Azymuth Acoustics UK

Professional Acoustic Services

Approved by: Matthew Gibson
Date: 06/05/2021

Noise impact Assessment
Ref: AA0329

Planning for 187 Residential Units in 3 No. Blocks with commercial floorspace

Brunswick Place

Ancoats

Manchester

M40 7EZ



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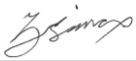
Produced by:		Zachary Simcox	06/05/2021
Checked by:		Dominic McCann	06/05/2021
Approved by:		Matthew Gibson	06/05/2021

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Contents

1.0 Introduction

Azymuth Acoustics UK is appointed by Maryland Securities to provide a Noise Impact Assessment in relation to a proposed residential development situated at the existing Brunswick Mill, Manchester, M40 7EZ. The proposed site is bounded by Bradford Road to the northwest, and by the Ashton Canal, and industrial units to the southeast. Manchester Sports City, and the Etihad Stadium are approximately 1km east of the site.

The development includes the construction of 3 No. Blocks comprising 187 No. residential units, across two new-build residential blocks, and the refurbishment of Brunswick Mill.
Results of the noise survey have been presented, along with the assessment criteria, in order to comply with the appropriate guidance. This noise assessment includes sections covering the following aspects:

- Results on an initial baseline noise survey undertaken at the proposed development.
- The appropriate assessment criteria and guidance relating to noise in the environment as associated with this kind of development.
- An assessment of the appropriate level of protection against noise that is likely to be required as part of the development and an outline set of noise control measures.

2.0 Baseline Noise Survey

2.1 Measurement Procedures

A SvanTek 959 type 1 precision sound level meter, along with a SvanTek 977 were used to undertake the environmental noise survey. The equipment was calibrated before and after the noise measurements. No significant drift in calibration was observed throughout the survey. The sound level meters measured at A-weighted (fast response) noise levels as well as octave bands noise levels for all measurement record.

The attended daytime survey was undertaken between 12:00 and 13:30 on 19th February 2021, and between 10:40 and 12:35 on 3rd March 2021.

The attended night-time survey was undertaken between 23:30 and 00:35 on 2nd/3rd March 2021.

The fixed position noise survey covered a period from 12:00 19th February 2021 to 09:00 22nd February 2021.

The ambient noise measurements were undertaken using the sound level meter microphone at the locations shown in figure 1 below. The sound level meter was positioned at the following measurement locations on the site:

- Position F1: Roof of Brunswick Mill (SvanTek 977)
- Position 1: Brunswick Road East (SvanTek 959)
- Position 2 Brunswick Road West (SvanTek 959)
- Position 3: Ashton Canal tow path West (SvanTek 959)
- Position 4: Ashton Canal tow path East (SvanTek 959)

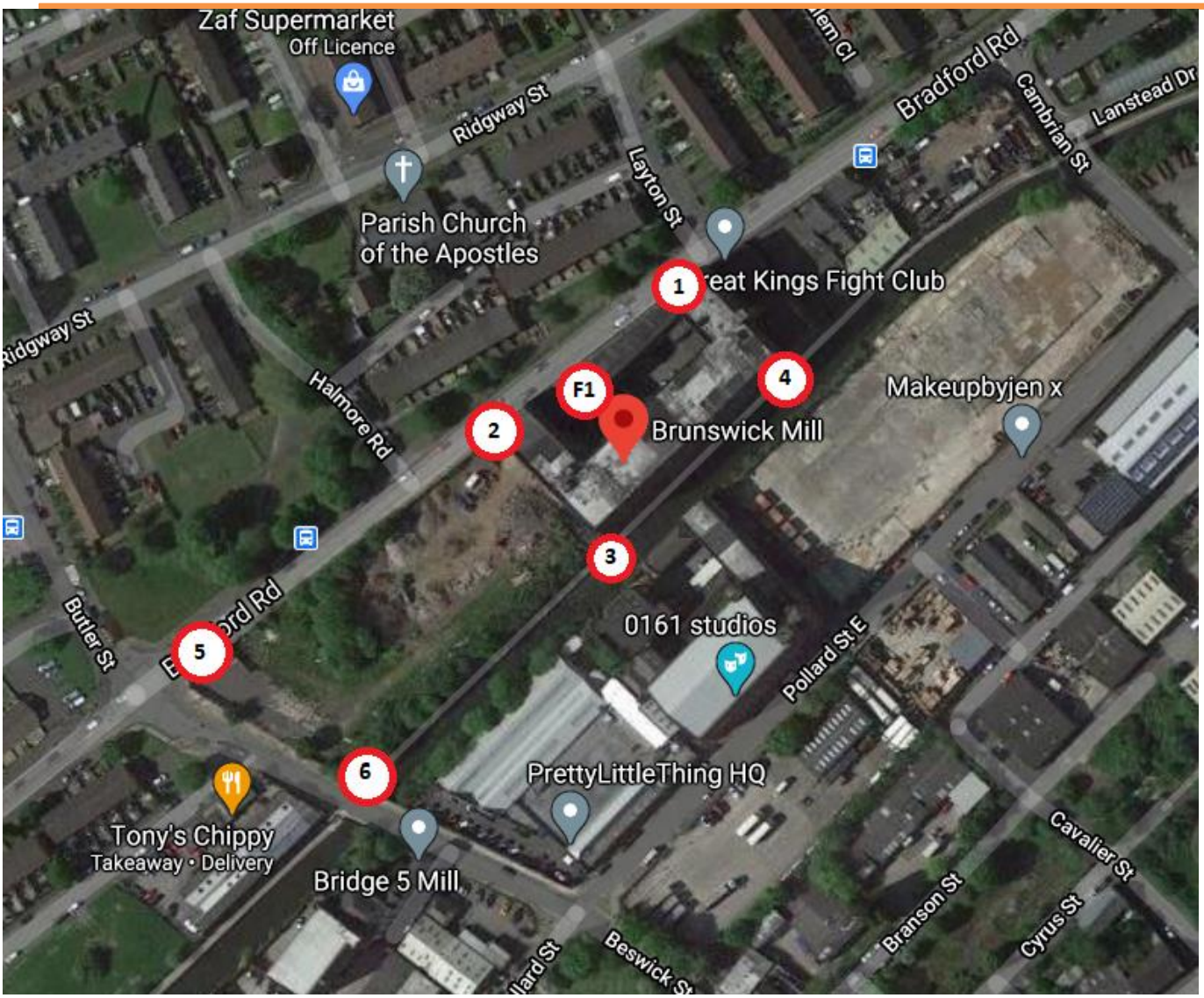


Figure 1: satellite view of site location with noise measurement positions marked in red.

2.2 Results of Noise Measurements

Full results of the noise levels recorded during the course of the survey are included in Appendix B of this report.

The following table summarises the results of the noise measurements undertaken at the proposed site in terms of the average daytime (07:00 to 23:00 hours) and night-time (23:00 to 07:00 hours) statistical noise levels.

Location	Time	L_{Amax}	L_{Amin}	L_{Aeq}	L_{A90}
F1) Roof of Brunswick Mill	Day	85	36	55	48
	Night	77	32	45	39
1) Bradford Road East (SvanTek 959)	Day	96	43	74	61
	Night	86	37	66	43
2) Brunswick Road Mid (SvanTek 959)	Day	90	50	74	57
	Night	88	34	70	42
3): Ashton Canal tow path West (SvanTek 959)	Day	75	40	54	48
	Night	60	39	44	41
4) Ashton Canal tow path East (SvanTek 959)	Day	78	41	46	49
	Night	63	35	40	31
5) Bradford Road / Beswick Street traffic lights	Day	89	47	69	56
	Night	85	38	62	41
6) Beswick Street	Day	87	43	70	51
	Night	85	39	65	41

Table 1: The results of the Azymuth Acoustics noise measurements.

2.3 Description of Noise Climate

The daytime noise climate in the area is dominated by road traffic using Brunswick Road. Noise from the current tenants of Brunswick Mill, such as machinery and extraction fans also contribute to the noise climate during daytime hours.

In addition, noise from birdsong, wind through fauna and pedestrians on the canal towpath, and Brunswick oad were audible.

The night-time noise climate in the area is similar to the daytime noise climate, however, the level of noise gradually reduces over the course of the night. The noise levels in the area were found to increase from 04:00hrs onwards.

Noise levels within the vicinity of the site are typically 55-75 $L_{Aeq,\ 16hr}$ during the daytime and typically 44-63 dB $L_{Aeq,\ 8hr}$ during the night-time. The daytime Background levels across the site are typically 48 - 63 dB L_{A90} falling to a 40 dB L_{A90} during the night-time.

3.0 Assessment Criteria

In order to assess the extent of any measures required in order to comply with suitable conditions relating to potential noise sources, Azymuth Acoustics has reviewed various guidance documents and standards, these include:

- ProPG: Professional Practice Guidance on Planning and Noise (New residential development)
- National Planning Policy Framework (NPPF) 2019
- BS 8233: 2014
- World Health Organisation Guidelines on Community Noise
- BS4142: 2014

3.1 ProPG: Planning and Noise - May 2017

This Professional Practice Guidance on Planning and Noise (ProPG) has been produced to provide practitioners with guidance on a recommended approach to the management of noise within the planning system in England. The National Planning Policy Framework (NPPF) encourages improved standards of design. The CIEH, IOA and the ANC have worked together to produce this guidance which encourages better acoustic design for new residential development and aims to protect people from the harmful effects of noise.

The Professional Practice Guidance on Planning and Noise States 'The recommended approach is intended to give the developer, noise practitioner, and decision maker an early indication of the likely initial suitability of the site for new residential development from a noise perceptive and the extent of acoustic issues that would be faced'. It is important that acoustic design is reviewed at an early stage of the development process.

3.2 National Planning Policy Framework (NPPF) 2019

The NPPF provides guidance to local authorities considering noise in making planning decisions. Paragraph 123 of the National Planning Policy Framework (NPPF) states that planning polices, and decisions should aim to:

- Avoid noise giving rise to significant adverse impacts on health and quality of life as a result of new development.
- Mitigate and reduce to a minimum other adverse impact on health and quality of life arising from noise from new development, including through the use of conditions

The National Planning Policy Framework states that the planning system should 'prevent both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability'.

3.3 British Standard 8233: 2014

BS 8233 provides a code of practice for the sound insulation of a variety of building types affected by general environmental noise. It provides recommendations for control of noise in and around buildings and suggests appropriate internal ambient noise level criteria / limits for a variety of different situations including residential properties.

The following table summarises the noise limits suggested by BS 8233 applying to residential properties:

Activity	Room	Good Design Range $L_{Aeq,T}$ dB	
		07:00-23:00hrs	23:00-07:00hrs
Resting	Living rooms	35	-
Dining	Dining room / area	40	-
Sleeping (daytime resting)	Bedroom (at night)	35	30

Table 3: Noise Limits for Residential Properties Suggested in BS 8233

3.4 W.H.O. Guidelines on Community Noise

In 1980 the World Health Organisation proposed environmental health criteria for community noise including consideration of noise levels at which sleep disturbance may take place. These guidelines were amended by the World Health Organisation in 1999. The guidance suggests that an internal L_{Aeq} below 30dB is required to preserve the restorative process of sleep. This is equivalent to a free-field level of around 42 to 45dB L_{Aeq} or a façade level of 45 to 48dB L_{Aeq}, assuming open windows.

3.5 British Standard 4142:2014

The test that is generally applied to assess the potential for noise from industrial and commercial installations to give rise to community response is contained in British Standard BS 4142: 2014. This standard predicts the likelihood of complaint due to noise from a new or modified source.

BS 4142 describes a method for determining the specific source and background noise levels outside residential buildings and for assessing whether the noise is likely to give rise to complaints from the occupants. The specific noise level from the commercial source is rated based on any tonal or intermittent characteristics of the sound. BS 4142 assessment methodology involves comparing the existing background level with the predicted noise from the new development. This predicted level is adjusted to allow for any tonal or impulsive characteristics and is called the Rating Level. The difference between the two levels can be used to indicate the likelihood of complaints arising, e.g. a predicted level of 10dB greater than the background level indicates a significant adverse impact; an increase of around 5dB indicates an adverse impact and where the rating level does not exceed the background sound level (BSL) this is an indication of the source having a low impact.

In the context of proposed new noise sensitive receptors in the vicinity of industrial sources, the document states that ‘where a new noise-sensitive receptor is introduced and there is extant industrial and / or commercial sound, it ought to be recognized that the industrial and / or commercial sound forms a component of the acoustic environment. In such circumstances other guidance and criteria in addition to or alternative to this standard can also inform the appropriateness of both introducing a new noise-sensitive receptor and the extent of required noise mitigation’.

3.6 Recommended Noise Assessment Criteria

Based on the guidance above it is recommended that the following criteria would be reasonable with the aim of minimising the impact of the environmental noise on the proposed new residential accommodation:

- Daytime noise levels not to exceed 35dB $L_{Aeq,\ 16\ hr}$ in living rooms / bedrooms
- Daytime noise levels not to exceed 40dB $L_{Aeq,\ 16\ hr}$ in dining room / kitchen
- Noise levels in bedrooms not to exceed 35dB $L_{Aeq,\ 16\ hr}$ for daytime periods
- Night-time noise levels in bedrooms not to exceed 30dB $L_{Aeq,\ 8\ hr}$

Table 4, Note 5 of BS 8233:2014 states: ‘If relying on closed windows to meet the guide values, there needs to be an appropriate alternative ventilation that does not compromise the façade insulation or the resulting noise level. If applicable, any room should have adequate ventilation (e.g. trickle ventilators should be open) during assessment.’

4.0 Assessment of Noise Levels

4.1 Assessment of Road Traffic Noise Levels

The results of the Azymuth Acoustics UK noise survey indicates that the daytime noise levels along the Bradford Road Boundary (at 2m from the kerbside) are typically 70-75 dB $L_{Aeq,\ 1\ hour}$ during the daytime and predicted to be 62-63 dB $L_{Aeq,\ 1\ hour}$ during the night-time. In accordance with the ProPG pre-planning guidance, this would be deemed to represent a high noise risk during the daytime and a high noise risk during the night-time. The internal noise limit criteria detailed in Section 3.6 relate to 16-hour daytime and 8-hour night-time average levels. As such, the measured average daytime and night-time noise levels are used to assess the required level of noise reduction from outside to inside new dwellings.

The daytime noise levels on the Ashton Canal boundary of the site have been found to be typically in the range of 55–59 dB $L_{Aeq,\ 16\ hour}$ and predicted to be 40-44 dB $L_{Aeq,\ 8\ hour}$ during the night-time. The noise levels include a modest contribution from traffic on Bradford Road and surrounding local roads. This would normally be deemed to represent a medium noise risk within the ProPG pre-planning guidance.

On the basis of the measured noise levels it is estimated that an overall noise reduction of 34 - 38 dB would normally be required through the façade in order to achieve satisfactory conditions inside across the whole site. These levels of noise are presented in greater detail in Section 5 of the report which identifies the recommended mitigation measures for this scheme.

4.2 Assessment of Potential Noise Levels from Proposed Commercial Premises

At the present time the nature of the commercial premises has not been specified as shops, cafes or bars. However, for the purpose of this noise assessment Azymuth Acoustics UK has considered the following general aspects of the proposed commercial premises:

- Fixed plant associated with the residential and commercial elements of the scheme.
- Noise break-out from the commercial elements of the scheme; worst case noise levels inside the commercial / retail spaces on the ground and 1st floors of the development are assumed to be in the range 75-80 dBA (i.e. typical for café bars and restaurants)
- The glazing for the windows of the commercial units is assumed to have a minimum sound insulation value R_w 36 dB. The resulting noise level @1m outside the commercial units will be 34-37 dBA based on the internal noise level; NB R_w 40 dB is recommended for the glazing in the mitigation measures.

5.0 Recommendations for Noise Mitigation

This section sets out the recommended minimum noise mitigation measures required in order to satisfy the requirements of the noise assessment criteria and ensure satisfactory noise conditions inside and (generally where practical) outside the proposed residential properties.

5.1 Glazing Specifications

All windows on the existing buildings will be replaced with double glazing. The appropriate specifications for the glazing to the new dwellings based on the current proposed layout are summarised in Table 5 and Figure 2 below.

Location (Bedrooms, Living Rooms, Dining Rooms)	Glazing Specifications	Appropriate Glazing Types
Type A (Red): generally elevations and side façades of dwellings facing Bradford Road.	Airborne sound insulation min. R_W 38dB and R_W+C_{tr} 33dB	Acoustically rated double glazing (eg 6mm float glass /16mm argon filled cavity / 10mm laminated glass)
Type B (Yellow): dwellings with elevations predominantly facing inwards and along Ashton Canal.	Airborne sound insulation min. R_W 34dB and R_W+C_{tr} 30dB	Acoustically rated double glazing (eg 6mm float glass /16mm cavity / 10mm float glass)

Table 5: Recommended glazing specifications for new dwellings.

5.2 Ventilation Specifications

The recommended ventilation strategy based on the current proposed layout are summarised in Table 6 and Figure 2 below.

Location (Bedrooms, Living Rooms, Dining Rooms)	Ventilation Specifications	Window slot vent trickle ventilation (where applicable)
Type A (Red): generally elevations and side façades of dwellings facing Bradford Road.	System 4 MVHR mechanical (windows can be opened but MVHR has purge vent for acoustics)	No Trickle Vents Required – MVHR
Type B (Yellow): dwellings with elevations predominantly facing inwards and along Ashton Canal.	System 3 fan assisted enhanced background ventilation Opening windows generally acceptable during hottest days of the year (daytime)	$D_{n,e,w}$ (open) 44 dB

Table 6: Recommended ventilation strategy for new dwellings.

Where mechanical ventilation is required, it should be noted that ProPG allows for opening of windows for the case of purge ventilation, and to allow for the choice of the residents. However, closed windows with mechanical ventilation are required to provide good internal acoustics, with sufficient ventilation, during normal use.

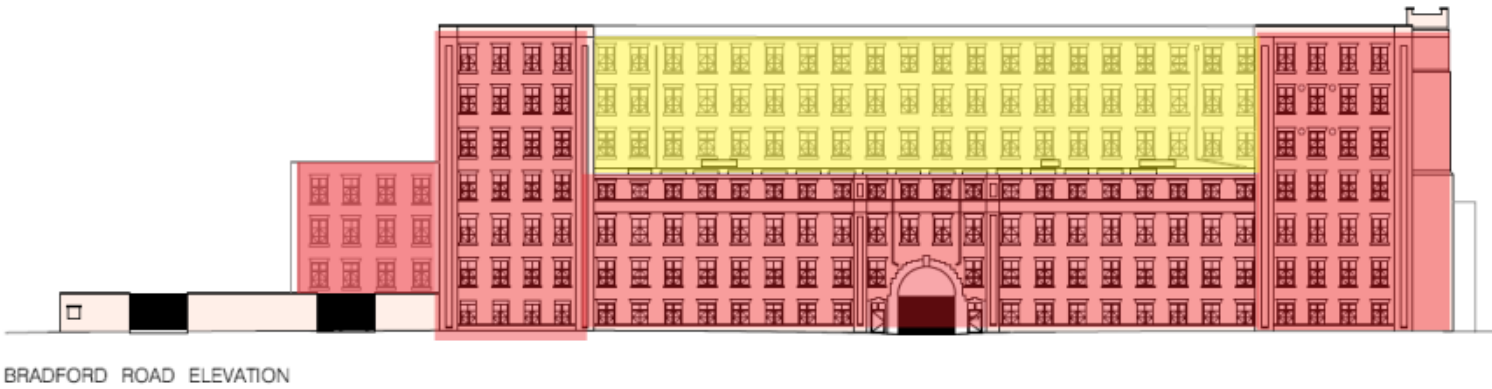


Figure 2a: Brunswick Mill Elevations Primarily facing towards Bradford Road

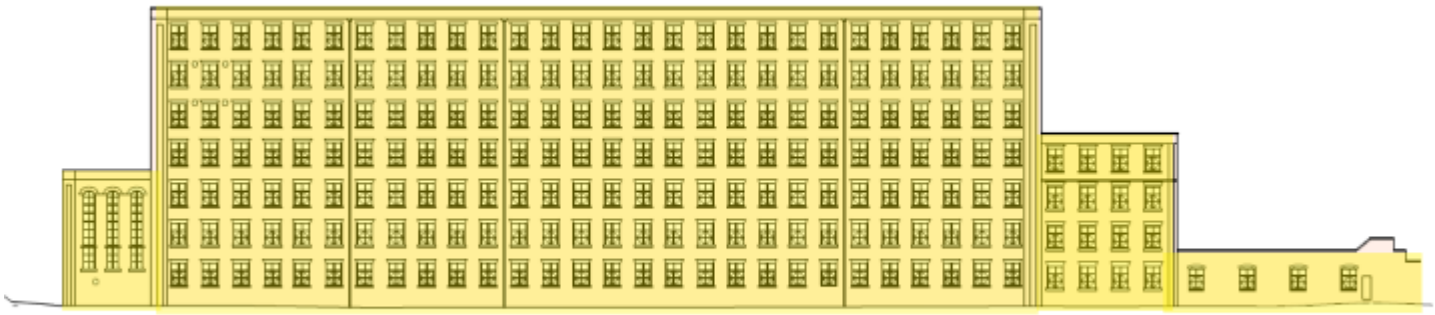


Figure 2b: Brunswick Mill Elevations predominantly facing towards Ashton Canal

Figure 2c: Middle Building Elevations predominantly facing towards Bradford Road

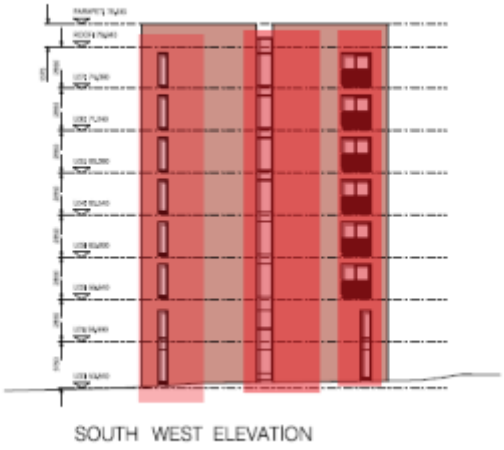


Figure 2d: Middle Building Elevations facing Southwest

Figure 2e: Middle Building Elevations predominantly facing towards Ashton Canal

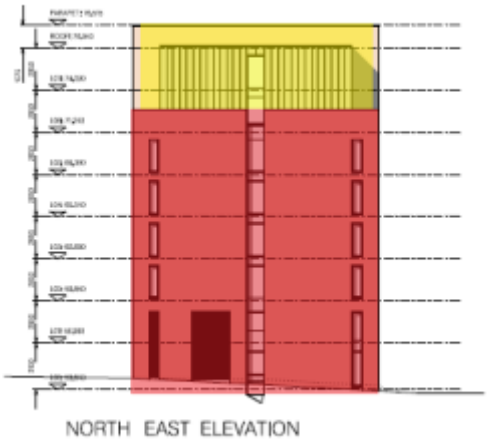


Figure 2f: Middle Building Elevations predominantly facing northeast

Figure 2g: Corner Building Elevations predominantly facing towards Bradford Road

Figure 2h: Corner Building Elevations predominantly facing towards Beswick Street

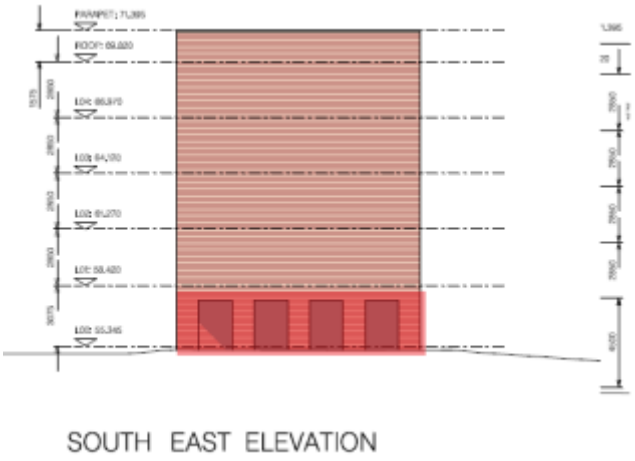


Figure 2i: Corner Building Elevations predominantly facing towards Ashton Canal

Figure 2j: Corner Building Elevations predominantly facing northeast

***Figures 2 (a to j)*. Elevations demonstrating recommended R_W values for different areas of the development**

5.3 Other Elements of Building Envelope

Other elements of the building envelope should have the following minimum sound insulation performance:

- External Walls: minimum sound insulation R_W 52dB. This minimum is likely to be significantly exceeded by a normal brickwork façade. Where alternative external wall types are proposed on habitable areas it will be appropriate to check that they comply with the R_W 52dB target.
- Roof: minimum sound insulation R_W 57dB. This minimum would likely be exceeded by a suitably insulated composite flat roof or concrete roof construction. NB for composite flat roof build-ups a minimum 300mm roof / ceiling zone would be recommended with a minimum 200mm roof void and 100m mineral wool insulation would be recommended over and above the rigid insulation required to provide the required levels of thermal insulation and a surface mass of at least 30kg/m^2 for the roof structure as a whole.

5.4 Noise limits for externally mounted plant / atmosphere connections

The exact location(s) or quantity/type of proposed fixed external plant is unclear at time of writing. Based on the guidance set out above and the results of the noise survey it is recommended that the following criteria represent suitable targets for noise levels emanating from new plant associated with the building Table 5 below lists noise limits for externally mounted plant at various distances. Assuming plant items could be running during both day and night-time periods, internal noise levels in next door or adjacent rooms should not exceed 30dB $L_{Aeq,\ 5min}$ (NR25) or regularly exceed 45dB L_{Amax} for any period. Plant noise level limits are detailed in the following table:

Location	Period	Noise limit $L_{Aeq,T}$
@ 1m from any louver to plant room on ground to 1st floor levels facing out to any elevations of the residential buildings	All	55 dBA
@ 1m from any roof mounted plant directly over-looked by other apartments in the development	All	50 dBA
@ 1m from any roof mounted plant on roof (but not directly overlooked by apartments windows forming part of the scheme)	All	60 dBA

Table 7: Plant noise limits at various distances (dBA)

The noise levels set out above have been developed so as to ensure that noise from any plant associated with the development does not have a significant effect on ambient noise level within other rooms in the development and the wider environment beyond the site perimeter.

5.5 Noise Mitigation for Commercial Unit(s)

The areas of commercial accommodation will have a separating concrete floor slab between residential and the commercial areas.

The minimum sound insulation for the floors between commercial areas and the residential apartments is a field measured airborne sound insulation of D_{nTw} 60dB. Suitable floor constructions for the separating floor should include a minimum surface mass of 450kg/m^2 (equivalent to 200mm dense solid concrete). Alternatively, the floor may be constructed with a suitably specified acoustic barrier ceiling as part of the shell construction, notwithstanding and in addition to any other ceiling finishes that may be provided as part of the fit out. At the present time the separating floor construction is not known, however, it is likely that additional layers such as a floating screed or a plasterboard barrier ceiling are likely to be required to achieve the D_{nTw} 60dB minimum.

It should also be noted that a set of noise limiting clauses are likely to be required as part of any commercial

tenancy agreements with leisure facilities such that a noise level of 30 dB $L_{Aeq,\ 30\ seconds}$ is not exceeded inside the apartments. As previously stated, this is likely to require noise limits in the range 75-80 dBA (inside commercial premises) but this is likely to require a more detailed assessment when the nature of the commercial lease(s) has been identified.

Compliance with the latter condition is likely to require a minimum sound insulation of R_w 40 dB ($R_{w + Ctr}$ 34 dB) for glazing and doors to cafes and/or restaurants within the scheme. Where loud amplified music is likely to be a feature of a proposed tenancy then specialist acoustic design advice is likely to be required in order to comply with local planning guidance.

6.0 Conclusion

Azymuth Acoustics has undertaken a noise impact assessment of the proposed residential development situated at the existing Brunswick Mill, Ancoats, Manchester.

The site is affected by traffic noise using Bradford Road, and other local roads. Noise levels within the vicinity of the site are typically 55-75 dB $L_{Aeq,\ 16hr}$ during the daytime and typically 44-63 dB $L_{Aeq,\ 8hr}$ during the night-time. Noise mitigation measures, through glazing and ventilation design have been considered.

Apartments fronting the Ashton Canal are not deemed to be as sensitive as dwellings along the Bradford Road, and northern and southern façades. The Brunswick Mill facades facing the courtyard are also considered to be less sensitive as direct line of sight of Bradford Road is blocked at all floor levels by the lower block of the mill fronting the road.

As such, the findings of the assessment are that the residential development should be protected by noise mitigation measures including:

- Acoustic double glazing to rooms is required on all elevations. The highest level of sound insulation will be required for habitable rooms with line of sight to Brunswick Road where R_W 38 dB glazing is recommended. Similar / corresponding recommendations have been provided for other elements of the building envelope.

- The proposal will provide mechanical ventilation with heat recovery for the areas requiring the highest levels of noise protection. Elsewhere system 3 ventilation with $D_{n,e,w}$ 44 dB acoustically rated trickle ventilation is recommended.

- Noise limits and sound insulation recommendations for the separating floor between the proposed commercial spaces and the first-floor apartments are dependent on the commercial tenants. A minimum sound reduction of 60 dB $D_{nt,w}$ is recommended, with adequate glazing.

- Noise limits applicable to any externally mounted plant or atmosphere connections / louvres are recommended based on positioning.

    - Louvres / Plant overlooked by residential apartments – 50 dB(A) at 1 m.
    - Louvres / Plant mounted at ground or first floor level – 55 dB(A) at 1 m.
    - Roof mounted Plant – 60 dB(A) at 1 m.

Appendix A – Glossary of Terms

Decibel (dB)
this is the unit used to measure sound. The human ear has an approximately logarithmic response to acoustic pressure over a very large dynamic range (typically 20 micro Pascal to 100 Pascal).

dB (A)
This is a measure of the overall noise level of sound across the audible spectrum with a frequency weighting (i.e. A-weighting) to compensate for the sensitivity of the human ear to sound of different frequencies. The A-weighting curve is implemented in sound level meters using an electronic filter that approximately corresponds to the frequency response of the ear.

Octave Band Noise Level
The human ear is sensitive to sound over a range of frequencies between approximately 20 Hz to 20 kHz. The ear is also generally more sensitive to medium and high frequencies than to low frequencies. In order to define the frequency content of a noise, the spectrum can be divided into frequency bands. The most commonly used frequency bands are octave bands, in which the mid-frequency of each band is twice that of the band below it.

L_{Aeq}
this is the equivalent steady sound level in dB (A) containing the same acoustic energy as the actual fluctuating sound level over a given time period.

Reverberation Time (RT or sometimes T_{30} or T_{60})
This is the time taken for the reverberant sound energy in an enclosure to decay one millionth of its equilibrium value, i.e. by 60 dB, after the source has been switched off, is known as the reverberation time. The reverberation time is frequency dependent and it is customary to measure its value in octave or one-third octave bands. Reverberation occurs when sound waves are repeatedly reflected from each surface of the room.

Sound Reduction Index (SRI)
Difference measured between the amount of energy flowing towards the wall in the source room and the total amount of energy flowing towards the wall in the source room and the total amount of energy entering the receiving room (usual range 100 - 3150 Hz for one third octave band values). The SRI varies with frequency and is measured in a laboratory in either octave or one-third octave bands.

SRI = L1 - L2 + 10 log (S/A)

Where: L1 = Noise level in the source room
L2 = Noise levels in the receiving room
S = Surface area of test specimen
A = Equivalent acoustic absorption area in the receiving room

Weighted Sound Reduction Index (R_w)
this is a weighted single figure descriptor of the sound insulation performance of a partition measured under laboratory conditions. The procedure used to quantify the R_w is to compare the sound reduction index (SRI) in each of the one-third octave bands from 100Hz to 3150Hz against a set of standard reference curves.

Appendix B – Full Tabulation of Noise Survey Results

Start	L_{Amax}	L_{Amin}	L_{Aeq}	L_{A90}
19/02/2021 12:03	79.4	45.8	56	49
19/02/2021 12:18	74.7	46.6	56.8	50.4
19/02/2021 12:33	77.8	47	62.3	51.9
19/02/2021 12:48	74	46.6	61.7	49.6
19/02/2021 13:03	73.4	47.2	61.9	51.3
19/02/2021 13:18	75.3	48.3	64.3	60.2
19/02/2021 13:33	75.2	45.4	65.4	51.5
19/02/2021 13:48	77	47.6	65.1	60.7
19/02/2021 14:03	74.4	47.2	62.6	52
19/02/2021 14:18	75.1	47.7	57.8	51.9
19/02/2021 14:33	73.4	46.2	53.3	49.1
19/02/2021 14:48	75.3	45.8	54.7	49.1
19/02/2021 15:03	76	45.7	55.2	49.5
19/02/2021 15:18	70.5	46.9	54.2	49.8
19/02/2021 15:33	75.8	44.6	56.8	48.2
19/02/2021 15:48	62.4	44.6	52.5	47.4
19/02/2021 16:03	78.6	45.9	54.2	48.8
19/02/2021 16:18	71.2	44.8	52.8	48
19/02/2021 16:33	71.2	45.8	52.8	48.1
19/02/2021 16:48	66.8	45.2	53.1	48.8
19/02/2021 17:03	69.9	44.3	52.8	48.1
19/02/2021 17:18	77.4	45.5	55.3	48.4
19/02/2021 17:33	74.9	44.1	53.1	47

Start	L_{Amax}	L_{Amin}	L_{Aeq}	L_{A90}
19/02/2021 17:48	76.8	45.1	52.8	48.2
19/02/2021 18:03	69.3	44.3	52.9	47.8
19/02/2021 18:18	76	44.5	53.6	48.6
19/02/2021 18:33	75.1	43.8	56.1	48
19/02/2021 18:48	75.3	44.6	56	49.2
19/02/2021 19:03	78.1	44.7	56	49.2
19/02/2021 19:18	74.1	42.8	54.3	47.3
19/02/2021 19:33	76	44.3	53.7	47.1
19/02/2021 19:48	63.8	43	52.4	46.7
19/02/2021 20:03	64.6	43.7	51.5	46.2
19/02/2021 20:18	70.5	42.9	54.4	47.4
19/02/2021 20:33	72.8	42.5	54.1	47.9
19/02/2021 20:48	75.2	41.7	54.4	45.8
19/02/2021 21:03	64	41.7	50.5	45
19/02/2021 21:18	68.5	41.7	50.4	44.8
19/02/2021 21:33	66.4	39.6	48.5	42.8
19/02/2021 21:48	61.7	40.2	47.8	42.7
19/02/2021 22:03	64.7	40.1	48.9	43.4
19/02/2021 22:18	64.2	40.7	49.1	43.7
19/02/2021 22:33	72.9	40.1	50.1	43.3
19/02/2021 22:48	72	39.7	49	42.3
19/02/2021 23:03	70.5	39.6	49.3	42.4
19/02/2021 23:18	67.3	38.1	47	40.4
19/02/2021 23:33	60.6	37.9	46.9	40

Start	L_{Amax}	L_{Amin}	L_{Aeq}	L_{A90}
19/02/2021 23:48	63.5	37.3	45.3	39.1
20/02/2021 00:03	61.4	37.1	44.9	39
20/02/2021 00:18	67.2	36.9	46.4	39
20/02/2021 00:33	59.4	35	43.4	37.2
20/02/2021 00:48	60	36	44.2	38.1
20/02/2021 01:03	59.6	36.4	44.4	38.6
20/02/2021 01:18	60.8	35.4	44	36.9
20/02/2021 01:33	60.4	35.6	43.5	37.3
20/02/2021 01:48	63.9	37	45.3	38.3
20/02/2021 02:03	71.1	36.3	45.4	37.7
20/02/2021 02:18	60.4	37	44.1	38.6
20/02/2021 02:33	59.5	36.8	42.9	38.7
20/02/2021 02:48	60.9	36.4	42.3	38.1
20/02/2021 03:03	61.5	34.6	43.3	36.3
20/02/2021 03:18	60.4	34.4	41.1	35.5
20/02/2021 03:33	64	33.8	41.6	35.3
20/02/2021 03:48	59.8	33.7	40.7	35.6
20/02/2021 04:03	64.7	32.5	43	34.9
20/02/2021 04:18	60.9	32.4	42.7	34.6
20/02/2021 04:33	63.8	33.4	44.1	35.6
20/02/2021 04:48	62.2	33.9	45.4	35.7
20/02/2021 05:03	60.5	34.3	42.6	36.1
20/02/2021 05:18	61.8	34.7	44.9	37.1
20/02/2021 05:33	64.1	35.5	44	37.4

Start	L_{Amax}	L_{Amin}	L_{Aeq}	L_{A90}
20/02/2021 05:48	60.5	35.9	46.6	38.4
20/02/2021 06:03	62.8	36.9	46.2	38.7
20/02/2021 06:18	64.7	36.9	46.2	38.9
20/02/2021 06:33	60.6	36.7	46.9	39.9
20/02/2021 06:48	62.5	37.5	48	41
20/02/2021 07:03	64.7	38.5	48.4	40.8
20/02/2021 07:18	61	38.6	49	41.3
20/02/2021 07:33	65.5	39.4	50	42.4
20/02/2021 07:48	63.2	38.6	49.3	41.7
20/02/2021 08:03	73.8	40	51.5	42.2
20/02/2021 08:18	61.3	40.6	48.9	42.9
20/02/2021 08:33	60.9	39.4	48.8	42.8
20/02/2021 08:48	66	40.1	49.4	42.8
20/02/2021 09:03	66.7	39.3	49.5	42.2
20/02/2021 09:18	63.6	41.8	51.2	46.5
20/02/2021 09:33	76.2	45.2	52.4	46.9
20/02/2021 09:48	66	44.9	51.6	46.9
20/02/2021 10:03	72.4	44.9	51.7	46.9
20/02/2021 10:18	68.7	45.5	52.8	47.5
20/02/2021 10:33	72.4	45.1	52.9	47.3
20/02/2021 10:48	75.8	46.8	55	49.5
20/02/2021 11:03	72.8	45.4	53.6	48.2
20/02/2021 11:18	66.9	46.8	55.5	49.9
20/02/2021 11:33	72	45.7	55.4	49.8

Start	L_{Amax}	L_{Amin}	L_{Aeq}	L_{A90}
20/02/2021 11:48	70.6	45.5	52.6	47.8
20/02/2021 12:03	71.1	45.5	53.1	48
20/02/2021 12:18	62.3	45.7	52.5	48.2
20/02/2021 12:33	62	45.7	52.5	48
20/02/2021 12:48	72.2	44.2	52.9	48
20/02/2021 13:03	64.3	43	52.1	46.5
20/02/2021 13:18	64.6	42.4	52.4	46.7
20/02/2021 13:33	66.6	43.7	53.1	48
20/02/2021 13:48	69.7	45.2	53.8	49.1
20/02/2021 14:03	73.1	44.9	53.1	48.3
20/02/2021 14:18	74.4	44.9	53.9	47.7
20/02/2021 14:33	82.5	44.2	55.1	48
20/02/2021 14:48	63.9	44.4	52.3	48.2
20/02/2021 15:03	63.4	44.2	52	47.5
20/02/2021 15:18	64.2	44.9	52.5	48.4
20/02/2021 15:33	68	45.6	52.7	48.6
20/02/2021 15:48	65.2	44.4	52.4	47.8
20/02/2021 16:03	67.1	43.8	52.5	48
20/02/2021 16:18	63.7	45.3	52.2	48.3
20/02/2021 16:33	66.2	44.7	52.7	47.7
20/02/2021 16:48	66.7	43.7	52.1	47.5
20/02/2021 17:03	65.8	43.9	51.7	46.6
20/02/2021 17:18	85.3	43.8	55.2	47.9
20/02/2021 17:33	63.4	43.8	50.9	46.5

Start	L_{Amax}	L_{Amin}	L_{Aeq}	L_{A90}
20/02/2021 17:48	68.3	44.8	51.5	47.3
20/02/2021 18:03	70.4	44.6	51.6	47.3
20/02/2021 18:18	70.3	43.7	51.4	47.2
20/02/2021 18:33	70	45	52.9	47
20/02/2021 18:48	70	45.5	53.3	47.8
20/02/2021 19:03	71.8	44.1	52.8	47.2
20/02/2021 19:18	67.6	45.8	53.4	48.5
20/02/2021 19:33	74.5	44.6	52.4	47.3
20/02/2021 19:48	63.5	43.4	51	47
20/02/2021 20:03	65	43.8	51.5	46.5
20/02/2021 20:18	68.3	42	50.9	45.2
20/02/2021 20:33	67.6	43.4	51.7	47
20/02/2021 20:48	66	42.3	51.8	47.9
20/02/2021 21:03	61	43	51.5	46.7
20/02/2021 21:18	73.8	42.2	51.2	45.5
20/02/2021 21:33	65.8	41.6	49.2	44.5
20/02/2021 21:48	61.2	40.7	48.9	43.9
20/02/2021 22:03	67.5	40.2	48.4	42.6
20/02/2021 22:18	64.3	40.2	47.2	41.7
20/02/2021 22:33	61.5	39	47.4	41.4
20/02/2021 22:48	68.4	38.4	48.5	42.3
20/02/2021 23:03	63.2	38.6	47.9	41
20/02/2021 23:18	67.5	38.4	49.3	41.5
20/02/2021 23:33	61.4	38.8	44.5	40.2

Start	L_{Amax}	L_{Amin}	L_{Aeq}	L_{A90}
20/02/2021 23:48	59.1	38.6	45	40.9
21/02/2021 00:03	55.2	37	43.9	39.2
21/02/2021 00:18	54.2	36	42.6	37.8
21/02/2021 00:33	53.8	35.7	42.9	37.8
21/02/2021 00:48	53.7	36.1	42.7	37.4
21/02/2021 01:03	53	34.3	40	35.7
21/02/2021 01:18	53.5	34.5	40.6	36.1
21/02/2021 01:33	63.9	35.1	41.9	36.7
21/02/2021 01:48	53.2	34.7	41	36.3
21/02/2021 02:03	52.5	34.7	39.6	36.1
21/02/2021 02:18	57.7	34	39.8	35.9
21/02/2021 02:33	55.3	33.9	39.8	35.5
21/02/2021 02:48	53.2	34.3	39.3	35.5
21/02/2021 03:03	55.3	33.6	39.8	35.3
21/02/2021 03:18	50	33.7	39.9	35.8
21/02/2021 03:33	67.3	33.4	43.1	35.3
21/02/2021 03:48	60	33.5	39.7	35
21/02/2021 04:03	53.3	33.1	40.4	34.7
21/02/2021 04:18	55.9	33.3	43.5	35.1
21/02/2021 04:33	56.1	33.5	42.7	35
21/02/2021 04:48	57.4	33.3	43.5	35.1
21/02/2021 05:03	59.8	32.8	44	34.9
21/02/2021 05:18	54.7	32.7	42.4	34.9
21/02/2021 05:33	57.1	33.7	42.1	35.3

Start	L_{Amax}	L_{Amin}	L_{Aeq}	L_{A90}
21/02/2021 05:48	56.9	34.6	44.5	36.7
21/02/2021 06:03	55.1	34.4	43.5	37.2
21/02/2021 06:18	57.5	34.7	42.8	36.9
21/02/2021 06:33	52.4	35.9	43.4	38
21/02/2021 06:48	57.1	36.3	44.6	39.1
21/02/2021 07:03	58.6	38.2	46.6	41.3
21/02/2021 07:18	62.7	37.8	47	40.1
21/02/2021 07:33	67.3	36.7	46.4	39.7
21/02/2021 07:48	57.5	37	45.8	39.8
21/02/2021 08:03	75.3	38.2	50.9	41.2
21/02/2021 08:18	65.2	37.4	47.7	40.7
21/02/2021 08:33	60.4	38.2	47.8	41
21/02/2021 08:48	68	37.7	48.7	41
21/02/2021 09:03	68.8	36	48.6	40.2
21/02/2021 09:18	69.1	35.6	47.3	38.8
21/02/2021 09:33	64.8	36.4	47.1	39.6
21/02/2021 09:48	63.4	36.6	47.6	39.6
21/02/2021 10:03	67.9	35.9	49.5	40.4
21/02/2021 10:18	63.4	36.8	49	40.2
21/02/2021 10:33	79.5	37.4	52.6	41.3
21/02/2021 10:48	62.7	38.3	48.8	41.8
21/02/2021 11:03	63	37.5	48.8	41.3
21/02/2021 11:18	70.4	39.1	50.2	42.7
21/02/2021 11:33	66.3	37.9	49.6	42

Start	L_{Amax}	L_{Amin}	L_{Aeq}	L_{A90}
21/02/2021 11:48	70.1	37.7	50.4	43.9
21/02/2021 12:03	77.2	40.1	56.1	44.9
21/02/2021 12:18	78.8	40.4	53.8	44.8
21/02/2021 12:33	76.6	39.9	52.6	45
21/02/2021 12:48	74.3	40	53	45.2
21/02/2021 13:03	76.8	42	57	45.9
21/02/2021 13:18	69.8	40	52.4	43.6
21/02/2021 13:33	74.7	40.6	55.9	44.7
21/02/2021 13:48	72.1	39.7	51.9	44.4
21/02/2021 14:03	72.6	42.7	56.1	46.8
21/02/2021 14:18	72.1	40.9	51.9	44.2
21/02/2021 14:33	71.9	40.8	50.6	44.8
21/02/2021 14:48	73.2	42.9	51.6	46.3
21/02/2021 15:03	72.6	42.9	52.9	47.2
21/02/2021 15:18	74.3	41.3	55.9	46.4
21/02/2021 15:33	83.8	43.7	54.3	48.2
21/02/2021 15:48	64.2	44.3	52.8	48.1
21/02/2021 16:03	81.8	45.5	53.7	48.1
21/02/2021 16:18	72	44.4	53.4	47.2
21/02/2021 16:33	74.3	42.4	56.9	46.7
21/02/2021 16:48	66	44.9	53.2	48.3
21/02/2021 17:03	68.5	41.9	53.4	47.1
21/02/2021 17:18	76.2	42.3	57.3	47
21/02/2021 17:33	75.5	42.7	52.7	46.2

Start	L_{Amax}	L_{Amin}	L_{Aeq}	L_{A90}
21/02/2021 17:48	71.9	40.7	55.5	45.8
21/02/2021 18:03	72.7	41.2	55.8	45.4
21/02/2021 18:18	66.9	44.5	58.6	53.6
21/02/2021 18:33	70.9	40.5	56.7	45.9
21/02/2021 18:48	65.9	40.5	57.1	46.9
21/02/2021 19:03	69	39	57.2	47.4
21/02/2021 19:18	65	45.2	57.1	49.5
21/02/2021 19:33	64.5	38.3	55.7	43.8
21/02/2021 19:48	63.7	38.4	53	42.2
21/02/2021 20:03	63.6	38.3	54.5	42.1
21/02/2021 20:18	64.5	37.6	56.8	46.5
21/02/2021 20:33	65.6	38.5	49.6	41.8
21/02/2021 20:48	68.1	39.1	48.5	42
21/02/2021 21:03	63	38.7	48.4	42
21/02/2021 21:18	60.5	38	48.1	40.9
21/02/2021 21:33	62.4	37.9	47.6	40.8
21/02/2021 21:48	59.9	36.7	47	39.7
21/02/2021 22:03	61.4	36	46.7	39.5
21/02/2021 22:18	65.5	36.5	49	39.6
21/02/2021 22:33	65.8	38.1	49.2	40.2
21/02/2021 22:48	59.4	36.7	45.8	39
21/02/2021 23:03	60.4	36.4	44.9	38.2
21/02/2021 23:18	76.7	39.2	49.2	41.4
21/02/2021 23:33	61	38.5	46.2	41.2

Start	L_{Amax}	L_{Amin}	L_{Aeq}	L_{A90}
21/02/2021 23:48	63.2	36.5	45.2	38.8
22/02/2021 00:03	65.4	36.8	45.6	39.2
22/02/2021 00:18	60.4	36.2	44.7	38.2
22/02/2021 00:33	65.4	37.4	45.5	39.2
22/02/2021 00:48	71.6	37	47.3	39.1
22/02/2021 01:03	69.8	36.6	46.7	39.1
22/02/2021 01:18	60.4	35.8	44.2	38.2
22/02/2021 01:33	61.8	36	43.8	37.6
22/02/2021 01:48	64.4	35.6	43.7	37.6
22/02/2021 02:03	58.4	36.4	41.9	37.7
22/02/2021 02:18	67.7	36.4	44.3	37.6
22/02/2021 02:33	56.5	33.5	40.6	36.1
22/02/2021 02:48	62	33.3	42.6	35.4
22/02/2021 03:03	60.9	34.7	42.6	36
22/02/2021 03:18	59	34.8	41.2	36.2
22/02/2021 03:33	59.4	35	42.7	36.9
22/02/2021 03:48	58.6	34.9	43.5	36.8
22/02/2021 04:03	58.8	35.9	45.6	37.9
22/02/2021 04:18	63.5	35.6	44.8	38
22/02/2021 04:33	60.7	37.9	45.9	40.2
22/02/2021 04:48	63.2	39.2	46.8	41.8
22/02/2021 05:03	60	39.8	45.6	41.9
22/02/2021 05:18	63.4	40.5	46.7	42.4
22/02/2021 05:33	62.8	41.1	48.6	43.1

Start	L_{Amax}	L_{Amin}	L_{Aeq}	L_{A90}
22/02/2021 05:48	64.4	43	49	44.4
22/02/2021 06:03	62.5	43.2	49.7	44.7
22/02/2021 06:18	63.1	42.7	50.3	44.9
22/02/2021 06:33	65.6	44.4	51.7	46.4
22/02/2021 06:48	65.9	45.7	53	48.2
22/02/2021 07:03	62.6	45	52.9	48.7
22/02/2021 07:18	67.2	45	55	49.5
22/02/2021 07:33	70.3	51	56.2	53.3
22/02/2021 07:48	64	50.9	55.8	53
22/02/2021 08:03	71.5	50.5	56.4	53.2
22/02/2021 08:18	70.5	51.1	56.4	53.2
22/02/2021 08:33	66.5	51.5	56.5	53.9
22/02/2021 08:46	63.5	51.2	56.1	53.4

Table A: Results of Azymuth Acoustics fixed position noise survey.

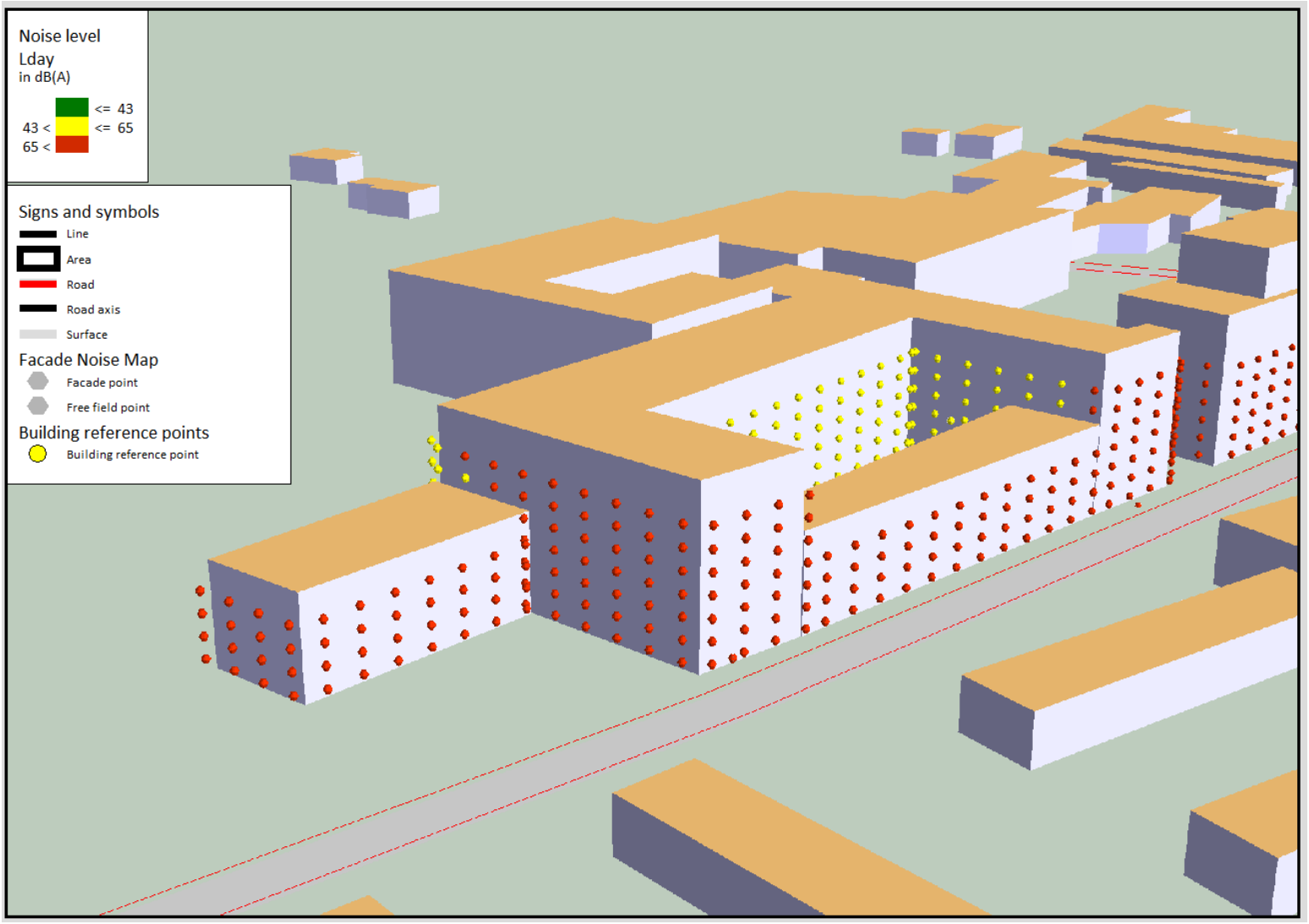
Start	Position	Time	L_{Amax}	L_{min}	L_{Aeq}	L_{A10}	L_{A50}	L_{A90}
Daytime 19th February 2021								
19/02/2021 12:03	1	00:05:00	91.3	75.1	83.1	78.9	71.5	61.3
19/02/2021 12:08	1	00:05:00	86.9	75.6	83.8	79.4	72.6	64.2
19/02/2021 12:13	1	00:04:32	86.7	74.6	84.1	78.3	71.2	62.7
19/02/2021 12:19	2	00:05:00	89.9	74.3	83.5	78.7	68.6	54.9
19/02/2021 12:24	2	00:05:00	85.5	74.4	82.1	78.7	70.8	58.8
19/02/2021 12:27	2	00:02:44	90.4	73.9	81.8	77.9	69.1	54.3
19/02/2021 12:36	3	00:05:00	75.2	57.1	69.6	57.8	51	48.7
19/02/2021 12:41	3	00:05:00	63.9	51.1	58.4	52.7	50.1	48.2
19/02/2021 12:43	3	00:01:47	73.8	54.9	66	55.3	51.4	49.3

Start	Position	Time	L_{Amax}	L_{min}	L_{Aeq}	L_{A10}	L_{A50}	L_{A90}
19/02/2021 12:49	4	00:05:00	77.9	59.4	70.4	62.2	54.2	51.7
19/02/2021 12:54	4	00:05:00	74.7	58.8	69.5	61.9	54.4	51.3
19/02/2021 12:57	4	00:02:15	72.2	57.5	68.6	59.9	53.4	51.2
Daytime 3rd March 2021								
03/03/2021 12:07	1	00:05:00	84.3	43.4	70.8	75.1	64.7	53.5
03/03/2021 12:12	1	00:05:00	96.4	52.9	74	77.1	68.9	58.1
03/03/2021 12:17	1	00:05:00	85.4	53.9	73.7	77.7	69.4	60.2
03/03/2021 11:52	2	00:05:00	89.3	50.4	73.8	76.7	69.5	59.3
03/03/2021 11:57	2	00:05:00	85.6	52.2	72.9	77.2	68.6	58.4
03/03/2021 10:58	3	00:05:00	72.9	45.2	51.5	49	47	46
03/03/2021 11:06	3	00:05:00	66.3	39.6	50.3	51.5	48.8	43.4
03/03/2021 10:41	4	00:05:00	63.9	40.5	46.7	48.5	43.6	41.7
03/03/2021 10:46	4	00:05:00	56.8	40.7	44.2	45.9	43.7	41.8
03/03/2021 10:51	4	00:05:00	70.6	40.9	50.7	49	43.8	42
03/03/2021 11:35	5	00:05:00	78.6	47.3	65.7	69.8	62	53.8
03/03/2021 11:40	5	00:05:00	89	52.9	71	73.1	65.5	59
03/03/2021 11:45	5	00:05:00	81.1	48.4	67.3	71.5	63	54.1
03/03/2021 11:17	6	00:05:00	87.2	43.1	70.2	74.4	60.6	49.4
03/03/2021 11:22	6	00:05:00	85.3	44.1	69.8	73.9	60.6	51
03/03/2021 11:27	6	00:05:00	83.4	46.6	68.7	72.7	62	51
Night-time 2nd / 3rd March 2021								
02/03/2021 23:28	1	00:05:00	84.2	37.9	65.9	67	51.7	40
02/03/2021 23:33	1	00:05:00	86	37.4	67	68.9	55.4	44
02/03/2021 23:38	1	00:05:00	82.7	40.1	66.3	68.6	53.1	43.6
02/03/2021 23:45	2	00:05:00	84.3	34.3	67.8	71.3	44.8	35.8

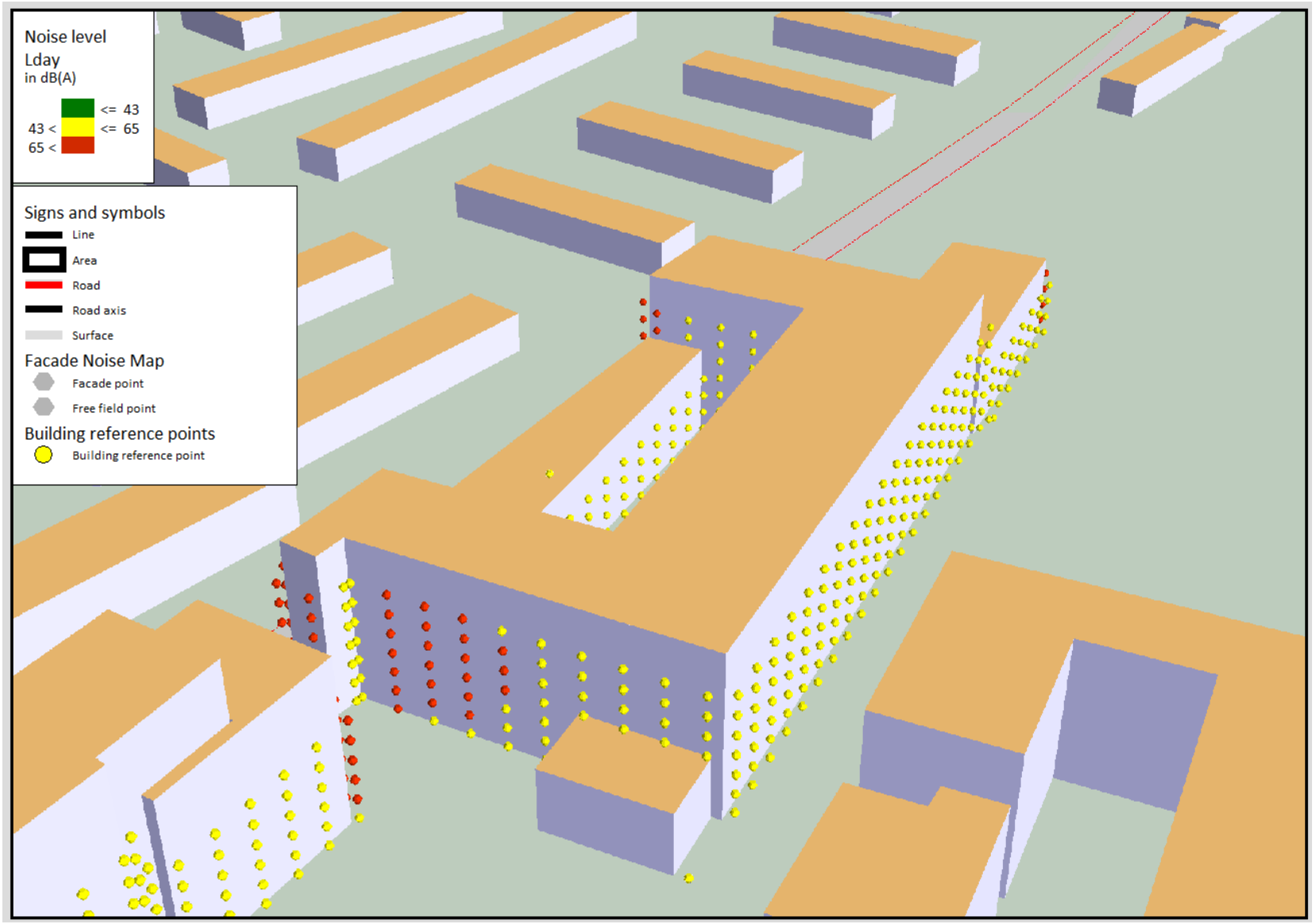
Start	Position	Time	L_{Amax}	L_{min}	L_{Aeq}	L_{A10}	L_{A50}	L_{A90}
02/03/2021 23:50	2	00:05:00	95.1	36.7	70.9	71	51.8	42.7
02/03/2021 23:55	2	00:05:00	88.3	39.5	71	73.3	58.8	43.4
03/03/2021 00:37	3	00:05:00	55.4	39.4	43.6	45.5	42.7	40.6
03/03/2021 00:42	3	00:05:00	59.7	39.1	43.9	45.3	42.9	40.7
03/03/2021 00:48	4	00:05:00	62.9	35.4	40.8	42.4	38	36.6
03/03/2021 00:52	4	00:05:00	51	35	39	40.8	38.2	36.4
03/03/2021 00:03	5	00:05:00	79.6	37.7	58.6	59.6	45.7	39.2
03/03/2021 00:08	5	00:05:00	84.9	38.3	65.9	68.7	57	42.3
03/03/2021 00:12	5	00:05:00	73.9	39.1	58.3	62.5	51.8	41.7
03/03/2021 00:19	6	00:05:00	85.2	39.4	65.8	63.3	43.9	40.8
03/03/2021 00:24	6	00:05:00	84.7	38.8	66	66	46.6	41.2
03/03/2021 00:28	6	00:05:00	78	39.7	61.2	62.2	46.4	41.4

Table 6: Results of attended Azymuth Acoustics noise surveys.

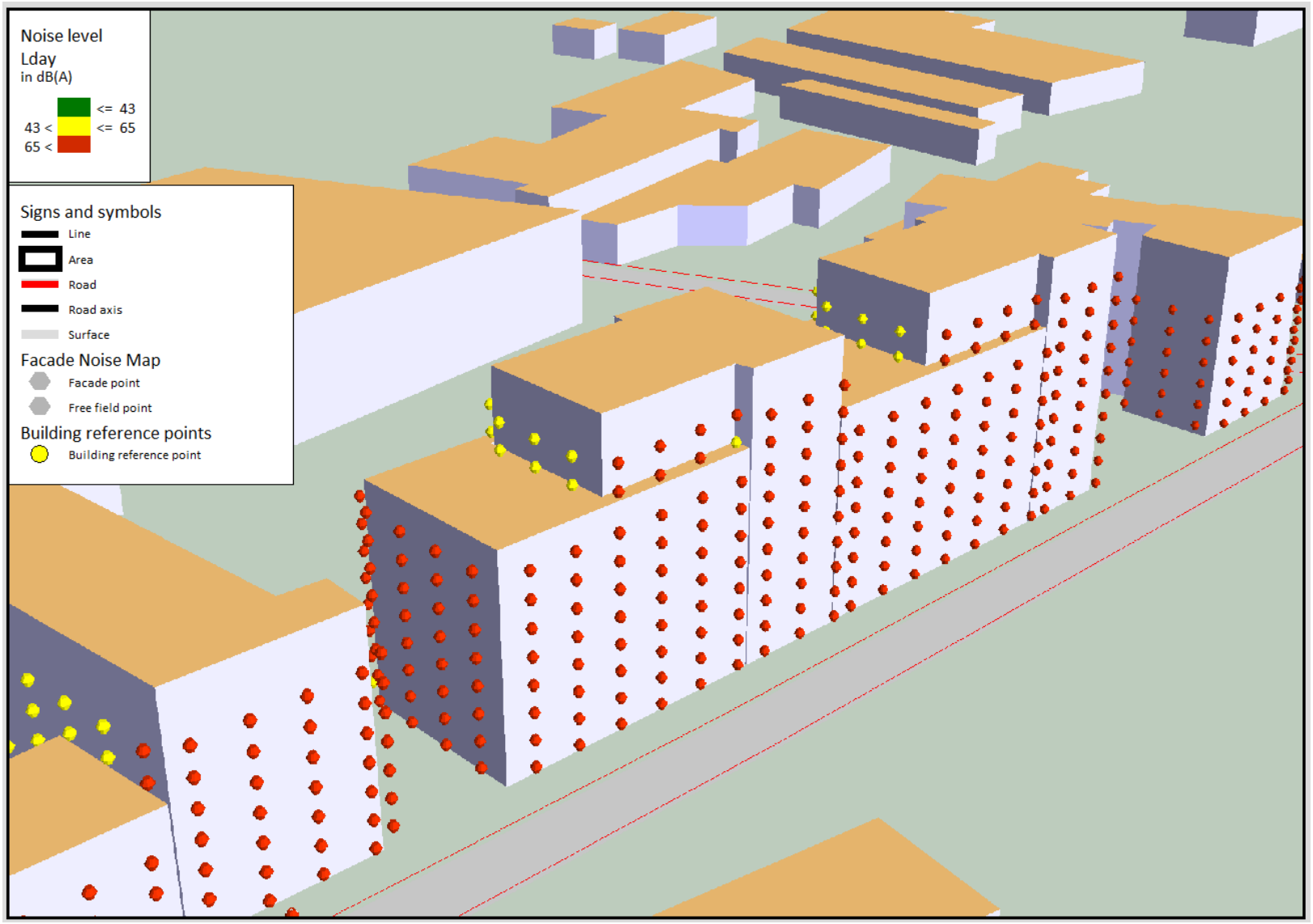
Appendix C –SoundPLAN Glazing Specification Recommendations



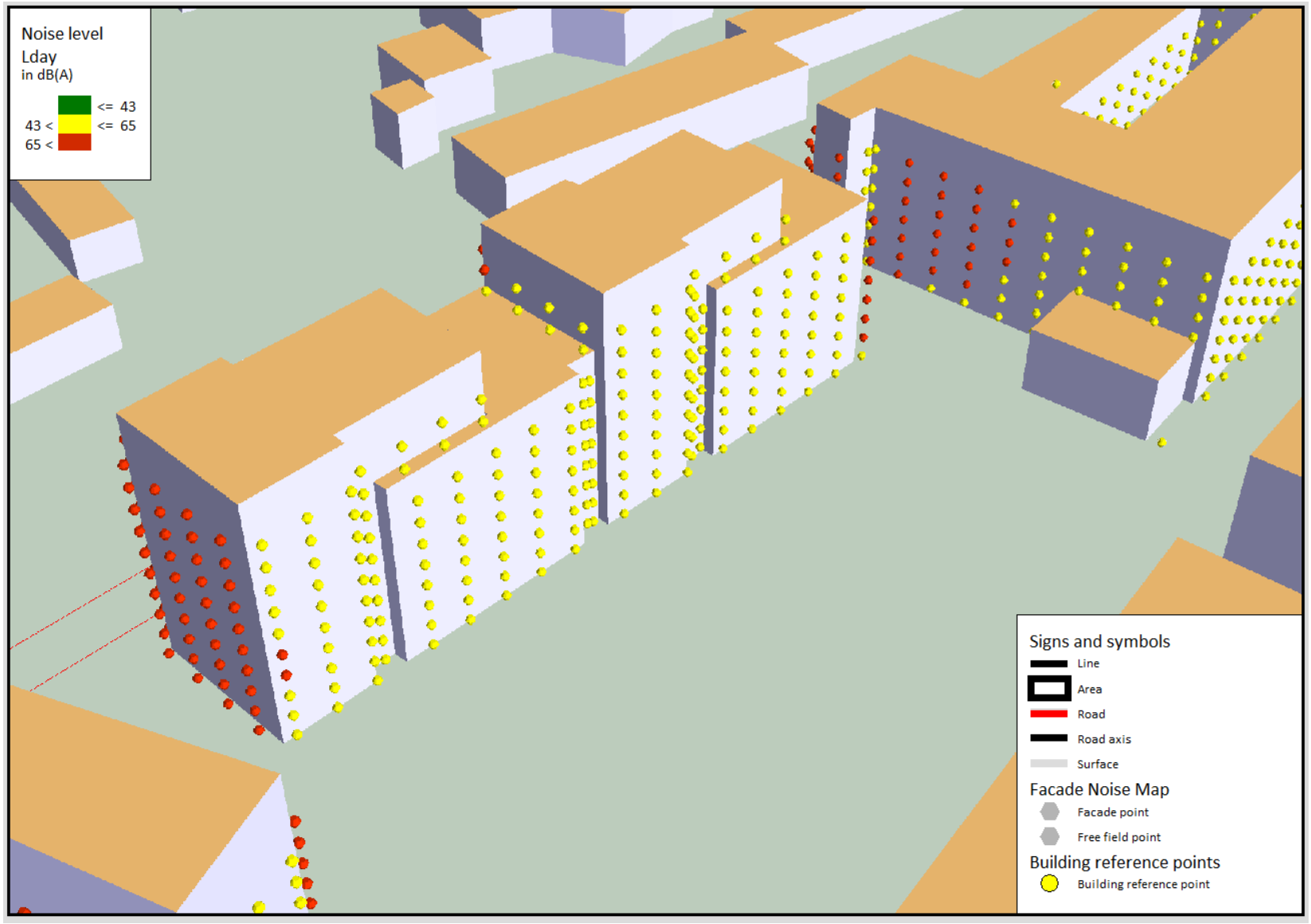
Brunswick Mill – Bradford Road Elevation



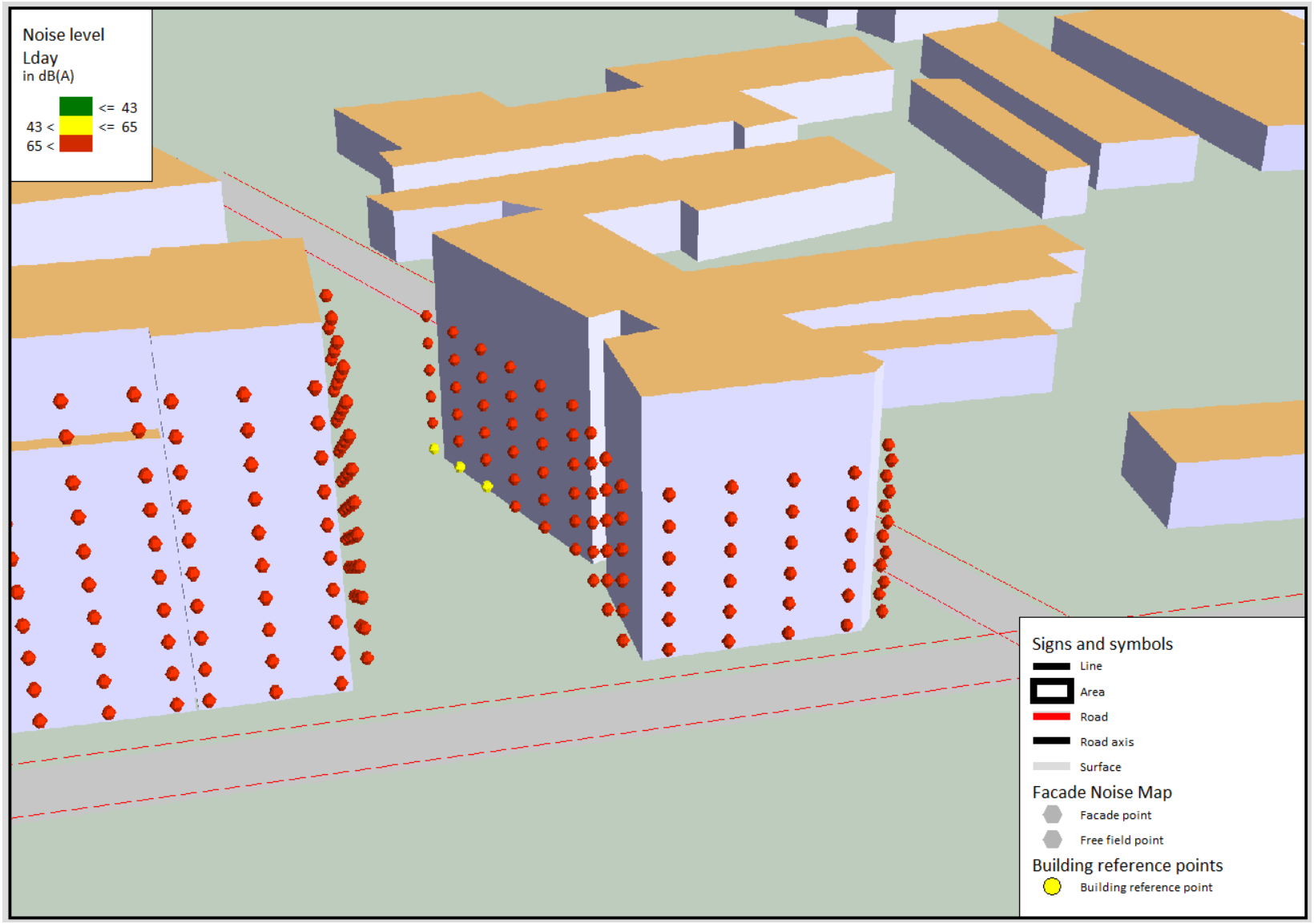
Brunswick Mill – Canal Elevation



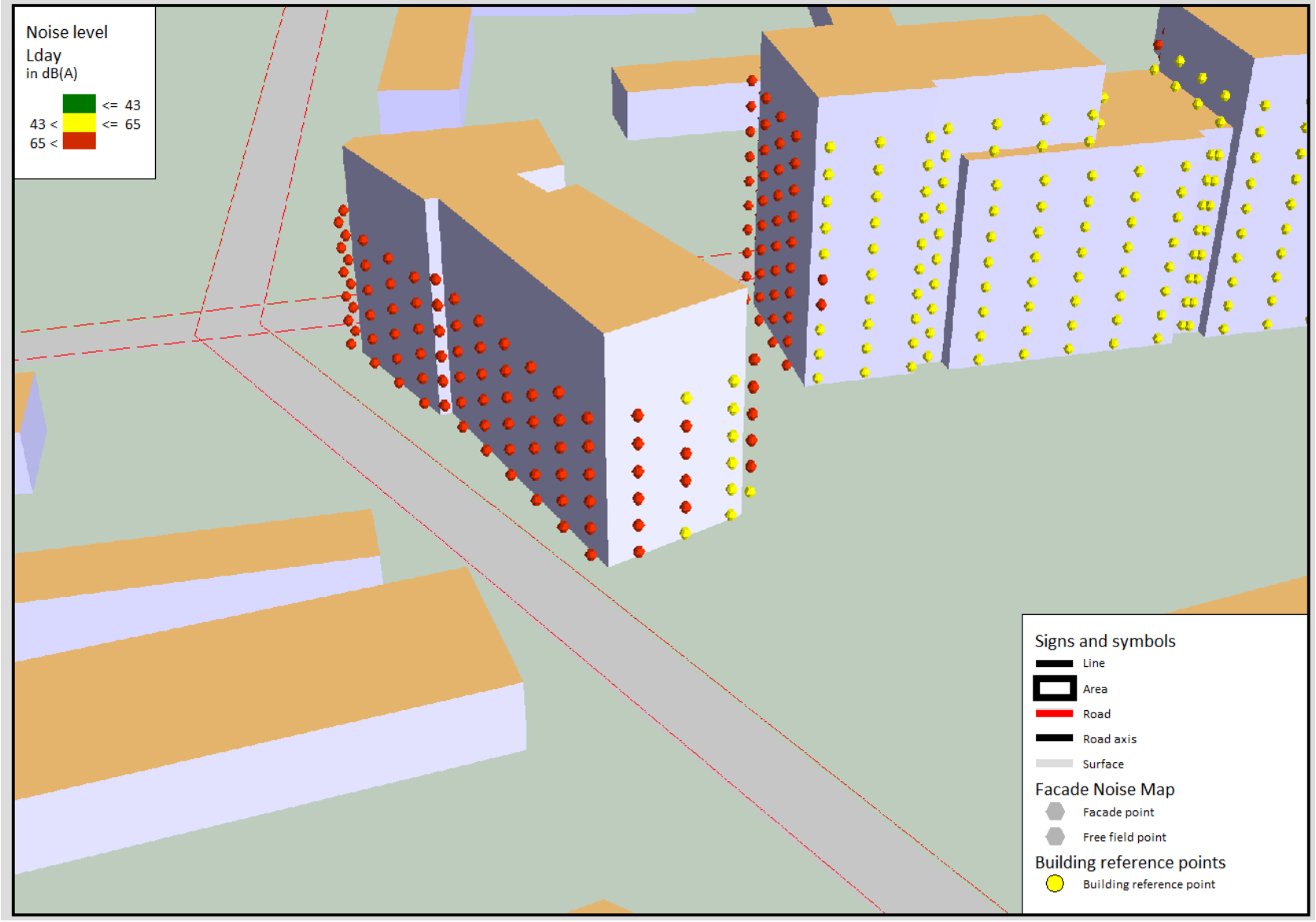
Middle Building – Bradford Road Elevation



Middle Building – Canal Elevation



Corner Building – Bradford Road Elevation



Corner Building – Canal Elevation