiver)	1.5 m & 4.5 m	5CW
1 Grosvenor Road (receiver)	1.5 m & 4.5 m	1GR
2 Grosvenor Road (receiver)	1.5 m & 4.5 m	2GR
111 London Road (receiver)	1.5 m & 4.5 m	111LR
119 London Road (receiver)	1.5 m & 4.5 m	119LR
1 Mary's Terrace (receiver)	1.5 m & 4.5 m	1MT
6 Mary's Terrace (receiver)	1.5 m & 4.5 m	6MT
11 Mary's Terrace (receiver)	1.5 m & 4.5 m	11MT
16 Mary's Terrace (receiver)	1.5 m & 4.5 m	16MT

3.14 A number of receivers were also modelled at the proposed development façades. See Table 4 below and Figure 2.

Table 4 List of on-site receivers used in the model (receivers located 1 m from façades)

Development Block	Façade	Floor levels								Model code
		-1	G	1	2	3	4	5	6	
A	East	-	-	✓	✓	✓	✓	✓	-	BA1
	North	✓	✓	✓	-	-	-	-	-	BA2
	West	-	✓	✓	✓	✓	-	-	-	BA3
		-	-	-	-	-	✓	✓	-	BA4
	South	-	-	✓	✓	✓	✓	✓	-	BA5
B	East	-	-	✓	✓	✓	✓	✓	✓	BB1
		-	-	✓	✓	✓	✓	-	-	BB2
	West	-	-	-	✓	✓	✓	-	-	BB3
		-	-	✓	✓	✓	✓	-	-	BB4
		-	-	✓	✓	✓	✓	✓	✓	BB5
	South	-	-	✓	✓	✓	✓	✓	✓	BB6
C	South	-	✓	✓	✓	-	-	-	-	BC1
		-	✓	✓	-	-	-	-	-	BC2
	North	-	✓	✓	-	-	-	-	-	BC3
		-	✓	✓	✓	-	-	-	-	BC4
		-	✓	✓	✓	-	-	-	-	BC5
	West	-	-	✓	✓	-	-	-	-	BC6

G = ground floor; - = no receiver; ✓ = receiver



Based on Drawing No. 4674 / T(20)P07 dated November 2010 "Scheme 7 Proposed Plan Floor 7"

Fig. 2 ON-SITE RECEIVER LOCATION PLAN

December 2011

Not to Scale

4. Model calibration and verification

4.1 The model was calibrated against the 15 and 30 minute noise monitoring data recorded around the site in May and June 2010, and was verified against the continuous 48-hour monitoring carried out in June 2011 (see Figure 3 for monitoring locations) as previously reported in Chapter 10 of the Environmental Impact Statement and the Addendum to Chapter 10 of the Environmental Impact Statement of July 2011. See Table 5 below.

Table 5 Summary of model calibration (Existing pre-redevelopment situation)

Receiver	Day-time $L_{(A)eq}$		Night-time $L_{(A)eq}$	
	Measured mean ($dB_{(A)}$)	Model output ($dB_{(A)}$)	Measured mean ($dB_{(A)}$)	Model output ($dB_{(A)}$)
Monitoring location 1	58.1	54.76	58.6	53.58
Monitoring location 2	58.2	55.91	57.7	51.99
Monitoring location 3	59.2	55.16	57.9	50.09
Monitoring location 4	69.2	66.51	66.9	61.65
Monitoring location 5	60.0	52.57	51.0	46.92
Monitoring location 6	65.3	63.51	-	60.97

4.2 The model output predictions were found to be low compared with the mean short-term monitoring measurements. This would be anticipated as the short-term measurements were taken at the times of the day and night when noise levels were likely to be highest for the period as the objective of the short-term measurements was to identify the worse case ambient exposures for the PPG 24 analysis.

4.3 It would be anticipated that the model predictions would most closely fit with the continuous 48-hour monitoring results recorded at monitoring location 7, and this was used for the verification of the model outputs. See Table 6 below.

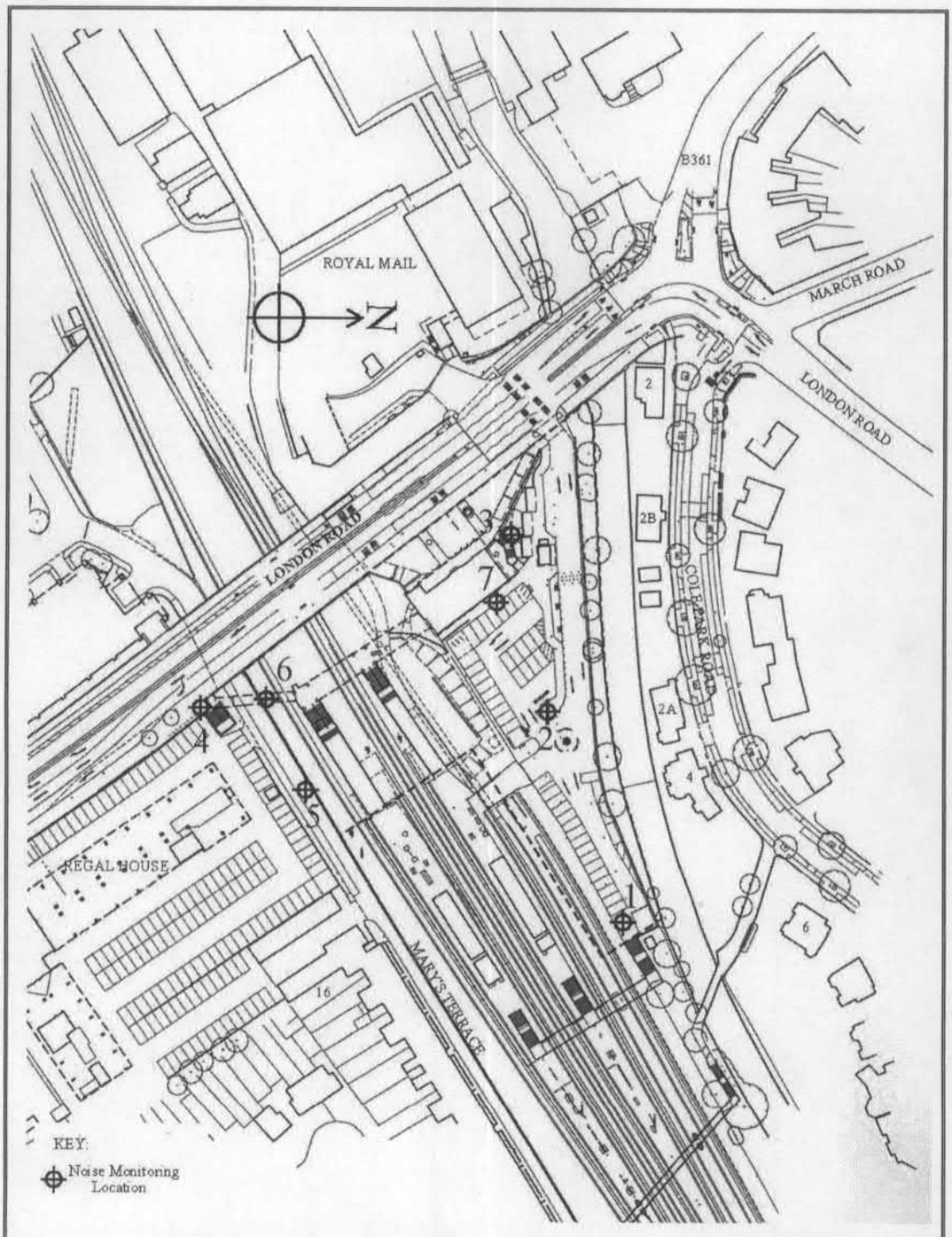
Table 6 Summary of model verification (Existing pre-redevelopment situation)

Receiver	Day-time $L_{(A)eq}$		Night-time $L_{(A)eq}$	
	Measured mean ($dB_{(A)}$)	Model output ($dB_{(A)}$)	Measured mean ($dB_{(A)}$)	Model output ($dB_{(A)}$)
Monitoring location 7	55.1	54.38	48.3	50.35

4.4 The verification appears to confirm that the model predictions are realistic and represent a satisfactory simulation of acoustic conditions at the site.

5. Results

5.1 The model was run for the pre-redevelopment and for the post-redevelopment scenarios. See summary of the noise modelling results in Tables 7 and 8 and graphic outputs in Appendix B.



Based on Rolfe Judd drawing number 4674/Z6(10)P00 Revision A 'Existing Plan at Platform Level Ground Floor' May 2010

Fig. 3 NOISE MONITORING LOCATIONS

December 2011 Not to Scale

Table 7 Summary of the daytime noise modelling results

Receiver	HAGL	Pre-redevelopment Scenario ($dB_{(A)}$)	Post redevelopment Scenario ($dB_{(A)}$)	$dB_{(A)}$ Difference
18B361	1.5 m	60.57	60.57	0.00
	4.5 m	60.08	60.08	0.00
2 BR	1.5 m	45.63	45.68	0.05
	4.5 m	44.76	44.78	0.02
1CPR	1.5 m	60.24	60.32	0.08
	4.5 m	60.72	60.67	-0.05
2CPR	1.5 m	57.42	58.06	0.64
	4.5 m	60.55	60.26	-0.29
2aCPR	1.5 m	53.13	49.95	-3.18
	4.5 m	53.96	49.91	-3.82
2bCPR	1.5 m	53.73	53.75	0.02
	4.5 m	54.78	53.41	-1.37
4CPR	1.5 m	51.07	46.86	-4.21
	4.5 m	52.60	47.14	-5.46
6CPR	1.5 m	48.20	47.10	-1.10
	4.5 m	50.78	49.71	-1.07
7CPR	1.5 m	50.45	50.15	-0.30
	4.5 m	51.01	50.44	-0.57
5CW	1.5 m	32.84	32.83	-0.01
	4.5 m	38.89	38.89	0.00
1GR	1.5 m	49.95	49.93	-0.02
	4.5 m	50.40	50.40	0.00
2GR	1.5 m	53.88	53.88	0.00
	4.5 m	53.90	53.90	0.00
111LR	1.5 m	65.47	65.46	-0.01
	4.5 m	65.52	65.51	-0.01
119LR	1.5 m	65.40	65.40	0.00
	4.5 m	65.39	65.38	-0.01
1MT	1.5 m	52.48	52.42	-0.06
	4.5 m	59.09	58.99	-0.10
6MT	1.5 m	52.84	52.73	-0.11
	4.5 m	59.86	59.72	-0.14
11MT	1.5 m	52.99	52.85	-0.14
	4.5 m	60.26	60.06	-0.20
16MT	1.5 m	52.87	52.66	-0.21
	4.5 m	60.06	59.65	-0.41

HAGL = Height above ground level

Table 8 Summary of the night-time results from the model

Receiver	HAGL	Pre-redevelopment Scenario ($dB_{(A)}$)	Post redevelopment Scenario ($dB_{(A)}$)	$dB_{(A)}$ Difference
18B361	1.5 m	55.02	55.02	0.00
	4.5 m	54.65	54.65	0.00
2 BR	1.5 m	36.62	36.81	0.19
	4.5 m	36.73	36.72	-0.01
1CPR	1.5 m	54.59	54.67	0.08
	4.5 m	55.32	55.28	-0.04
2CPR	1.5 m	52.21	52.87	0.66
	4.5 m	55.70	55.40	-0.30
2aCPR	1.5 m	48.43	44.16	-4.27
	4.5 m	49.51	44.12	-5.39
2bCPR	1.5 m	48.72	48.44	-0.28
	4.5 m	49.97	48.33	-1.64
4CPR	1.5 m	47.01	42.31	-4.70
	4.5 m	48.99	43.11	-5.88
6CPR	1.5 m	44.18	43.62	-0.56
	4.5 m	47.16	46.43	-0.73
7CPR	1.5 m	41.16	40.54	-0.62
	4.5 m	42.76	41.37	-1.39
5CW	1.5 m	26.80	26.78	-0.02
	4.5 m	33.75	33.75	0.00
1GR	1.5 m	39.14	39.08	-0.06
	4.5 m	39.67	39.65	-0.02
2GR	1.5 m	45.31	45.31	0.00
	4.5 m	45.37	45.37	0.00
111LR	1.5 m	60.13	60.14	0.01
	4.5 m	60.33	60.32	-0.01
119LR	1.5 m	60.06	60.05	-0.01
	4.5 m	60.17	60.16	-0.01
1MT	1.5 m	47.90	47.81	-0.09
	4.5 m	56.95	56.89	-0.06
6MT	1.5 m	48.36	48.22	-0.14
	4.5 m	57.52	57.43	-0.09
11MT	1.5 m	48.41	48.21	-0.20
	4.5 m	58.04	57.93	-0.11
16MT	1.5 m	48.02	47.70	-0.32
	4.5 m	57.94	57.71	-0.23

HAGL = Height above ground level

5.2 The results of the model runs for the pre- and post redevelopment scenarios suggest that noise levels at the selected receivers will mostly be slightly lower, although a few may be marginally higher. The reductions in the noise levels predicted at many of the surrounding roads, especially to the east of London Road, will largely be due to the proposed new buildings on the north side of the station acting as a noise barrier by blocking the line of sight to the railway and to the traffic on London Road.

5.3 See Tables 9 and 10 for noise modelling results for receivers at the proposed development façades.

Table 9 Daytime noise modelling results at 1 m from proposed development façades

Development block	Façade	Noise level ($dB_{(A)}$) Floor levels -1	G	1	2	3	4	5	6	Model code	NEC*
A	East	-	-	44.5	45.3	46.4	46.8	47.9	-	BA1	A
	North	53.8	55.3	56.0	-	-	-	-	-	BA2	B
	West	-	67.0	66.0	65.1	64.1	-	-	-	BA3	C
		-	-	-	-	-	63.6	63.0	-	BA4	
	South	-	-	57.1	59.9	60.0	60.3	60.7	-	BA5	B
B	East	-	-	60.9	60.0	59.3	58.8	58.3	57.8	BB1	B
		-	-	56.4	56.8	56.8	56.7	-	-	BB2	
	West	-	-	-	46.3	48.4	53.1	-	-	BB3	B
		-	-	53.6	54.0	54.6	56.3	-	-	BB4	
		-	-	57.0	57.3	58.7	58.7	58.6	59.1	BB5	
	South	-	-	58.1	57.9	57.5	56.8	56.2	55.8	BB6	B
C	South	-	58.0	57.7	58.1	-	-	-	-	BC1	B
		-	59.3	58.8	-	-	-	-	-	BC2	
	North	-	43.8	44.9	-	-	-	-	-	BC3	A
		-	45.2	45.5	46.3	-	-	-	-	BC4	
		-	45.4	45.9	46.8	-	-	-	-	BC5	
	West	-	-	32.7	39.8	-	-	-	-	BC6	A

G = ground floor; - = no receiver; * = average Noise Exposure Category (NEC) for the façade

Table 10 Night-time noise modelling results at proposed development façades

Development block	Façade	Noise level ($dB_{(A)}$) Floor levels -1	G	1	2	3	4	5	6	Model code	NEC*
A	East	-	-	38.7	39.6	40.9	41.6	42.9	-	BA1	A
	North	48.5	50.3	51.0	-	-	-	-	-	BA2	B
	West	-	62.1	61.2	60.3	59.4	-	-	-	BA3	C
		-	-	-	-	-	58.9	58.4	-	BA4	
	South	-	-	52.7	55.3	55.5	55.7	56.2	-	BA5	B
B	East	-	-	56.7	56.0	55.4	55.0	54.6	54.2	BB1	B
		-	-	52.6	52.9	52.9	52.9	-	-	BB2	
	West	-	-	-	40.7	43.1	48.5	-	-	BB3	B
		-	-	49.2	49.7	50.2	51.9	-	-	BB4	
		-	-	52.5	52.8	54.2	54.2	54.1	54.7	BB5	
	South	-	-	53.2	52.9	52.6	51.9	51.3	51.0	BB6	B
C	South	-	57.0	56.0	55.6	-	-	-	-	BC1	B
		-	58.4	56.9	-	-	-	-	-	BC2	
	North	-	38.7	40.1	-	-	-	-	-	BC3	A
		-	39.2	39.6	40.6	-	-	-	-	BC4	
		-	39.6	40.2	41.3	-	-	-	-	BC5	
	West	-	-	24.6	33.6	-	-	-	-	BC6	A

G = ground floor; - = no receiver; * = average Noise Exposure Category (NEC) for the façade

5.4 The noise modelling of the proposed development puts the façades generally in NEC B for both the daytime and night-time periods.

5.5 The model has not included an allowance for noise generated by visitors to, or residents in, the proposed buildings on the north side of the station and ventilation systems elsewhere in the proposed redevelopment. These inputs need to be added to the completed development when the detailed design stage has been completed. It is understood that this will be covered by appropriate planning condition and is not anticipated that this will significantly impact on the selected receivers.

6. Conclusions

6.1 The model was set up and run for calibration and subsequent verification. From the results, it is concluded that the model predictions are realistic and represent a satisfactory simulation of acoustic conditions at the site.

6.2 The model runs for the pre- and post redevelopment scenarios appear to indicate that the proposed redevelopment, once complete, will not result in additional adverse noise impacts at the nearest existing residential receivers.

6.3 These conclusions are provisional and subject to additional data on the mechanical services proposed for the new buildings.

☆ ☆ ☆ ☆ ☆ ☆ ☆