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Crown St School, Manchester

Environmental Noise Study

March 2022

Report Reference: C3-FAC-A180-RP-XX-001 P01

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PROJECT TITLE CROWN STREET PRIMARY SCHOOL, MANCHESTER

REPORT TITLE ENVIRONMENTAL NOISE STUDY

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1.0 INTRODUCTION

Outline planning permission (with all matters reserved) has been granted for a single-form entry primary school (Use Class D1) at Crown Street, Manchester. The school forms Phase C of the Crown Street Phase 2 development approved under application 126668/FO/2020 on 3 August 2020.

Fisher Acoustics has been appointed by Renaker Build Limited to compile a technical report to discharge Condition 94(a) attached to planning permission 126668/FO/2020) and in support of the reserved matters application for Phase C (education facility / school) of the Crown Street Phase 2 development..

An intrusive noise study has been conducted in order to identify the minimum recommended acoustic performance of façade elements to rooms to achieve appropriate internal noise levels the various areas of the school.

An assessment of noise egress has also been conducted to determine the potential levels of noise at the nearest residential receptors due to activities within the school hall. The potential levels of noise at the nearest residential receptors due to noise propagation from the rooftop playground and from external ground floor areas associated with the daycare, nursery and reception class have also been determined.

Environmental noise limits for building services plant serving the school have been determined.

2.0 PLANNING APPROVAL

Outline planning approval for Crown Street primary school was granted on 3 August 2020 (planning reference number 126668/FO/2020). The school is referenced as Building C3 within Phase C of the Crown Street Phase 2 development.

The approval included the following conditions relating to noise.

- 94) a. *Prior to the commencement of above-ground construction works within Phase C, a scheme for acoustically insulating the proposed educational facility building against noise from the Mancunian Way and Chester Road shall be submitted to and approved in writing by the City Council as local planning authority. There may be other actual or potential sources of noise which require consideration on or near the site, including any local commercial/industrial premises. The approved noise insulation scheme shall be completed before the school is first brought into use.*

Noise survey data must include measurements taken during a rush-hour period to determine the appropriate sound insulation measures necessary.

b. The approved noise insulation scheme shall be completed and a post-completion verification report (including validation that the work undertaken throughout the development conforms to the recommendations and requirements of the acoustic report approved under part a. above and including the results of post-completion testing to confirm that the internal noise criterion have been met) shall be submitted to and approved in writing by the City Council as local planning authority before the school is first occupied. Any instances of non-conformity with the approved acoustic report shall be detailed within the post-completion report along with any measures required to ensure compliance with internal noise criteria. Those measures shall be implemented in full before the school is first occupied.

Reason - To secure a reduction in noise from the main roads and surrounding road networks and any other potential sources of noise, in order to protect future residents from noise nuisance, pursuant to policies SP1, H1 and DM1 of the Core Strategy.

- 95) *Prior to first occupation of Phase C, the educational facility building shall be acoustically insulated and treated to limit the break out of noise in accordance with a noise study of the premises and a scheme of acoustic treatment that has been submitted to and approved in writing by the City Council as local planning authority.*

Upon completion of Phase C of the development a verification report to validate that the work undertaken throughout Phase C of the development conforms to the recommendations and requirements in the approved acoustic consultant's report shall be submitted to and approved in writing by the City Council as local planning authority. The verification report shall include post completion testing to confirm that acceptable criteria has been met.

Any instances of non-conformity with the recommendations in the report shall be detailed along with any measures required to ensure compliance with the agreed noise criteria and timescales for the implementation of those measures.

Reason - To safeguard the amenities of the occupiers of the building and occupiers of nearby properties, pursuant to policies SP1 and DM1 of the Core Strategy.

- 96) *Prior to first occupation of Phase C, the educational facility building, together with any externally mounted ancillary equipment, shall be acoustically insulated in accordance with a scheme submitted to and approved in writing by the City Council as local planning authority in order to secure a reduction in the level of noise emanating from the equipment. Upon completion of Phase C of the development a verification report to validate that the work undertaken throughout Phase A of the development conforms to the recommendations and requirements in the approved acoustic consultant's report shall be submitted to and approved in writing by the City Council as local planning authority. The verification report shall include post completion testing to confirm that acceptable criteria has been met. Any instances of non-conformity with the recommendations in the report shall be detailed along with any measures required to ensure compliance with the agreed noise criteria and timescales for the implementation of those measures.*

Reason - To safeguard the amenities of the occupiers of nearby residential accommodation, pursuant to policies SP1 and DM1 of the Core Strategy.

3.0 INTERNAL NOISE CRITERIA FOR SCHOOLS

Planning condition 94 requires that the school is acoustically insulated against noise from the Mancunian Way and Chester Road and any other environmental noise source.

Building Bulletin 93 'Acoustic design of schools: performance standards', published in February 2015 by the Department for Education provides appropriate criteria for the indoor ambient noise level within various school room types. The indoor ambient noise level includes contributions from external noise sources such as transportation and from building services. Compliance with the performance standards for internal noise levels given in BB 93 is a requirement of Approved Document E of the Building Regulations.

In particular, section 1.1.2 'Acoustic performance standards' of BB93: 2015 states that '*Table 1 specifies upper limits for indoor ambient noise levels in terms of $L_{Aeq,30mins}$ during normal teaching hours*'.

Table 1 identifies the applicable noise levels for new build primary schools.

Type of Room	Upper Limit for the indoor ambient noise level $L_{Aeq, 30mins}$ dB
Nursery school rooms Primary school: classroom, class base, general teaching area, small group room	35
Teaching space intended specifically for students with special hearing and communication needs ²	30
SEN calming room	35
Libraries: Quiet study area Resource area	40 40
Drama studio, assembly hall, multi-purpose hall (drama, PE, audio/visual presentations, assembly, occasional music)	35

Type of Room	Upper Limit for the indoor ambient noise level $L_{Aeq, 30mins}$ dB
<i>Administration and ancillary spaces:</i>	
Kitchen	50
Office, medical room, staff room	40
Corridor, stairwell, coats and locker area	45
Changing area	50
Toilet	50

Table 1: BB93: 2015 guideline values for new build indoor ambient noise levels

Notes:

² *Alternative Performance Standards are commonly required for these rooms and should be agreed by an acoustician and the school client body. See section 0.4.'*

Section 1.1.2 of BB93: 2015 states: '*In order to protect students from regular discrete noise events, e.g., aircraft or trains, indoor ambient noise levels should not exceed 60 dB $L_{A1, 30mins}$. This is achieved by default for spaces with IANLs up to 40 dB $L_{Aeq, 30min}$, but requires assessment in spaces with higher IANL limits, eg, 45 and 50 dB.'*

4.0 ENVIRONMENTAL NOISE CRITERIA

Building Services Noise

BS4142: 2014

For noise of an industrial nature such as fixed building services plant, an assessment of the likely effects on people inside or outside residential buildings due to noise can be carried out using BS4142: 2014 'Methods for rating and assessing industrial and commercial sound'.

The following acoustic parameters are described within BS4142: 2014:

- Specific Noise Level – the equivalent continuous A-weighted sound pressure level measured over a specified time period, T_r , at the assessment position with the specific noise source contribution, L_{Aeq, T_r} (i.e. the noise level due to the new noise source).
- Rating Level – the Specific Noise Level plus an adjustment for any characteristic noise features, L_{Ar, T_r}
- Residual Noise Level – the equivalent continuous A-weighted sound pressure level measured when the specific noise does not contribute to the ambient noise
- Background Noise level – measured for a specific duration, T , in the absence of the specific noise source, $L_{A90, T}$

To complete a BS4142 assessment of potential noise effects upon residential properties, it is necessary to obtain the Rating Level due to the sound source in question. The Rating Level is derived by adding corrections to the measured Specific Noise Level, if the noise source:

- is tonal (correction of 0dB to +6dB, depending on severity)
- contains distinct impulses (correction of 0dB to +9dB, depending on severity)
- is intermittent (correction of +3dB if applicable)
- is otherwise distinctive against the residual acoustic environment (correction of +3dB)

For instance, where a sound source is strongly tonal and impulsive over the duration of the appropriate assessment period, a correction of +15 dB may apply.

The Rating Level can then be used in order to ascertain the *likelihood of complaints* due to industrial noise disturbance by subtracting the measured background noise level. The greater the positive difference, the greater the likelihood of complaints.

Table 2 summarises the assessment method.

Difference between Rating Level and Measured Background Level	Assessment
+10 dB or greater	Significant adverse impact
+5 dB	Indication of adverse impact, depending on context
0 dB or less	Indication of low impact, depending on context

Table 2: BS4142: 2014 Assessment Method

Where a new noise source has not yet been introduced, a recommended specific noise level can be determined based on a knowledge of the existing background noise level.

BS 4142: 2014 recognises that where background and rating levels are low, the potential absolute noise levels at the sensitive receptor might be more relevant in assessing potential impact than a simple comparison of the rating level and background noise level.

In such instances, reference can be made to BS 8233: 2014 in order to determine appropriate external noise levels due to buildings services plant, such that acceptable noise levels are achieved inside buildings.

Music Noise

Noise egress from the proposed school hall must be controlled to appropriate levels so as to avoid noise nuisance to existing sensitive receptors. As music replay may be employed in the hall, an assessment of 'entertainment' (music) noise must be carried out. With regard to entertainment venues, 'Planning & Noise, Technical Guidance' published by Manchester City Council in December 2015 states:

- 'When considering the potential impact of a proposal for an entertainment venue, consultants should consider the overall noise level (LAeq) and the 63 Hz and 125 Hz octave band noise levels (Leq). Music noise in the 63 Hz and 125 Hz octave bands, which is often described as "bass noise", is particularly difficult to contain and the impulsive character of this low frequency music noise is particularly disturbing for local residents exposed to it'.

-
- 'A planning application for a new entertainment venue that is structurally detached from other building uses should demonstrate that music noise from the proposal will not be 'audible' in nearby residential properties, assuming that the residential properties in question have their windows open. The criterion here is:

Entertainment noise (LAeq) should be controlled to 10dB below the background noise level (LA90) without the entertainment noise present, in each octave band at the nearest noise sensitive location'.

5.0 ENVIRONMENTAL NOISE SURVEY DATA

In order to determine the prevailing ambient noise levels at the site, a survey of the existing noise environment was carried out by Fisher Acoustics on 28 January 2022 between 16:40 hrs and 19:40 hrs. The measurement locations used for the surveys are identified in Figure 1. A number of the measurement positions are representative of the closest façades of the school to the A57 (Mancunian Way) and Chester Road. The measured noise levels can therefore be used to assess the expected internal noise levels within the proposed building.

The noise measurement locations were as follows:

- Location 1: At the corner of the proposed school building at a microphone height of 10 metres above the A57(M) slip road.
- Location 1a: At the corner of the proposed school building at a microphone height of 1.5 metres above the A57(M) slip road.
- Location 2: 3.7 metres from the kerb of the A57(M) slip road at a microphone height of 6.0 metres above the A57(M) slip road.
- Location 3: At the east corner of the proposed school building at a microphone height of 1.7 metres above the A57(M) slip road.
- Location 4: 1.2 metres from the kerb of the A57(M) slip road at a microphone height of 1.8 metres above the A57(M) slip road.

Full survey details are given in Appendix A. Appendix A also contains a summary of the results obtained from the surveys.

Figure 1 identifies the location of the noise survey measurement position.

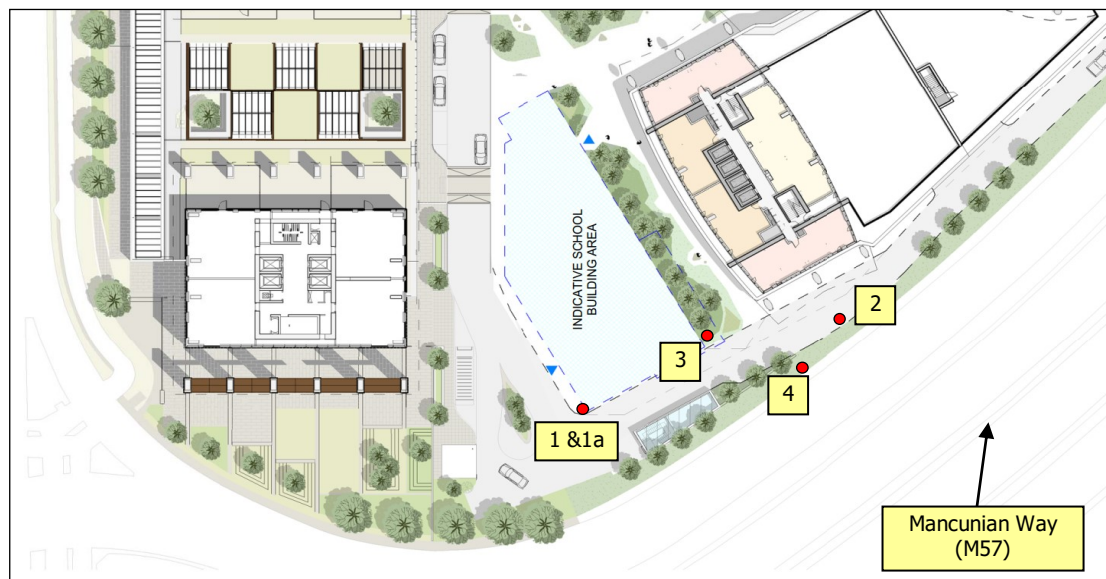


Figure 1: Noise Survey Measurement Locations

The noise levels measured during the noise survey are summarised in Table 3.

Measurement Location	Measured Noise Levels		
	Daytime (Defined as 7 am to 11 pm)		
	dB, LAeq	dB, LAmix	dB, LA90
1	77	79 to 89	73 to 77
1a	68	69 to 71	65 to 67
2	80	80 to 98	70 to 80
3	69	71	64
4	78	76 to 87	71 to 74

Table 3: Summary of measured environmental noise levels

The quoted average (L_{Aeq}) noise levels are the average noise levels measured over the full measurement periods in question at each measurement position. The quoted L_{Amix} noise levels show the range of noise levels measured over the sample periods.

From the measured noise levels, the potential noise levels around the school building have been determined using a 3D computer model. The model has included the acoustic influence of the other buildings within the Crown Street development, including those that are currently under construction. Figures 2 and 3 show the calculated free-field external noise levels at the school building. For clarity, all other buildings have been omitted from the Figures.

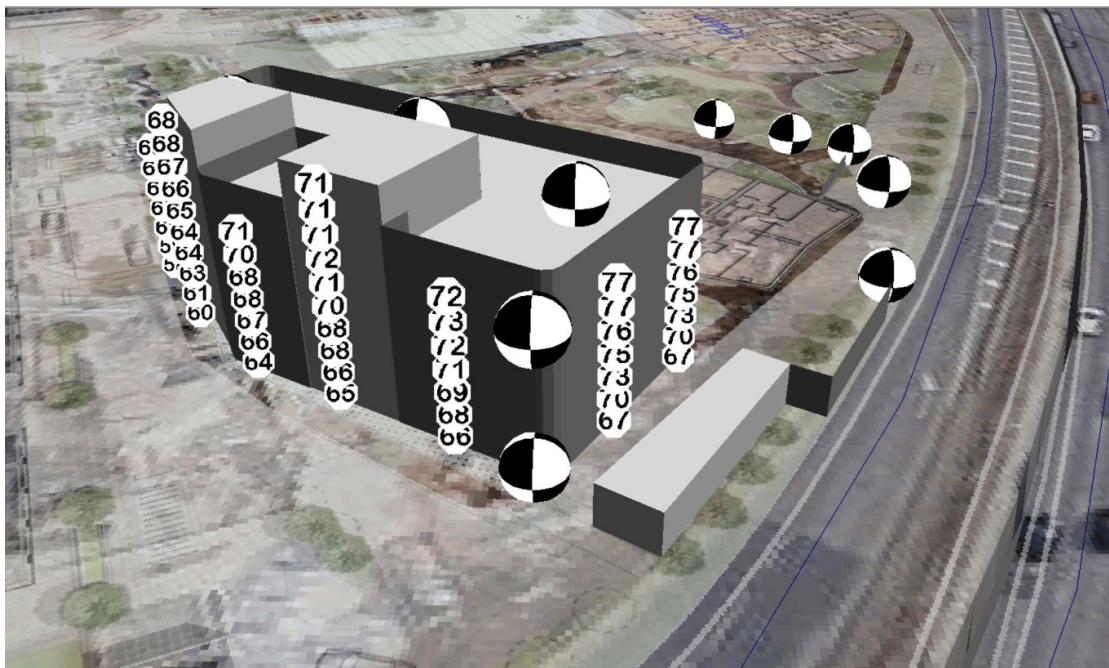


Figure 2: Calculated free field noise levels at north and west facades of school

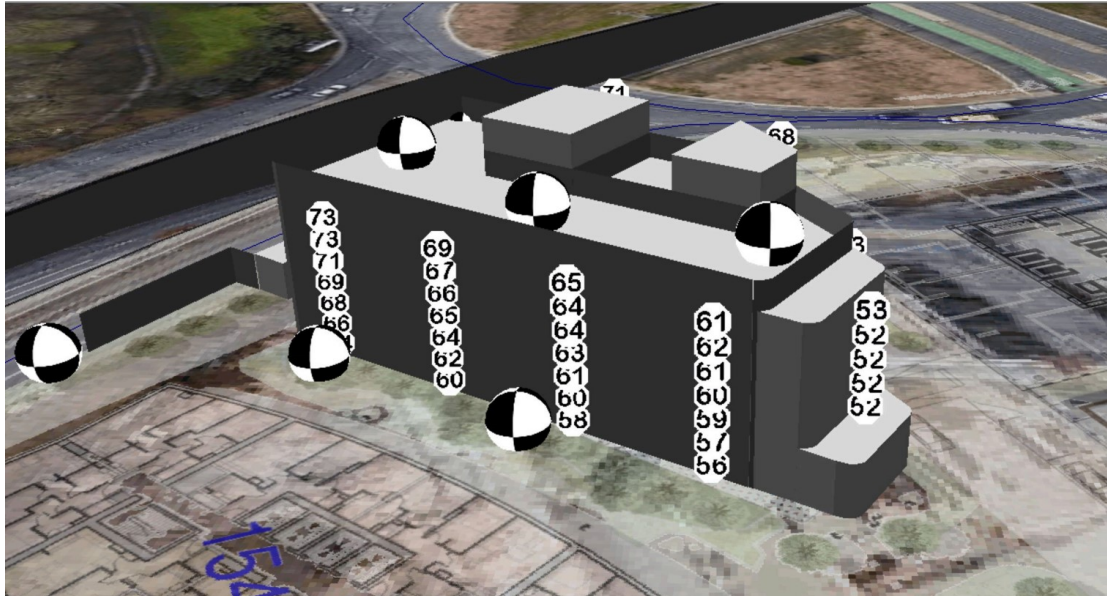


Figure 3: Calculated free field noise levels at south and east facades of school

6.0 NOISE INGRESS

The external noise survey data and the results of the 3D modelling studies have been used to calculate the required sound insulation performance of façade elements to achieve the internal noise criteria within the primary school rooms due to external noise. The calculations are based on the 'more rigorous' calculation method identified in Annex G.2.1 of BS8233:2014 'Guidance on sound insulation and noise reduction for buildings'.

The calculations take into account the measured levels of noise at the site, the areas of individual façade elements, (e.g. windows, external wall, open area of ventilation units) identified in the drawings submitted for planning purposes and the mid-frequency reverberation time of the primary school rooms identified in BB93.

Windows

It has been determined that double glazed windows of certain acoustic performance would be capable of achieving the specified internal noise levels. Figures 4 to 6 identify the locations of the recommended specifications.

Table 4 identifies the minimum recommended sound reduction index of the window specifications referred to below and in Figures 4 to 6. The recommended performance values in Table 4 relate to the composite performance of the glazing, the frames and seals, and the cavity closer between the frames and the structural opening.

Window panel type	Sound Reduction Index (dB) @ Octave Band Centre Frequency (Hz)						
	63	125	250	500	1k	2k	4k
Type A	25	28	37	42	45	48	56
Type B	25	24	27	36	44	45	49
Type C	22	25	25	34	41	41	45
Type D	18	21	21	28	36	37	37

Table 4: Minimum Recommended Sound Reduction Index of windows, including frame

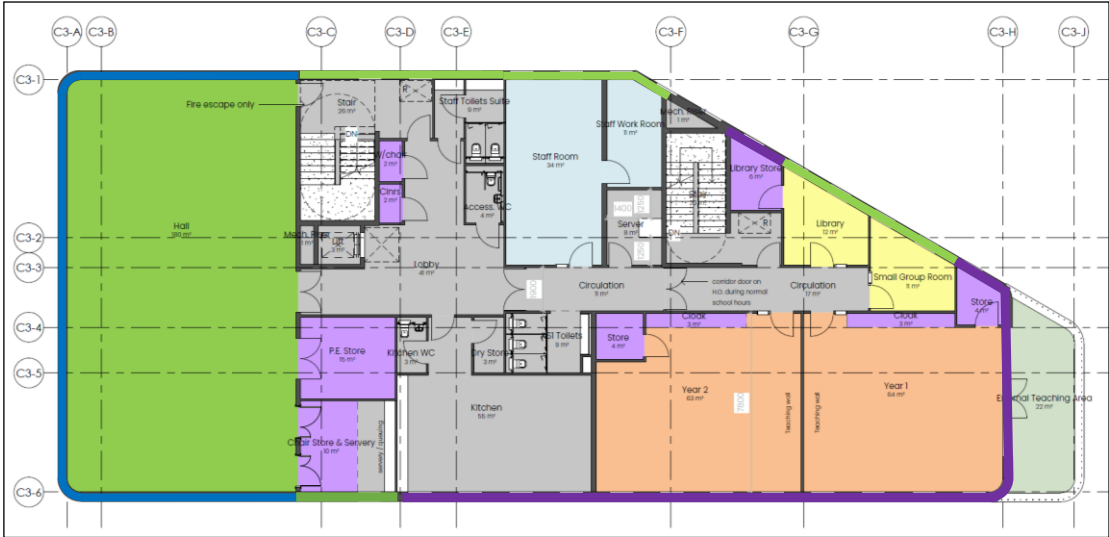


Figure 5: Acoustic Specification Location Plan, First Floor

KEY

- Type A
- Type B
- Type C
- Type D



Figure 6: Acoustic Specification Location Plan, Second Floor

KEY

- Type A
- Type B
- Type C
- Type D

Ventilation Ductwork

The majority of the rooms within the school are to be ventilated by a hybrid ventilation system with heat recovery. The rooms in question are to be provided with Monodraught HVR Zero X+ façade-based mixed ventilation unit.

Each room will have the required number of HVR Zero X+ units installed to suit the heating and ventilation requirements of the space. The unit is installed within ceiling voids and is connected to a damper within the external façade, and can incorporate acoustic attenuation and air filtration. The units provide a single-sided ventilation solution with seasonal operation and are designed to meet thermal comfort and air quality criteria of Building Bulletin 101 (BB101) 'Guidelines on ventilation, thermal comfort and indoor air quality in schools'.

Table 5 identifies the measured sound reduction of the HVR Zero X+ unit both with and without an acoustic attenuator.

Unit	Insertion Loss (dB) @ Octave Band Centre Frequency (Hz)						
	63	125	250	500	1k	2k	4k
HVR Zero X+ unit with no attenuator	15	22	20	31	48	53	52
HVR Zero X+ unit with 300 mm attenuator	12	11	12	17	31	44	37

Table 5: Minimum recommended insertion loss of ductwork

In order to achieve the internal noise criteria of BB93, each of the HVR ventilation units to the following rooms must be provided with the proprietary 300 mm long attenuator:

- Ground floor: Office, Staff Room, Under 2s, 2 Years, 3-5 years
- 1st floor: Hall, Staff Room, Library, Small Group Room
- 2nd floor: Hall, Food Bay & Practical Resources, Year 3, Year 4, Year 5, Library, Small Group Room

External Wall

The solid external wall of the school is to comprise an external brickwork leaf. It is expected that the brickwork leaf will be fixed to a lightweight metal SFS frame, with cement bonded particle board to the outer face of the SFS studs. The SFS frame would be drylined internally with plasterboard.

Table 6 identifies the expected minimum sound insulation performance of the external wall. The expected performance is fully commensurate with the achievement of the applicable internal noise criteria.

Building element	Sound Reduction Index (dB) @ Octave Band Centre Frequency (Hz)						
	63	125	250	500	1k	2k	4k
External wall	30	38	45	53	60	67	70

Table 6: Minimum expected sound reduction index of external wall

Given the recommended sound insulation performance of windows, the expected performance of the external wall and the recommended sound insulation performance of the ventilation units, compliance with the applicable daytime 'average' (dB LAeq) noise criteria is expected in the various areas of the school

7.0 EXTERNAL NOISE LEVELS DUE TO BUILDING SERVICES

The measured background noise levels around the site can be used to establish the acceptable level of noise from plant serving the school. Final plant selections have not been made at this design stage. In the absence of specific selection of plant items, overall plant noise limits can be provided.

With reference to the discussion in Section 4, the cumulative rating level due to all simultaneously operating non-emergency plant at the school must be at least 5dB lower than the typical pre-existing background noise level at the nearest residential receptors to the site.

Table 7 identifies the allowable combined free-field noise level at the nearest residential receptors to the school, due to all simultaneously-operating non-emergency building services plant and equipment.

Location	Rating noise level (dB LAeq)	
	Daytime (07:00 hrs to 23:00 hrs)	Night time (23:00 hrs to 07:00 hrs)
Crown Street Building C1	47	37
Crown Street Building C2	47	37
Crown Street Building C4	50	40

Table 7: Environmental noise limits for non-emergency building services plant

The above noise limits for non-emergency plant must be forwarded to the project's Mechanical Engineer to allow the selection of appropriate equipment and any associated noise control hardware. Building services equipment must also be provided with appropriate vibration isolation to minimise the risk of disturbance to the building occupants by structureborne noise.

8.0 NOISE EGRESS FROM PRIMARY SCHOOL INTERNAL AND EXTERNAL AREAS

In order to avoid potential noise nuisance to the noise-sensitive buildings around the site, activity noise propagation from the school must be controlled.

Activity noise egress from school hall

As the school hall may potentially employ music replay, suitable limits relating to music noise egress from the hall must be established.

As detailed in Section 4 above, Manchester City Council suggests that external music noise levels (measured as an L_{eq} noise level) external to a residential property due to an 'entertainment' venue should be 10dB lower than the prevailing background noise level in each octave band.

Octave band noise limits at the nearest noise sensitive receptors have been determined by reference to noise survey data.

Table 8 identifies the recommended maximum allowable cumulative daytime free-field noise levels at the closest residential façades due to music noise from the school hall to comply with the guidance of Manchester City Council.

Location/period	Sound Pressure Level (dB Leq) @ Octave Band Centre Frequency (Hz)						
	63	125	250	500	1k	2k	4k
Crown Street Building C1 (daytime)	48	44	41	40	44	37	24
Crown Street Building C2 (daytime)	48	44	42	40	44	37	24
Crown Street Building C4 (daytime)	51	47	45	43	47	40	27

Table 8: Maximum allowable external noise levels due to proposed primary school

Calculations have been carried out to determine the maximum allowable noise level within the school hall in order to comply with the noise limits given in Table 8. The calculations are based on the minimum recommended sound insulation of the windows, ventilation units and external wall of the school hall.

Table 9 identifies the calculated maximum allowable internal noise level within the school hall.

Location	Sound Pressure Level (dB Leq) @ Octave Band Centre Frequency (Hz)						
	63	125	250	500	1k	2k	4k
Crown Street School Hall	86	90	90	95	100	100	95

Table 9: Maximum recommended internal activity/ music noise levels within school hall

The allowable noise levels given in Table 9 are substantially greater than the expected maximum activity and music noise levels within the school hall. Therefore no disturbance of the residents of the closest residential properties would be expected due to noise propagation from the school hall

Noise propagation from rooftop playground and ground floor external areas

Calculations have been carried out to determine the potential levels of noise at the closest residential façade due to activity noise on the rooftop playground and in the external areas at ground floor. In particular, the potential level of noise generated by school children has been determined.

It is understood that during the lunch break, morning break and afternoon break, up to one hundred and eighty children could be on the roof at any one time and up to forty three children could be in the ground floor external areas.

Calculations of noise propagation from people must include an assumed sound power level of a person's voice. Table 10 identifies the sound power level of the human voice at different voice efforts (ref: ANSI 3.5:1997 'Methods for calculation of the speech intelligibility index'). As a guide, 'raised' voice effort would be similar to that used by a teacher when addressing a full classroom. The sound power level for a 'loud' voice effort would be that generated by an adult when using as loud a voice as possible without straining the voice.

Voice effort	Sound Power Level (dB Leq) @ Octave Band Centre Frequency (Hz)						
	63	125	250	500	1k	2k	4k
Raised	48	59	70	75	72	64	57
Loud	52	63	72	80	80	73	66

Table 10: Sound power of human voice at different effort levels

The calculations have assumed that all the children on the rooftop playground and in the ground floor external areas are using a 'loud' voice simultaneously and that the pupils are spaced evenly across the areas in question. Whilst it is expected that a certain number of pupils would be shouting in a louder voice than the 'loud' voice in Table 10, it can be expected that a number of the pupils would be using a quieter voice than the 'loud' voice and that at any one time, not all children would be talking/shouting. Therefore the calculated noise levels are considered to be a robust assessment of the potential noise levels at the closest residential façades.

The highest calculated free-field noise level at the closest building façade is 73 dB LAeq during school breaks. A noise level of 70 dB LAeq to 73 dB LAeq has been calculated external to approximately twenty six apartments within Building C4 (The Blade). The playground noise level external to all other apartments in Building C4 is 69dB LAeq or less. The calculated playground noise level external to all apartments in Building C2 (Elizabeth Tower) and C1 (Victoria Residence) is 65dB LAeq or less.

Figure 7 shows the calculated noise levels (dB LAeq) at Buildings C4 and C2 due to noise propagation from the rooftop playground during break times, assuming that 180 children are on the playground.

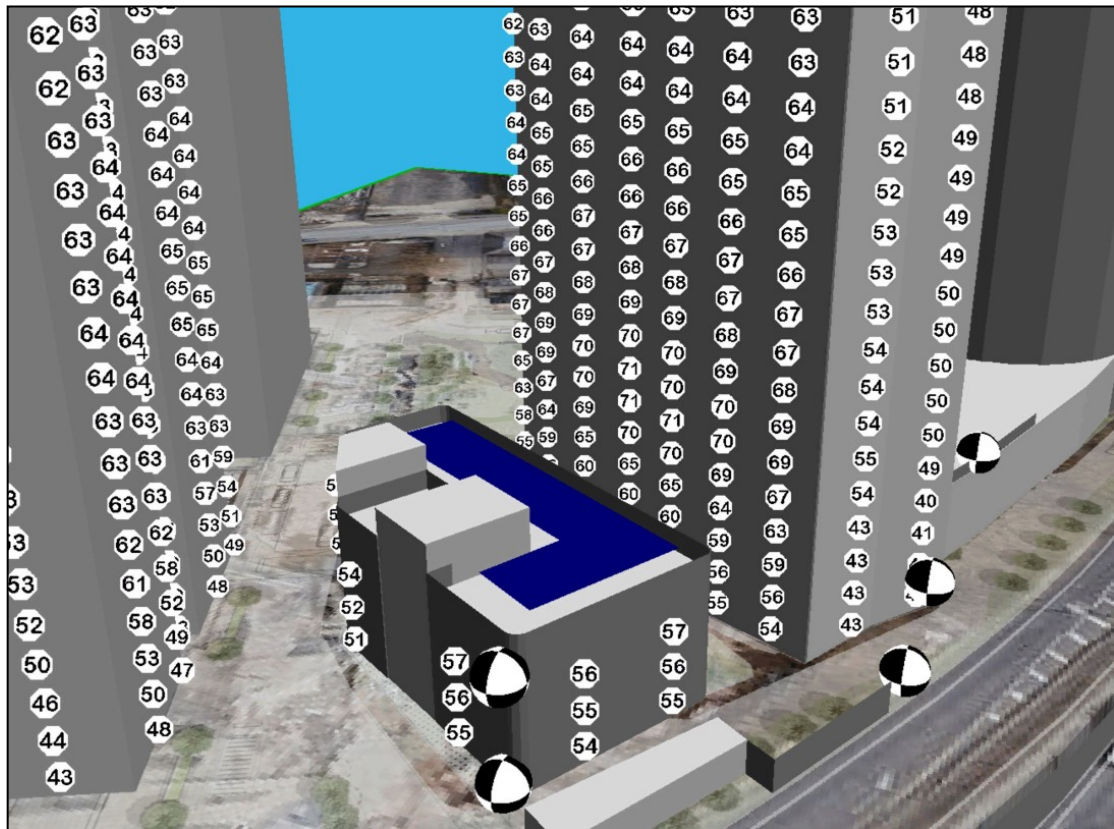


Figure 7: Calculated noise levels (dB LAeq) at Building C4 and C2 due to playground noise propagation

To initially assess the potential impact of playground noise, the calculated noise levels at Buildings C4 and C2 due to use of the playground can be compared to the expected levels of noise due to road traffic noise. Figure 8 shows the calculated noise levels (dB LAeq) at Buildings C4 and C2 due to road traffic noise.

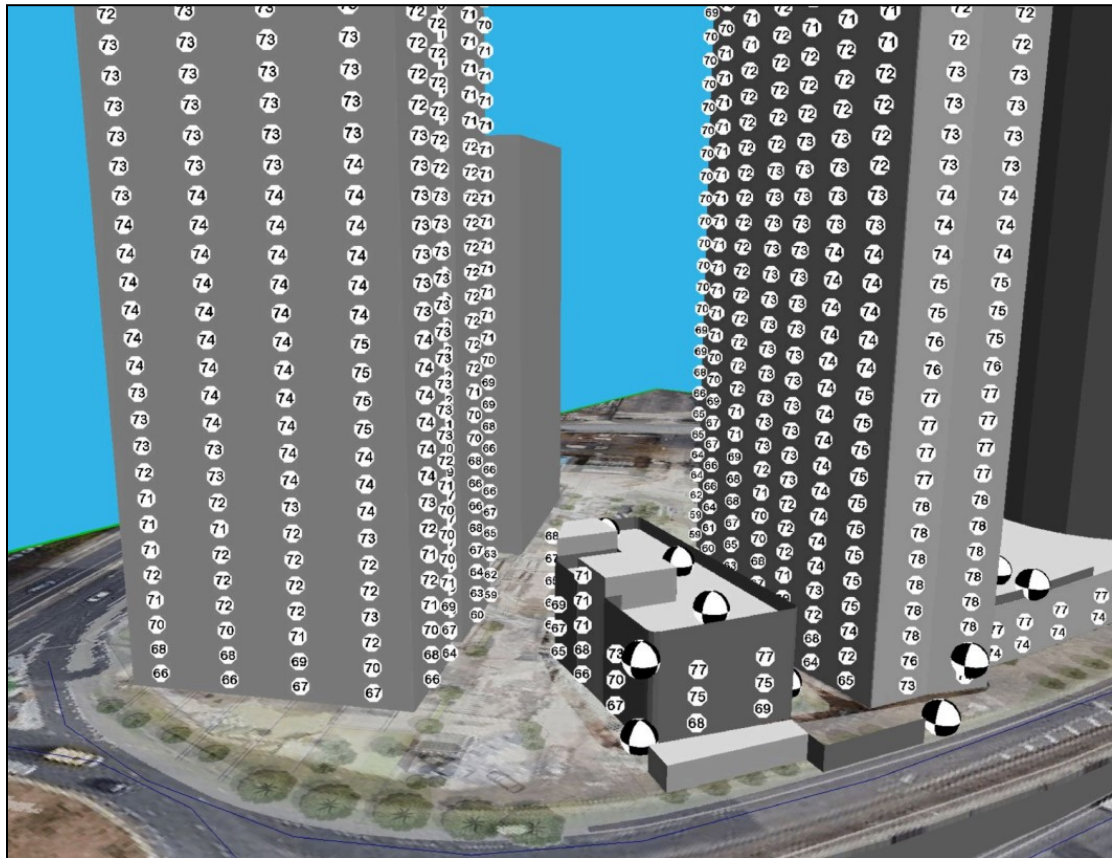


Figure 8: Calculated noise levels (dB LAeq) at Building C4 and C2 due to road traffic

It can be seen that at all facade locations at Building C2 (the building to the left (west) of the school), the predicted noise level due to use of the playground is less than the pre-existing noise level due to road traffic.

At the majority of facade locations at Building C4 (the building to the right (east) of the school), the predicted noise level due to use of the playground is less than the pre-existing noise level due to road traffic. Where the playground noise level is greater than the predicted noise level due to road traffic, this is a consequence of the beneficial acoustic screening of road traffic that the school building provides (i.e. without the school building, road traffic noise levels at some locations of Building C4 would be greater than is otherwise the case).

Given the predicted worst case façade noise level of 73 dB LAeq at Building C4, the expected internal noise level within the affected apartments has been calculated to be 33 dB LAeq. This noise level would only prevail during the use of the playground. As discussed in BS8233: 2014, daytime noise within dwellings is normally referenced in terms of 'LAeq,16 hrs'. This is the 'average' noise level due to a noise source over the course of the day. BS8233: 2014 'Guidance on sound insulation and noise reduction for buildings' and 'Planning & Noise, Technical Guidance' published by Manchester City Council recommends that a daytime noise level of 35dB LAeq,16 hrs is not exceeded in living rooms and bedrooms.

BS8233: 2014 advises that this noise level relates to sources that are 'without a specific character', such as road traffic. For external noise sources that have a specific character, such as voices, it would be normal practice to recommend a noise level that is 5dB lower than the normally-applicable criterion.

It is understood that the rooftop playground could be in use by the full school for 100 minutes per day, with use by smaller groups of sixty pupils for approximately 100 minutes per day. The duration of use of the ground floor external areas is understood to be similar. The calculated internal noise level within the most exposed apartment given this pattern of use is 24dB LAeq,16 hrs. Therefore, the calculated worst-case daytime average noise level in apartments that overlook the rooftop playground and other external areas is 6dB lower than would be recommended given the character of noise from the playground.

Therefore the impact of activity noise from the rooftop playground and ground floor external areas is expected to be minimal.

APPENDIX A: NOISE SURVEY DETAILS AND SUMMARY RESULTS

LOCATION

Crown Street, Manchester

DATES AND TIMES

Friday 28 January 2022

16:40 to 19:40

WEATHER DURING SURVEYS

Friday 28 January 2022

5/8 cloud cover, 1 m/s light breeze, no rain, 9 °C

PERSONNEL PRESENT DURING SURVEY

Matt Fisher – Fisher Acoustics

INSTRUMENTATION

Norsonic Type 118 IEC 60651 Type 1 Integrating-Averaging Sound Level Meter (serial no. 31498)

Norsonic Type 140 IEC 60651 Type 1 Integrating-Averaging Sound Level Meters (serial no. 1406387)

Norsonic Type 140 IEC 60651 Type 1 Integrating-Averaging Sound Level Meters (serial no. 1403193)

Norsonic Type 1251 IEC 60942-1997 Class 1 Sound Calibrators (x2) (serial nos. 31971, 27878)

MEASUREMENT METHODOLOGY

Before and after the noise survey the sound level meters were checked calibrated to an accuracy of ± 0.3 dB using the Norsonic Type 1251 Calibrators - no drift in sensitivity was detected. The measurement microphones were installed at the locations identified in this report. All survey measurements were in 'free field' conditions.

Figures 9 to 13 identify the free-field noise levels measured around the Site. Measurement locations are shown in Figure 1 and described below.

- Location 1: At the corner of the proposed school building at a microphone height of 10 metres above the A57(M) slip road.
- Location 1a: Adjacent to the A57 slip road, at the corner of the proposed school building at a microphone height of 13 metres above the A57(M) slip road.
- Location 2: 3.7 metres from the kerb of the A57(M) slip road at a microphone height of 6.0 metres above the A57(m) slip road.
- Location 3: At the east corner of the proposed school building at a microphone height of 1.7 metres above the A57(M) slip road.
- Location 4: 1.2 metres from the kerb of the A57(M) slip road at a microphone height of 1.8 metres above the A57(M) slip road.

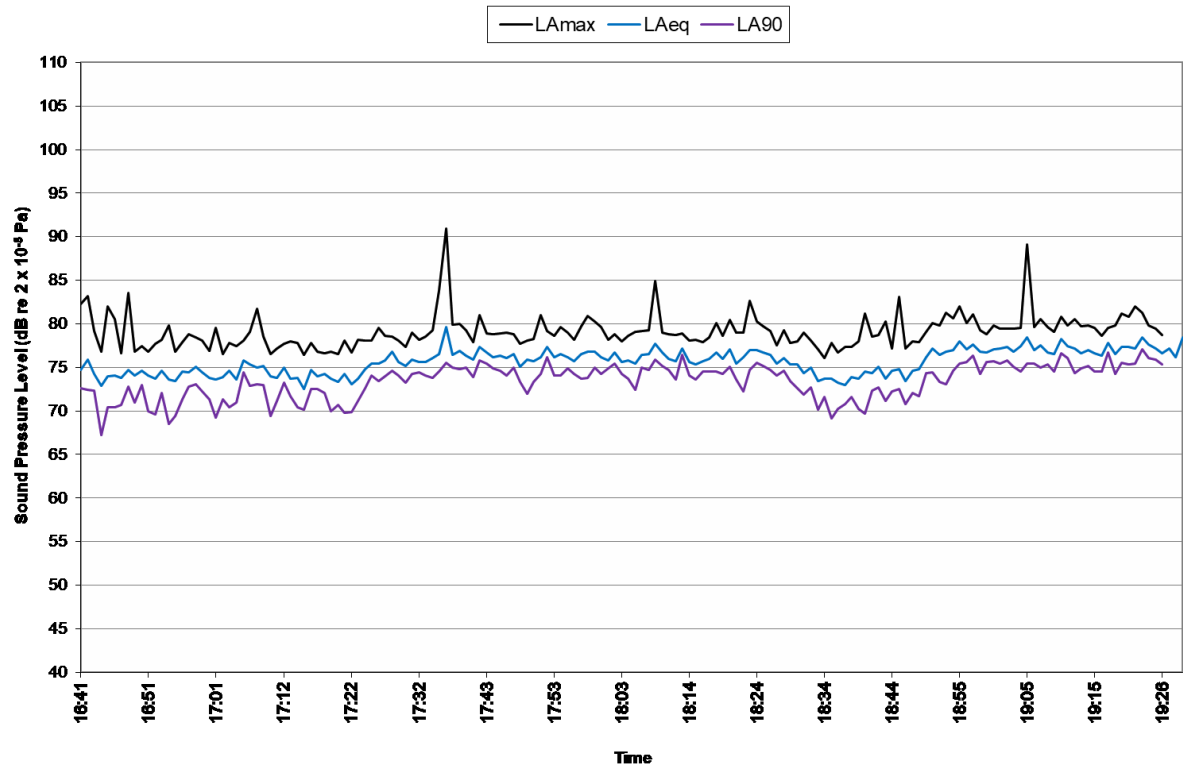


Figure 9: Position 1 noise measurements, Friday 28 January 2022, maximum (LAmx), average (LAeq) and background (LA90) noise levels

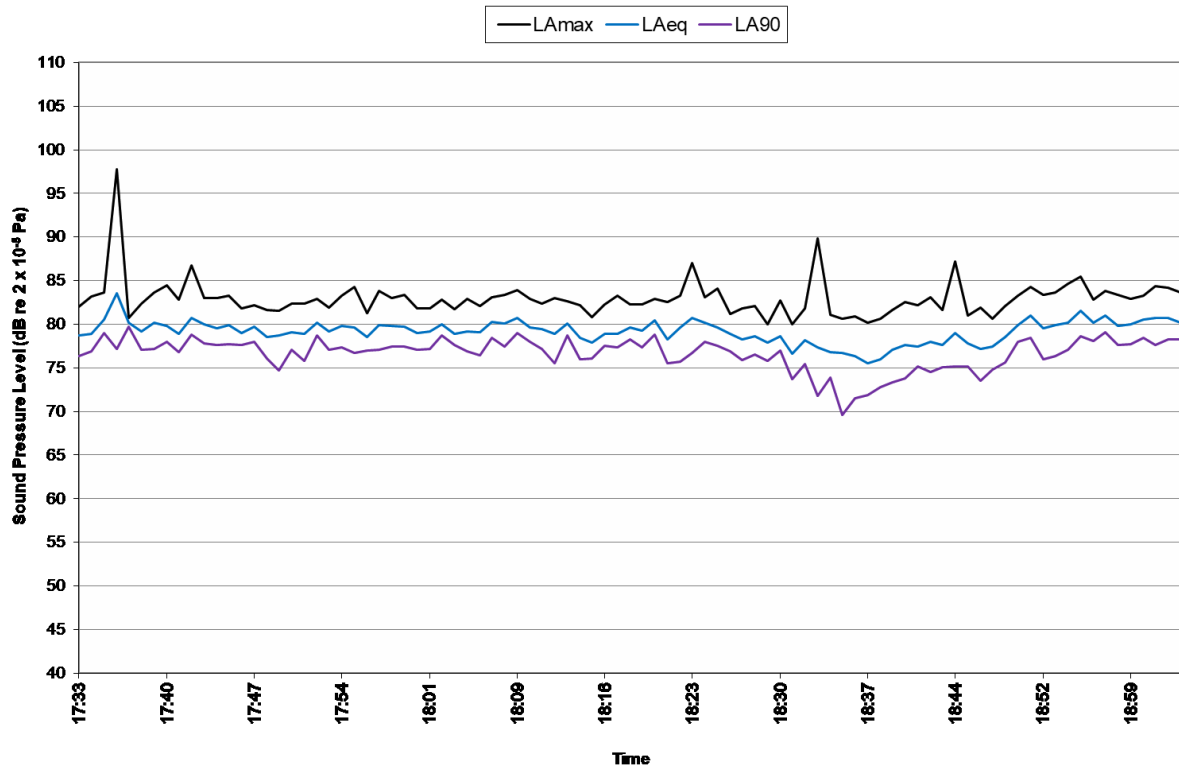


Figure 10: Position 2 noise measurements, Friday 28 January 2022, maximum (LAmix), average (LAeq) and background (LA90) noise levels

Measurement Position	Start Time	Measured Noise Levels, dB			Noise sources
		L _{Aeq}	L _{Amax}	L _{A90}	
1a	19:33	67.7	70.9	65.2	Road traffic (A57 underpass free flowing)
1a	19:34	67.7	69.7	65.6	"
1a	19:35	68.0	69.3	67.2	"
3	19:37	68.8	70.8	64.2	"
4	18:10	78.6	86.5	73.6	"
4	18:11	80.1	86.4	73.9	"
4	18:12	72.2	76.4	70.9	"

Table 11: Summary Statistical Noise Levels, Daytime, 28 January 2022

Measurement Position	Start Time	Noise Level, dB L _{Aeq}	Sound Pressure Level (dB) @ Octave Band Centre Frequency (Hz)						
			63	125	250	500	1k	2k	4k
1a	19:33	67.7	68.6	60.6	59.8	60.7	66.1	58.7	45.3
1a	19:34	67.7	69.1	61.2	60.0	60.9	66.1	58.8	45.6
1a	19:35	68.0	71.4	61.7	61.5	61.4	66.3	59.2	46.7
3	19:37	68.8	71.6	65.0	62.4	62.4	67.1	59.9	46.6
4	18:10	78.6	75.3	71.5	71.6	71.6	76.7	70.7	58.6
4	18:11	80.1	75.0	73.0	73.3	73.7	77.9	72.4	62.1
4	18:12	72.2	71.6	70.4	67.0	65.4	70.3	63.6	51.0

Table 12: Measured Octave Band L_{eq} Noise Levels, Daytime, 28 January 2022