

2&3 Angel Square (NOMA Plots 2&3), Manchester

Planning Report - Acoustics

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Glossary

Term	Definition
Decibel, dB	Standardised (SI) unit used for the measurement and assessment of the intensity (or power) of sound levels. Abbreviation: "dB". This is the level derived from the logarithm of the ratio between the value of a quantity and a reference value. For sound pressure levels (L_p) the reference quantity is 2×10^{-5} N/m ² . The sound pressure level existing when measured at a microphone of pressure; 2×10^{-5} N/m ² is 0 dB, which approximates to the threshold of hearing.
Frequency	Number of cycles per second, measured in Hertz (Hz), related to sound pitch.
L_p - sound pressure level	Sound pressure level, in decibels, of a sound is 20 times the logarithm to the base of 10 of the ratio of the sound pressure to the reference pressure. The reference pressure shall be explicitly stated and is defined by standard.
Frequency Weightings (as defined in IEC 61672:2003):	A-Weighting: Frequency weighting devised to attempt to take into account the fact that human response to sound is not equally sensitive to all frequencies; it consists of an electronic filter in a sound level meter, which attempts to build in this variability into the indicated noise level reading so that it will correlate, approximately, with human response.). C-Weighting: One of the frequency weightings corresponding to the 100-phon contour and the closest to the linear or un-weighted value.
L_{eq} (& L_{Aeq}) - Equivalent continuous noise level of a time-varying noise	Steady noise level (usually in dB(A)) which, over the period of time under consideration, contains the same amount of sound energy as the time-varying noise over the same period of time.
$L_{Aeq,T}$	Equivalent continuous sound pressure level (A-weighted) over a period of time, "T".
$L_{A90,T}$	Sound pressure level (A-weighted) exceeded for 90% of the measurement period. The background noise level is commonly represented by this metric.
Ambient noise (as defined in BS 4142)	Totally encompassing noise in a given situation at a given time; it is usually composed of noise propagating from many sources, near and far.
Background noise (as defined in BS 4142)	A-weighted sound pressure level of the environmental noise at the assessment position, that is exceeded for 90 % of a given time interval, "T" and measured using the time weighting, "F".
Specific noise level (as defined in BS 4142)	The equivalent continuous A-weighted sound pressure level at the assessment position produced by the specific noise source, over a given reference time interval.
Rating Level (as defined in BS 4142)	The specific noise level plus any adjustment for the characteristic features of the sound.
Single Event Level (SEL [L_{AE}])	The sound level over one second, which would have the same energy content as the whole event.

1 Introduction

1.1 Report scope

Buro Happold have been commissioned by *NOMA (GP) Ltd.* to produce a Planning Report (Acoustics) to support a full Planning Permission for the construction of two office-led buildings (Use Class Egi) with commercial retail uses at lower levels and flexible restaurant / office space at Level 12 of 2 Angel Square, with associated car and cycle parking, public realm, and access arrangements (the “Proposed Development”) within the NOMA Masterplan area of Manchester.

The purpose of this Report is to assess the suitability of the site for development in the context of existing environmental noise affecting the proposed development, as well as the potential noise impact of mechanical services equipment installed as part of the proposed development, upon the existing noise-sensitive receptors (NSRs). In summary, this assessment considers the following:

- Description of the proposed development and site location
- Conditions of Planning Consent (Noise) and associated noise-related planning guidance from *Manchester City Council* (MCC)
- Baseline noise conditions at the site and surrounding area
- Potential noise impact upon the proposed development including:
 - Potential operational noise impacts upon existing NSRs in compliance with the relevant planning condition
 - Potential construction noise and vibration impacts covered under the provisions of the *Construction Management Plan* (CMP) in compliance with the relevant planning condition.
- Noise mitigation measures such as acoustic facade requirements and limiting noise levels for plant and equipment (where required)
- Additional noise management (including restrictions on the use of amplified sound or music) is also considered
- Conclusions informing planning.

1.2 Planning status

The planning status of this document should be considered as a standalone succession of an original Planning Report (Acoustics) which was issued by Buro Happold (ref: *2&3 Angel Square (Plot M and N), NOMA, Manchester - Noise Impact Assessment*) in August 2019, when these schemes were designated as; “Plot N” and “Plot M” respectively. The purpose of this is to ensure the current scheme proposals are comprehensively considered under the current planning submission and includes a review of the MCC Decision Notice (February 2020), which attaches a set of Conditions of Planning Consent against which the 2019 report was issued, now superseded by this document.

All remaining technical assessments and conclusions contained in this document, therefore, reflect the current scheme proposals and all legislative instruments applicable to date in their entirety.

1.3 Description of the proposed development

The development proposal pertinent to “NOMA Plots 2 & 3” includes the redevelopment of land bound by Angel Street to the north, the new-build Angel Gardens residential complex to the east, the A664 Ring Road to the south, with Angel Gardens and 4 Angel Square (currently under construction) to the west, on the edge of Manchester City centre. 1 Angel Square (immediately due west of the proposed sites for Plots 2 & 3) is bound by the existing *Co-operative Group* Headquarters building.

The proposed development involves the redevelopment of Plots 2 and 3 of the adopted NOMA Masterplan (2&3 Angel Square) to deliver office-led development (Use Class Egi), with ground-floor retail and commercial units at lower and upper ground floor levels, external terraces at upper levels, car parking and cycle facilities.

The proposed development will include a comprehensive public realm scheme with hard and soft landscaping, access, highways, and other associated works.

The current development proposals are understood to consist of the following:

2 Angel Square, Angel Street: total GIA (including basement) of 277,644 sqft (total NIA of 215,967 sqft) distributed as follows:

- Provision of two flexible use retail units at upper ground floor level and associated external seating
- Office entrance, internal car parking, plant, refuse, cycle parking and changing facilities on lower ground floor level
- Office floorspace from upper ground floor level up to level 12, with associated roof terrace and flexible restaurant / office floorspace on Level 12.

3 Angel Square, Angel Street: total GIA (including basement) of 331,012 sqft (total NIA of 263,296 sqft) distributed as follows:

- Provision of two flexible use retail units on lower ground floor level, and associated external seating, office entrance, internal car parking, plant, refuse, cycle parking and changing facilities
- Provision of two flexible use commercial units on upper ground floor level with associated external seating, a CCTV room, gym, and flexible retail and seminar/cinema space
- Office floorspace from Level 1 up to level 11.

The development site is located on the edge of Manchester City centre and within the NOMA Masterplan area, in a mixed-use area comprising commercial and some residential land uses and is bound by:

- **West** – Angel Square public realm and 1 Angel Square
- **North** – Angel Street, with residential properties opposite
- **East** – Existing Angel Gardens residential complex
- **South** – Miller Street (A664 Ring Road), with commercial properties opposite.

Annotated site images are shown in the figures overleaf.

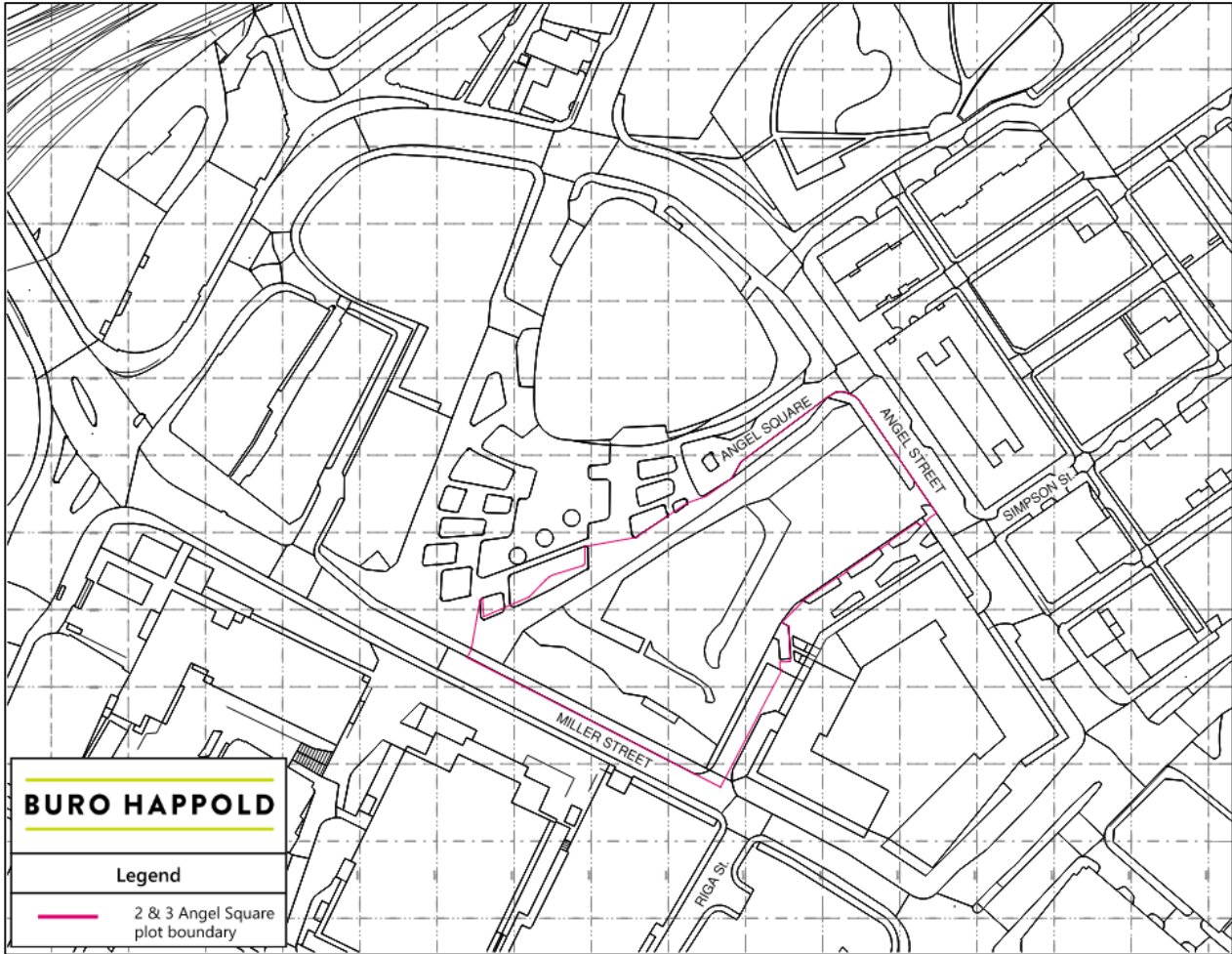


Figure 1—1 Proposed development site plan (Source: Cartwright Pickard)

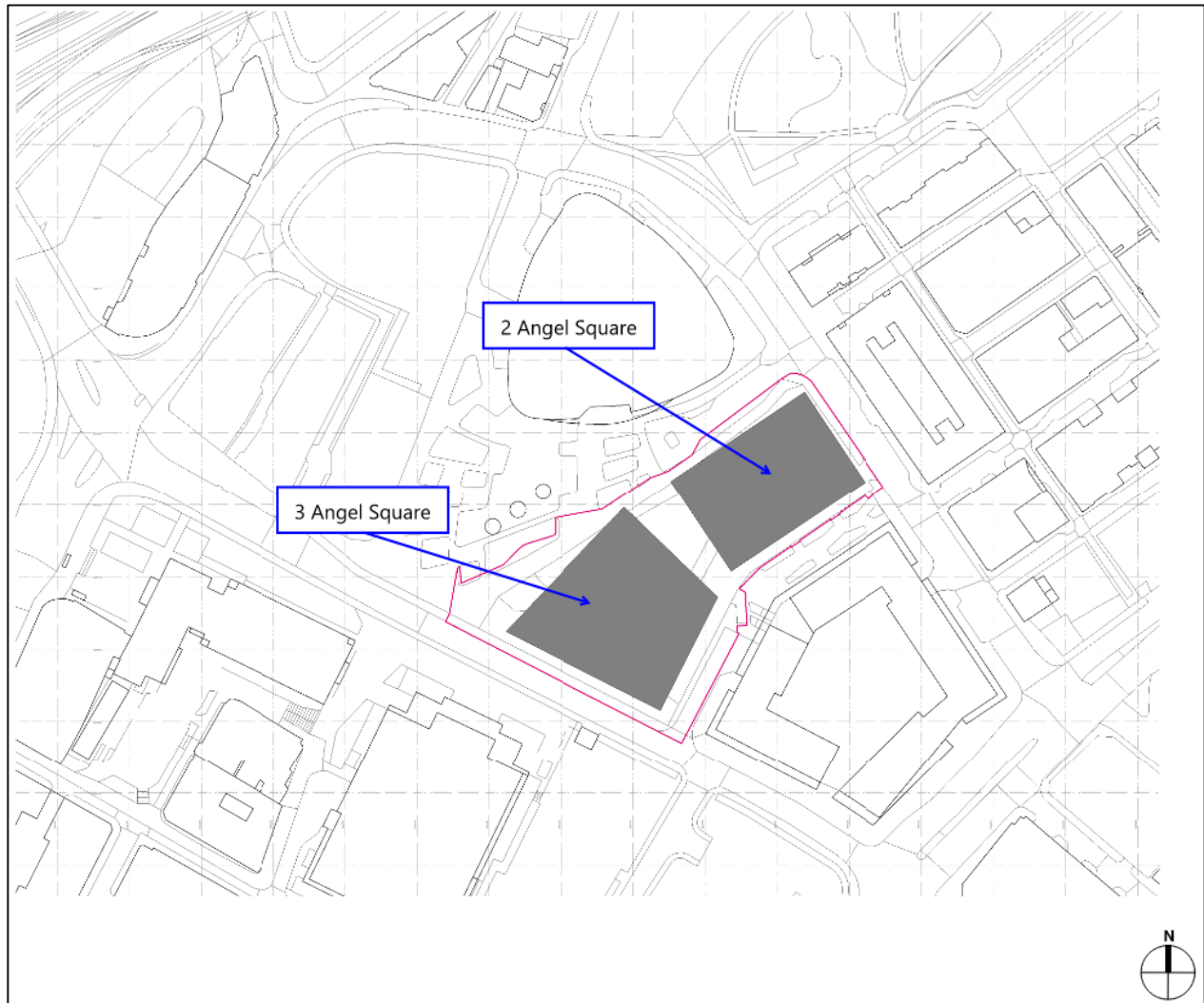


Figure 1—2 NOMA Plots 2 & 3 layouts (Source: Cartwright Pickard)

The local road network is considered the dominant source of environmental noise in this area.

2 Planning Consent and Guidance

2.1 Relevant guidance documentation

This planning submission should be considered under compliance with the following planning consent and guidance documents, as pertinent to the proposed scheme:

2.1.1 National Planning Policy

- The *National Planning Policy Framework*, July 2021 (NPPF)
- The *Noise Policy Statement for England*, March 2010 (NPSE)
- *Planning Practice Guidance: Noise*, July 2019 (PPG:N)

2.1.2 Local Planning Policy

- *Manchester City Council Saved Policies of the Unitary Development Plan* (2005)
- *Manchester City Council, Local Development Framework: Core Strategy (2012-2027)*, adopted 11/07/2012
- *Manchester City Council – Planning and noise technical guidance document*, June 2022

2.1.3 Technical guidance

- British Standard; BS8233:2014 *guidance on sound insulation and noise reduction for buildings*
- British Standard; BS4142:2014 *Methods for rating and assessing commercial and industrial sound* (referred to within MCC guidance, cf. Section 2.1.3.)
- British Standard; BS5228-1:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites. Noise.*
- British Standard; BS5228-2:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites. Vibration.*
- Building Research Establishment; *BREEAM UK New Construction – Non-domestic Buildings (U.K.), Technical Manual SD5078: 1.0 – 2018*

2.1.4 Local Planning Authority

- Manchester City Council, Decision Notice (ref. 124973/FO/2019)

2.2 Planning Policy (England) on Noise Impact – The NPPF and NPSE

The NPPF (July 2021) is the overarching planning policy document that applies to all new developments in England. The guidance and assessment criteria given (or referred to) in this document can, therefore, be applied to all other standards in terms of assessing the suitability of granting Planning permission with respect to noise impact.

The NPPF states that planning policies and decisions should aim to:

- mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life
- identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.

With specific reference to noise impact, the NPPF document refers to the *Noise Policy Statement for England* (NPSE). The NPSE provides guidance, which enables decisions to be made regarding the acceptable noise burden to place on society, using three key precepts: the *No Observed Effect Level* (NOEL), the *Lowest Observed Adverse Effect Level* (LOAEL) and the *Significant Observed Adverse Effect Level* (SOAEL).

To provide a consistent frame of reference (and to allow a view to be taken on the suitability of the application with reference to the relevant Planning guidance), the levels or criteria given in other relevant documents used in the assessment will be re-framed in terms of the following:

2.2.1 No Observed Effect Level (NOEL)

The NOEL is the level at which the noise cannot be discerned and where no impact can be observed, therefore there would be no appreciable negative effect on health or quality of life. The “No Observed Adverse Effect Level” (NOAEL) is the level at which noise can be discerned but does not result in an adverse effect which, by extension, the applicable action is equivalent to that of the NOEL.

2.2.2 Lowest Observed Adverse Effect Level (LOAEL)

The LOAEL is the lowest level of noise impact above which adverse effects on health or quality of life can be detected. Designing noise impacts to be equal-to-or-less-than the LOAEL, should result in any adverse effects on health or quality of life being negligible.

2.2.3 Significant Observed Adverse Effect Level (SOAEL)

The SOAEL is the level above which significant adverse effects on health and quality of life occur. Scheme designs should always seek to avoid noise impacts which are categorised as a SOAEL.

2.3 Planning Practice Guidance: Noise

In England, *Planning Practice Guidance* are a set of web-based resources issued for use by LPAs by the *Department for Communities and Local Government* (DCLG). The purpose of the guidance is to complement the NPPF and provide advice on how to deliver its policies.

The section on noise was first published in March 2014, updated in December 2014 with the current version dated July 2019. It includes a table that summarises the “noise exposure hierarchy” based on the likely average response and offers ‘examples of outcomes’ relevant to the NOEL, LOAEL and SOAEL observed effect levels described in the NPSE. The effect level; “Unacceptable Adverse Effect” (UAE) was introduced within this guidance, which aims to describe noise perceived as “noticeable and very intrusive”. The guidance states that UAEs should be prevented.

Whilst these outcomes are in qualitative in nature, no objective criteria relative to the NOEL, LOAEL, SOAEL or UAE effect levels exist, nor any detailed advice regarding methodologies on how to determine them. Further, no references are available with regards to the “further research” that is identified as necessary in the NPSE. The noise exposure hierarchy table is duplicated in the figure overleaf:

Table 2—1 Noise Exposure Hierarchy Based on the Likely Average Response

Perception	Examples of outcomes	Increasing effect levels	Action
Not noticeable	No effect.	No Observed Effect (NOEL)	No specific measures required
Noticeable and not intrusive	Noise can be heard but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect (NOAEL)	No specific measures required
Lowest Observed Adverse Effect Level			
Noticeable and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, e.g., turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	Lowest Observed Adverse Effect (LOAEL)	Mitigate and reduce to a minimum
Significant Observed Adverse Effect Level			
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, e.g., avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening, and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect (SOAEL)	Avoid
Noticeable and very intrusive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g., regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g., auditory and nonauditory.	Unacceptable Adverse Effect (UAEL)	Prevent

2.4 Manchester City Council (MCC): Decision Notice (124973/FO/2019)

The Decision Notice issued by MCC in relation to the 2020 Planning Permission for 2&3 Angel Square (ref: 124973/FO/2019 dated 12/02/2020) has attached 5No. conditions of planning consent which relate to sustainability and noise protection. These are: Conditions: 4), 14), 18), 19), and 20), which are all excerpted in Appendix C for reference and summarised below:

- Condition 4). Submission of a *Construction Management Plan* (CMP) prior to commencement
- Condition 14). Sustainability objective (including noise performance) in line with achievement of a *BREEAM* "Very Good" rating
- Condition 18). Control of noise egress to the nearest-affected, noise-sensitive receptors (primarily due to commercial activities arising from the proposed development)
- Condition 19). Approved hours of operation and restriction of outdoor amplified sound

2.5 Condition 20). Control of external noise due to new building services equipment at the nearest-affected, noise-sensitive receptors Manchester City Council (MCC): Planning and Noise – Technical Guidance

MCC states the following with regards to "Industrial/commercial developments" in Section 3.7.1.5 of the Planning and Noise – Technical Guidance document (June 2022):

- *BS 4142 should be used to assess the likely impact of noise from industrial and commercial sources at noise-sensitive premises (section 3.5). One of the indications of the impact of a BS 4142 assessment is the lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.*

The Council consider that new developments should contribute and enhance the area in which they are located and where possible, contribute to the improvement of people's health and quality of life as per the NPSE. The design objective should be:

'The development should be designed to achieve a rating level of 5 dB (L_{Aeq}) below the typical background (L_{A90}) level at the nearest noise-sensitive location'.

2.6 British Standard; BS8233

BS 8233:2014 *Guidance on sound insulation and noise reduction for buildings*, provides criteria for internal ambient noise levels due to break-in of external environmental noise that should be achieved in various locations within buildings. In addition, BS8233 provides guidance on desirable noise levels in areas that are intended to be used for external amenity spaces.

2.7 British Standard; BS4142

BS4142:2014 *Method for rating and assessing industrial and commercial sound*, is a widely accepted method for assessment of the impact of noise from services equipment. The equipment noise level (corrected to account for characteristics such as tonality, intermittency, or impulsivity) is compared to the representative background sound level without the noise source operating. The difference between the corrected equipment noise level and the background sound level, determines the significance of impact of the noise under assessment. Typically, the greater this difference the greater the magnitude of impact. The lower the “Rating Level” (i.e., the specific sound level, adjusted to reflect the existence of any characteristic corrections), relative to the measured background sound level, the less likely that the specific sound source will have an adverse impact.

2.8 British Standards; BS5228-1 & BS228-2

BS5228-1:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites. Noise*, and BS5228-2:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites. Vibration*, provide methodologies for predicting the magnitude of noise and vibration generated from construction and open sites, such as quarries. This includes noise and vibration generated from both stationary and mobile plant. This family of standards include source noise and vibration emission data, for different types of equipment that may typically be deployed on a construction or open site.

2.9 BREEAM Certification

Compliance with MCC Planning Condition 14), requires a minimum achievement of a “Very Good” rating according to the *Building Research Establishment Environmental Assessment Method* (BREEAM), which is a globally recognised accreditation system used to assess, rate, and certify the sustainability performance of buildings. The objectives of BREEAM are:

- To provide market recognition of buildings with a low environmental impact
- To ensure the best environmental practice is incorporated in building planning, design, construction, and operation
- To define a robust, cost-effective performance standard surpassing that required by regulations
- To challenge the market to provide innovative, cost-effective solutions that minimise the environmental impact of buildings
- To raise the awareness amongst owners, occupants, designers, and operators of the benefits of buildings with a reduced life cycle impact on the environment
- To allow organisations to demonstrate progress towards corporate environmental objectives.

2.9.1 Adopted BREEAM requirements

It is understood that the scheme is to be assessed and rated according to the requirements of the following Technical Manual: *BREEAM UK New Construction – Non-domestic Buildings (U.K.), Technical Manual SD5078: 3.0 – 2018*.

2.9.2 BREEAM criteria

It is understood that the development is targeting the combined 4No. credits available for award between; BREEAM Hea 05 'Acoustic Performance' and Pol 05 'Noise Pollution' toward the achievement of a rating of "Outstanding".

The aim of BREEAM Hea 05 is:

- *"To ensure the building is capable of providing an appropriate acoustic environment to provide comfort for building users."*

The aim of BREEAM Pol 05 is:

- *"To reduce the likelihood of noise arising from fixed installations on the new development affecting nearby noise-sensitive buildings."*

The table below details the BREEAM criteria applicable to the scheme:

Table 2—2 BREEAM 2018 Non-domestic Buildings Criteria

Building Type	BREEAM Reference	Acoustic Parameter	No. of Credits	Criterion
Office	Hea 05 - Acoustic Performance	Sound Insulation	1	<i>"The sound insulation between rooms and other occupied areas complies with the performance criteria given in Section 7 of BS 8233:2014. This should be based on the layout and function of the different spaces within the building."</i>
Retail				<i>"If testing is to be carried out where the office is not yet furnished, then section 7.5 of BS 8233:2014 should be referred to when determining the performance criteria. Where the office is to be furnished at the time testing is carried out, then refer to section 7.7.6 of BS 8233:2014 for the relevant performance criteria."</i>
Office / Retail		Indoor ambient noise levels (IANL)	1	<i>"The sound insulation between rooms and other occupied areas complies with the performance criteria given in Section 7 of BS 8233:2014. Alternatively, propose performance standard based on demonstrably best practice."</i> <i>"Achieve indoor ambient noise levels that comply with the design ranges given in Section 7 of BS 8233:2014."</i>
		Room acoustics	1	<i>"A programme of pre-completion acoustic testing is carried out by a compliant test body in accordance with the acoustic testing and measurement procedures outlined in Methodology."</i> <i>"Achieve the requirements relating to sound absorption and reverberation times, where applicable, set out in Section 7 of BS 8233:2014."</i>

Development Wide	Pol 05	Reduction of noise pollution	1	<i>"1 There are no noise-sensitive areas within the assessed building or within 800 m radius of the assessed site.</i> <i>OR</i> <i>2 Where there are noise-sensitive areas within the assessed building or noise-sensitive areas within 800 m radius of the assessed site, a noise impact assessment compliant with BS 4142:2014(222) is commissioned. Noise levels must be measured or determined for:</i> <i>2.a Existing background noise levels:</i> <i>2.a.i at the nearest or most exposed noise-sensitive development to the proposed assessed site</i> <i>2.a.ii including existing plant on a building, where the assessed development is an extension to the building</i> <i>2.b Noise rating level from the assessed building.</i> <i>3 The noise impact assessment must be carried out by a suitably qualified acoustic consultant.</i> <i>4 The noise level from the assessed building, as measured in the locality of the nearest or most exposed noise-sensitive development, must be at least 5dB lower than the background noise throughout the day and night.</i> <i>5 If the noise sources from the assessed building are greater than the levels described in criterion 4, measures have been installed to attenuate the noise at its source to a level where it will comply with the criterion."</i> In summary, the <i>BREEAM</i> credit Pol 05 requires that the level of noise impact from any newly introduced plant is at least 5 dB lower than the background noise level (in terms of the "L_{AF90,15mins}" (dB) metric) throughout both the daytime and night-time periods, when assessed at an existing NSR location. However, planning requirements are usually no less onerous than that stated under <i>BREEAM</i> Pol 05. Consequently, demonstration of compliance with planning requirements almost always confers compliance with Pol 05, by default.
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BREEAM targets have been addressed in the following sections of this report.

2.9.3 BREEAM Suitably Qualified Acoustician (SQA)

This report has been prepared by Alex Krasnic, who is a corporate member of the *Institute of Acoustics* and therefore fulfils the requirements of an SQA for *BREEAM* assessment purposes (as per the Compliance Notes contained under both sections Hea 05 and Pol 05).

3 Baseline Environmental Noise Data

3.1 Scope

In accordance with the planning requirements of *Manchester City Council*, as well as holistically applying relevant planning policy and applicable guidance (as detailed in the previous section), Buro Happold has set about conducting a series of baseline noise surveys (externally) in the vicinity of the proposed development site, with the following aims:

- To assess the potential for noise impact due to surrounding environmental noise sources (e.g., road traffic) incident on the facades of the proposed schemes. In so doing, enabling the sound reduction performance requirements of building envelope elements (e.g., roofs, glazing and, where applicable, natural ventilation etc.) to be determined, thereby permitting *Internal Ambient Noise Level* (IANL) criteria to be achieved
- To quantify background noise levels, representative of those which would be existent at the nearest-affected, noise-sensitive receptors (e.g., residential). This allows the specification of limiting noise levels for any externally installed (or external terminations of) building services equipment, such that the environmental noise protection objectives of MCC may be complied with, when assessed at those NSR locations.

3.2 Historical noise survey data (January 2019)

To discharge the above scope, Buro Happold have assessed several sets of baseline environmental noise data, acquired over several both long-term and short-term surveys. The end-purpose of which is for the following uses:

- Calibration of a 3D acoustic model for the 2 & 3 Angel Square scheme
- Determining limiting noise levels for new mechanical equipment proposed to service the scheme.

Noise survey data (acquired in January 2019) presented in the Buro Happold Planning Report (Acoustics), previously submitted in support of the 2020 planning application (see Appendix A) for the NOMA Plots P & Q sites (ref: "*4 Angel Square (Plot P) and Primary Sub-station (future 5 Angel Square - Plot Q), NOMA, Manchester*" revision P01 dated 25 April 2019), had been used to calibrate the initial 3D model, from which the latest iteration has been refined (see Section 4.2. hereafter) and to inform the noise planning outcomes presented in this Report.

The initial survey methodology had previously been agreed with MCC, with confirmation agreed over a telephone conversation between Gareth Davies (Buro Happold) and Laura Miller (MCC Environmental Protection Specialist) held on Tuesday 22nd January 2019 (recorded transcript not available).

3.3 Additional Noise Surveys

3.3.1 Adopted measurement locations (August 2019)

Additionally, Buro Happold acousticians visited the NOMA site to undertake additional attended noise surveys on Thursday 15 August 2019. Environmental noise measurements were acquired to calibrate a wider area of the original 3D noise model.

The following image (overleaf) identifies the adopted measurement positions marked on an annotated aerial view of the proposed development site. This methodology was also agreed upon over a telephone conversation between Daniel Bailey (Buro Happold), and Sue Jones (MCC EHO) held on Monday, 12 August 2019 (recorded transcript not available).

3.3.2 Survey methodology (August 2019)

The noise survey methodology (based on a combination of existing and additional noise measurements), provides a comprehensive and complete picture of how noise levels change around the site throughout various times of the day and night. Measurement locations are marked on an annotated aerial image in the figure below:

- **Location 1** – Short-term noise measurement, representative of noise levels along the south-western boundary of the proposed site. This measurement location was undertaken to capture the levels of noise associated with road traffic on Miller Street, a dual-carriageway road due west. The measurement location was set back at approximately 10 m to the nearside carriageway of this road.
- **Location 2** – A short-term noise measurement on the north-eastern boundary of the proposed site. This measurement location is proposed to capture the levels of noise associated with road traffic on Angel Way/Rochdale Road, a dual-carriageway road due east as the road runs past the site. The measurement location was set back at approximately 8 m to the nearside carriageway.
- **Location 3** – A short-term noise measurement to the south-east of the proposed side. This noise measurement location was undertaken to capture the levels of noise associated with road traffic on the A664 to the south-east of the site, set back at approximately 8 m from the nearside carriageway.

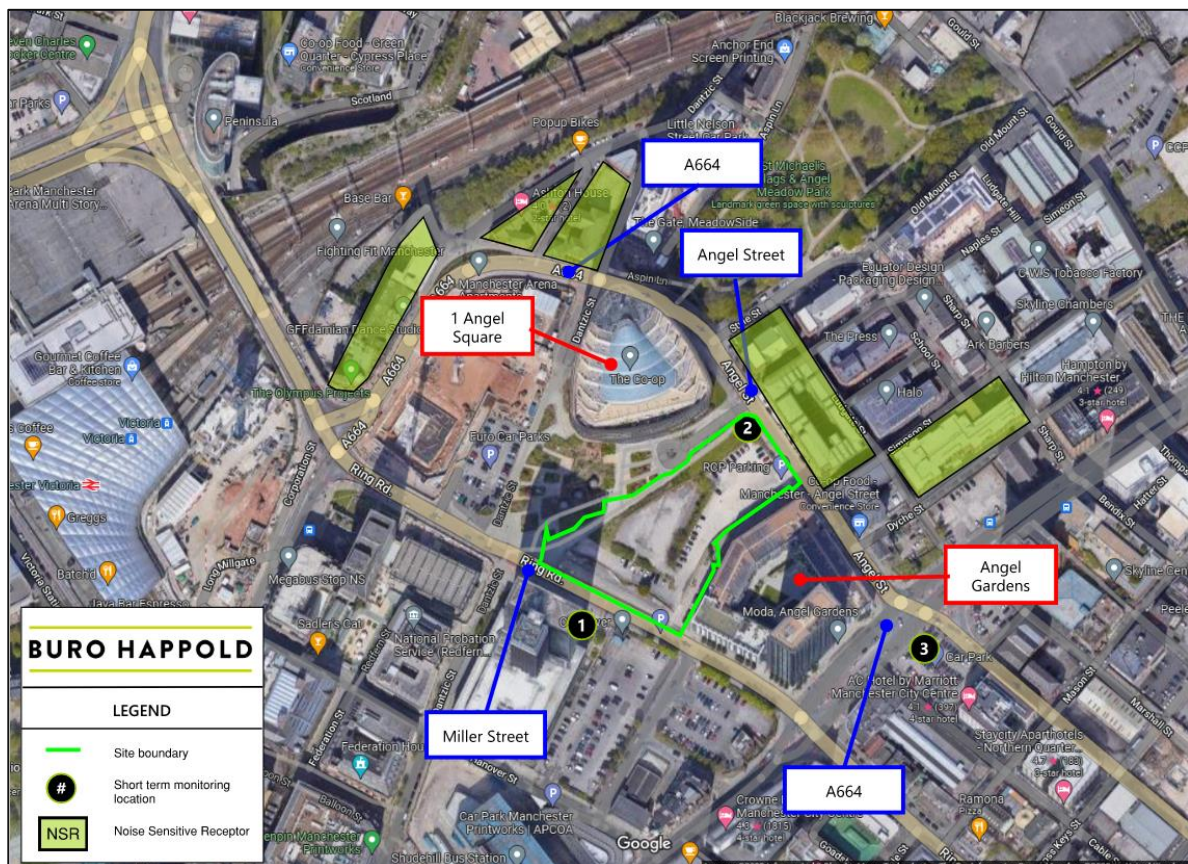


Figure 3—1 Annotated aerial image containing the survey methodology

3.3.3 Latest noise survey (April 2022)

In attempting to further supplement the historical noise data acquired during both the January and August 2019 surveys, Buro Happold returned to the NOMA development site on the 29 April 2022 to acquire the most up-to-date noise data possible but met with several challenges, namely:

- For significant durations of the daytime survey period, pertinent to office hours (09.00 to 17.00 hrs weekdays), the NOMA development is subject to discernible construction noise propagating from the Plot P site (south-western corner, facing the A664 Ring Road)
- Advice taken from the project Transportation Engineers are that current traffic movements observed in the surrounding areas close to Manchester City Centre (including the NOMA development site) are exhibiting flows which are significantly higher than those recorded during pre-COVID pandemic periods and over comparative weekdays periods
- A lack of secure and representative long-term survey locations (which had otherwise existed before the planning stage for the 1 Angel Square NOMA scheme, i.e., pre-2019) has effectively negated the possibility of acquiring additional representative, baseline noise data, to supplement historical noise data used to calibrate the latest 3D model presented in this Report.

Considering the extenuating constraints identified in the first two points above, a sample set of short-term noise measurements were acquired during the 29/04/22 survey. However, Buro Happold has adopted the 2019 survey data as the basis of the 3D environmental noise model update.

A request to formally accept the collective 2019 survey data, in lieu of measuring (and assessing) the environmental noise conditions observed in April 2022, has been communicated to Richard Knightley (*MCC Environmental Health Directorate*) by electronic mail on the 12 and 13 April 2022. A response confirming this approach was subsequently received by Sue Jones (*MCC Environmental Health Directorate*), also by electronic mail, on the 18 May 2022 (a copy is included in Appendix B for reference).

3.4 Instrumentation (August 2019)

The following instrumentation was used during the 15/08/19 noise survey and in general accordance with the guidance contained in British Standard; BS 7445:2003 *Description and measurement of environmental noise - Part 1: Guide to quantities and procedures*:

Table 3—1 Survey instrumentation

Description	Manufacturer	Model no.	Serial no.	Precision
Sound Level Meter	RION	NL-52	01265411	Class 1 ^[1]
Field Calibrator	Brüel & Kjær	Type 4231	3008216	Class 1 ^[2]

^[1] In accordance with British Standard; BS EN 61672-1:2003 *Electroacoustics. Sound level meters. Specifications*;

^[2] In accordance with British Standard; BS EN 60942-2018 *Electroacoustics. Sound level calibrators*.

The calibration of the meter was verified with a field calibration check before and after use, with no significant drift in level witnessed. Copies of the relevant laboratory calibration certificates associated with the meter are available upon request.

3.5 Weather Conditions (August 2019)

The weather conditions during the 15/08/2019 noise survey was noted to have been between 10°C and 17°C in temperature, with wind speeds no greater than 5 ms⁻¹.

Using appropriate windshields and careful selection of monitoring positions, precautions were taken against weather and environmental factors affecting measurements, and it is not considered that rain, wind, or environmental, electrical interference (e.g., overhead power lines) influenced readings.

3.6 Measurement Conditions (August 2019)

All measurements were undertaken at heights of approximately 1.5 m above local ground level and were in free field environments.

3.7 Survey Results (August 2019)

The dominant noise sources in the vicinity of the site were reported to be associated with road traffic on the roads surrounding the site.

A summary of the results is detailed in the tables below. The included descriptors are as follows:

- **L_{Aeq,15min}** – the continuous equivalent A-weighted sound pressure level over a 15-minute period. The steady-state noise level, which over the period under consideration contains the same amount of sound energy as the time-varying noise; and
- **L_{A90,15min}** – the A-weighted sound pressure level exceeded for 90% of the measurement period. A level which would be perceived as a constant, background noise level. Typically, largely unaffected by local traffic pass-by or by transient events. More usually attributable to constantly running building services plant or distant road traffic. What one would hear when there is no local traffic present (or other readily identifiable noise source).

The “Daytime design level” values identified in the tables below, and shown on an annotated aerial image in the subsequent figure, are derived from short-term measurements undertaken at Locations 1, 2 and 3, with each descriptor calculated as follows:

- **Existing Ambient L_{Aeq,15min}** – a logarithmic average of measured L_{Aeq,15min} values, measured during representative, **worst-case (highest level)** daytime office hours (09.00 to 17.00 hrs), and.
- **Background L_{A90,15min}** – lowest measured L_{A90,15min} values, measured during representative, **worst-case (lowest level)** daytime office hours (09.00 to 17.00 hrs).

Table 3—2 Noise survey results and design levels at Location 1 – South-west – Miller Street

Date	Start time (HH:MM)	Time Interval	L _{Aeq,15min} (dB)	L _{A90,15min} (dB)	Notes
15-08-2019	14:35	15-minutes	67	59	Road traffic.
	15:35	15-minutes	68	60	Road traffic.
	16:34	15-minutes	81	60	Fire engine stuck in traffic. Excluded.
	17:31	15-minutes	60	59	Rush hour – traffic at a standstill. Excluded.
Daytime design level - dB(A)			68	59	Daytime

Table 3—3 Noise survey results and design levels at Location 2 – North-east – Angel Way/Rochdale Road

Date	Start time (HH:MM)	Time Interval	L _{Aeq,15minutes} (dB)	L _{A90,15minutes} (dB)	Notes
15-08-2019	14:55	15-minutes	69	58	Road traffic.
	15:55	15-minutes	73	59	Road traffic.
	16:53	15-minutes	68	60	Road traffic.
	17:49	15-minutes	66	59	Rush hour – traffic at a standstill. Excluded.
Daytime design level - dB(A)			71	58	Daytime

Table 3—4 Noise survey results and design levels at Location 3 – South-east - A664

Date	Start time (HH:MM)	Time Interval	L _{Aeq,15minutes} (dB)	L _{A90,15minutes} (dB)	Notes
15-08-2019	15:15	15-minutes	69	63	Road traffic.
	16:14	15-minutes	68	62	Road traffic.
	17:12	15-minutes	71	64	Road traffic.
	18:09	15-minutes	67	62	Rush hour – traffic at standstill. Excluded.
Daytime design level - dB(A)			70	62	Daytime

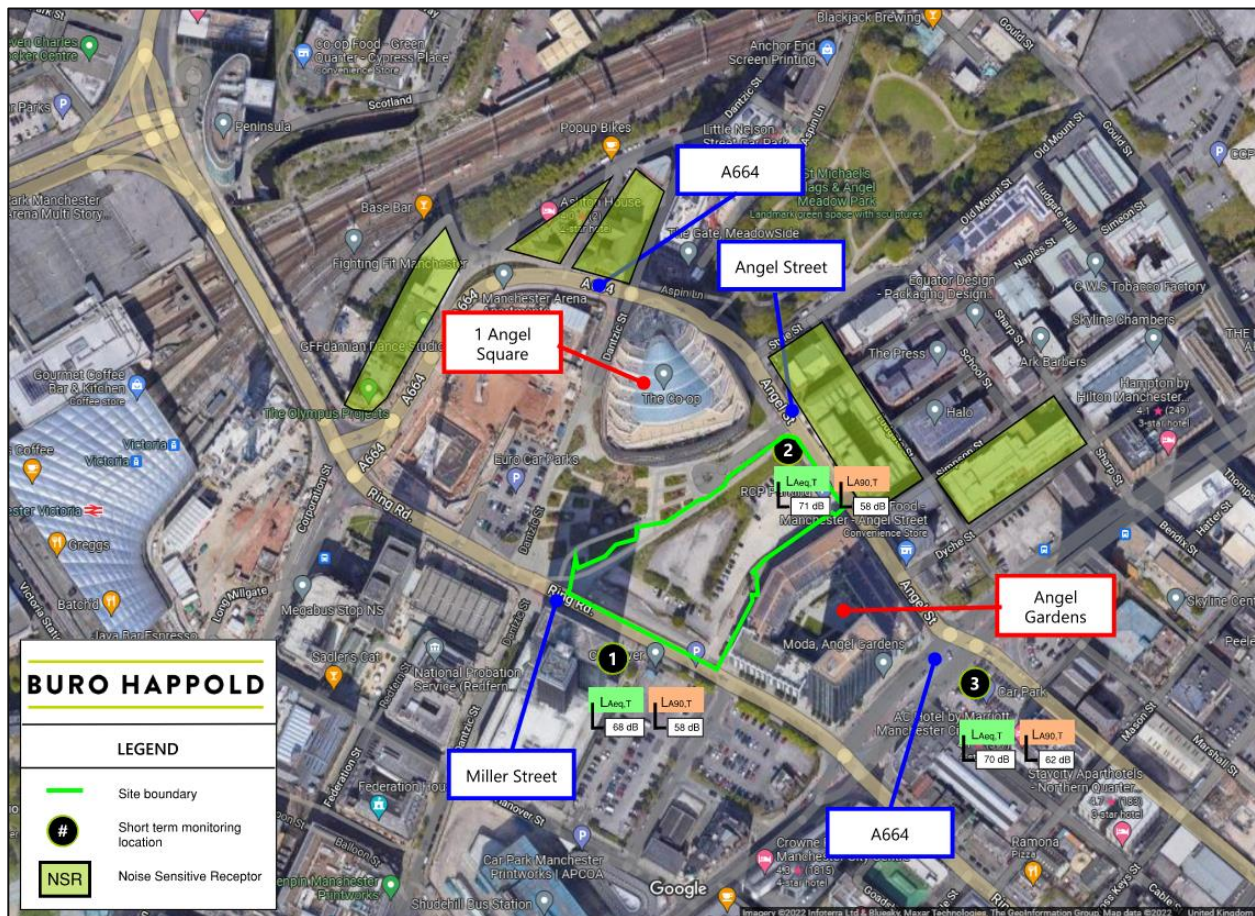


Figure 3—2 Design noise levels at each measurement location

3.8 Discussion

3.8.1 Assessment of the collective survey data

By collective assessment of noise data acquired across all surveys and during all measurement periods, the dominant noise climate was always noted to constitute road traffic movements.

Generally, all ambient and background noise levels measured across all the surveys and during comparative periods and representative locations are noted to be relatively consistent with little fluctuation.

Noise levels measured during the rush-hour periods were observed to be lower due to traffic moving more slowly due to congestion on the surrounding road network. The above commentary is supported by site observations made by each survey acoustician.

The lowest observed daytime background noise level, was acquired during the January 2019 survey at the attended (short-term) "Location 2" (see Appendix A, Table 3–3) and has therefore been adopted in this assessment, following a review of the collective noise background noise levels acquired between the two surveys, as follows:

- Background noise survey data (January 2019): Daytime** $L_{AF90,15min}$ 56 dB – Location 2 (23/01/19)

3.8.2 Road traffic changes

A transport assessment has been undertaken, and it has been predicted that there will be a net reduction in traffic movements predicted to occur as part of this scheme development.

As such, this is considered representative of a “no change” scenario and the measurement noise levels are considered representative for the purposes of this noise impact assessment.

4 Environmental Noise Modelling

4.1 Introduction

A noise modelling exercise has been undertaken to determine the likely noise levels incident on the facades of the proposed Plots 2 & 3 schemes. The results of the acoustic model can inform the facade build-up design, in terms of the airborne sound insulation requirements. The key outcome of this exercise is the assessment of required ventilation conditions and the selection of appropriate glazing (e.g., certain walling) specification(s) for the proposed schemes.

4.2 Methodology

To determine noise propagation across the proposed development site, a noise model has been produced using the proprietary *CadnaA 2019* environmental noise modelling software. The noise model has been constructed based on detailed *Google Earth™* mapping data. Local roads were added to the model to simulate noise sources that were evident during the collective noise surveys.

The model predicts and maps, the noise impacts on the proposed facades of each building, considering factors such as distance attenuation, natural and man-made barrier attenuation, reflections, and source directivity. It has already been established that the dominant noise source affecting the scheme during the daytime period is local road traffic.

For this noise planning assessment, the constructed model has been calibrated, adopting the worst-case (i.e., numerically highest) daytime (office hours) noise levels observed between both the August 2019 survey (*cf.* Section 3.7) and the January 2019 survey (*cf.* Appendix A: "Plots P & Q – Planning Report (Acoustics)").

Under the above methodology, the survey data acquired during the January 2019 survey (re: long-term "LT1" position) is deemed as the "worst-case" daytime (office hours; 09.00 to 17.00 hrs) noise impact condition, and therefore the result obtained during this survey and at this location, has been adopted to calibrate the *CadnaA 2019* model (which in turn, is used to define the noise emission levels of each source, by adopting the methodology described in the; *Calculation of Road Traffic Noise* (CRTN)), as follows:

- **Ambient noise survey data (January 2019): Daytime (office hours; 09.00-17.00 hrs)** $L_{Aeq,8hour}$ 72 dB – Location 1 (22/01/19)

Figure 4—1 Highest predicted daytime (office hours) facade noise levels $L_{Aeq,8hour}$ dB(A) identifies the sample receiver positions (3No. black and white spots) which have been superimposed on the site plan to calibrate the *CadnaA 2019* model. This is done by matching the same physical distance (approximately 8-metres) observed during the January 2019 survey, between the measurement location (LT1) and the roadside, with the in-model distance between the receiver "spots" and their closest road sources (e.g., A664 Ring Road to the south of NOMA Plot 3).

In the case of NOMA Plot 3, given its south-facing elevation is slightly closer to the roadside than the original survey location (i.e., < 8-metres), the highest facade level is predicted to be greater than the adopted survey ambient noise level above (by about +2 dB(A)).

4.3 Limitations

The end acoustic assessment is based on the results obtained from the above noise model, which provides predictions on the likely future noise levels. To increase the reliability of this assessment, the model has been calibrated to the worst-case noise levels described in Section 4.2. However, this does not result in 100% accuracy of the predicted facade noise levels. Typically, therefore, an uncertainty of approximately ± 3 dB could be expected from this computer-based, modelling software. Consequently, this uncertainty has been controlled (as far as practicable) by cross-referencing the levels of predicted noise impact against survey measurements acquired on site, adopting the methodology described in Section 4.2. above.

The figures overlaid indicate the highest predicted levels (in terms of the " $L_{Aeq,8hour}$ " metric), incident on the facades of each scheme (Plots 2 & 3) during the daytime period (office hours of; 09.00 to 17.00 hrs). As expected, elevations closest to the surrounding road network are exposed to the highest levels of environmental noise.

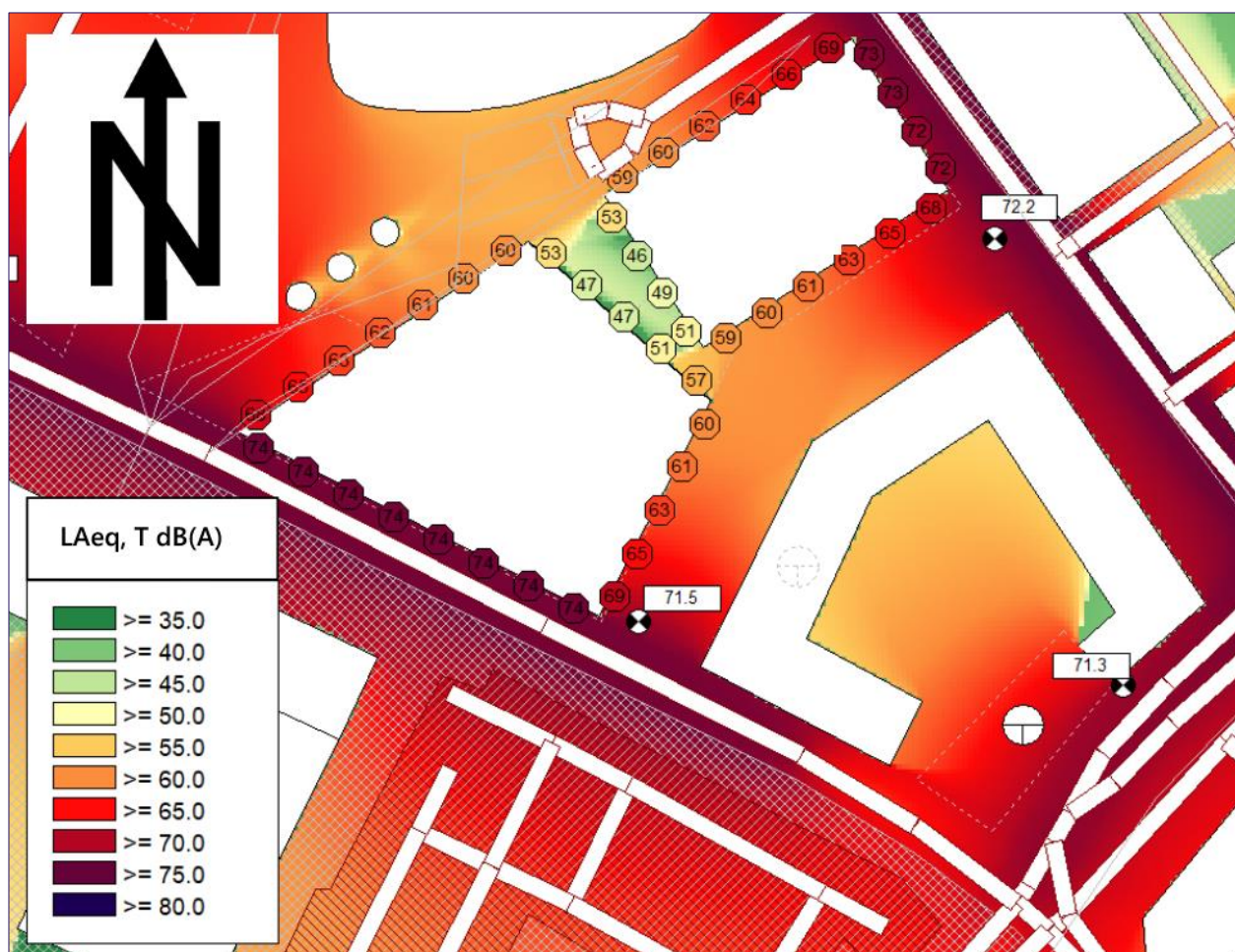


Figure 4—1 Highest predicted daytime (office hours) facade noise levels $L_{Aeq,8hour}$ dB(A)

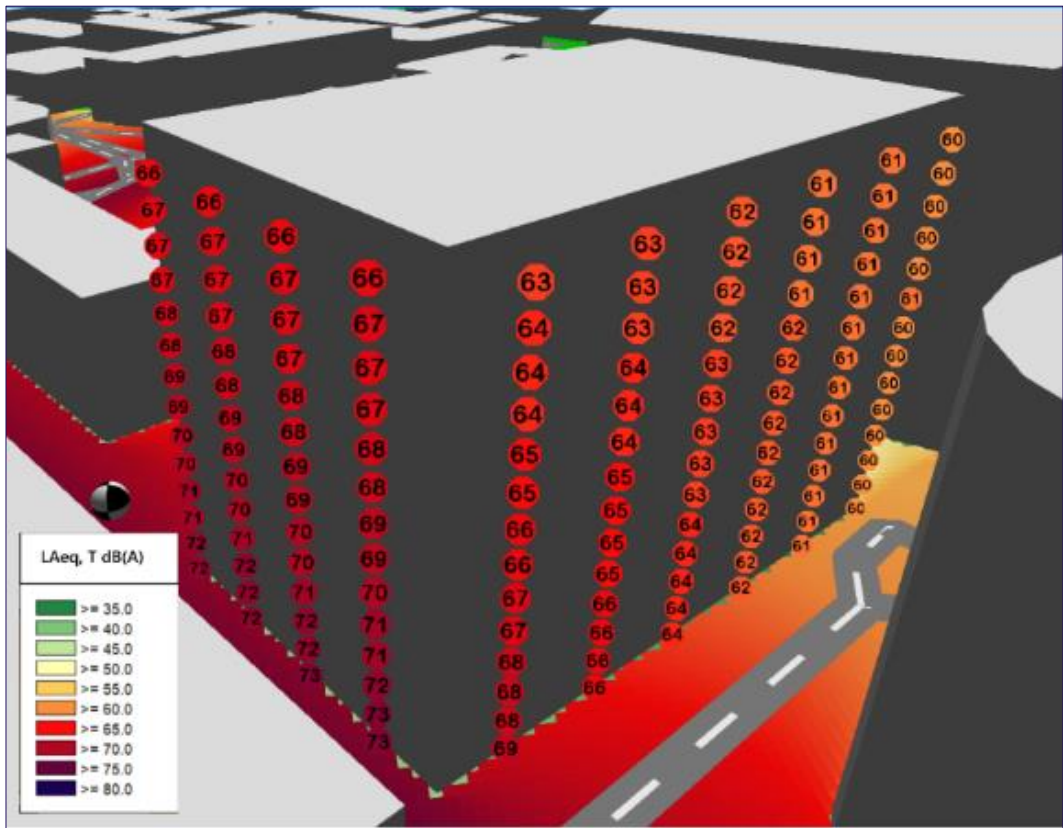


Figure 4—2 Daytime (office hours) facade noise levels LAeq,8hour dB(A) – View from the north-west

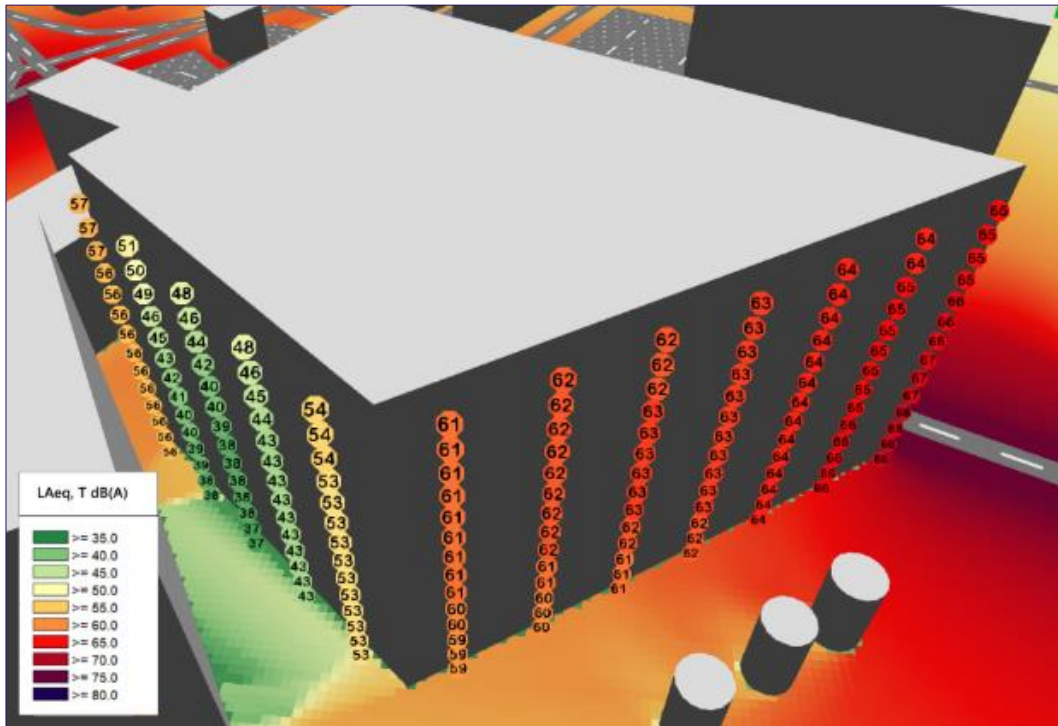


Figure 4—3 Daytime (office hours) facade noise levels LAeq,8hour dB(A) – View from the west

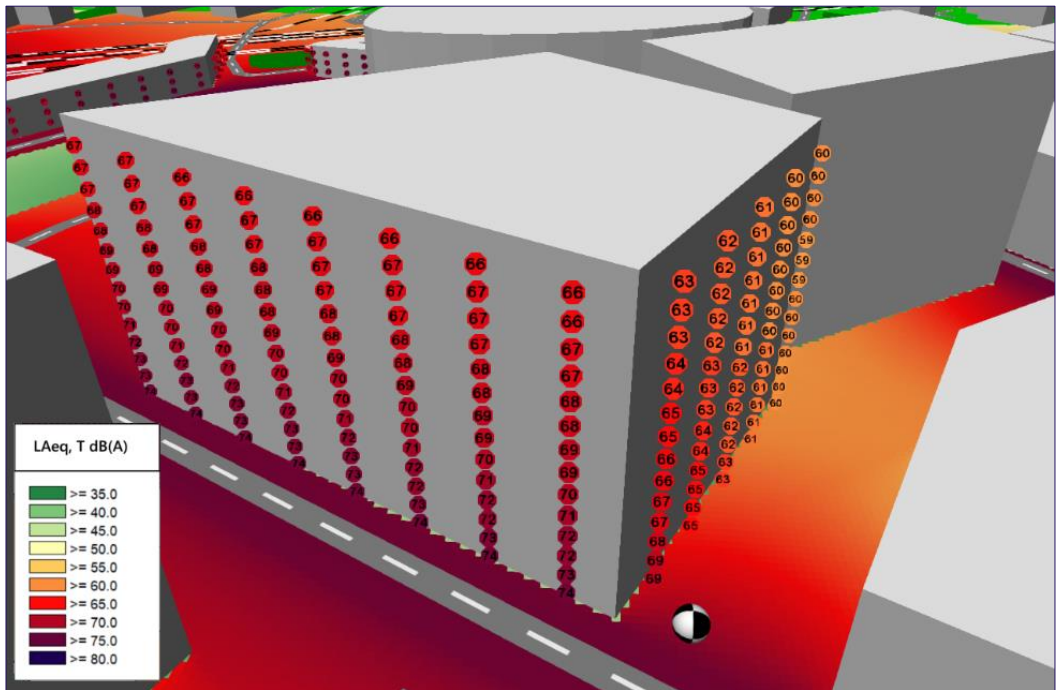


Figure 4—4 Daytime (office hours) facade noise levels $L_{Aeq,8hour}$ dB(A) – View from the south-east

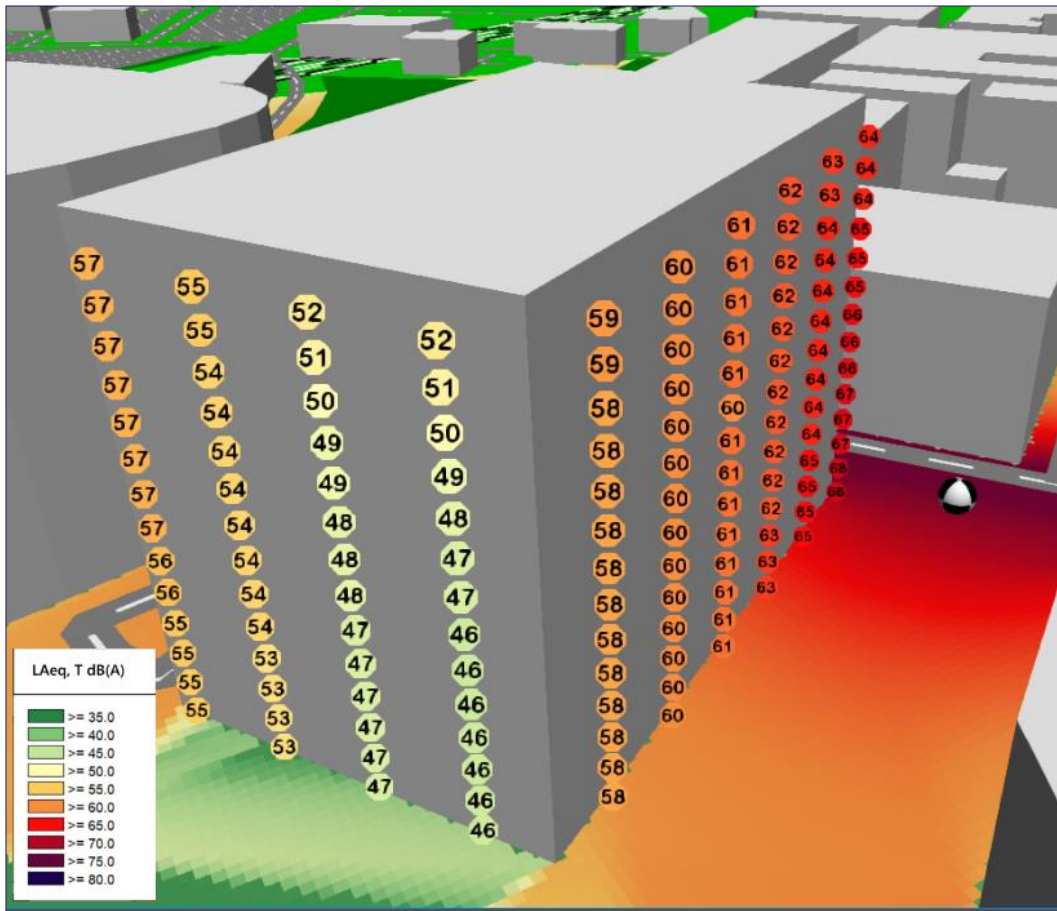


Figure 4—5 Daytime (office hours) facade noise levels $L_{Aeq,8hour}$ dB(A) – View from the east

The results derived from this 3D modelling exercise broadly correlate with measured noise levels acquired between the January 2019 and August 2019 surveys, as observed at the boundaries of the proposed scheme sites. The following image presents the highest daytime (office hours) facade noise levels, predicted across the full height of both schemes (Plots 2 & 3), but plotted axially in a 2D rendering.

The layout of the development is such that quieter noise levels have been predicted in areas towards the centre of the schemes. These lower noise levels are due to the screening provided by the massing of the development (despite some cross-reflections occurring between each plot), as well as from existing buildings surrounding the site, such as the adjacent Angel Gardens residential complex (immediately due east of the scheme sites).

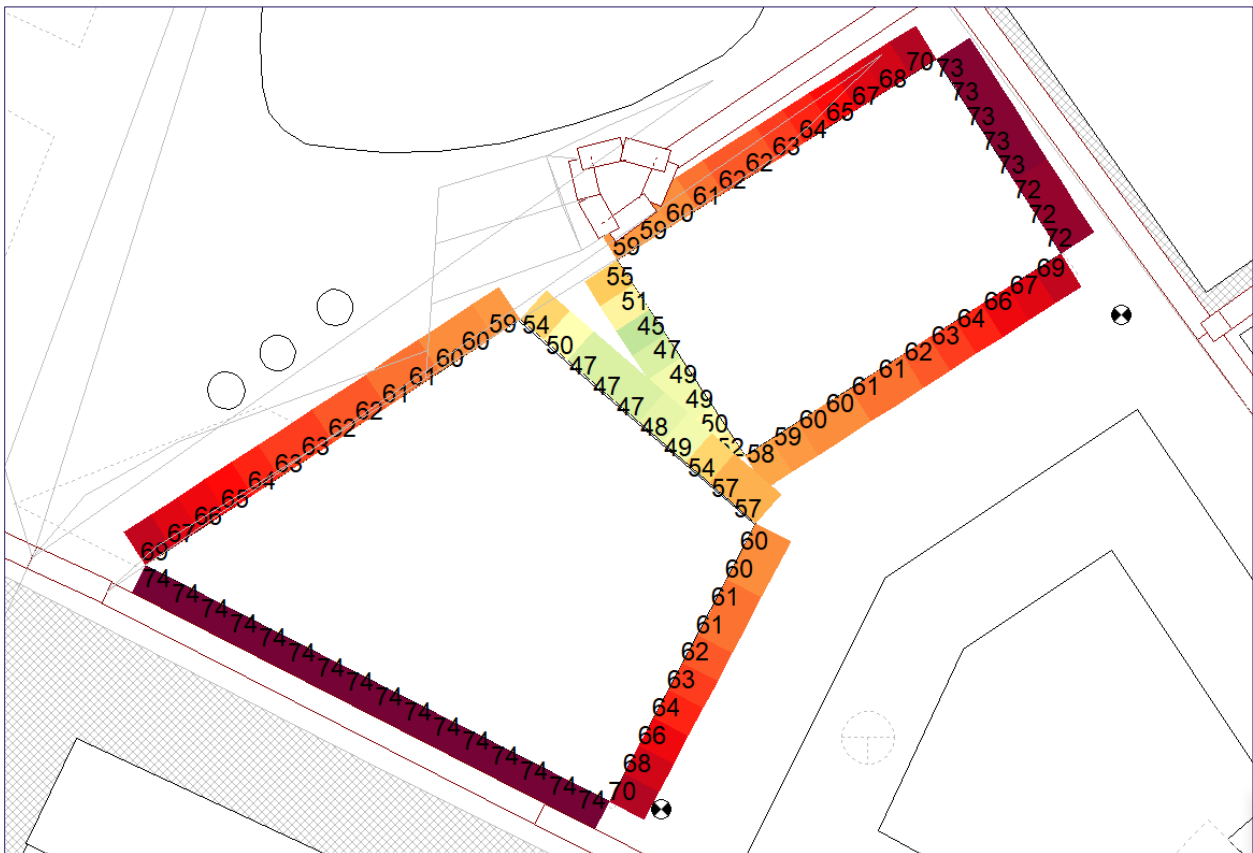


Figure 4—6 Highest daytime (office hours) facade noise levels $L_{Aeq,8hour}$ dB(A) - across the full building heights and plotted axially

5 Facade Sound Insulation Requirements

5.1 Internal Ambient Noise Level Guidance

Proposed internal ambient noise levels (based on BS8233:2014 guidance) within commercial units are detailed in the table below.

Table 5-1 Acceptable internal ambient noise levels within commercial and retail units

Activity	Location	Design range $L_{Aeq,T}$ (dB)
Speech or telephone communications	Retail units	50 → 55
Typical noise levels for acoustic privacy in shared spaces	Open plan office	45 → 50
Study and work requiring concentration	Executive office	35 → 40

Given the proposed scheme will comprise commercial/retail units, a gymnasium and a flexible seminar/cinema space, it will be necessary for the acoustic design of the facade to consider the degree of noise egress via the building envelopes of both Plots 2 and 3 (primarily via the facades), such that the requirements of Planning Condition 18). May be complied with, when assessed at the locations of the nearest-affected, noise-sensitive receptors.

5.2 Ventilation Strategy

It is understood that the ventilation strategy across the proposed development is to consist of mechanical supply and extract ventilation via localised MHVR (mechanical ventilation with heat recovery) units. Therefore, the background ventilation rates can be achieved without having to rely on openable windows or facade (through-wall) ventilators.

By their nature, mechanical Ventilation with Heat Recovery (MVHR) units are effective at preventing the ingress of environmental noise, due to removing the need for un-ducted/un-attenuated openings in the external elevation required by passive systems (i.e., trickle vents). On this basis, the level of external noise intrusion through these systems is likely to be negligible and the internal noise levels within demises are likely to principally be driven by the sound insulation performance of the building envelope elements (facades, roofs etc.).

5.3 Building Envelope Requirements

Aside from the roof constructions (the acoustic performances of which are likely to significantly outweigh those of the facades), a review of the currently proposed plans and elevations indicates that the facade build-ups are required to predominantly consist of glazed systems (e.g., curtain-walling).

Under this design condition, it is assumed that a singular curtain-walling type will be unilaterally specified across all facades of both schemes (Plots 2 & 3). Adopting this assumption, a single curtain-walling type will be required to achieve a single sound insulation performance requirement and therefore, the single (worst-case) facade sound level, as obtained from the 3D modelling presented in Figure 4—6 Highest daytime (office hours) facade noise levels $L_{Aeq,8hour}$ dB(A) - across the full building heights and plotted axially, has been adopted universally (i.e. across all external facades of both scheme plots).

At the planning stage, these facade sound insulation requirements are subsequently estimated by assuming typical internal space dimensions (i.e., those commonly designed), based on similar historical commercial developments. It should be noted that drawings submitted for planning, mostly identify speculative open-plan office spaces; however it is considered possible (during Spatial Coordination (usually, RIBA Stage 3)) that such office floor plates could be fitted-out with smaller cellular rooms (e.g., executive offices), or meeting/board rooms, and located on the external facade lines of either scheme plot.

As such, these spaces would be more appropriately required to achieve an internal ambient noise level criterion of up to; $L_{Aeq,T}$ 40 dB (as opposed to a higher design range of; $L_{Aeq,T}$ 45 to 50 dB recommended for open-plan offices in BS8233:2014) and therefore the noise ingress calculation has been based on this “worst-case” design outcome.

Noise ingress calculation assumptions:

- Worst-case daytime (office hours) ambient facade noise level of; $L_{Aeq,8hour}$ 74 dB
- Worst-case area dimensions of 10 m x 10 m x 2.8 m (larger cellular (executive) office or meeting/board room) based on likely seating locations, internally lining the worst-case facades (those overlooking the roadsides.)
- Internal ambient noise level criterion of $L_{Aeq,T}$ 40 dB
- Fully glazed facades
- Mechanical ventilation
- A 1.0 second (full-frequency range) reverberation time is assumed for a large, cellularised space.

The facade sound insulation performance requirements are given in terms of the “ $R_w + C_{tr}$ ” (dB) metric, which is derived as follows:

- **Weighted Sound Reduction Index, R_w** – it is a single figure value which describes the standardised performance of partitions when measured in a test laboratory, and;
- **Correction Traffic, C_{tr}** – it is a single correction value applied which takes into account the urban traffic noise spectrum.

Calculation procedures follow the “more rigorous calculation method” outlined in BS 8233:2014, based on the following equation:

$$L_{eq,2} = L_{eq,ff} + 10 \log_{10} \left(\frac{A_0}{S} 10^{\frac{-D_{ne}}{10}} + \frac{S_{wi}}{S} 10^{\frac{-R_{wi}}{10}} + \frac{S_{ew}}{S} 10^{\frac{-R_{ew}}{10}} + \frac{S_{tr}}{S} 10^{\frac{-R_{tr}}{10}} \right) + 10 \log_{10} \left(\frac{S}{A} \right) + 3$$

$L_{eq,ff}$ is the equivalent continuous sound pressure level outside the room elements under consideration¹

A_0 is a reference absorption area of 10 m² and is independent of frequency

S_f is the total Facade area in square metres (m²) of the room in question

¹ It is the free-field sound level (i.e. in the absence of the facade), measured or estimated at the intended position of the element under consideration. It is related to the level $L_{eq,1}$ measured within a few millimetres of the actual facade by the relation; $L_{eq,ff} \approx L_{eq,1} - 6$, and to the level $L_{eq,2m}$ measured 2 m away from the facade by the relation; $L_{eq,ff} \approx L_{eq,2m} - 3$.

S_{wi}	is the area in square metres (m^2) of the windows of the room
S_{ew}	is the area in square metres (m^2) of the external wall of the room
S_{rr}	is the area in square metres (m^2) of the ceiling of the room
S	is the total area in square metres (m^2) of elements through which sound enters the room, i.e. $S_f + S_{rr}$
$D_{n,e}$	is the laboratory-measured octave-band, sound insulation of the trickle ventilator measured according to BS EN ISO 10140
R_{wi}	is the sound reduction index (octave band value) of the window
R_{ew}	is the sound reduction index (octave band value) of the external wall
R_{rr}	is the sound reduction index (octave band value) of the roof/ceiling
A	is the equivalent absorption area of the receiving room being considered
3	An overarching correction factor which aims to compensate for the likely loss in acoustic performance due to the difference between the laboratory-rated performance and the in-situ (i.e. installed) performance of any facade element

5.4 Facade Noise levels

As explained in Section 5.3, a worst-case design facade noise level of $L_{Aeq,T}$ 74 dBA has been adopted for the purpose of the noise ingress calculation. The assumed noise ingress spectrum is derived by adjusting (shifting) the normalised road traffic spectrum given in British Standard; BS EN 1793-3:1998 *Road traffic noise reducing devices. Test method for determining the acoustic performance. Normalised traffic noise spectrum* to match the predicted broadband (dB(A)) facade noise level. The adjusted spectrum is subsequently adopted as the source term to determine the octave-band requirements for the sound insulation performance of all facade elements (e.g. glazing/curtain walling and through-wall ventilators/louvres, etc.) as per the methodology given in British Standard; BS EN 12354-3:2017 *Building acoustics. Estimation of acoustic performance in buildings from the performance of elements. Airborne sound insulation against outdoor sound*.

5.5 Noise Break-in Calculation

The noise break-in calculation is reproduced in the figure below.

FAÇADE BREAK-IN CALCULATION										
Project Name	NOMA Plots 2 & 3, Manchester					BURO HAPPOLD ENGINEERING				
Room or space	Large Cellular Space									
Date	18/05/22									
ROOM CONSTANT & FAÇADE AREA										
Façade area (incl. window)	20.0 m ²		Area of the external wall	0 m ²	Room reverberation time (s)					
Area of the louver	0.0 m ²				Tmf	125Hz	250Hz	500Hz	1kHz	2kHz
Area of the windows	20.0 m ²		Area of exposed envelope	####	1.0	1.0	1.0	1.0	1.0	1.0
Area of the roof/ceiling	100.0 m ²									
Room Depth (x)	10.0 m		Room Volume	####						
Room Width (y)	10.0 m									
Ceiling height (z)	2.8 m									
DISTANCE ATTENUATION CALCULATION										
Distance correction	No		Calculated Distance Attenuation	-						
Type of distance correction	Line source									
Distance from source to microphone	-									
Distance from source to receiver	-									
FREE FIELD LEVELS AT 1m FROM THE NOISE SENSITIVE FAÇADE										
LAeq			dB(A)	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	
	Free Field Leq in octave bands (dB)		74	76	72	70	70	66	61	
	Resultant Free-Field Leq with distance attenuation (dB(A))		74	76	72	70	70	66	61	
LAmx (if applicable)			dB(A)	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	
	Free Field Lfmax in octave bands		-	-	-	-	-	-	-	
	Resultant Free-Field LAmx with distance		-	-	-	-	-	-	-	
SOUND REDUCTION PROPERTIES OF BUILDING ELEMENTS										
			125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	R _w + C _{tr} (dB)	
Window (R _w)	R _w + C _{tr} 34dB SGG 8/6/6.4 (Stadip Silence)		26	28	31	40	44	50	38	
Louver (R _w)	Manual		0	0	0	0	0	0	0	
External wall Construction (R _w)	Typical external wall construction		46	44	46	54	62	67	52	
Roof Construction (R _w)	Typical roof construction		99	99	99	99	99	99	99	
			125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	D _{n,ew} (dB)	
Trickle Vent (D _{n,ew})	No Vent		200	200	200	200	200	200	-	
CALCULATED INTERNAL LAeq AND LAF,max LEVELS										
			125Hz	250Hz	500Hz	1kHz	2kHz	4kHz		
Calculated LAeq in the receiver room (dB)			49	43	38	29	21	10		
Calculated LAFmax in the receiver room (dB)			-	-	-	-	-	-		
			L_{avg} (125-4000Hz) 40 dB(A)				L_{max} (125-4000Hz) -			

Figure 5—1 Noise break-in calculation (in accordance with; BS8233:2014 / BS EN 12354-3:2017)

5.6 Glazing Requirements

The acoustic glazing requirements are shown in the table below. The glazing shall achieve the sound insulation performance values, at each 1/1-octave-band centre frequency equal to or greater than, of the values given below. Indicatively the overall, single-figure performance requirement is given (in terms of the "R_w + C_{tr}" (dB) metric), with an indicative glazing configuration provided which could be capable of achieving these values.

Table 5—2 Facade glazing requirements

Space	Airborne sound insulation (dB) at 1/1-octave band centre frequency (Hz)						R _w + C _{tr} dB	Indicative glazing configuration
	125	250	500	1K	2k	4k		
All rooms	26	28	31	40	44	50	34	Saint Gobain Glass: 8mm pane / 6mm inert gas cavity / 6.4mm acoustic laminate

It can be seen from the table above that the sound insulation requirements are not particularly onerous and can be achieved with typical curtain walling, double-glazed configurations.

From previous experience, it is considered likely that specified glazing configurations may be thicker, thus achieving greater sound insulation performances than the (minimum) requirements detailed above, and usually where non-acoustic (e.g. thermal) requirements act as the primary drivers on the facade design.

In such cases, where the acoustic performance of specified facade systems has the potential to over-perform (thereby potentially resulting in a reduction of the sound masking provided by recommended levels of intrusive noise which, in turn, may degrade acoustic privacy) then "sound conditioning" systems may be specified, to mitigate this possibility.

5.6.1 General Glazing Notes

Where specified to be closable, all windows should be well-sealed. It is imperative that the frame does not compromise the acoustic performance of the installed system, and the acoustic requirements given above apply to the glazing configuration, the frame, and any associated ironmongery. It is usually recommended to specify uPVC, hardwood, or aluminium frames, which should be well-sealed into their respective apertures.

Where softwood windows are to be specified, these should be provided with guarantees given by the manufacturer that the specified acoustic performance will be maintained for the life of the windows.

No gaps should be visible around frames from the exterior, and all specified glazing systems (including curtain walling) should be certified to achieve the minimum thermal performance requirements stipulated under *Approved Document: Part L2B* of the Building Regulations ($U\text{-value} \leq 1.8 \text{ W}/(\text{m}^2.\text{K})$ or less, according to Para. 4.28 of *Part L2B*).

5.7 Compliance with MCC Planning Condition 18) of Planning Permission Ref. 124973/FO/2019

MCC Planning Condition 18). states that any part of the scheme falling within Use Classes: A1, A2, A3, A4, B1a, and D1, under any phase of the NOMA Plots 2 & 3 development (including the proposed retail, gymnasium, and flexible seminar/cinema spaces), shall be required to be acoustically insulated and treated to mitigate noise egress. The target criterion which noise egress via any of the scheme building elements (e.g. facades) is required to be achieved, will be a level which is 10 dB below the typical background level "Without Entertainment Noise" coinciding with the proposed hours of operation of each Use Class and at each 1/1-Octave Band Centre Frequency (OBCF) between 63 Hz and 8 kHz (and in terms of the " L_{F90} " (dB) metric), when assessed at the location of the nearest-affected, noise-sensitive receptors (NSRs).

Additionally, at completion of each phase of development, a verification report will be required to validate that the work undertaken throughout the development conforms to the recommendations and requirements in the approved acoustic consultant's report in respect of that phase.

A schedule of post-completion testing, the results of which should be presented in an acoustic report, shall be commissioned, to confirm that the noise criteria determined for compliance with the stated condition, is demonstrated to be 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.

Upon completion of each phase of development, a verification report will be required to validate that the work undertaken throughout the development conforms to the recommendations and requirements in the approved acoustic consultant's report in respect of that phase. The report shall also undertake post completion testing to confirm that acceptable criteria have 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.

Commercial retail units are designed to shell and units will be acoustically insulated in accordance with tenant fit out. As such an acoustic report will be prepared at condition discharge stage.

6 Noise Impact on Noise-Sensitive Receptors

6.1 External Plant Noise Impacts

With regards to demonstration of compliance with MCC Planning Condition 20), the target for externally generated plant noise, has been reproduced in the following section. This target is replicated from the same Buro Happold Planning Report (Acoustics) submitted for NOMA Plots P & Q (presented in Appendix A).

Furthermore, on the 12 August 2019, Sue Jones (MCC EHO) confirmed their agreement with the use of the “*previous measurements taken in the vicinity of the site as they are recent and representative*”.

For reference, measured background noise levels, captured as part of the additional noise monitoring undertaken on the 15 August 2019 survey are slightly higher (i.e. which would result in a less onerous noise target), than those measured as part of the NOMA Plots P & Q planning submission, which are adopted in this assessment.

6.2 External Plant Noise Target

As indicated in Section 3.8.1. the lowest-measured background noise level (in terms of the “ $L_{AF90,15min}$ ” (dB) metric) was acquired at (short-term) Location 2, during the January 2019 survey and the corresponding plant noise target (by application of MCC’s Planning Consent 20) and *Planning & Noise Technical Guidance* (June 2022), cf. Section 3.6.1.5.) is shown in the table below:

Table 6—1 Measured background noise levels and target plant noise levels at NSRs

NSR	Lowest measured daytime background noise; $L_{AF90,15min}$ dB(A) (07:00-23:00 hrs)	MCC Planning Consent 20) and Planning & Noise Technical Guidance (§3.6.1.5.)	Plant daytime Rating Level at 1-metre from NSR Facades; $L_{A,r,Tr}$ dB(A) (07:00-23:00 hrs)
All	56	- 5 dB	51

Whilst specific plant selections and retail uses have not been finalised at the planning stage, the most robust method in terms of demonstrating compliance with planning requirements is to set target noise levels for plant at the nearest-affected, noise-sensitive receptors (NSRs). It should be noted that the target given in the table above is a “Rating Level” (as defined in BS4142:2014+A1:2019) and will therefore require correcting if the noise generated by the final plant selections or retail uses, contain acoustically distinguishable features (such as; “intermittence”, “impulsiveness” or “tonality”).

It should also be noted that they are the target for all items of plant operating simultaneously, and if there are multiple items, then the sound pressure level of each would need to be lower to factor in the cumulative effect.

It is considered likely that the physical distances between the proposed mechanical plant (including; fresh air intake (FAI)/exhaust air terminations) and the noise-sensitive elements of the proposed scheme (e.g. their own facades), will be significantly less than the distances between the same equipment locations and the nearest-affected NSRs. As such, it is anticipated that the cumulative noise impact due to all proposed plant, when assessed at the proposed scheme facades, will likely drive the specified noise levels for all externally located equipment. In turn, this would result in a lower noise impact than the permissible planning requirements indicated in the above table.

6.3 Outline Plant Mitigation Proposals

When achieving target noise emissions for discrete items of proposed equipment, it may be necessary to specify noise mitigation measures. These could include, but are not limited to, atmospheric-side attenuators (FAIs or exhausts), acoustic enclosures, duct lagging and acoustic barriers/louvred screens or reselection of quieter plant and/or operating modes. Such noise mitigation measures are usually specified at the detailed design stage (i.e. RIBA Stage 4) and once all plant schedules are finalised. Examples of a selection of these measures are shown below.

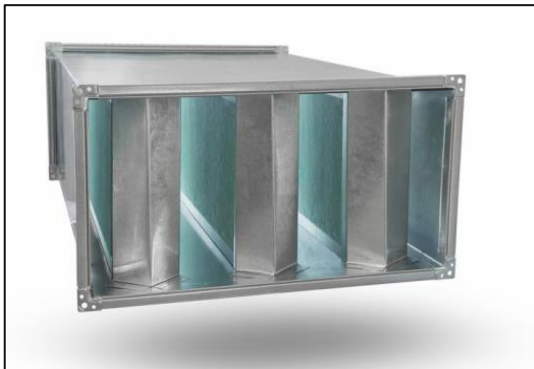


Figure 6—1 Rectangular in-duct attenuator

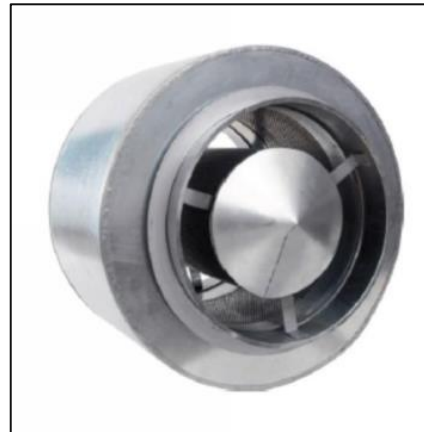


Figure 6—2 Circular in-duct attenuator



Figure 6—3 Duct lagging



Figure 6—4 Acoustic barrier

6.4 Compliance with MCC Planning Condition 4

Planning Condition 4 mandates a requirement to provide a detailed *Construction Management Plan* (CMP) before the commencement of works during any phase of development (to be submitted to and approved by the Local Planning Authority).

Whilst not explicitly stipulated under Condition 4), but as recommended under Section 3.6.1.4. of MCC's *Planning and Noise – Technical Guidance* (June 2022); where a scheme is required to submit a CMP, the Local Planning Authority may request this includes a Noise & Vibration section which makes an allowance for the assessment of construction noise and vibration impacts, at the boundaries of the nearest-affected NSRs by adopting the methodologies contained in British Standards; BS5228-1 and BS5228-2 respectively.

Any potential acoustic impacts from the construction stage will be mitigated through measures set out within a detailed construction management plan to be submitted to discharge the relevant planning condition. Outline noise mitigation measures are detailed within the Outline Construction Management Plan submitted in support of the planning application.

6.5 Operational Noise Impacts

As identified under Section 5.7, specific Use Classes comprising the development, pertinently those anticipated to generate internal noise levels notionally more than 70 dB $L_{Aeq,T}$, shall be subject to demonstration of compliance with Planning Condition 18). In the context of this development, it is likely that the proposed gymnasium and the flexible seminar/cinema spaces may be expected to generate internal operating sound levels over this notional level. In these cases, appropriate acoustic measures will need to be implemented (at the appropriate design stage) to ensure continued compliance with the requirements of the stated condition.

6.6 Compliance with MCC Planning Condition 19

With the objective of safeguarding the amenities of occupiers of nearby properties, compliance with Condition 19 mandates that no part of the site outside of the building in any phase, shall be used other than in accordance with a schedule of days and hours of operation submitted to and approved in writing by the City Council.

Pertinently, no amplified sound or any music shall be produced or played, in any part of the site outside of the building (including any of the external or roof terraces) and under any phase of development.

Consequently, no specific noise impact assessments or associated noise control measures due to externally generated amplified sound are recommended in this Report.

7 Conclusions

The existing noise climate at the proposed development is such that acceptable internal ambient noise levels (IANLs) can be achieved with conventional double-glazed constructions.

It is understood that mechanical ventilation (specifically MVHR units) is to be used to provide the ventilation requirements for all spaces.

A target daytime, plant noise level at the facades of the nearest-affected NSRs has been set. The corresponding Rating Level is based on achieving -5 dB below the lowest background noise level measured over a long-term survey, representing that which would be incident on nearest-affected, NSRs. It is anticipated that the limiting plant noise level will be achieved due to the design-based requirement to control noise levels at noise-sensitive areas of the proposed scheme, which are likely to be significantly closer than the NSRs themselves.

Any potential acoustic impacts from the construction stage will be mitigated through 'best practicable means' set out within a detailed construction management plan to be submitted to discharge the relevant planning condition.

Based on the above, the proposed development is considered suitable in compliance with all relevant national and local planning requirements, and concerns on the grounds of noise need not be considered a significant barrier to development.

Appendix A Angel Square (Plot P) and Primary Sub-station (future 5 Angel Square - Plot Q), NOMA, Manchester (April 2019)

**4 Angel Square (Plot P) and Primary Sub-station (future
5 Angel Square - Plot Q), NOMA, Manchester**

Planning Report – Acoustics & Vibration

0042512

25 April 2019

Revision 01

Revision	Description	Issued by	Date	Checked
00	First issue	DB	18/04/19	BFB
01	Minor changes to Section 5.2.1. Sub-station mitigation included in Section 6.	GD	25/04/19	BFB

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date

25 April 2019

approved

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date

25 April 2019

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Glossary

Term	Definition
α (&- α_w)	Sound absorption coefficient (& weighted sound absorption coefficient) is a measure of the effectiveness of materials as sound absorbers; it is the ratio of the sound energy absorbed or transmitted (i.e. not reflected) by a surface to the total sound energy incident upon that surface. The value of the coefficient varies from 0 (perfect reflector) to 1 (perfect absorber).
A (& A_T)	Absorption area (& total absorption area) is equal to the product of multiplying the surface area of a construction (in m2) and its sound absorption coefficient (α).
Ambient Noise (as defined in BS 4142:2014)	Totally encompassing noise in a given situation at a given time; it is usually composed of noise from many sources, near and far.
Background Noise (as defined in BS 4142:2014)	A-weighted sound pressure level of the residual noise at the assessment position that is exceeded for 90% of a given time interval, T, measured using time weighting, F, and quoted to the nearest whole number of decibels.
C _{tr}	Spectrum adaptation term calculated using traffic noise as described in ISO 717-1:1996. This term is provided with weighted single values such as $D_{nT,w}$ or R_w to match with particular requirements (building acoustic or traffic noise spectrum).
Decibel, dB	Commonly used unit used for the comparison of the powers of levels sound. Abbreviation dB. Is the unit of level derived from the logarithm of the ratio between the value of a quantity and a reference value? For sound pressure level (L_p) the reference quantity is 2x10-5 N/m². The sound pressure level existing when microphone measured pressure is 2x10-5 N/m² is 0 dB, the threshold of hearing.
$D_{n,fw}$	The weighted transmission of sound energy from a source room to a receiving room via structural (vibrational) paths in the construction mainly, e.g. walls, floors, ceilings.
$D_{nT,w}$ – standardised level difference	$D_{nT,w}$ is widely used to denote the weighted sound insulation criteria for residential dwellings, where T_0 is taken as 0.5 seconds. In the instance of testing in schools, T_0 is taken as the rooms T_{mf} .
D_{nTw} (C, C _{tr})	Weighted standardized level difference: Single figure value of airborne sound insulation performance. This European index is described in ISO 140-4:1998 and ISO 717-1:1996. This performance describes the installed site performance of the composite separating constructions, including the partition element performance, the flanking path transmission and the reception room reverberation time factors. $D_{nT,w}$ target leads to a selection of adequate construction elements and methods to build the partition that is rated using weighted sound reduction index R_w (C;C _{tr}).
D_w	Weighted level difference: Single-number quantity that characterizes airborne sound insulation between rooms, but which is not adjusted to reference conditions
Flanking Noise	The transmission of sound around the perimeter or through holes within partitions (or barriers) that reduces the otherwise obtained sound transmission loss of a partition. Examples of flanking paths within buildings are ceiling plenum above partitions or raised floor cavities, ductwork, piping, and electrical conduit penetrations through partitions, back to back electrical boxes within partitions, window mullions, etc.
Frequency	Number of cycles per second, measured in hertz (Hz), related to sound pitch.
IANL – indoor ambient noise level	Table 1.1 in BB93 specifies the upper limit for indoor ambient noise levels within teaching areas. The design criteria are set for a 30-minute average level (i.e. $L_{Aeq,30mins}$). However, where there is a negligible change in the noise level, BB93 states that a much shorter time period (e.g. $L_{Aeq,5min}$) can be used. BB93 also states that for rooms identified having limits of $L_{eq,30min}$ 35 dBA or less, the noise should not regularly exceed $L_{1,30min}$ 55 dBA.
$L_{90,T}$ (& $L_{A90,T}$)	Sound pressure level exceeded 90% of the measurement period. Referred to as background noise level.

$L_{Ar,T}$	Rating Noise Level (as defined in BS 4142:2014), the specific noise level plus any adjustment for the characteristic features of the noise.
$L_{eq,T}$ (& $L_{Aeq,T}$) - equivalent continuous noise level of a time-varying noise	Steady noise level which, over the period of time under consideration, contains the same amount of sound energy as the time-varying noise over the same period of time.
$L_{Fmax,T}$ (& $L_{AFmax,T}$)	The maximum sound pressure level measured during the measurement period T using the fast time constant.
$L'_{nT,w}$	Weighted standardized impact sound pressure level: a single-figure value of impact sound insulation performance. This European index is described in ISO 140-7:1998 and ISO 717-2:1997, used for comparing and rating floors and based on the values of L'_{nT} at different frequencies. L'_{nTw} target leads to a selection of adequate construction elements and methods to build the floor that is rated using weighted normalized impact sound pressure level $L_{n,w}$.
$L_{n,w}$	Weighted normalized impact sound pressure level: European single figure rating for transmission loss of impact sound through building elements as described in ISO 140-6:1998 and ISO 717-2:1997. The lower the $L_{n,w}$ the better the performance.
L_p - sound pressure level	Sound pressure level, in decibels, of a sound is 20 times the logarithm to the base of 10 of the ratio of the sound pressure to the reference pressure. The reference pressure shall be explicitly stated and is defined by the standard.
L_w – sound power level	Sound power level, in decibels, of a sound is 10 times the logarithm to the base of 10 of the ratio of the sound power level to a specified reference level. The reference pressure shall be explicitly stated.
Noise Rating (NR)	Curves developed by the International Organization for Standardization (ISO) to determine the acceptable indoor environment for hearing preservation, speech communication and annoyance. These can be compared to NC curves and also can be referred to as equivalent dBA levels.
Reverberation Time (RT)	The time required for the steady sound pressure level in an enclosed space to decay by 60 dB, measured from the moment the sound source is switched off. Reverberation time is described in ISO 354:2003.
R_w (C, C _{tr})	Weighted sound reduction index: Single-figure value of sound reduction according to ISO 140-3:1995, used for rating partition systems, door-sets or glazing, based on the values of sound reduction index R at different frequencies. The higher the R_w the better the performance.
Single Event Level (SEL [L_{AE}])	The sound level over one second which would have the same energy content as the whole event.
Specific Noise Level (as defined in BS 4142:2014)	The equivalent continuous A-weighted sound pressure level at the assessment position produced by the specific noise source over a given reference time interval.
T_{mf} – mid-frequency reverberation time	Within BB93, the reverberation time criteria are set in terms of the averaged value of the 500 Hz, 1000 Hz and 2000 Hz frequency bands. The various levels for T_{mf} are specified within Table 1.5 of BB93 and are generally upper limits. The Sub-Note to Table 1.5 notes that the specified mid-frequency reverberation times are for ‘finished but unoccupied and unfurnished rooms’.
Vibration	The force which oscillates about some specified reference point. Vibration is commonly expressed in terms of frequency such as cycles per second (cps), Hertz (Hz), cycles per minute (cpm) or (rpm) and strokes per minute (spm). This is the number of oscillations which occurs in that time period. The amplitude is the magnitude or distance of travel of the force.
Weightings (as defined in IEC 61672:2003):	A-Weighting: Frequency weighting devised to attempt to take into account the fact that human response to sound is not equally sensitive to all frequencies; it consists of an electronic filter in a sound level meter, which attempts to build in this variability into the indicated noise level reading so that it will correlate, approximately, with human response.). C-Weighting: One of the frequency weightings corresponding to the 100-phon contour and the closest to the linear or un-weighted value.

1 Introduction

1.1 Scope of Work

BuroHappold (acoustics) have been commissioned by NOMA (GP) Ltd. to carry out a Noise Impact Assessment to support a planning application for a proposed new office building at 4 Angel Square (Plot P), and a primary sub-station at 5 Angel Square (Plot Q) NOMA site, Manchester.

The assessment details the noise impact upon the proposed development from the existing noise climate as well as the potential noise impact of mechanical plant and equipment installed as part of the proposed development upon existing noise sensitive receptors (NSRs). In summary, the assessment includes the following:

- Description of the proposed development and site;
- Acoustic criteria and pertinent planning guidelines;
- Existing baseline conditions at the site and surrounding area;
- Potential noise impact upon the proposed development;
- Potential noise impact upon existing NSRs;
- Noise mitigation measures such as acoustic façade requirements and limiting noise levels for plant and equipment (where required); and
- Conclusions.

The purpose of this assessment is to evaluate the existing noise climate at and within the vicinity of the proposed development site and where required, provide recommendations for noise mitigation measures in order to achieve an appropriate internal and external acoustic environment. Recommendations within this report are in line with relevant Standards and pertinent Planning Policy.

1.2 Description of Proposed Development and Site

The development proposal includes the redevelopment of land bound by Miller Street to the south and Corporation Street to the west to provide various new buildings within the mixed-use NOMA scheme in Manchester city centre. Currently, the former Ducie Bridge pub and associated buildings occupy the south-west corner of the site with car parks on the remainder of the site.

The 4 Angel Square development is proposed in the south-west corner of the site to include redevelopment and erection of offices (B1); and flexible A1 to A4 and D2 uses at ground floor with associated parking, hard and soft landscaping and access.

The proposed development of 4 Angel Square is to total a maximum gross internal floor area of 20180 m² over 11 stories as follows;

- **Grade A office space** – approx. 17800 m²;
- **Commercial (A1, A2, A3, A4, B1 and D2)** – approx.. 680 m² on the ground floor;
- **Basement** – Car Park - up to 1700 m²; and
- **Roof terrace** – proposed at Level 6 or 10.

An annotated site plan is shown in the figure below.



Figure 1—1 Proposed development site

The following bound the proposed development site:

- Parkers Hotel Apartment adjacent to the western boundary;
- Car parks immediately to the north and east;
- The Co-op building to the north-east;
- Residential properties to the north separated by the car park and Corporation Street road;
- Corporation Street road immediately to the west;
- Miller Street road immediately to the south;
- Corporation Street to the south;
- Corporation Street, Miller Street and Corporation Street junction at the south-west corner boundary;
- Office buildings to the south separated by Corporation Street road;
- Red Bank road at a lower level to the north of the site;
- Manchester Victoria station to the south-west with associated train and tram lines extending west to east to the north of the site; and
- Working construction site to the east.

An annotated aerial site image is shown in the figure below.

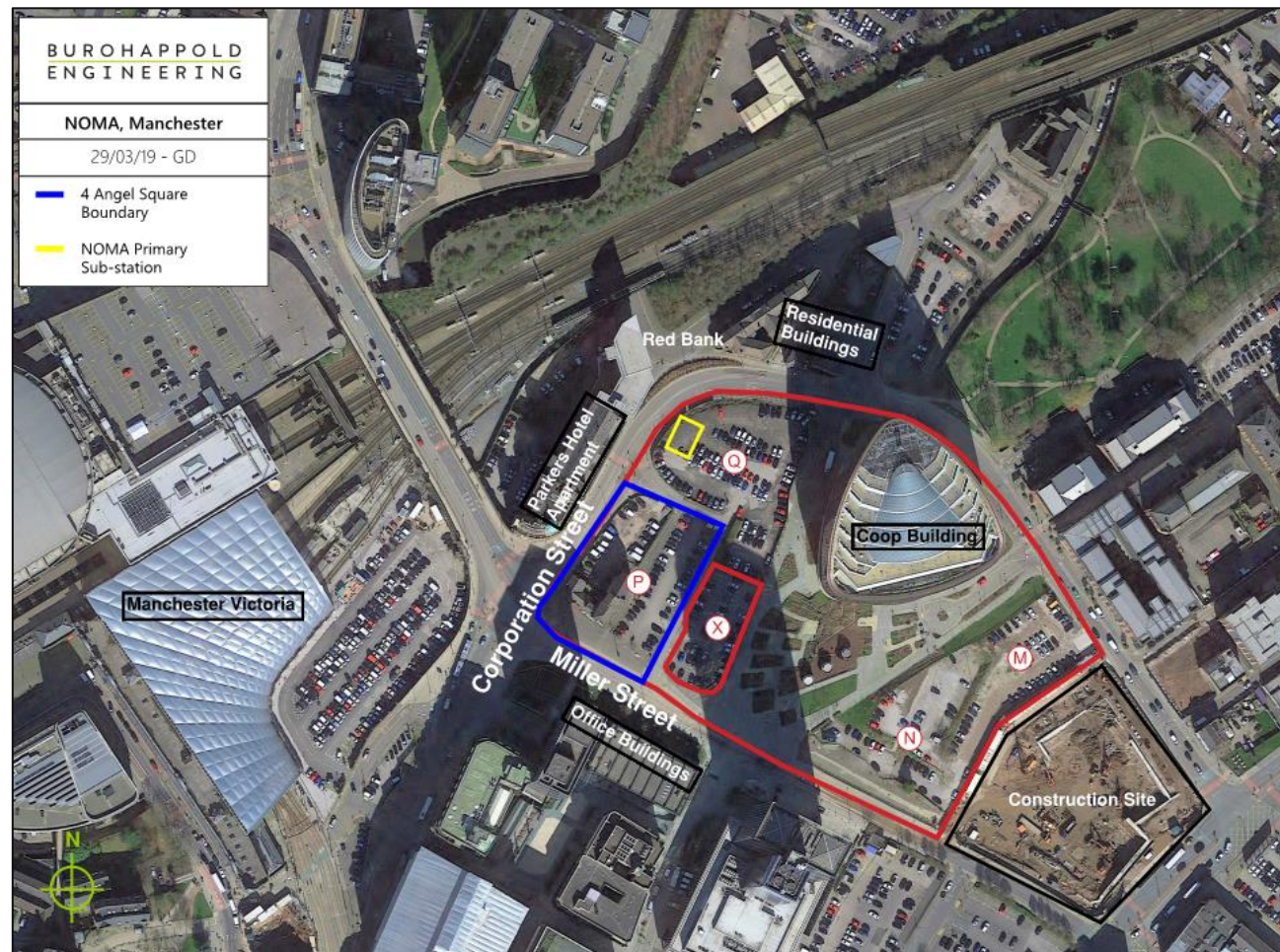


Figure 1—2 Site map

The local road network is considered the primary noise source in the area.

2 Acoustic Design Criteria

2.1 Draft Planning Application

The Draft Application Document Schedule (dated October 2018) by Deloitte provides the following guidance with regards the likely following planning requirements for the proposed development.

Noise Impact Assessment – Details of the existing noise levels in the area and what measures will need to be implemented on site to meet internal noise requirements. Also, details will be required of any potential noise breakout from the building and transfer between building levels, in particular, the retail uses at ground level and any external equipment that will need to be acoustically insulated. If any external seating areas are proposed, the assessment should consider the noise impact of these spaces. The assessment should be in line with Manchester City Council's Planning and Noise Technical Guidance (December 2015).

These recommendations have been considered in later sections of this report.

Noise transfer between spaces will be considered as part of the RIBA design reports. It is recommended that the minimum sound insulation performance of separating floors between retail uses at ground floor and office use above, should be $D_{nT,w}$ 55 dB.

External seating areas have not been proposed at the site at this stage, this could be assessed at a later stage, as required, as the design is developed.

2.2 Relevant Guidance Documentation

This report is to be primarily informed by the following standards and guidelines:

- The National Planning Policy Framework, 2012 (NPPF);
- The Noise Policy Statement for England, 2010 (NPSE);
- BS 4142:2014 - Methods for rating and assessing commercial and industrial sound;
- BS 8233:2014 - Guidance on sound insulation and noise reduction for buildings;
- World Health Organisation (WHO) – Guidelines for community noise;
- BREEAM UK New Construction – Non-domestic Buildings (U.K.), Technical Manual SD5078: 1.0 – 2018;
- Manchester City Council (MCC) - Planning and Noise - Technical Guidance (December 2015); and
- Chartered Institution of Building Services Engineering (CIBSE) – Environmental design - CIBSE Guide A (January 2016).

National planning policy and BREEAM criteria are referenced in this section. Quantitative criteria from relevant standards and guidelines are contained within relevant sections of the report.

2.3 English Planning Policy on Noise Impact – The NPPF and NPSE

The NPPF is the over-arching planning policy document that applies to all new developments in England. The guidance and assessment criteria are given (or referred to) in this document can, therefore, be applied to all other standards in terms of assessing the suitability of granting Planning permission with respect to noise impact.

The NPPF states that planning policies and decisions should aim to:

- avoid noise from 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 impacts on health and quality of life arising from noise from new development, including through the use of conditions;
- recognise that development will often create some noise and existing businesses wanting to develop in the continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land uses since they were established; and
- identify and protect areas of tranquillity, which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.

With specific reference to noise impact, the NPPF document refers to the Noise Policy Statement for England (NPSE). The NPSE provides guidance, which enables decisions to be made regarding the acceptable noise burden to place on society, using three key phrases – the No Observed Effect Level (NOEL), the Lowest Observed Adverse Effect Level (LOAEL) and the Significant Observed Adverse Effect Level (SOAEL).

In order to provide a consistent frame of reference (and to allow a view to be taken on the suitability of the application with reference to the relevant Planning guidance), the levels or criteria given in other relevant documents used in the assessment will be re-framed in terms of the following:

2.3.1 No Observed Effect Level (NOEL)

The NOEL is the level of noise impact below which no effect can be detected, and there would be no discernible negative effect on health or quality of life.

2.3.2 Lowest Observed Adverse Effect Level (LOAEL)

The LOAEL is the lowest level of noise impact above which adverse effects on health or quality of life can be detected. Designing noise impacts to be equal-to-or-less-than, the LOAEL should see that any adverse effects on health or quality of life are negligible.

2.3.3 Significant Observed Adverse Effect Level (SOAEL)

The SOAEL is the level above which significant adverse effects on health and quality of life occur. Designs should always seek to avoid a noise impact, which would be categorised as a SOAEL.

2.4 BREEAM Acoustic Requirements

Building Research Establishment's Environmental Assessment Method (BREEAM) is a method used to assess, rate and certify the sustainability of buildings. The objectives of BREEAM are:

- To provide market recognition of buildings with a low environmental impact;
- To ensure the best environmental practice is incorporated in building planning, design, construction and operation;

- To define a robust, cost-effective performance standard surpassing that required by regulations;
- To challenge the market to provide innovative, cost-effective solutions that minimise the environmental impact of buildings;
- To raise the awareness amongst owners, occupants, designers and operators of the benefits of buildings with a reduced life cycle impact on the environment; and
- To allow organisations to demonstrate progress towards corporate environmental objectives.

2.4.1 Available credits

It is understood that the building is to be assessed and rated according to BREEAM UK New Construction – Non-domestic Buildings (U.K.), Technical Manual SD5078: 1.0 – 2018. This development is targeting all (four) available credits.¹

2.4.2 BREEAM criteria

It is understood that the development is targeting four credits under BREEAM Hea 05 ‘Acoustic Performance’ and Pol 05 ‘Noise Pollution’.

The aim of Hea 05 is:

“To ensure the building is capable of providing an appropriate acoustic environment to provide comfort for building users.”

The aim of Pol 05 is:

“To reduce the likelihood of noise arising from fixed installations on the new development affecting nearby noise-sensitive buildings.”

Table 2—1 details the BREEAM criteria applicable to the development.

Table 2—1 BREEAM 2018 Non-domestic Buildings Criteria

Building Type	BREEAM Reference	Acoustic Parameter	No. of Credits	Criteria
Office	Hea 05 - Acoustic Performance	Sound Insulation	1	<i>“The sound insulation between rooms and other occupied areas complies with the performance criteria given in Section 7 of BS 8233:2014. This should be based on the layout and function of the different spaces within the building.</i> <i>... If testing is to be carried out where the office is not yet furnished, then section 7.5 of BS 8233:2014 should be referred to when determining the performance criteria. Where the office is to be furnished at the time testing is carried out, then refer to section 7.7.6 of BS 8233:2014 for the relevant performance criteria.”</i>
Retail				<i>“The sound insulation between rooms and other occupied areas complies with the performance criteria given in Section 7 of BS 8233:2014. Alternatively, propose performance standard based on demonstrably best practice.”</i>

¹ Confirmed in an e-mail from Ben Wells (Director, Mainer Associates) dated 28 January 2019.

Office / Retail		Indoor ambient noise levels (IANL)	1	<i>“Achieve indoor ambient noise levels that comply with the design ranges given in Section 7 of BS 8233:2014.”</i>
		Room acoustics	1	<i>“Achieve the requirements relating to sound absorption and reverberation times, where applicable, set out in Section 7 of BS 8233:2014.”</i>
Development Wide	Pol 05	Reduction of noise pollution	1	<i>“1 There are no noise-sensitive areas within the assessed building or within 800 m radius of the assessed site.</i> <i>OR</i> <i>2 Where there are noise-sensitive areas within the assessed building or noise-sensitive areas within 800 m radius of the assessed site, a noise impact assessment compliant with BS 4142:2014(222) is commissioned. Noise levels must be measured or determined for:</i> <i>2.a Existing background noise levels:</i> <i>2.a.i at the nearest or most exposed noise-sensitive development to the proposed assessed site</i> <i>2.a.ii including existing plant on a building, where the assessed development is an extension to the building</i> <i>2.b Noise rating level from the assessed building.</i> <i>3 The noise impact assessment must be carried out by a suitably qualified acoustic consultant.</i> <i>4 The noise level from the assessed building, as measured in the locality of the nearest or most exposed noise-sensitive development, must be at least 5dB lower than the background noise throughout the day and night.</i> <i>5 If the noise sources from the assessed building are greater than the levels described in criterion 4, measures have been installed to attenuate the noise at its source to a level where it will comply with the criterion.”</i> <i>In summary, the BREEAM credit Pol 05 requires that the level of noise impact from any newly-introduced plant items is at least 5 dB lower than the background noise level (L_{A90,15mins}) throughout the day and night when assessed at an existing noise-sensitive receptor.</i>

BREEAM targets have been addressed in the following sections of this report.

2.4.3 BREEAM Suitably Qualified Acoustician (SQA)

This report has been prepared by Daniel Bailey, who is a full member of the Institute of Acoustics and is therefore considered a SQA consultant for BREEAM purposes.

3 Site and External Noise Survey Results

3.1 Introduction

BuroHappold Engineering conducted an external noise survey at 4 Angel Square, NOMA, primarily for two purposes, relating both to the design as a whole and the requirements of planning:

- To capture the noise impact from surrounding environmental noise sources (e.g. roads) on the proposed façades. This allows the specification of external building envelope attenuation (i.e. glazing and ventilation) to see that internal ambient noise levels within noise-sensitive rooms can be compliant with appropriate criteria (as a minimum); and
- To capture the existing background noise levels at nearby noise-sensitive (i.e. residential) receivers. This allows the specification of limiting noise levels for any externally located (or external terminations of) services plant, to see that the installation will not unduly increase existing noise levels in the vicinity of the site.

BuroHappold Engineering staff visited the site to undertake an attended noise survey between Tuesday 22 and Wednesday 23 January 2019 to obtain the required data as described above.

This section details the methodology and results of the environmental noise survey.

3.2 Survey Details

The survey methodology, timings and positions were agreed in principle with Laura Miller (Environmental Protection Specialist) at Manchester City Council (MCC) prior to attending site². MCC are interested in the results from measurements taken during the absolute quietest period of a typical week, and also from some of the noisiest periods of a typical week (agreed to be adequately represented by the morning rush hour). As such, the noise survey methodology provides a comprehensive and complete picture of how noise levels change around the site throughout various times of the day and night-time.

Long-term (24 hours) unattended noise measurements were made at one location on site with concurrent short-term (15 minutes) attended noise measurements were undertaken during the day and night-time periods at three locations around the site.

Measurement locations are detailed below and marked on an annotated aerial image in Figure 3—1:

- Location 1** – (Lat.: 53.4878, Long.: -2.2398) – This is a long-term unattended measurement position which is subject to façade corrections (- 3 dB applied to all measurement figures at this location). Noise measurements were undertaken at the south-west corner of the site at Level 2 of the Ducie Bridge building overlooking Miller Street. This measurement location was set back at a distance of approximately 15 m from Miller Street at a height of approximately 8 m. This measurement location is considered representative of noise levels along the proposed south-western site boundary.
- Location 2** – (Lat.: 53.4880, Long.: -2.2387) – Short-term attended noise measurements were undertaken at the north-east corner of the proposed development site approximately 1 m from Beswick Row in free field conditions. This measurement location is approximately 45 m from the Coop Building to the east and approximately 1.5 m above ground level. This measurement position is considered representative of noise levels along the proposed north-eastern site boundary.

- Location 3** – (Lat.: 53.4882, Long.: -2.2393) – Short-term attended noise measurements were undertaken at the north-west corner of the proposed development site approximately 10 m from the Corporation Street in free field conditions. This measurement location was set approximately 17 m from the nearest noise sensitive receptor to the west (Parkers Hotel Apartment) of the development, and 1.5 m above ground level. This measurement position is considered representative of noise levels along the proposed western site boundary and background noise levels at the nearby noise-sensitive receptors.
- Location 4** – (Lat.: 53.4875, Long.: -2.2391) – Short-term attended noise measurements were undertaken at the south-west corner of the proposed development site, in free field conditions, approximately 8 m from the entrance to Beswick Row, 10 m from the Miller Street, and 1.5 m above ground level. This measurement location is considered representative of noise levels along the proposed south-eastern site boundary.

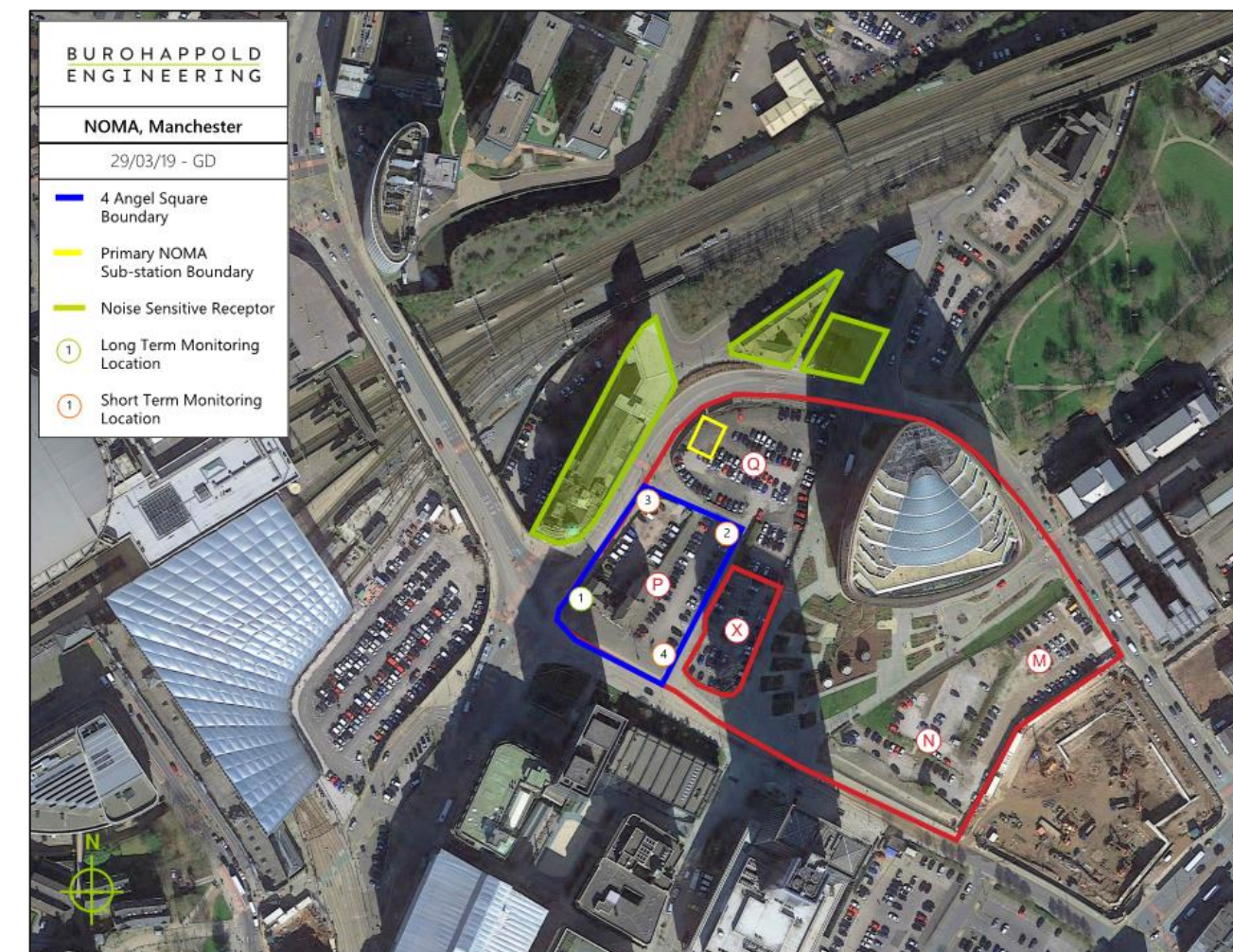


Figure 3—1 Site plan showing measurement locations, NSRs and site boundary

Weather conditions during the noise survey were generally appropriate, being mostly dry with light winds (i.e. <5m/s).

Unattended noise measurements were made generally in accordance with BS EN 61672:2003 and BS 7445:2003 using the following equipment:

- Rion NL-52 Class 1 sound level meter (serial number: 01265411).

Attended noise measurements were made generally in accordance with BS EN 61672:2003 and BS 7445:2003 using the following equipment:

² In a telephone conversation on 22 January 2019.

- Class 1, Brüel & Kjær sound level meter (serial number: 3008216).

On-site calibration checks were performed on all the meters before and after the measurements and were found to be within the permitted tolerance of BS EN 61672-1:2013. All equipment had a valid calibration certificate at the time of the survey.

Sources of significant vibration such as over-ground rail and tram lines are more than 65 m away from the development site. Therefore baseline vibration monitoring was not conducted as it is generally considered that at a distance of 10 m or more the effects of ground-borne vibration will be minimal. No significant levels of noise vibration were experienced by the site survey engineer during the course of the survey.

3.3 Results

3.3.1 Unattended noise survey

Results of the unattended noise survey are shown in the table below. The presented noise levels are the period log averaged façade corrected $L_{Aeq,T}$ value, lowest measured $L_{A90,15min}$, and the highest typically occurring façade corrected $L_{AF,max}$ event (i.e. road traffic events) during the period.

Table 3—1 Unattended noise measurements with façade corrections at Location 1 (22/01/18 – 23/01/18)

Period (hours)	Elapsed Time (HH:MM)	$L_{Aeq,T}$ dBA	$L_{A90,15min}$ dBA	$L_{AF,max}$ dBA
Daytime (07:00 – 23:00)	16:00	69	58	100
Office hours (09:00 – 17:00)	07:00	72	63	100
Night-time (23:00 – 07:00)	08:00	64	46	77

In order to compare unattended and attended measurements the following table provides the approximate concurrent noise measurements from the unattended position.

Table 3—2 Unattended noise measurements with façade corrections at Location 1 (22/01/18 – 23/01/18)

Date	Start Time (HH:MM)	Elapsed Time (MM:SS)	$L_{Aeq,T}$ dBA	$L_{A90,15min}$ dBA	$L_{AF,max}$ dBA
23/01/19	08:15	15:00	68	62	84
	08:30	15:00	67	62	83
	08:45	15:00	68	62	83
23/01/19	06:00	15:00	65	58	74
	06:15	15:00	67	60	77

	06:30	15:00	69	63	92
	06:45	15:00	68	63	77

3.3.2 Attended noise survey

Measured noise levels at each attended monitoring location are reproduced in Table 3—3 to Table 3—5. The presented noise levels are the period log averaged $L_{Aeq,T}$, $L_{A90,15min}$ values, and the highest typically occurring $L_{AF,max}$ event (i.e. road traffic events) during the period.

Table 3—3 Attended noise measurements at Location 2

Date	Start Time (HH:MM)	Elapsed Time (MM:SS)	$L_{Aeq,T}$ dBA	$L_{A90,15min}$ dBA	$L_{AF,max}$ dBA
23/01/19	08:16	15:00	62	56	76
23/01/19	06:00	15:00	59	51	77

Table 3—4 Attended noise measurements at Location 3

Date	Start Time (HH:MM)	Elapsed Time (MM:SS)	$L_{Aeq,T}$ dBA	$L_{A90,15min}$ dBA	$L_{AF,max}$ dBA
23/01/19	08:32	15:00	69	59	84
23/01/19	06:23	15:00	68	54	79

Table 3—5 Attended noise measurements at Location 4

Date	Start Time (HH:MM)	Elapsed Time (MM:SS)	$L_{Aeq,T}$ dBA	$L_{A90,15min}$ dBA	$L_{AF,max}$ dBA
23/01/19	08:49	15:00	69	60	84
23/01/19	06:45	15:00	70	58	85

3.4 Measurement Summary

A summary of typical, measured noise levels to be used for the assessment are overlaid onto an aerial site image in the image below.

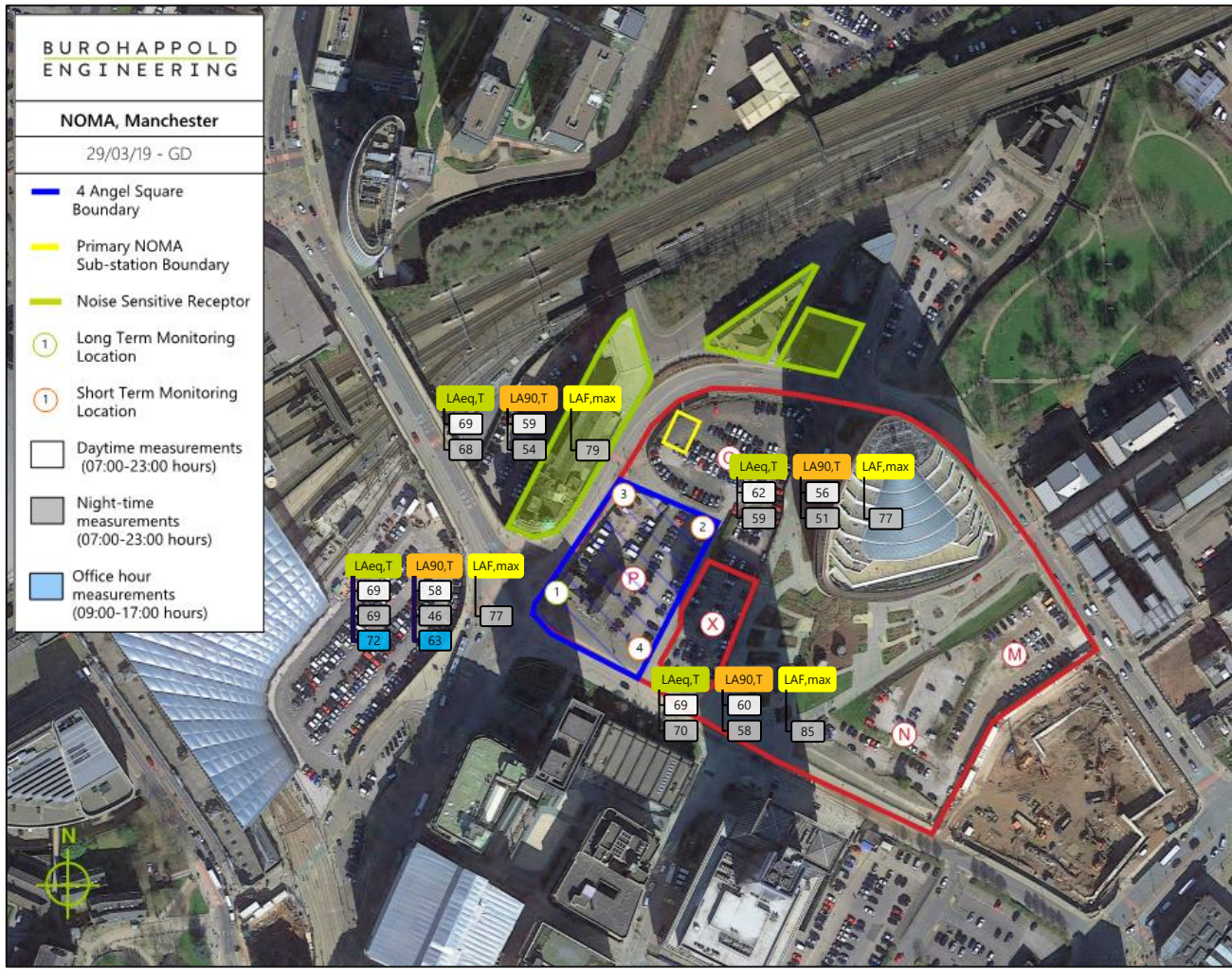


Figure 3—2 Site plan showing noise measurement summary

3.5 Discussion

The prevailing noise source at all locations was perceived to be traffic on the surrounding road network, particularly on Corporation Street and Miller Street. This is evident in the survey results, which show higher noise levels at locations that are closer to Corporation Street and Miller Street. Furthermore, it is noted that worst-case noise levels were measured at Location 1 during office hours (09:00-17:00 hours).

During attended noise measurements up to 15 cars, in 15 minutes, entered surrounding car parks via Beswick Row and Munster Street. These movements affected attended noise measurements and have been included in the presented results. Other audible noise sources included construction to the east of the site, and tram and train movements to the north above Red Bank road. However, it was noted, that these did not significantly contribute to measured noise levels.

4 Modelling

4.1 Introduction

A noise modelling exercise has been undertaken to estimate what the likely noise levels are at the façades of the proposed development. In addition, the NOMA development as a whole has been modelled according to Simpson Haugh architects Plot P – Planning Application Boundary drawing 10257-SHP-ZZ-XX-SK-A-G100-107 rev. P03 dated 6 March 2019. This includes the proposed sub-station building to the north on NOMA Primary Sub-station and the removal of Munster Street to the north and Oswald Street to the east. The plans for the whole of the NOMA development include pedestrianised areas between the proposed commercial buildings which will replace access roads that currently serve the car parks on site. The key outcome of this exercise is the assessment of required ventilation conditions and the selection of appropriate glazing specification(s) for the proposed commercial building (4 Angel Square).

4.2 Methodology

In order to determine noise propagation across the development site, a noise model has been produced using CadnaA 4.3 acoustic modelling software. The noise model has been constructed based on detailed Google Earth and OpenStreetMap mapping data. Local roads were added into the model to simulate noise sources that were measured during the on-site noise surveys.

The model predicts and maps the noise impacts on the proposed façades, considering factors such as distance attenuation, natural and man-made barrier attenuation, reflections and source directivity.

It has been established that the dominant, continuous noise source affecting the site during both daytime and night-time periods is the adjacent Corporation Street and Miller Street roads to the south and west. The constructed noise model has therefore been calibrated, based upon the measurement results summarised in Figure 3—2 to represent the noise climate on site as closely as possible. Furthermore, it is noted that worst-case noise levels were measured at Location 1 during office hours (09:00-17:00 hours) and, in-line with MCC recommendations (see Section 3.2), these noise levels have been used in the noise model to provide a worst-case assessment of predicted façade incident noise levels.

4.3 Limitations

The assessment has been based on the results produced through a noise modelling exercise, which provides predictions on the likely future noise levels. In order to increase the reliability of the results, the models have been calibrated to the noise levels measured on site during worst-case time periods, as described in Section 3.3. However, this does not guarantee the full accuracy of the predicted noise levels. Typically, an uncertainty within a range of approximately +/- 3 dB could be expected from computer noise modelling software. However, this uncertainty has been controlled as far as practicable by cross-referencing the levels of predicted noise impact against the measurements captured on site.

4.4 Results

The following noise maps show how noise is predicted to impact the proposed elevations during office hours (as identified above.)

Figure 4—1 to Figure 4—4 illustrate the predicted noise levels incident on the façades of the development during the daytime.

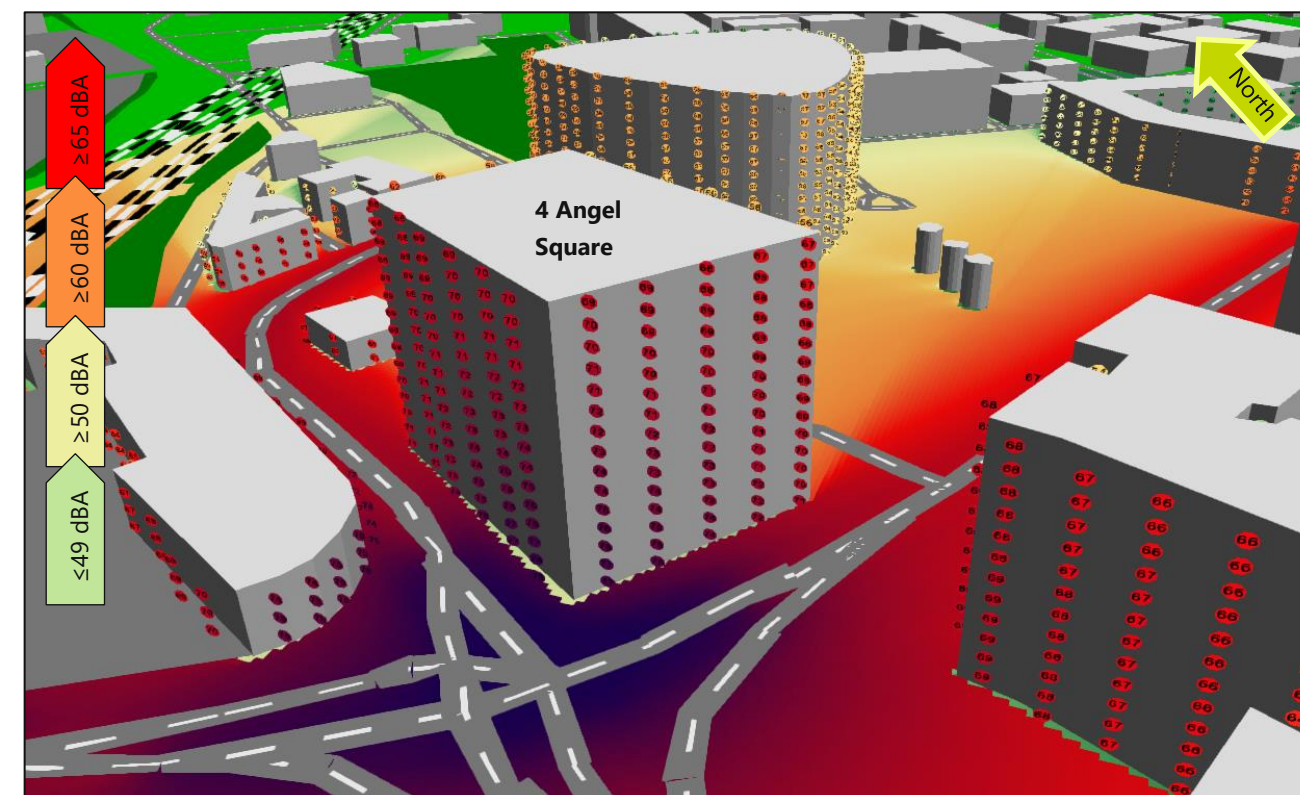


Figure 4—1 3D view of predicted daytime site wide noise levels ($L_{Aeq,T}$ dBA) south and west elevations

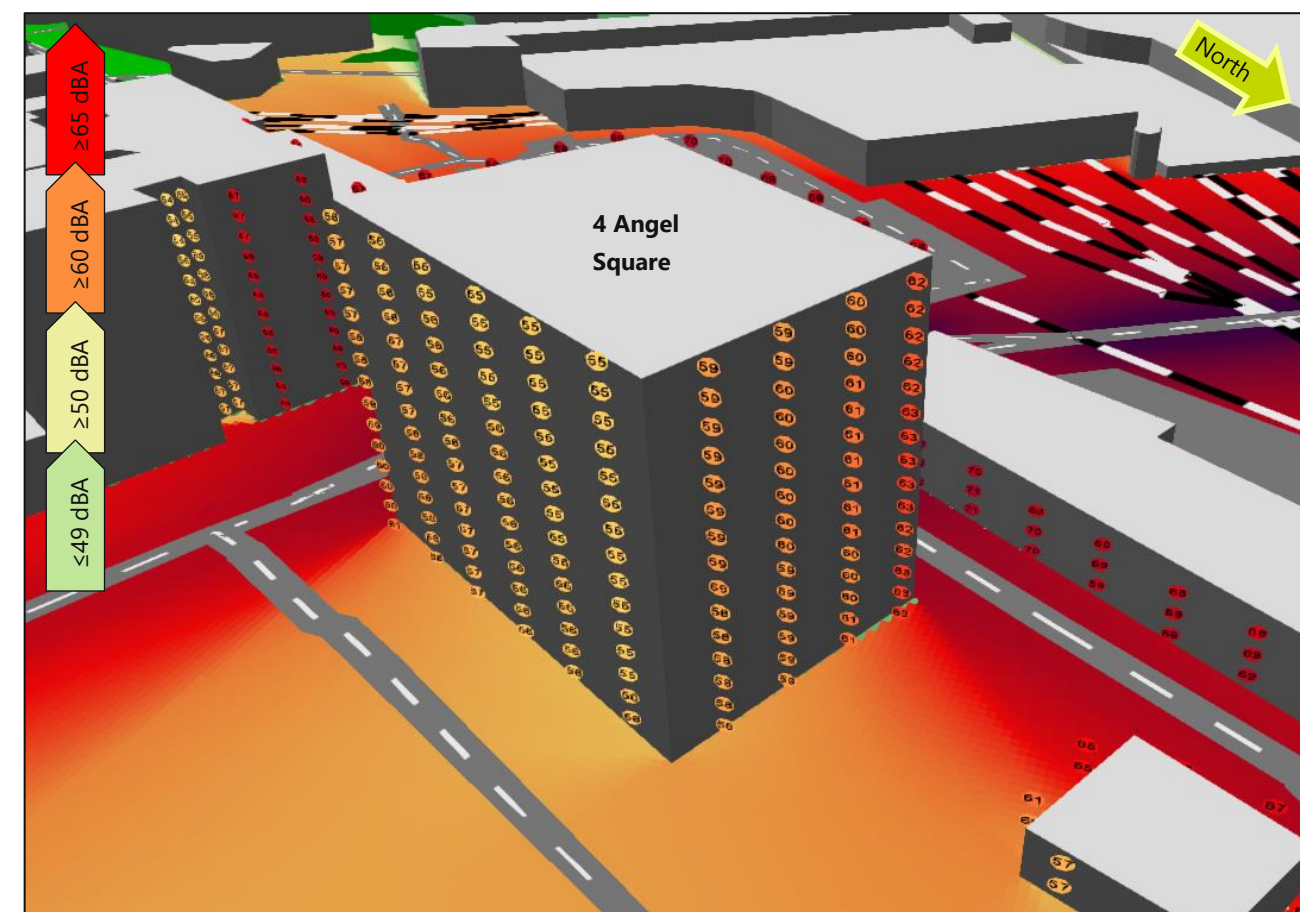


Figure 4—2 3D view of predicted daytime Plot P noise levels ($L_{Aeq,T}$ dBA) north and east elevations

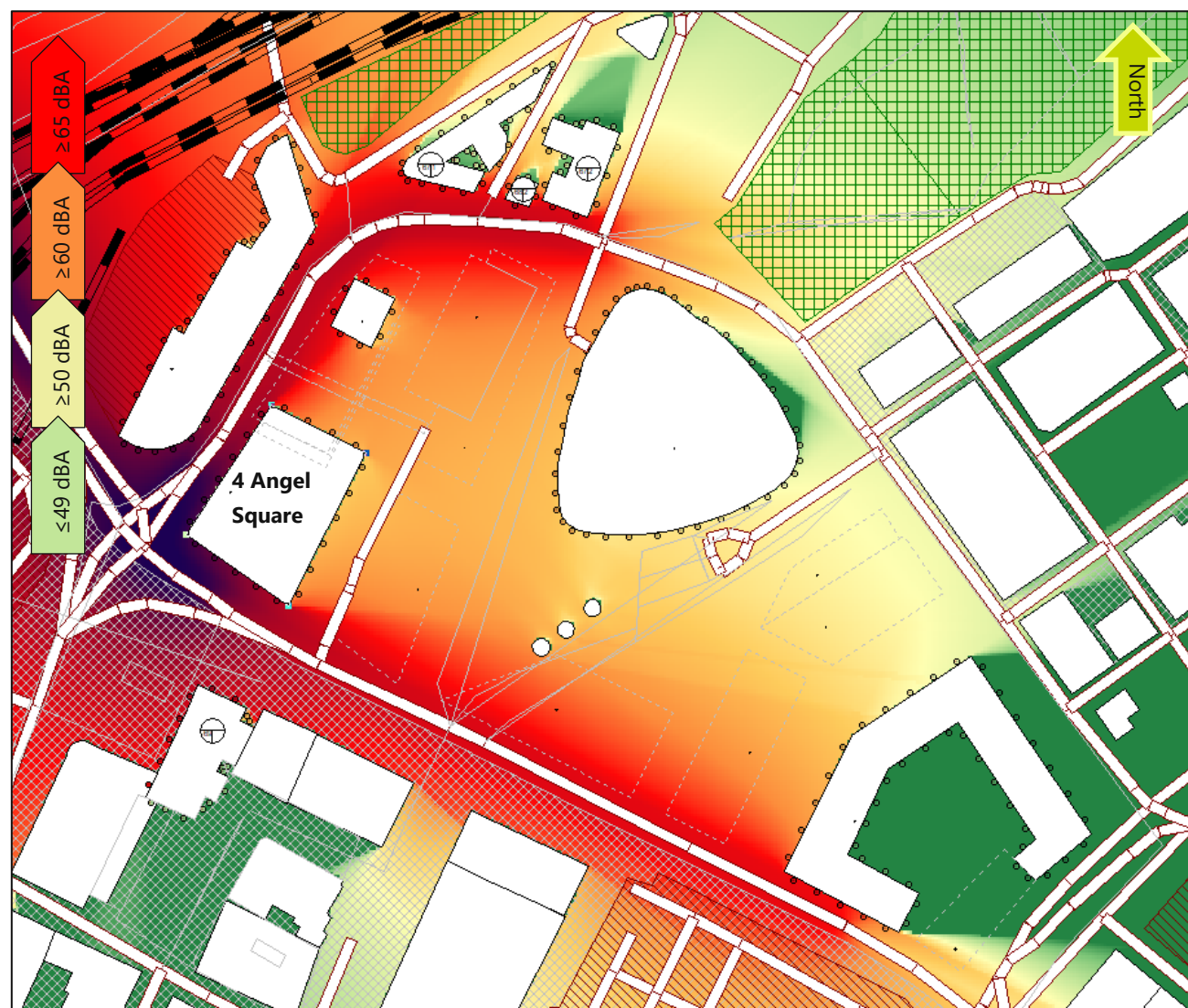


Figure 4—3 Plan view of predicted daytime site wide noise levels ($L_{Aeq,T}$ dBA)

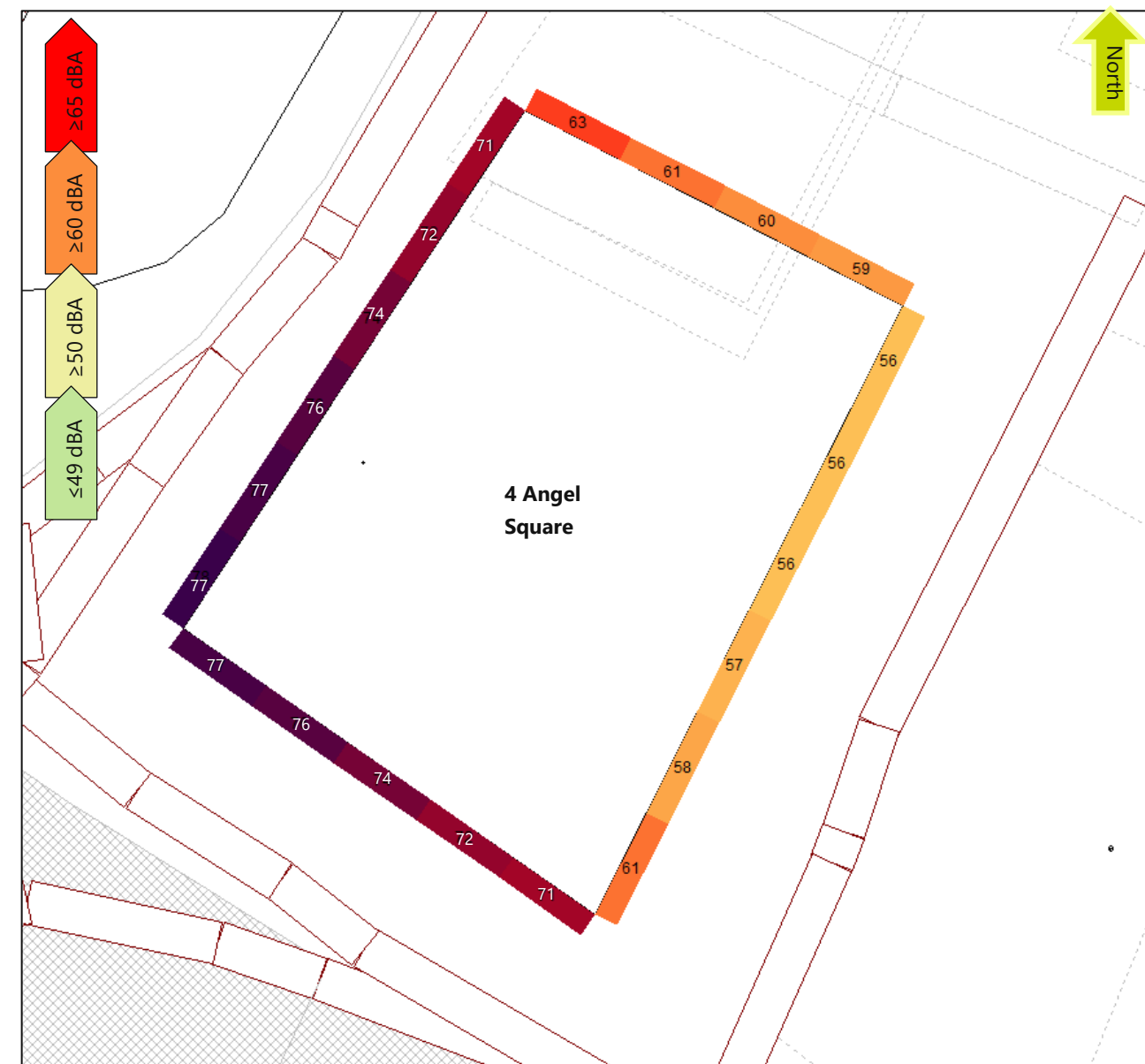


Figure 4—4 Predicted highest daytime 4 Angel Square façade incident noise levels ($L_{Aeq,T}$ dBA) for all elevations

4.5 Discussion

As can be seen from predicted noise levels presented in Figure 4—4, south and west elevations of the proposed 4 Angel Square building are likely to be exposed to high levels of traffic noise, up to approximately 77 $L_{Aeq,T}$ dBA, from the adjacent Miller Street and Corporation Street roads during the daytime. Moderate noise levels, up to approximately 63 $L_{Aeq,T}$ dBA, are predicted where elevations are at least partially screened from Miller Street and Corporation Street, or the junction of these roads on the south-west corner of the site.

As shown in Figure 4—1 and Figure 4—2, higher elevations benefit from an increased distance from the road network resulting in a decrease in noise levels with worst-case predicted noise levels located at ground floor level. In addition, the proposed roof terrace at Level 10 is likely to be subject to worst-case daytime noise levels of approximately 68 $L_{Aeq,T}$ dBA at the south façade.

5 Façade Acoustic Design & Noise Break-In

5.1 Introduction

The following section sets out the acceptable internal ambient noise level (IANL) criteria within commercial areas. Preliminary façade sound insulation requirements are also outlined in this section.

Regarding acoustics, the primary function of the building envelope (façade) is to attenuate external noise levels to achieve acceptable IANLs.

5.2 Building Orientation and Layout

As shown in Section 4, the dominant noise source is the Miller Street to the South and Corporation Street to the west and north of the site. If at all possible, the design of the building should aim to locate the most noise-sensitive spaces away from elevations which front the Miller Street and Corporation Street. It would also be helpful if the building is located as far away from these roads as possible.

It is understood that 4 Angel Square is to accommodate the following layout:

- Basement level - back-of-house (BOH) areas;
- Ground floor level - retail, back-of-house (BOH) and office lobby areas. These are considered double height areas i.e. 7 m high facades;
- Levels 1 to 11 – open plan office areas (shell and core);
- Roof terrace – proposed at Level 10; and
- Level 12 – enclosed roof plant area.

5.2.1 NOMA site development layout

The Proposed Development comprises the development on 4 Angel Square for office use and on part of 5 Angel Square to accommodate a Primary Sub-Station. The proposals are located within the 8.1 hectare / 20 acre NOMA Strategic Regeneration Framework Area located on the northern fringe of Manchester city centre. It is bounded by Corporation Street to the west, Angel Street to the north, Rochdale Road to the east and Balloon Street to the south.

It’s understood that the NOMA site is to consist of up to seven plots including 4 Angel Square which is understood to be the first building, alongside the NOMA Primary Sub-station enclosure, to be built as part of the latest NOMA site development. As such, the replacement of existing car parks and access road Munster Street with a pedestrianised area to north and east of 4 Angel Square, between the proposed commercial buildings has been outlined. In addition, the MCC draft planning application (see Section 2.1), states that consideration should be given if “any external seating areas are proposed, the assessment should consider the noise impact of these spaces.”

In order to protect 4 Angel Square from noise ingress on the existing site before screening via the proposed NOMA plots has been established, worst-case predicted noise levels as detailed in Figure 4—4 have been used in this assessment. This more onerous approach is likely to lead to over-specification should further plots be constructed on the NOMA site which later provides screening to 4 Angel Square. It will also allow for some degree of comfort from pedestrianised activities, which have not been detailed at this stage.

Furthermore, it has been agreed with MCC Highways regards car parking proposals and HGV movements for the NOMA development, “that the net impact of the proposal is very small as there are only circa 60 parking spaces and these replace existing car parking.”³ Accordingly, this assessment includes the existing site conditions bordering 4 Angel Square, i.e. existing car parks and Beswick Row road, as the difference in traffic movements on the proposed site is understood to be ‘very small’.

5.3 Acoustic Criteria – Internal Ambient Noise Levels

Proposed internal ambient noise levels, based on BS 8233:2014 for the development are detailed in Table 5—1.

Table 5—1 Acceptable internal ambient noise levels within commercial and retail units (BS 8233:2014)

Activity	Location	Design range L _{Aeq,T} dBA
Speech or telephone communications	Department store Cafeteria, canteen, kitchen	50 - 55
-	Open plan office	45 - 50
Study and work requiring concentration	Executive office	35 - 40
Study and work requiring concentration	Staff / meeting room, training room	35 - 45
-	Restaurant	40 - 55
-	Night club, public house	40 - 45

Based on the proposed usages across the development, it is anticipated that internal ambient noise levels may need to be controlled to levels as low as L_{Aeq,T} 40 dBA. This level of internal ambient noise would be relevant for private offices where quiet concentration is required. Guidance documents such as the British Council for Offices (BCO) guidelines and BS 8233 recommend that the average internal noise level in private offices is typically ≤ L_{Aeq,T} 40 dBA, facilitating the users to carry out their daily tasks in relative peace and quiet. Levels within other spaces in the building (e.g. department store) could be considerably higher, however, the sections below focus on showing that levels within the most noise-sensitive spaces can be adequately controlled to ≤ L_{Aeq,T} 40 dBA. By definition, this indicates that the noise levels in less sensitive spaces are likely to be within required target values.

5.4 Façade Design Noise Levels

The design spectra is derived (based on a typical traffic noise spectrum) from the measured and subsequently calculated noise levels, in the CadnaA model to provide octave band design values. The figure below details the façade design noise levels across each elevation.

³ Confirmed in an e-mail from Alex Vogt (Technical Director, Curtins) dated 4 January 2019.

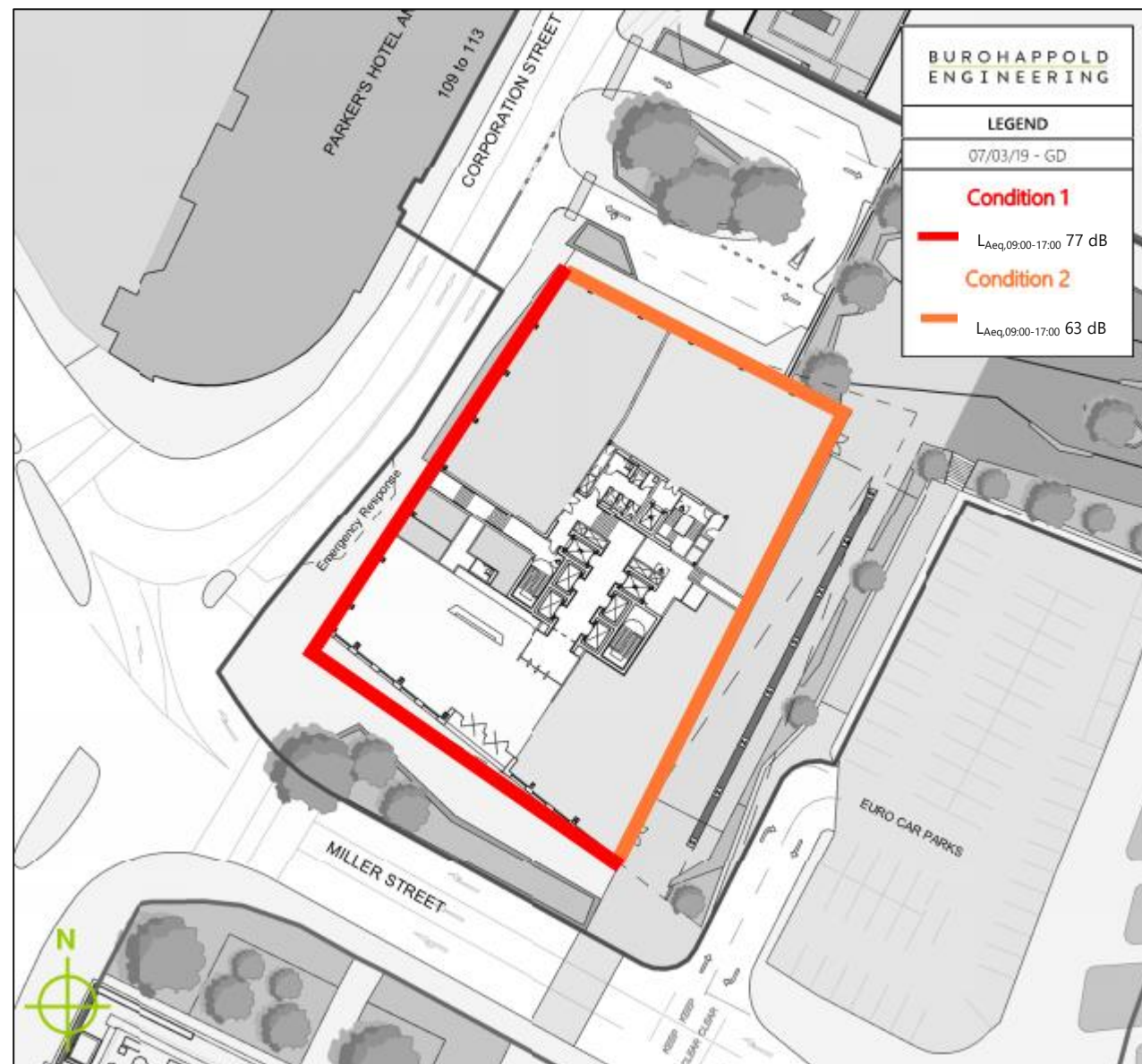


Figure 5—1 Façade design noise levels

5.5 Feasibility of Natural Ventilation

Natural ventilation is likely to be acceptable only where external levels are very low i.e. $L_{Aeq, daytime}$ 55 dBA. This is based on the following formula for the likely attenuation performance of a façade containing an open window and proposed internal noise levels (Section 5.3):

$$external\ level - 15\ dB = internal\ level$$

With reference to measured and predicted noise levels summarised in Section 5.4, it is likely that external noise levels will not be low enough in the majority of locations of the proposed development to consider natural ventilation.

5.6 Ventilation Strategy

Following consultation with Buro Happold MEP (the MEP consultants for the scheme) it is understood that 4 Angel Square, NOMA will be mechanically ventilated throughout, via a centralised system providing balanced supply and extract.

Mechanical ventilation, by its nature, is effective at preventing the ingress of environmental noise, due to the lack of need for un-ducted/un-attenuated openings in the external elevation required by natural systems (i.e. trickle vents). On that basis, the level of external noise break-in through the systems is likely to be negligible. Duct noise break-out into the commercial areas via the façade inlet/outlet terminations will be considered such that the noise path is negligible in comparison to the path through the façade and its elements (masonry and glazed).

In-line with the above, it is expected that the weakest elements of the external elevation will be the glazing systems. The specification of these elements will be the primary factor in determining the internal ambient noise level within commercial areas due to noise ingress from outside.

Calculation procedures follow the "more rigorous calculation method" outlined in BS 8233:2014, based on the following equation:

$$L_{eq,2} = L_{eq,ff} + 10 \log_{10} \left(\frac{A_0}{S} 10^{\frac{-D_{ne}}{10}} + \frac{S_{wi}}{S} 10^{\frac{-R_{wi}}{10}} + \frac{S_{ew}}{S} 10^{\frac{-R_{ew}}{10}} + \frac{S_{rr}}{S} 10^{\frac{-R_{rr}}{10}} \right) + 10 \log_{10} \left(\frac{S}{A} \right) + 3$$

Where:

S_f is the total façade area in square metres (m²) of the room in question;

S_{wi} is the area in square metres (m²) of the windows of the room;

S_{ew} is the area in square metres (m²) of the external wall of the room;

S_{rr} is the area in square metres (m²) of the ceiling of the room;

S is the total area in square metres (m²) of elements through which sound enters the room, i.e. $S_f + S_{rr}$;

$D_{n,e}$ is the insulation of the trickle ventilator measured according to BS EN ISO 10140;

R_{wi} is the sound reduction index (octave band value) of the window;

R_{ew} is the sound reduction index (octave band value) of the external wall;

R_{rr} is the sound reduction index (octave band value) of the roof/ceiling;

A is the equivalent absorption area of the receiving room being considered; and

3 is a correction factor.

5.7 Calculation Assumptions

The façade sound insulation requirements have been calculated using the design noise levels shown in Figure 5—1, an indoor ambient noise level of $\leq L_{Aeq,T} 40$ dBA (Section 5.3), and the following indicative typical dimensions taken from Simpson Haugh architect drawings.

Dimensions used for cellular (executive) offices:

- 20 m² floor area;
- 13 m² (total) façade area;
- 13 m² of glazing within the façade;
- Mechanical ventilation; and
- 0.8 s reverberation time.

Open Plan Offices:

- 100 m² floor area;
- 26 m² (total) façade area;
- 26 m² of glazing within the façade;
- Mechanical ventilation; and
- 1.0 s reverberation time.

It is understood that designs are still subject to further development, therefore the glazing specification provided in this report are for guidance purposes only.

5.8 Glazing Requirements

The façade acoustic requirements are given in terms of $R_w + C_{tr}$, which are described as:

- **Weighted Sound Reduction Index, R_w** – a single figure value which describes the standardised performance of partitions when measured in a laboratory; and
- **Correction Traffic, C_{tr}** – a single correction value applied which takes into account the urban traffic noise spectrum.

The glazing for Conditions 1 and 2 should achieve sound reduction values, at each octave band centre frequency, equal to or greater than the values given below. Table 5—2 should be viewed in conjunction with Figure 5—1 to determine the sound insulation requirements across each elevation. These are considered worst-case glazing requirements due to the assumptions detailed in Section 5.3.

Table 5—2 Façade glazing requirements using mechanical ventilation

Condition	Room Type	Sound Reduction (dB) at Octave Band Centre Frequencies (Hz)						$R_w + C_{tr}$ dB	Example glazing Construction
		125	250	500	1K	2k	4k		
Condition 1	Cellular Office	29	40	45	47	56	68	42	Pilkington Optiphon double glazing - 16.8 mm laminated glass / 6 to 20 mm air gap / 16.8 mm laminated glass
	Open Plan Office	28	36	39	45	46	58	39	Saint Gobain Glass double glazing – 8 mm glass / 16 mm air gap / 16 mm glass with 2No. PVB interlayer
Condition 2	Cellular Office	20	18	28	38	34	38	27	Typical double glazing performance for 6 mm glass / 20 mm air gap / 6 mm
	Open Plan Office	21	17	25	35	37	31	25	Typical double glazing performance for 4 mm glass / 20 mm air gap / 4 mm

Calculations for the glazing requirements are for guidance purposes only, and are reproduced in Appendix A. Results of the calculations will be reviewed as the design progresses, and room sizes and glazing areas are confirmed.

6 Limiting Levels for Plant Noise Break-Out

6.1 Introduction

This section outlines mechanical plant noise limits to meet the requirements of the Local Planning Authority.

At this stage, plant selections have not been finalised and the most robust method in terms of controlling noise output will be to set limiting noise levels for plant at nearby noise-sensitive receptors (NSRs).

6.2 Noise Sensitive Receptors

The following noise sensitive receptors (NSRs) have been identified, these have been outlined in green on the annotated aerial image in Figure 6—1.

- Parkers Hotel Apartment adjacent to the western boundary separated by Corporation Street; and
- Residential properties to the north separated by Corporation Street.

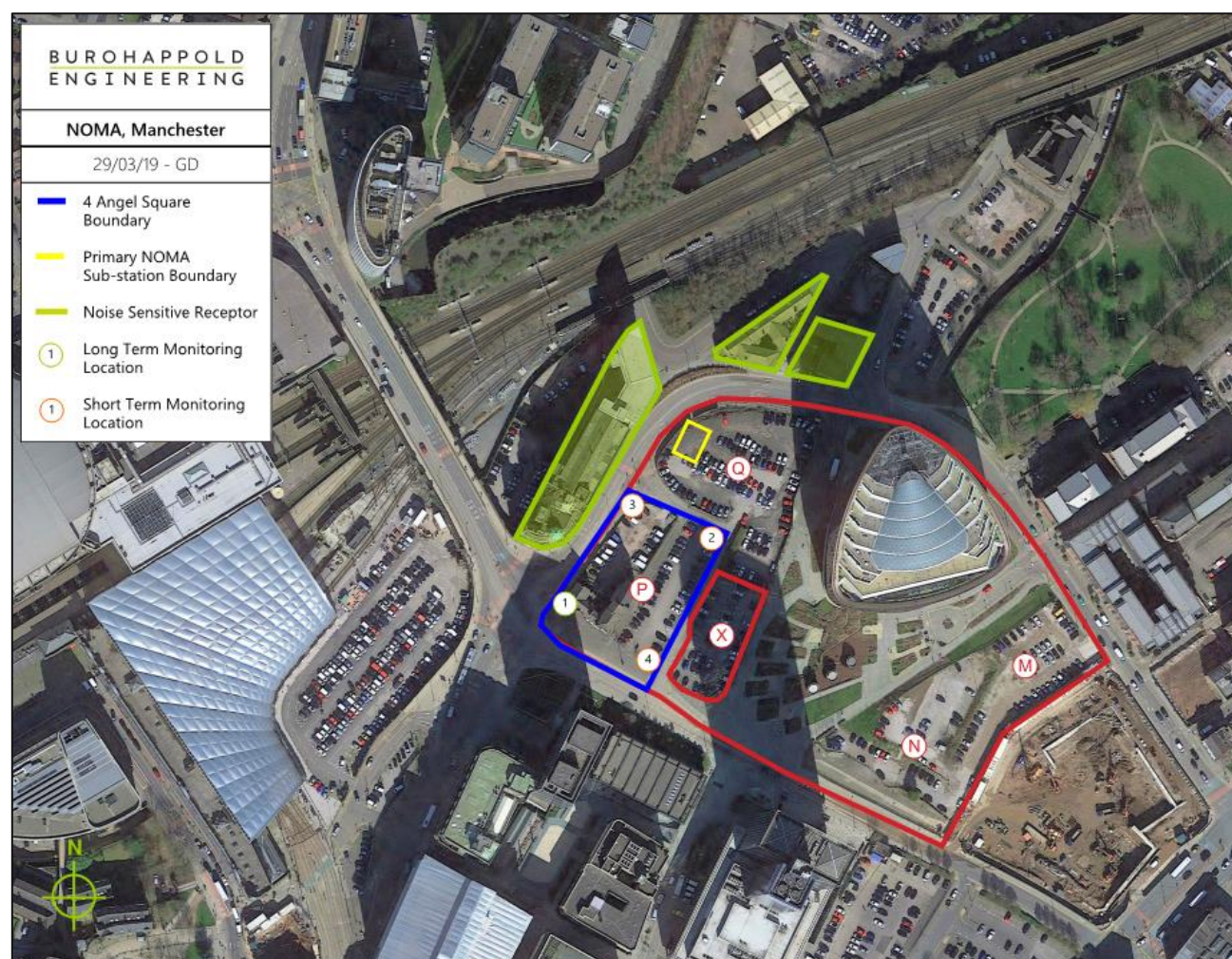


Figure 6—1 Site plan showing measurement locations, NSRs and site boundary

6.3 Design Criteria

6.3.1 Manchester City Council (MCC) - Planning and Noise - Technical Guidance

MCC state the following regards "Industrial / commercial developments" in Section 3.6.1.5 of the Planning and Noise - Technical Guidance document dated December 2015:

"BS 4142 should be used to assess the likely impact of noise from industrial and commercial sources at noise sensitive premises (section 3.5). One of the indications of the impact of a BS 4142 assessment is the lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

The Council consider that new developments should contribute and enhance the area in which they are located and where possible, contribute to the improvement of people's health and quality of life as per the NPSE. With this in mind, the design objective should be:

'The development should be designed so as to achieve a rating level of 5dB (LAeq) below the typical background (LA90) level at the nearest noise sensitive location'."

Furthermore, Section 3.6.1.5.1 in the MCC document states:

"Where fixed plant, equipment or machinery is attached to a building the vibration caused by it can pass through the building structure and cause structure-borne noise elsewhere in the building. Where it is to be installed in or on a building containing a noise sensitive use structure-borne noise, should be considered in the noise assessment and adequate control measures should be proposed."

Selections of plant have not been made at this stage of the design process and therefore no mitigation measures have been specified. All plant should be mounted on suitable anti-vibration mounts which should adequately control structure-borne noise transfer into the proposed development.

6.3.2 BREEAM – Pol 05 criteria

The BREEAM credit Pol 05 requires that the level of noise impact from any newly-introduced plant items is at least 5 dB lower than the background noise level ($L_{A90,15mins}$) throughout the day and night when assessed at an existing noise-sensitive receptor. This is in-line with Local Authority criteria as detailed in Section 6.3.1, and as a result, applicable BREEAM credits are likely to be attained when compliance with the Local Authority is achieved.

6.3.3 British Standard 4142:2014

BS 4142:2014 provides methods for rating and assessing sound of an industrial and/or commercial nature. This includes sound from industrial and manufacturing processes, fixed services plant, sound generated by the loading/unloading of goods and sound from mobile plant / vehicles associated with industrial / commercial premises (e.g. forklift trucks).

The standard utilises various descriptors to assess complaints, the impact of sound associated with proposed industrial / commercial activities on existing noise-sensitive receptors, or the impact and likely suitability of siting new noise-sensitive receptors in the vicinity of existing industrial / commercial noise sources.

The standard is specifically precluded from being used to determine likely internal sound levels arising from external noise, or from the assessment of various sound sources for which other (more relevant) guidance exists, including music/entertainment noise, person noise and construction noise.

The magnitude of impact is assessed by subtracting the measured background sound level at a location representative of the nearest noise-sensitive receptor indices, from the ‘rating level’ indices (the specific sound source to be introduced into the locality, corrected for acoustically distinguishing characteristics which may make it more subjectively prominent).

Typically, the greater the difference between the background and rating level, the greater the magnitude of impact, although BS 4142 emphasises that this is highly context-specific.

As a guideline, BS 4142 states that:

- A difference (between the background and rating level) of around +10 dB or more is likely to be indicative of significant adverse impact, depending on context;
- A difference (between the background and rating level) of around +5 dB or more is likely to be indicative of adverse impact, depending on context;
- The lower the rating level relative to the background level, the less likely it is that the specific sound will have an adverse impact; and
- Where the rating level does not exceed the background level, this is an indication that the specific sound will have a low impact, depending on the context.

In addition to the above, Note 2 and Note 3 of BS 4142:2014 state that:

NOTE 2 Adverse impacts include, but are not limited to, annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact.

Where the initial estimate of the impact needs to be modified due to the context, take all pertinent factors into consideration, including the following.

1) The absolute level of sound. For a given difference between the rating level and the background sound level, the magnitude of the overall impact might be greater for an acoustic environment where the residual sound level is high than for an acoustic environment where the residual sound level is low.

Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night.

Where residual sound levels are very high, the residual sound might itself result in adverse impacts or significant adverse impacts, and the margin by which the rating level exceeds the background might simply be an indication of the extent to which the specific sound source is likely to make those impacts worse.

2) The character and level of the residual sound compared to the character and level of the specific sound. Consider whether it would be beneficial to compare the frequency spectrum and temporal variation of the specific sound with that of the ambient or residual sound, to assess the degree to which the specific sound source is likely to be distinguishable and will represent an incongruous sound by comparison to the acoustic environment that would occur in the absence of the specific sound. Any sound parameters, sampling periods and averaging time periods used to undertake character comparisons should reflect the way in which sound of an industrial and/or commercial nature is likely to be perceived and how people react to it.

NOTE 3 Consideration ought to be given to evidence on human response to sound and, in particular, an industrial and/or commercial sound where it is available. A number of studies are listed in the “Effects on humans of industrial and commercial sound” portion of the “Further reading” list in the Bibliography.

3) The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions, such as:

i) façade insulation treatment;

- ii) ventilation and/or cooling that will reduce the need to have windows open so as to provide rapid or purge ventilation; and*
- iii) acoustic screening.*

As such, BS 4142:2014 requires qualified engineering consultants and technical planning professionals (e.g. Environmental Health Officers) to use a combination of quantitative assessment techniques and rational qualitative judgements to come to a reasoned conclusion.

6.4 External Plant Noise Limits

Below, worst-case plant noise limiting levels are set for the proposed 4 Angel Square and Primary Sub-Station developments, based on the lowest measured background noise levels during the day and night-time periods (summarised in Figure 3—2) and Local Authority Criteria (Section 6.3.1). As a result, where plant noise levels are limited to those identified in Table 6—1, it is considered that the amenity of existing NSRs surrounding the proposed development site should be suitably protected in line with Local Planning Authority guidelines.

However, when further plant details are available (i.e. proposed locations), it may be suitable to base limiting noise levels on accompanying higher measured noise levels. It should be noted that the levels given in the table below are Rating levels i.e. include any required corrections for acoustically distinguishable features.

Table 6—1 Measured background noise levels and limiting plant noise levels at NSRs

NSR	Lowest measured daytime background noise level LA90,15min dBA (07:00-23:00)	Plant daytime noise limit at 1 metre from NSR Façades LA _{r,T} dBA (07:00-23:00)	Lowest measured night-time background noise level LA90,15min dBA (23:00-07:00)	Plant night-time noise limit at 1 metre from NSR Façades LA _{r,T} dBA (23:00-07:00)
All	56	51	46	41

It is considered likely that the separation distances between the mechanical plant inlet/outlet terminations and the noise sensitive elements (e.g. façade) of the proposed development itself will be much less than the distances to existing NSRs. Therefore, it is anticipated that the noise impact on proposed elevations will determine the likely noise levels at source, resulting in lower targets than given in Table 6—1, and as a result, the limiting plant sound pressure levels at existing NSRs should also be met.

6.5 NOMA Primary Sub-station

A single storey standalone housing construction for a sub-station consisting of 2No. transformers and cooling auxiliaries has been proposed on NOMA Primary Sub-station to the north of 4 Angel Square (see Figure 6—2). This sub-station will serve the whole NOMA Masterplan including 4 Angel Square.

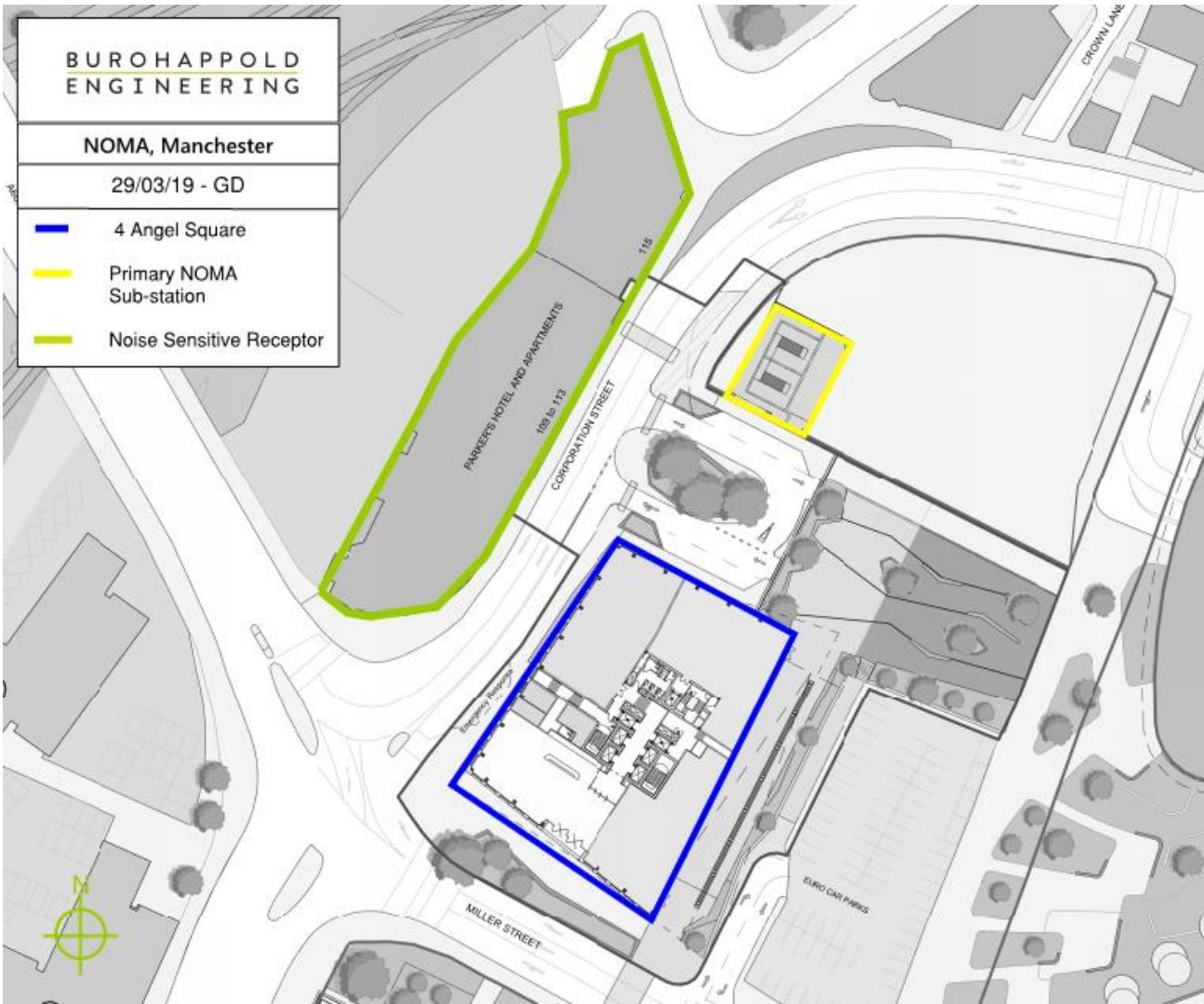


Figure 6—2 Site plan showing NOMA Primary Sub-station location, nearest NSR and 4 Angel Square

The following assessment has been based on sub-station layout, elevation, section and site plan drawings as received from Simpson Haugh architects (ref. 10257-SHP-Z1-XX-SK-A-G200-725 to 728 dated 10 April 2019).

The following assessment has been based on the following worst-case noise levels as agreed with Power On and BuroHappold Mechanical. All figures are in Sound Power Level (SWL):

- Daytime = SWL 78 dBA
- Night time = SWL 59 dBA

It is understood that the sub-station is to be naturally ventilated (i.e. no ducted fans). The sub-station will ventilate via acoustic louvres, DucoWall Acoustic W150, taking up 75.5 m² of the west elevation and 33 m² of the north elevation, and achieve the following performance levels.

Table 6—2 Proposed acoustic louvre performance – DucoWall Acoustic W150

Transmission loss (dB) at Octave Band Centre Frequencies (Hz)						
63	125	250	500	1k	2k	4k
8	5	4	7	11	12	13

The nearest noise sensitive receptors will be windows located at ground floor level on the adjacent Parkers Hotel Apartment, which is 21.5 m to the west and separated from the proposed sub-station by Corporation Street. In order to carry out a preliminary assessment a typical spectrum for a transformer noise has been used and adjusted to the single figure manufacturer data.

Based on the information within this section, noise levels at the nearest noise sensitive receptor are likely to be within the required Local Authority criteria outlined in Section 6.

Recommendations have been based on the details above and will not hold should plant be reselected and / or proposed sub-station design is altered. Furthermore, further design developments and / or consultation with suppliers may negate the proposed acoustic louvres should Local Authority Criteria still be achieved.

6.6 Discussion and Implications

As can be seen above, plant must be limited to L_{A,T} 51 dBA / 41 dBA during daytime and night-time periods, respectively. These are reasonably high limits due to the high background noise in the vicinity of the nearest NSRs (dwellings adjacent to Corporation Street). It is understood that the design currently includes boilers within the basement for heating and chillers on the roof for cooling. Air handling plant is also proposed on the roof. It is understood operating hours are likely to be for 24 hours a day.

It is expected that noise from plant can be controlled to satisfy Local Authority criteria by selecting low noise plant items, and use of noise mitigation measures. These could include but are not limited to, atmosphere-side attenuators, duct lagging and mass barrier screens, examples of these are shown below. Selections for the development shall be made at the detailed design stage, once proposed plant details are known.

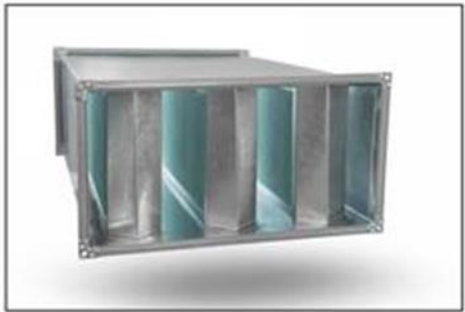


Figure 6—3 Rectangular attenuator

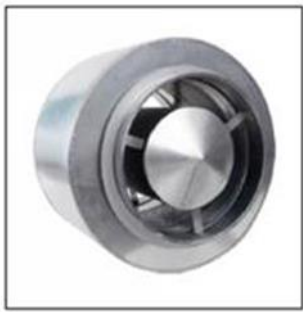


Figure 6—4 Circular attenuator



Figure 6—5 Duct lagging



Figure 6—6 Noise barrier with acoustic lining

7 Conclusions

The existing noise climate at the proposed development is such that acceptable internal ambient noise levels can be achieved with conventional double-glazed constructions.

It is understood that mechanical ventilation systems are to be used to provide the ventilation requirements for all internal spaces.

Limiting plant noise levels have been set in terms of $L_{A,T}$. These levels are based on achieving 5 dB below the representative background noise level at the nearest existing noise-sensitive receptors. It is anticipated that these limiting plant noise levels will be achieved due to the need to control noise levels at noise sensitive areas of the proposed development which are noted to be much closer.

Based on the above, the proposed development is considered suitable in terms of noise and planning, and acoustic concerns are not considered to represent any barrier to development.

Appendix A Noise Break-in Calculations

FAÇADE BREAK-IN CALCULATION														
Project Name	Plot P, NOMA, Manchester					BUROHAPPOLD ENGINEERING								
Room or space	Cellular Office - N and E													
Date	06/03/19													
ROOM CONSTANT & FAÇADE AREA														
Façade area (incl. window)	13.0 m ²					Area of the external wall	0 m ²	Room reverberation time (s)						
Area of the louver	0.0 m ²							Tmf	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz
Area of the windows	13.0 m ²							0.8	0.8	0.8	0.8	0.8	0.8	0.8
Area of the roof/ceiling	20.0 m ²					Area of exposed envelope	33 m ²							
Room Depth (x)	5.0 m													
Room Width (y)	4.0 m													
Ceiling height (z)	2.6 m					Room Volume	52 m ³							
DISTANCE ATTENUATION CALCULATION														
Distance correction	No					Calculated Distance Attenuation	-							
Type of distance correction	Line source													
Distance from source to microphone	-													
Distance from source to receiver	-													
FREE FIELD LEVELS AT 1m FROM THE NOISE SENSITIVE FAÇADE														
LAeq					dB(A)	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz			
	Free Field Leq in octave bands (dB)				63	65	61	59	59	55	50			
	Resultant Free-Field Leq with distance attenuation (dB(A))				63	65	61	59	59	55	50			
LAmaz (if applicable)					dB(A)	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz			
	Free Field Lfmax in octave bands				-	-	-	-	-	-	-			
	Resultant Free-Field LAmaz with distance				-	-	-	-	-	-	-			
SOUND REDUCTION PROPERTIES OF BUILDING ELEMENTS														
					125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	R _w	R _w +C _{tr} (dB)		
Window (R _w)	Rw+Ctr 27dB BS12354 6/20/6				20	18	28	38	34	38	31	27		
Louwer (Rw)	No Louwer				0	0	0	0	0	0	0	0		
External wall Construction (Rw)	Typical external wall construction				46	44	46	54	62	67	52	49		
Roof Construction (Rw)	Typical roof construction				99	99	99	99	99	99	99	99		
					125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	D _{n,ew} (dB)			
Trickle Vent (D _{n,ew})	No Vent				200	200	200	200	200	200	-			
CALCULATED INTERNAL LAeq AND LAF,max LEVELS														
					125Hz	250Hz	500Hz	1kHz	2kHz	4kHz				
Calculated LAeq in the receiver room (dB)					49	47	35	25	25	16				
Calculated LAFmax in the receiver room (dB)					-	-	-	-	-	-				
					L _{Aeq} (125-4000Hz)					L _{Amax} (125-4000Hz)				
					40 dB(A)					-				

FAÇADE BREAK-IN CALCULATION																
Project Name		Plot P, NOMA, Manchester				BUROHAPPOLD ENGINEERING										
Room or space		Cellular Office - S and W														
Date		06/03/19														
ROOM CONSTANT & FAÇADE AREA																
Façade area (incl. window)		13.0 m2				Area of the external wall	0 m2	Room reverberation time (s)								
Area of the louver		0.0 m2						Tmf	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz		
Area of the windows		13.0 m2						0.8	0.8	0.8	0.8	0.8	0.8	0.8		
Area of the roof/ceiling		20.0 m2				Area of exposed envelope	33 m2									
Room Depth (x)		5.0 m														
Room Width (y)		4.0 m														
Ceiling height (z)		2.6 m				Room Volume	52 m3									
DISTANCE ATTENUATION CALCULATION																
Distance correction		No						Calculated Distance Attenuation	-							
Type of distance correction		Line source														
Distance from source to microphone		-														
Distance from source to receiver		-														
FREE FIELD LEVELS AT 1m FROM THE NOISE SENSITIVE FAÇADE																
LAeq						dB(A)	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz				
	Free Field Leq in octave bands (dB)					77	79	75	73	73	69	64				
	Resultant Free-Field Leq with distance attenuation (dB(A))					77	79	75	73	73	69	64				
LAmx (if applicable)						dB(A)	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz				
	Free Field Lfmax in octave bands					-	-	-	-	-	-	-				
	Resultant Free-Field LAmx with distance					-	-	-	-	-	-	-				
SOUND REDUCTION PROPERTIES OF BUILDING ELEMENTS																
					125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	R _w	R _w +C _{tr} (dB)				
Window (R _w)		Rw+Ctr 42dB 16.8 Pilkington Optiphon/ 6 to 20 mm / 16.8 Pilkington Optiphon			29	40	45	47	56	68	48	42				
Louwer (R _w)		No Louwer			0	0	0	0	0	0	0	0				
External wall Construction (R _w)		Typical external wall construction			46	44	46	54	62	67	52	49				
Roof Construction (R _w)		Typical roof construction			99	99	99	99	99	99	99	99				
					125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	D _{n,ew} (dB)					
Trickle Vent (D _{n,ew})		No Vent			0 Units	200	200	200	200	200	200	-				
CALCULATED INTERNAL LAeq AND LAF,max LEVELS																
					125Hz	250Hz	500Hz	1kHz	2kHz	4kHz						
Calculated LAeq in the receiver room (dB)					54	39	32	30	17	0						
Calculated LAFmax in the receiver room (dB)					-	-	-	-	-	-						
										L _{Aeq} (125-4000Hz)			L _{Amax} (125-4000Hz)			
										40 dB(A)			-			

FAÇADE BREAK-IN CALCULATION															
Project Name	Plot P, NOMA, Manchester						BUROHAPPOLD ENGINEERING								
Room or space	Open Plan Office - S and W														
Date	06/03/19														
ROOM CONSTANT & FAÇADE AREA															
Façade area (incl. window)	26.0 m2						Area of the external wall	0 m2	Room reverberation time (s)						
Area of the louver	0.0 m2								Tmf	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz
Area of the windows	26.0 m2								1.0	1.0	1.0	1.0	1.0	1.0	1.0
Area of the roof/ceiling	100.0 m2						Area of exposed envelope	####							
Room Depth (x)	10.0 m						Room Volume	####							
Room Width (y)	10.0 m														
Ceiling height (z)	2.6 m														
DISTANCE ATTENUATION CALCULATION															
Distance correction	No						Calculated Distance Attenuation	-							
Type of distance correction	Line source														
Distance from source to microphone	-														
Distance from source to receiver	-														
FREE FIELD LEVELS AT 1m FROM THE NOISE SENSITIVE FAÇADE															
LAeq							dB(A)	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz		
	Free Field Leq in octave bands (dB)						77	79	75	73	73	69	64		
	Resultant Free-Field Leq with distance attenuation (dB(A))						77	79	75	73	73	69	64		
LAmax (if applicable)							dB(A)	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz		
	Free Field Lfmax in octave bands						-	-	-	-	-	-	-		
	Resultant Free-Field LAmax with distance						-	-	-	-	-	-	-		
SOUND REDUCTION PROPERTIES OF BUILDING ELEMENTS															
							125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	Rw	Rw+C (dB)	
Window (Rw)	Rw+Ctr 39dB SGG 8/16/16 PVB interlayer (2no.)						28	36	39	45	46	58	44	39	
Louver (Rw)	No Louver						0	0	0	0	0	0	0	0	
External wall Construction (Rw)	Typical external wall construction						46	44	46	54	62	67	52	49	
Roof Construction (Rw)	Typical roof construction						99	99	99	99	99	99	99	99	
							125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	Dn,ew	(dB)	
Trickle Vent (Dn,ew)	No Vent						0 Units	200	200	200	200	200	200	-	
CALCULATED INTERNAL LAeq AND LAF,max LEVELS															
							125Hz	250Hz	500Hz	1kHz	2kHz	4kHz			
Calculated LAeq in the receiver room (dB)							52	40	35	29	24	7			
Calculated LAFmax in the receiver room (dB)							-	-	-	-	-	-	-		
							LAeq (125-4000Hz)				LAmax (125-4000Hz)				
							39 dB(A)				-				

FAÇADE BREAK-IN CALCULATION															
Project Name	Plot P, NOMA, Manchester						BUROHAPPOLD ENGINEERING								
Room or space	Open Plan Office - N and E														
Date	06/03/19														
ROOM CONSTANT & FAÇADE AREA															
Façade area (incl. window)	26.0 m2						Area of the external wall	0 m2	Room reverberation time (s)						
Area of the louver	0.0 m2								Tmf	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz
Area of the windows	26.0 m2								1.0	1.0	1.0	1.0	1.0	1.0	1.0
Area of the roof/ceiling	100.0 m2						Area of exposed envelope	####							
Room Depth (x)	10.0 m						Room Volume	####							
Room Width (y)	10.0 m														
Ceiling height (z)	2.6 m														
DISTANCE ATTENUATION CALCULATION															
Distance correction	No						Calculated Distance Attenuation	-							
Type of distance correction	Line source														
Distance from source to microphone	-														
Distance from source to receiver	-														
FREE FIELD LEVELS AT 1m FROM THE NOISE SENSITIVE FAÇADE															
LAeq							dB(A)	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz		
	Free Field Leq in octave bands (dB)						63	65	61	59	59	55	50		
	Resultant Free-Field Leq with distance attenuation (dB(A))						63	65	61	59	59	55	50		
LAMax (if applicable)							dB(A)	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz		
	Free Field Lfmax in octave bands						-	-	-	-	-	-	-		
	Resultant Free-Field LAMax with distance						-	-	-	-	-	-	-		
SOUND REDUCTION PROPERTIES OF BUILDING ELEMENTS															
							125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	Rw	Rw+C1 (dB)	
Window (Rw)	Rw+Ctr 25dB BS12354 4/20/4						21	17	25	35	37	31	29	25	
Louver (Rw)	No Louver						0	0	0	0	0	0	0	0	
External wall Construction (Rw)	Typical external wall construction						46	44	46	54	62	67	52	49	
Roof Construction (Rw)	Typical roof construction						99	99	99	99	99	99	99	99	
							125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	Dn,ew (dB)		
Trickle Vent (Dn,ew)	No Vent						0 Units	200	200	200	200	200	200	-	
CALCULATED INTERNAL LAeq AND LAF,max LEVELS															
							125Hz	250Hz	500Hz	1kHz	2kHz	4kHz			
Calculated LAeq in the receiver room (dB)							45	45	35	25	19	20			
Calculated LAFmax in the receiver room (dB)							-	-	-	-	-	-			
							LAeq (125-4000Hz)					LAMax (125-4000Hz)			
							39 dB(A)					-			

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Email: gareth.davies2@burohappold.com

Appendix B MCC EH email confirmation (18/05/2022)

Alex Krasnic

From: Sue Jones <sue.jones@manchester.gov.uk>
Sent: 18 May 2022 11:04
To: Alex Krasnic
Subject: NOMA Plots 2&3, baseline survey

Follow Up Flag: Follow up
Flag Status: Flagged

****External Email. This email originated from outside Vanguardia.****

Dear Alex,

I have been forward you email regarding the above noise survey and we will accept the baseline survey for Plot P conducted in 2019 for the planning submission.

Kind regards

Sue

Sue Jones
Environmental Protection Officer
Environmental Protection
Environmental Health
The Neighbourhoods Directorate
Manchester City Council

email: sue.jones@manchester.gov.uk
website: www.manchester.gov.uk
Telephone 0161 234 1389
Internal: 31389

We are now on Twitter, for latest news and updates follow us [@EnvHealthMcr](https://twitter.com/EnvHealthMcr)

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This footnote also confirms that this email message has been swept for the presence of computer viruses.

Appendix C Excerpts of MCC Conditions of Planning Consent (Noise Protection)

no.763315); Archaeological Desk-Based Assessment (ref: 2019/71; Transport Assessment (72580-CUR-00-XX-RP-TP-001-V02 Revision: V02 Issue Date: 16 September 2019) as received by email from planning agent dated 16th December 2019 in regard to the numbers of Electric vehicle charging points Travel Plan Framework, Local employment plan -2 Angel Square; Local employment plan -3 Angel Square; Operational Management Plan 2 Angel Square ; Operational Management Plan 3 Angel Square ; Phasing strategy and construction plans figure nos. 5.1, 5.2, 5.3, 5.4, 5.5, 5.6 ; Wind modelling plans: Waste Management Strategy (ref: 70223-CUR-00-XX-RP-TP-003 Revision: V02 Issue Date: 16 September 2019) stamped as received on 1st October 2019.

Email from planning agent dated 13th December 2019 confirming dedicated access to the cycle stores from the extension of the proposed.

Email from planning agent dated 16th December 2019 in regard to the numbers of Electric vehicle charging points.
Reason -To ensure that the development is carried out in accordance with the approved plans, pursuant to policies SP1 and DM1 of the Core Strategy for Manchester.

4) Prior to the commencement of each phase of the development a detailed construction management plan outlining working practices during development shall be submitted to and approved in writing by the local planning authority for that phase, which for the avoidance of doubt should include:-

- The routing of construction traffic;
- Detail the quantification/classification of vehicular activity associated with the construction including commentary on types and frequency of vehicular demands together with evidence (appropriate swept-path assessment);
- Details of the location and arrangements for contractor parking;
- The identification of the vehicular access points into the site for all construction traffic, staff vehicles and Heavy Goods Vehicles;
- Identify measures to control dust and mud including on the surrounding public highway including: details of how the wheels of contractor's vehicles are to be cleaned during the construction period;
- Specify the working hours for the site;
- The details of an emergency telephone contact number for the site contractor to be displayed in a publicly accessible location on the site from the commencement of development until construction works are complete;
- Identify advisory routes to and from the site for staff and HGVs;
- A highway dilapidation survey including photographs and commentary on the condition of carriageway / footways on construction vehicle routes surrounding the site.

Reason - To safeguard the amenities of nearby residents and highway safety pursuant to policies SP1, EN9, EN19 and DM1 of the Core Strategy for Manchester

5) Prior to the commencement of each phase of development a programme for the issue of samples and specifications of all material to be used on all external elevations of that phase of the development shall be submitted for approval in writing by the City Council, as Local Planning Authority, the programme shall include timings for the submission of samples and specifications of all materials to be used on all external elevations, drawings to illustrate details of full sized sample panels that will be produced. The panel to be produced shall include jointing and fixing details between all

13) The development hereby approved shall be designed and constructed in accordance with the recommendations contained within the submitted Crime Impact Statement dated (10th September 2019 - URN: 2015/0291/CIS/02 Version A). The development shall only be carried out in accordance with these approved details. Each phase of the development hereby approved shall not be occupied or used until the City Council as local planning authority has acknowledged in writing that it has received written confirmation of a Secure by Design accreditation in respect of that Phase of development.

Reason - To reduce the risk of crime pursuant to policies SP1 and DM1 of the Core Strategy for Manchester and to reflect the guidance in the National Planning Policy Framework

14) The development within each phase of scheme hereby approved shall undergo an Uncertified Sustainability Review to demonstrate the achievement of a BREEAM rating of at least 'very good'. A post construction Sustainability Review document for that phase of development demonstrating achievement of a BREEAM rating of at least 'very good' shall be submitted to and approved in writing by the City Council as local planning authority within 3 months of the building in that phase hereby approved being first occupied. The Sustainability Review document will provide evidence once the building in that phase has been erected that it has been built in accordance with the relevant BREEAM criteria based on the current appropriate BRE manual and has incorporated feasibility measures to minimise the environmental impact and energy use.

Reason - In order to minimise the environmental impact of the development, pursuant to policies SP1, DM1, EN4 and EN8 of Manchester's Core Strategy, and the principles contained within The Guide to Development in Manchester SPD (2007) and the National Planning Policy Framework.

15) No loading or unloading to the Class A1, A2, A3, A4, B1a and D1 development (including waste collections), outside the following hours: 07:30 to 20:00, Mondays to Saturdays, and 10:00 to 18:00 Sundays/Bank Holidays.

Reason - In the interests of residential amenity, pursuant to saved policy DC26 of the Unitary Development Plan for the City of Manchester, policies SP1 and DM1 of the Core Strategy for Manchester.

16) The hours of use of the Class A1, A2, A3, A4, and D1 units in any phase of development, are to be submitted to and agreed in writing by the City Council as Local Planning Authority, prior to the first occupation of the buildings for those uses in that phase. The development shall only be carried out in accordance with the approved hours of opening.

Reason - To safeguard the amenities of the occupiers of nearby residential accommodation when the development is complete, pursuant to saved policy DC26 of the Unitary Development Plan for the City of Manchester and policies SP1 and DM1 of the Core Strategy for Manchester.

17) Before any above ground works relating development falling within Class A3 and A4 (in any phase of development), a scheme for the extraction of any fumes, vapours and odours for that use and Phase shall be submitted to, and approved in writing by, the City Council as local planning authority. The approved scheme shall be implemented prior to occupancy in that use and Phase, and shall remain operational thereafter.

Mixed use schemes shall ensure provision for internal ducting in risers that terminate at roof level. Schemes that are outside the scope of such developments shall ensure that flues terminate at least 1m above the eave level and/or any openable windows/ventilation intakes of nearby properties.

Reason - In the interests of the amenities of the occupiers nearby properties in order to comply with policies SP1 and DM1 of the Core Strategy for Manchester.

18) Before development falling within Class A1, A2, A3, A4, B1a, and D1, in any Phase of development is first occupied, the building within that Phase shall be acoustically insulated and treated to limit the break out of noise in accordance with a noise study of the building. A scheme of acoustic treatment relating to that phase of development, shall be submitted to and approved in writing by the City Council as local planning authority, prior to first occupation of that Phase. The scheme shall be implemented in full before the use commences in the building in that phase of development.

Where entertainment noise is proposed the LAeq (entertainment noise) shall be controlled to 10dB below the LA90 (without entertainment noise) in each octave band at the facade of the nearest noise sensitive location

Upon completion of each phase of development a verification report will be required to validate that the work undertaken throughout the development conforms to the recommendations and requirements in the approved acoustic consultant's report in respect of that phase. The report shall also undertake 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.

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 for Manchester.

19) No part of the site outside of the building in any phase, shall be used other than in accordance with a schedule of days and hours of operation submitted to and approved in writing by the City Council as local planning authority. No amplified sound or any music shall be produced or played in any part of the site outside of the building (including on the roof terrace) in any phase.

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

20) Before any Class A1, A2, A3, A4, B1a, and D1 uses hereby approved commences, any externally mounted ancillary plant, equipment and servicing shall be selected and/or acoustically treated in accordance with a scheme designed so as to achieve a rating level of 5dB (LAeq) below the typical background (LA90) level at the nearest noise sensitive location.

The scheme for each phase of development shall be 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 site prior to occupation of that phase of

development.. The approved scheme shall be completed before the premises is occupied.

Upon completion of each phase of development a verification report will be required to validate that the work undertaken throughout the development conforms to the recommendations and requirements in the approved acoustic consultant's report. The report shall also undertake post completion testing to confirm that the noise 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.

Reason - To minimise the impact of the development and to prevent a general increase in pre-existing background noise levels around the site, and to safeguard the amenities of the occupiers of nearby residential accommodation, pursuant to policies SP1, H1 and DM1 of the Core Strategy for Manchester.

21) Prior to the occupation of any phase of development, details of the strategy for all external lighting, including lighting on the building, within the building's curtilage, and lighting units within the public realm works within that phase, shall be submitted to, and approved in writing by, the City Council as local planning authority. The development of that phase shall be implemented in accordance with the approved details.

Reason - To ensure adequate lighting within the development and to ensure full accessibility within the public realm works, pursuant to policies SP1 and policy DM1 of the Core Strategy for Manchester.

22) If, when the lighting units are illuminated, they cause glare or light spillage which is in the opinion of the City Council as Local Planning Authority to the detriment of adjoining and nearby residential properties, such measures as the Council as Local Planning Authority confirm in writing that they consider necessary including baffles and/or cut-offs shall be installed on the units and adjustments shall be made to the angle of the lighting units and the direction of illumination, which shall thereafter be retained in accordance with details which have received the prior written approval of the Local Planning Authority.

Reason - In order to minimise the impact of the illumination of the lights on the occupiers of existing and proposed nearby residential accommodation, pursuant to policies SP1 and policy DM1 of the Core Strategy for Manchester

23) Prior to the occupation of any phase of development, finalised details of any CCTV to be incorporated within that phase of the development, including design and location of columns and cameras, within the curtilage of the building in that phase, shall be submitted to, and approved in writing by, the City Council as local planning authority. The development of each phase shall be implemented in accordance with the approved details.

Reason - To ensure adequate security within the development and to ensure full accessibility within the public realm works, pursuant to policies SP1 and policy DM1 of the Core Strategy for Manchester.

24) The waste management strategy approved by the City Council as local planning authority and detailed in Waste Management Strategy (ref: 70223-CUR-00-XX-RP-TP-003 Revision: V02 and shown on drawing ref:MAS-AHR-00-XX-DR-A-00-004 rev.1

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