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ENVIRONMENT

Rylands Building

Market Street

Manchester

Noise and Vibration Impact Assessment

MCP2087

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Market Street

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NOISE AND VIBRATION IMPACT ASSESSMENT

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EXECUTIVE SUMMARY

BWB Consulting Ltd was appointed by CD9 Properties (Manchester) Ltd to undertake an environmental noise and vibration impact assessment to support a planning application for the redevelopment of the Rylands Building, on the corner of Market Street and High Street in Manchester. The development proposals are understood to comprise the restoration and refurbishment of the Rylands Building, including a four-storey roof-top extension. The proposals will see the ground floor and basement levels as an active retail and leisure use, whilst the upper floors will be Grade A office floorspace.

A baseline noise survey was undertaken at the Site in July 2020. The survey, and subsequent assessment work, have been undertaken in accordance with current standards and guidance.

Based on assessment findings, it is considered that noise levels can be satisfactorily controlled to within recommended acoustic design standards so that a suitable acoustic environment is provided to future occupants.

The results of the plant noise assessment indicate that the cumulative plant noise emissions at the sensitive receptor is predicted to be below background noise levels during the day and night-time periods, demonstrating *'low impact'* and therefore compliant with Manchester City Council's noise policy.

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1. INTRODUCTION

Brief

1.1 This noise and vibration assessment has been prepared by BWB Consulting Ltd (hereafter '*BWB*') as part of an application to obtain full planning consent for the proposed redevelopment of the Rylands Building. The development proposals are understood to comprise the restoration and refurbishment of the Rylands Building, including a four-storey roof-top extension. The proposals will see the ground floor and basement levels as an active retail and leisure use, whilst the upper floors will be Grade A office floorspace (hereafter referred to as '*the Proposed Development*') on the corner of Market Street and High Street in Manchester. (hereafter referred to as the '*Site*').

1.2 This report considers the Site's suitability for the nature of proposed uses through measurement of existing noise affecting the Site, which has been used to carry out the following works:

- Preliminary façade sound insulation assessment to provide early indication of the necessary façade airborne sound insulation required to achieve appropriate internal noise levels, whilst protecting against noise break out from the commercial retail units;
- Assessment of the degree to which the Proposed Development will be affected by tactile vibration and structure borne reradiated noise from tram movements along the tram lines bounding the Site to the south and west; and
- An external plant noise assessment to determine the potential impact upon the nearby sensitive receptors.

1.3 This report is necessarily technical in nature, so to assist the reader, a glossary of acoustic terminology can be found in **Appendix A**.

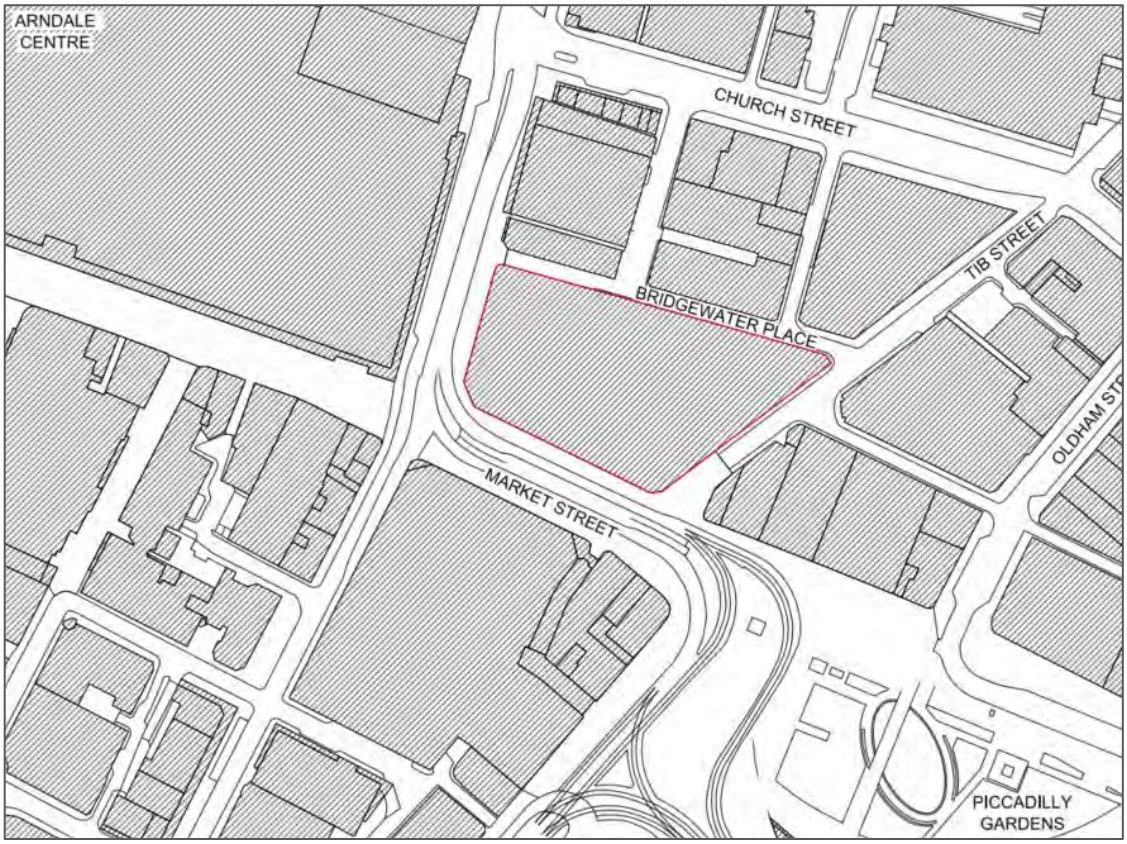
Site Description

1.4 The application site comprises the existing Rylands Building on the corner of Market Street and High Street in Manchester, with a site area totalling 0.44ha. The Site is centred on national grid reference 384264, 398424, and is located within the administrative area of Manchester City Council (MCC).

1.5 The site is bordered to the north by Bridgewater Place with commercial units and existing residential use beyond. To the west, the site is bound by High Street with the Arndale Shopping Centre beyond. To the south, the site is bordered by Market Street with existing retail beyond. To the east, the site is bordered by Tib Street, with Sacha's Hotel and existing commercial/retail units beyond. The Metrolink tramlines border the Site along High Street and Market Street.

1.6 **Figure 1-1** details the location of the Proposed Development.

Figure 1-1 – Site Location Plan



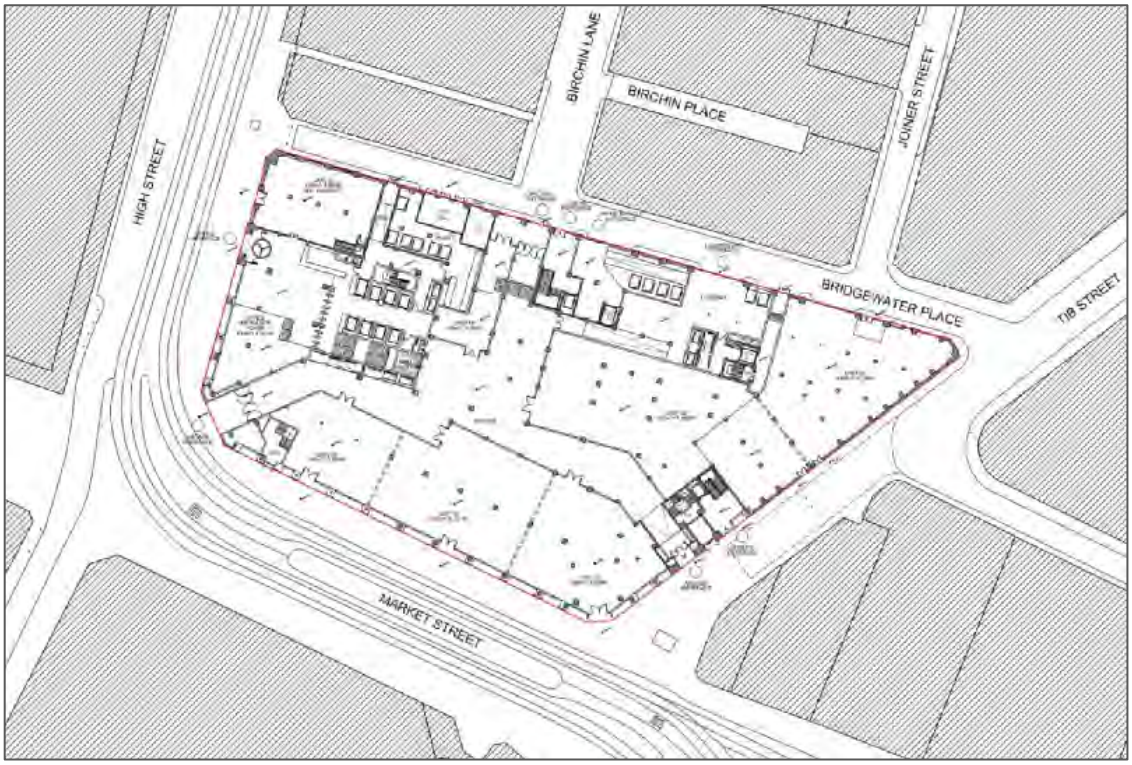
* SOURCE: Architectural drawing produced by Jeffrey Bell Architects (Title: Location Plan, Rylands Building, Manchester – Drawing Ref: AL[05]001).

Proposed Development

1.7 The Proposed Development comprises the restoration and refurbishment of the Rylands Building, including a four-storey roof-top extension. The proposals will see the ground floor and basement levels as an active retail and leisure use, whilst the upper floors will be Grade A office floorspace.

1.8 **Figure 1-2** overleaf shows the proposed site layout.

Figure 1-2 – Proposed Site Layout



* SOURCE: Architectural drawing produced by Jeffrey Bell Architects (Title: Proposed Site Plan, Rylands Building, Manchester – Drawing Ref: AL[05]200).

1.9 **Figure 1-3** overleaf illustrates the details of the rooftop plant type, number, and location associated with the proposed development.

Figure 1-3 – Rooftop Plant Layout Drawing

* SOURCE: Architectural drawing produced by Jeffrey Bell Architects (Title: Proposed Plan Roof, Rylands Building, Manchester – Drawing Ref: AL[05]223).

Plant Schedule

1.10 The information provided in **Table 1-1** presents the proposed external plant items associated to the development scheme.

Table 1-1- Schedule of plant equipment & activities

Quantity	Manufacturer	Model	Location
Fixed Plant			
3	Climaveneta (Mitsubishi Electric)	Heat Pumps: FOCS-N-GO5 4822	As per Figure 1.3

1.11 Associated manufacturers fixed plant data sheets can be found in **Appendix C**, as provided by the project mechanical engineer.

1.12 The anticipated hours of operation are understood to be during standard office and retail working hours.

2. STANDARDS AND GUIDANCE

2.1 When selecting appropriate criteria for assessment, consideration has been given to relevant planning policy and regulations concerning the Development. Consideration has been given to advice contained within the National Planning Policy Framework (NPPF)[1], the Noise Policy Statement for England (NPSE)[2] and Noise Planning Practice Guidance[3], although direct noise and vibration assessment criteria has not been drawn from these documents.

2.2 With regard to acoustic design and noise control, the NPPF provides a set of overarching aims, broadly reflecting those already contained in the NPSE. They are directed towards the avoidance of significant adverse impacts and reduction of other adverse impacts on health and quality of life; set within the context of the Government's policy on sustainable development.

BS 8233:2014: Guidance on Sound Insulation and Noise Reduction for Buildings

2.3 To help in the design of the building and the control of noise outside and in the building, reference has been made to relevant and credited guidance documents, notably, British Council for Offices (BCO) and BS 8233:2014, which recommend suitable external noise intrusion and internal ambient noise level (IANL) criteria to be met within commercial buildings to ensure the acoustic environment within different room spaces are appropriate to their function. The noise level criteria relevant to the development are presented in **Table 2-1**.

Table 2.1 - Internal Noise Criteria in Unoccupied Spaces

Room Space	Level of External Noise Intrusion	BS8233 $L_{Aeq,T}$ Criteria	Criterion
Meeting Rooms, Executive Offices	-	35-45 35-40	Reasonable conditions for study and work requiring concentration
Cellular Offices	NR 35	40-50	
Speculative Offices	NR 38		
Open Plan Offices, Reception Rooms	NR 40 NR 45	45-50 45-50	Reasonable acoustic privacy in shared spaces
Corridors, Toilets	-	45-55	Reasonable speech or telephone conversations

Noise Breakout from Commercial Use

2.4 The significance of noise impacts associated with the proposed retail/arcade complex at ground floor level depends upon the type of tenant and the nature of noise sources as this will dictate the sound insulation performance of the primary building fabric in

[1] Department for Communities and Local Government (DCLG) (2012); '*The National Planning Policy Framework*', TSO.
[2] Department for Environment, Food and Rural Affairs (DEFRA) (2010); '*Noise Policy Statement for England*', DEFRA.
[3] DCLG (2014); '*Planning Practice Guidance website*', DCLG. (http://planningguidance.planningportal.gov.uk/)

controlling noise break-out. Particular regard will need to be given to tenants whose use may be unusually noisy or noise sensitive to minimise conflict of use between adjacent occupants and wider off-site receptors. This is to ensure that tenanted activities are controlled to an unobtrusive level to safeguard the acoustic acceptability of the Development.

BS 6472-1: 2008: 'Guide to Evaluation of Human Exposure to Vibration in Buildings Part 1: Vibration Sources Other Than Blasting'

2.5 Vibration from passing train can manifest itself as tactile vibration and/or structure-borne noise. Tactile vibration is that which is perceived as mechanical motion. BS 6472-1: 2008: '*Guide to Evaluation of Human Exposure to Vibration in Buildings Part 1: Vibration Sources Other Than Blasting*' provides procedures for assessing the potential human response to vibration.

2.6 Vibration is assessed in terms of the equivalent '*vibration dose value'* (VDV in $m/s^{1.75}$), which relates to the level and duration of vibration, and effectively accumulates the vibration energy received over the daytime or night-time period in question. Present knowledge indicates the VDV indices to correspond most closely to the response of people to vibration inside a building. It is important to note, however, that people exhibit wide variations of vibration tolerance. Specific values are dependent upon social and cultural factors, psychological attitudes and expected degree of intrusion.

2.7 The guide VDVs set out in BS 6472-1 for evaluating the various probabilities of adverse comment within commercial office buildings relevant to the proposed Development are presented in **Table 2-2**. The criteria are presented as ranges to reflect the differing susceptibility to vibration evident among members of the population.

Table 2-2: BS 6472-1:2008 Probability of Adverse Comment Due to Vibration

Vibration dose values (VDV in $m/s^{1.75}$) above which might result in various degrees of adverse comment within residential buildings			
Place and Time	**Low Probability of Adverse Comment**	**Adverse Comment Possible**	**Adverse Comment Probable**
Office Units - 16hrs day	0.4[1] - 0.8	0.8 – 1.6	1.6 – 3.2[2]

Notes:

[1] BS 6472-1:2008 states that adverse comment is not expected for VDVs below the ranges in Table 2.3;

[2] Above these range values adverse comment is very likely.

2.8 VDVs in the different room spaces of the Development shall not exceed the minimum low probability of adverse comment value presented in **Table 2-2**, when assessed in accordance with BS 6472:2008.

Association of Noise Consultants 'Measurement and assessment of ground-borne noise and vibration', 2nd edition, 2012

2.9 There is currently no international or British Standard which provides guidance on assessing the impact of ground borne noise from railways on the occupants of a building. The Association of Noise Consultants (ANC) guidelines '*Measurement and*

assessment of ground-borne noise and vibration', 2nd edition published in 2012[4], is generally used as the basis of assessments such as this.

2.10 In the absence of any criteria specifically relating to tram noise, this guidance has been adopted to inform the assessment.

2.11 This document also provides discussion on the relevant research that has been carried out, and a summary of typically adopted criteria. The most relevant items are set out below:

- The American Public Transit Association (APTA) guidelines recommend criteria of between 30 and 40 dB(A) depending on the density and type of residential properties. They do not define where within a building these apply, or the time response that should be used.
- The Federal Transit Administration (FTA) of the US Department of Transportation, recommends limits for maximum pass-by levels of 35 dB(A) for frequent events (more than 70 events per day) and 43 dB(A) for infrequent events.
- The ANC guidelines also note that Local Authority guidelines for ground-borne noise, published in London and the South East, and state a limit of 35 dB $L_{Amax,S}$.

2.12 In all the above examples, the time constant is not defined, with the exception of the Local Authority guidelines in London and the South East, which is defined as having a fast (F) time weighting.

2.13 It should be noted that most of this research relates to residential accommodation and is aimed at providing good sleeping / resting conditions.

2.14 For the purposes of this planning assessment, an adopted structure-borne noise (SBN) limit of 35dB L_{ASmax} has been chosen for the office spaces.

BS 4142:2014+A1:2019; 'Methods for rating and assessing industrial and commercial sound'

2.15 The effect of industrial noise on the nearest noise sensitive residences will be assessed in accordance with BS4142:2014+A1:2019[5].

2.16 The standard describes a method of determining the level of sound of a commercial nature, together with procedures for assessing the impact of such a sound outside nearby noise sensitive areas.

[4] Association of Noise Consultants (ANC) (2012); 'Measurement and assessment of ground-borne noise and vibration', ANC.

[5] British Standard (BS) 2014, BS 4142:2014 'Methods for rating and assessing industrial and commercial sound', British Standards Institution (BSI).

2.17 The standard may be thought of as a procedure for comparing the sound from commercial sources with background sound levels in the absence of the commercial sound and determining the likely impact of the sound on noise sensitive residences.

2.18 In accordance with BS 4142 the background sound level is the typical A-weighted sound pressure level at the assessment position that is exceeded for 90% of a given time interval (L_{A90}). The specific sound level is the equivalent continuous (L_{Aeq}) sound pressure level at the assessment position produced by the commercial source over a given time interval.

2.19 Certain acoustic features can increase the impact over that expected from a simple comparison between the specific sound level and the background level. Where such features are present, these are taken into account by adding corrections to the specific sound level.

2.20 This correction is applied based on whether the following features occur or are expected to be present. The correction values can either be determined subjectively, or by various objective measurement procedures.

- The sound contains a distinguishable, discrete, continuous tone (whine, hiss, screech, hum, etc.). 0 – 6 dB penalty
- The sound contains distinct impulses (bangs, clicks, clatters, or thumps). 0 – 9 dB penalty.
- The sound is irregular enough to attract attention. 0 – 3 dB penalty.
- Where the specific sound features characteristics that are neither tonal nor impulsive, nor intermittent, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.

2.21 From the addition of the above penalties where appropriate the rating level is established, this being the value that is compared with the background noise. Note that corrections for impulsivity and tonality may be added arithmetically where both are present and likely to affect perception within the same reference period. However, if any single feature is dominant to the exclusion of the others then it might be appropriate to apply a reduced or even zero correction for the minor characteristics.

2.22 According to BS 4142, an initial estimate of the impact is given based on the rating level value as follows:

- a rating level 10 dB(A) or more above the background is an indication of significant adverse impact, depending on the context.
- a rating level 5 dB(A) above the background is an indication of an adverse impact, depending on the context.
- where the rating level does not exceed the background level, this is an indication of the specific sound source having a low impact, depending on the context.

2.23 BS4142 indicates that the noise source should be evaluated over the appropriate time interval which is as follows:

- 1-h during the day (07:00 – 23:00)
- 15-min during the night (23:00 – 07:00)

2.24 The above initial assessment may then be modified depending on the context, to take into account.

- The absolute level of the sound.
- The character and level of the residual sound compared to the character and level of the specific sound.
- 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:

    1. Façade insulation treatment;
    2. Ventilation and / or cooling that will reduce the need to have windows open so as to provide rapid or purge ventilation; and
    3. Acoustic screening.

Consultation with Manchester City Council (MCC)

2.25 Consultation was undertaken with MCC by email on 17th June 2020 with the Environmental Health Officer (EHO) Graeme Souter, seeking opinion on the specific requirement of a noise impact assessment and agreement on monitoring strategy.

2.26 A response was received from the EHO, Graeme Souter on 18th June 2020 by email, a copy of which is presented on **Appendix B**, confirming the approach amongst other queries.

MCC: Planning and Noise Technical Guidance document

2.27 MCC's Planning and Noise Technical Guidance document (Dec 2015) states the following regarding noise and vibration from fixed plant:

'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'.

3. BASELINE NOISE SURVEY

Summary

3.1 A comprehensive environmental baseline noise and vibration survey was undertaken to establish and quantify the existing noise and vibration climate on, and within the vicinity of, the Site.

3.2 Unattended monitoring was carried out over a 24-hour period to cover the daytime and night-time periods between Thursday 30th and Friday 31st July 2020 at two key long-term (LT) positions illustrated in **Figure 3-1**.

3.3 Additional short-term attended noise monitoring was undertaken on Friday 31st July 2020 along Market Street and High Street, at two key short-term (ST) positions also illustrated in **Figure 3-1**.

3.4 Attended baseline vibration surveys were also undertaken during the short-term monitoring periods on 31st July 2020 to determine the spatial variation of existing tram induced ground-borne vibration emanating with distance from trams on the ground level tramlines which border the Site to the south and west. The vibration measurement locations are also indicated in **Figure 3-1**.

Figure 3-1 – Noise and Vibration Monitoring Locations

*SOURCE: Google Earth with measurement locations as described in Table 3-1.

Table 3-1: Summary of Monitoring Observations

Monitoring Location	Description	Observations and Predominant Noise Sources
LT1	Facade measurement taken at the north-eastern site boundary, directly overlooking Tib Street at 5th floor level. Meter approximately 1m from the facade.	During equipment installation and collection, the noise climate was dominated by local road traffic noise and low-level anonymous plant noise. This is typical of the city centre location.
LT2	Facade measurement taken at the northern site boundary, directly overlooking Bridgewater Place at 5th floor level. Meter approximately 1m from the facade.	
ST1 & V1	Free-field measurement taken along the southern site boundary, along Market Street. Meter approximately 1.5m Above Ground Level (AGL).	Tram noise when passing and amplified music from street entertainers on Market Street are both dominant. Other main noise sources are pedestrian noise with occasional shouting, amplified speech from Piccadilly Gardens. Tram tannoy audible at times.
ST2 & V2	Free-field measurement taken along the western site boundary, along High Street. Meter approximately 1.5m AGL.	Amplified music from street entertainers on Market Street dominant. Tram noise also dominant when passing, including traction noise, grinding on tracks and beeping noise. Other main noise sources are pedestrian noise, occasional cars passing on High Street. Plant noise audible during quiet periods from vents above Arndale units.

Measurement Equipment

3.5 The baseline noise survey was undertaken using the Class 1 specification noise measurement equipment detailed in **Table 3-2**. Equipment was calibrated using a portable calibrator immediately before and after the measurements with no significant drift in calibration observed.

Table 3-2: Noise monitoring equipment

Survey Location	Equipment	Make & Model	Serial Number	Calibration Due Date
LT1	Sound Level Meter	01dB Fusion	12080	May 2022
	Pre-Amplifier	01dB Pre22	1805334	
	Microphone	Gras 40CE	331919	
	Calibrator	01dB CAL21	34675323	June 2021
LT2, ST1, ST2	Sound Level Meter	01dB Fusion + DMK	10919	Feb 2022
	Pre-Amplifier	01dB Pre22	1915155	
	Microphone	Gras 40CD	144851	
	Calibrator	01dB CAL21	34344463	Jan 2021
V1, V2	Vibration Meter	01dB Orion	10240	Dec 2020

3.6 The sound level meters, pre-amplifiers and microphones were calibrated to traceable standards within the 24-months prior to the measurements. The portable calibrators were calibrated within the 12-months preceding the date of the survey. Calibration certificates can be provided upon request.

3.7 Vibration measurements were taken over the same monitoring durations at the short-term monitoring locations along the southern and western boundaries to determine the magnitude of existing vibration from a representative sample of tram events using a calibrated 01dB ORION Smart Vibration Monitoring Terminal (Serial Number: 10240).

Meteorological Conditions

3.8 Weather conditions during the survey were conducive to the environmental noise measurement, it being fine and dry, with just a light wind from variable directions (<5ms^{-1}) prevailing. Temperatures were noted to range between 17 – 32 degrees Celsius.

Noise Measurement Results

3.9 A summary of the long-term unattended daytime and night-time measured noise levels of the survey period, undertaken from Thursday 30th – Friday 31st July 2020, are provided in **Table 3-3**.

Table 3-3: Summary of Noise Monitoring Results

Monitoring Location	Period	Duration	$L_{Aeq,T}$ dB[1]	$L_{A90,T}$ dB[2]	$L_{AFmax,T}$ dB	
					Range (5-min time intervals)	90th %tile[3]
LT1	13:00 -23:00, 07:00-13:00	16-hrs	60	53	61 – 90	77
	23:00-07:00	8-hrs	58	50	53 – 95	78
LT2	13:15-23:00, 07:00-13:15	16-hrs	58	50	59 – 87	79
	23:00-07:00	8-hrs	56	44	52 – 85	71

Notes:
[1] Monitored time periods (16hrs);
[2] Representative typical background (following statistical analysis) over the monitored time periods (8hrs);
[3] The 90th percentile L_{AFmax} value is presented and considered representative of typical L_{AFmax} levels experienced.
All figures are rounded to the nearest whole decibel.

3.10 The results of the short-term attended noise monitoring undertaken on Friday 31st July 2020 are tabulated in **Table 3-4**.

Table 3-4: Summary of Short-Term Monitoring Results

Monitoring Location	Period / Duration	Sound Pressure Level $L_{Aeq,T}$ Octave Band Centre Frequency Hz (dBA)								
		63	125	250	500	1000	2000	4000	8000	Total
ST1	14:03 – 15:02	72	70	67	66	65	59	53	46	69
ST2	15:06 – 16:06	75	75	72	70	67	61	56	51	72

3.11 It should be noted that the measurement results stipulated in **Tables 3-4** are not specific source noise levels. Observations on site highlight that tram noise, amplified music and pedestrian noise are the dominant noise source across the site at this location. As such, the results encompass the recordings of all sources on-site and considered rigorous for the assessment.

Vibration Measurement Results

3.12 A summary of the short-term attended daytime measured vibration levels of the survey period, undertaken on Friday 31st July 2020, are provided in **Table 3-5**.

3.13 The highest VDVs attributable to the tram movements captured are presented in **Table 3-5**.

Table 3-5: Existing Vibration Levels Representative of the Site

Monitoring Location	Period / Time	Maximum Measured Event Vibration Dose Value ($m/s^{1.75}$)		
		x-axis	y-axis	z-axis
		VDVd	VDVd	VDVb
V1	Daytime / 1-hr	0.0049	0.0062	0.0064
V2	Daytime / 1-hr	0.0120	0.0249	0.0853

3.14 Tactile vibration was not knowingly perceived during any of the tram events as is expected with such low magnitudes of measured vibration.

Plant Generating Noise Levels

3.15 A summary of the source noise sound power levels emitted by the proposed fixed plant are provided in **Table 3-6**, using the outdoor heating values as a worst-case scenario, as per the manufacturers data sheets presented in **Appendix C.** The sound power levels have been used directly in the assessment as these have been determined on the basis of measurements taken in compliance with ISO 9614, as per the manufacturer's notes.

Table 3-6: Sound Power Levels of Plant Items

Fixed Plant	Sound Power Level L_w Octave Band Centre Frequency Hz (dBA)								Global dB(A)
	63	125	250	500	1k	2k	4k	8k	
FOCS-N-G05 / SL-CA 4822 - Super Low Noise (in heating)	87	86	90	92	93	81	70	62	95

Noise Sensitive Receptors

3.16 The closest existing noise sensitive receptors (NSRs) have been identified as the hotel bedrooms of Sacha's hotel along Tib Street and Back Piccadilly directly to the east of the development site, and residential dwellings along Bridgewater Place and the Light Aparthotel bedrooms directly to the north. These receptors are listed in **Table 3-7**.

Table 3-7: Nearest Noise Sensitive Receptors

NSR	Description	Direction
NSR 1	Dwellings at Bridgewater Place	North
NSR 2	Light Aparthotel	North
NSR 3	Residential development currently under construction on Tib St /Bridgewater Place/Joiner St/ (planning ref: 114146/FO/2016)	North-East
NSR 4	Sacha's Hotel, Tib Street/Back Piccadilly	East

4. ASSESSMENT

Noise Break-In to Proposed Office

4.1 The glazing performance requirements are dependent on the use type, what percentage of the façade is glazed, the frequency composition of noise incident on the façade and the ventilation strategy.

4.2 Preliminary calculations have been undertaken to provide an early indication of the sound insulation performance requirements the glazing in the worst affected façades would be required to provide, to achieve the internal criteria set out in **Section 2** of this report (with windows closed). These are presented in **Table 4-1**.

4.3 The calculations adopt the detailed methodology set out in BS 8233:2014 and BS EN 12354-3:2000[6], and are based on the following assumptions:

- To ensure favourable acoustic conditions are provided for, assessment has been based on determined daytime ambient ($L_{Aeq,16hr}$) levels being experienced on the most noise exposed façade of the proposed Development.
- Assessment has been undertaken based upon the criteria for cellular office or meeting room as a worst case scenario.
- The internal finishes of the room will affect the reverberant component of the overall noise level, with a degree of soft furnishing considered in our calculations (RT = ~0.5 seconds).
- It has been assumed that the external walls forming a part of the Development achieve an acoustic performance of not less than 52dB R_w.
- The calculated noise levels are based on a 40% glazed area for different user elements of the Development. Should glazed areas change by +/-10% of the façade area then the performance of the proposed glazing units would need to be adjusted accordingly.

4.4 The predicted façade noise levels and the minimum required sound reduction index are presented in **Table 4-1.**

[6] BS EN 12354-3:2000; Building acoustics. Estimation of acoustic performance in buildings from the performance of elements. Airborne sound insulation against outdoor sound, BSI

Table 4-1: Indicative Noise Control Measures (Glazing Performances)

Façade Aspects	Day-time Façade Noise Levels ($L_{Aeq\,T}$ dB)	Minimum Required SRI ($R_w + C_{tr}$)
Eastern Façade (overlooking Tib Street)	60 - 75	≥ 30
Northern Facade (overlooking Bridgewater Place)	55 - 65	≥ 28
Southern Facade (Overlooking Market Street)	55 - 75	≥ 30
Western Façade (Overlooking High Street)	55 - 75	≥ 30

4.5 The sound insulation performance of the specified glazing units assumes that windows remain closed to achieve the internal ambient noise level requirements under BS8233.

4.6 It is understood that the intention is to replace the existing windows with Crittall W20 sections (apart from on the 7th floor where they will be retained). The performance stipulated above are likely to be achieved through the new windows. The retaining window are also likely to achieve the required performances, subject to the existing frame being in good condition, as to not undermine the performance of the glazing package.

4.7 During the detailed design phase of the project, a complete assessment would need to be undertaken and used to identify the detailed zoning of window types to ensure appropriate control of sound incident upon all the different façades of the Development.

Ventilation

4.8 The Building Regulations on ventilation (Approved Document F; ADF)[7] require that habitable rooms have background ventilation by natural or mechanical means. It is important to ensure that the alternative source of ventilation does not compromise the overall performance of the façade system or the internal ambient noise level criteria to be met within office spaces.

4.9 Where appropriate, the preferred choice of ventilation is through the use of mixed-mode ventilation strategy. Such methods can be used to meet the requirements of the Building Regulations ADF for background ventilation. The future occupants would then have the option of keeping windows closed for most of the time and opening windows for rapid ventilation and summer cooling.

Break-Out Noise Associated with Commercial Use

4.10 In order to not prejudice public areas outside of the proposed Development, it is recommended that break-out noise is controlled to below NR 40 (~48dBA) 3.0m from

[7] Department for Communities and Local Government (DCLG) (2010); '*The Building Regulations Approved Document F – Means of Ventilation*', HM Government.

the façade, which will ensure that noise levels at the nearest noise sensitive receptors fall to an unobtrusive (unnoticeable) level as not to materially affect or inconvenience user's amenity, thereby ensuring the acoustic acceptability of the Development.

4.11 At this stage in the design of the Development, the future tenant of the commercial use is not known. However, based upon a representative sample internal ambient noise level of 71 dB $L_{Aeq,T}$ and maximum noise level of 90 dB L_{AFmax} (90^{th} %tile) taken within a busy themed restaurant with incidental background music and raised voice to represent a '*severe case*' scenario, then provided the façade system provides a performance equal to or greater than that presented in **Table 4-1** then break-out noise levels associated with the operation of the restaurants would be controlled to a sufficient level as to ensure negligible disturbance to nearby sensitive receptors.

Tactile Vibration

4.12 Based on the maximum and average vibration values taken of single tram passes and utilising the tram timetables and site observations to estimate the number of tram passes for the daytime and night-time periods on each of the closest three tracks, an overall worst-case (based on the maximum event level) and typical (based on the mean event level) VDV for the 16-hour daytime period ($VDV_{,day}$) and 8-hour night-time ($VDV_{,night}$) period has been calculated as presented in **Table 4-2**.

Table 4-2: Maximum Vibration Dose Value

Period	Scenario	Maximum Vibration Dose Value (m/s1.75)		
		x-axis	y-axis	z-axis
Daytime	Worst case	0.02	0.03	0.15
	Typical	0.02	0.02	0.10
Semantic Rating		*Adverse Comment Not Expected*	*Adverse Comment Not Expected*	*Adverse Comment Not Expected*

4.13 Vibration levels as detailed in **Table 4-2** would result in a maximum VDV of 0.15 $m/s^{1.75}$ (z-axis) during the daytime period, which falls below the threshold criteria for '*low probability of adverse comment*' set out in BS 6472:2008.

Structure-Borne Noise

4.14 Re-radiated structure-borne noise (SBN) created by vibration through the structure of the building has been predicted using similar transfer functions as above (but extrapolated to correspond to frequency variation). The predicted range of re-radiated noise based on both worst-case and mean measured event data is presented in **Table 4-3**.

Table 4-3: Range of Re-radiated Noise Levels during a Passing Tram

Scenario	Re-radiated Noise Level (dB $L_{Amax,S}$)		
	Amplification Due to Floor Resonance		
	Minimum Amplification	Average Amplification	Maximum Amplification
Worst case	30	33	35
Typical	27	30	33

4.15 With reference to **Table 4-2**, rail induced ground-borne vibration is predicted to typically give rise to first floor SBN levels of between the adopted design limit of 35dB L_{ASmax}.

4.16 It should be noted that the exact transfer functon is unknown and that the interaction between the ground and the structure is impossible to accurately predict.

Plant Noise Emissions

4.17 With the application of MCC's policy on plant noise, requiring that plant should achieve a rating level of 5dB ($L_{Ar,T}$) below the typical background (L_{A90}) level at the nearest noise sensitive location, it follows that the maximum plant emission levels ($L_{Aeq,T}$) for fixed mechanical plant presented in **Table 4-4** must be met 1m from the façade of the closest noise sensitive properties, as set out in **Table 3-7.**

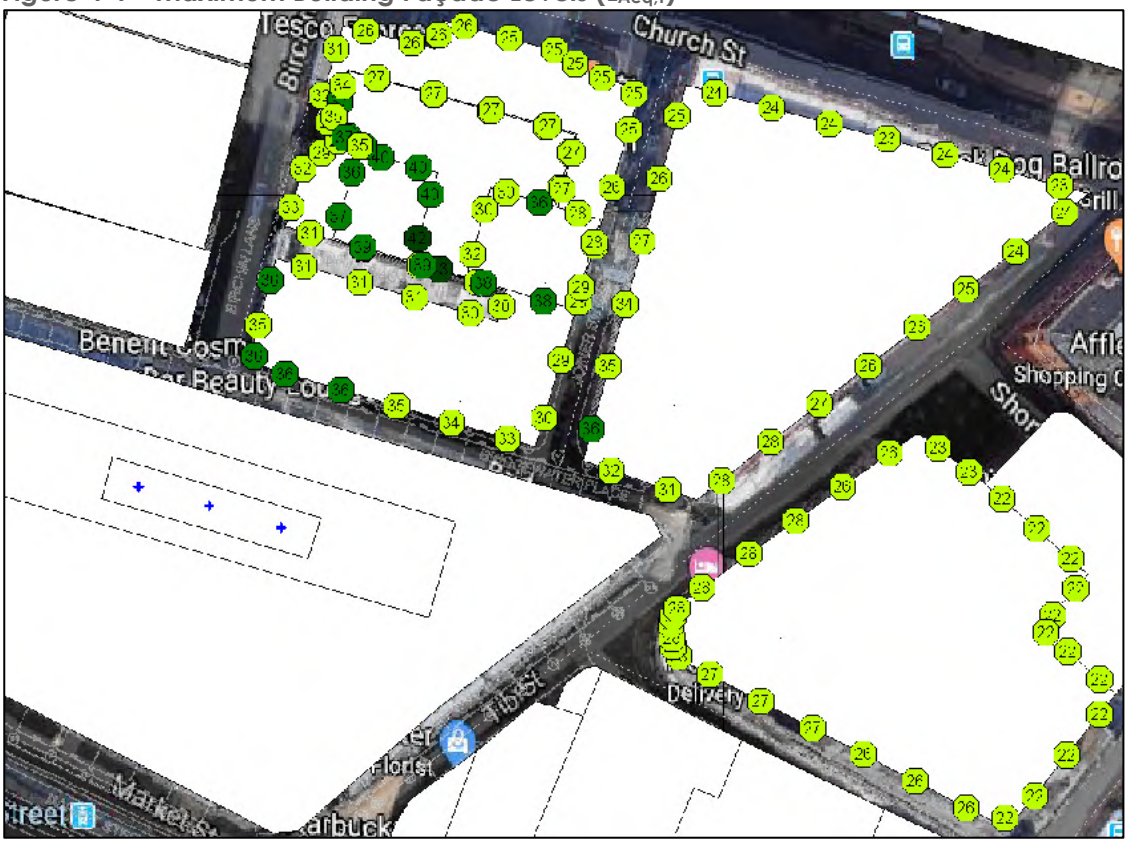
Table 4-4: Plant Noise Limits at Nearest Noise Sensitive Premises

Location	Period	Typical Measured $L_{A90,T}$	Plant Noise Emission Limit ($L_{Ar,T}$)[1]
NSRs 1 - 3	Daytime	50	45
	Night-time	44	39
NSR 4	Daytime	53	48
	Night-time	50	45

4.18 An assessment has been undertaken based on the rooftop plant drawing illustrated in **Figure 1-3**. A 3-dimensional (3D) noise model of the Site has been prepared using the acoustic software package CADNA-A®, which uses the methodology laid out in ISO 9613-210[8], to predict potential noise impact upon the NSRs. The resultant levels at the façades are shown in **Figure 4-1**.

[8] BS EN ISO 9613-2 - Attenuation of sound during propagation outdoors -- Part 2: General method of calculation, GB

Figure 4-1 – Maximum Building Façade Levels ($L_{Aeq,T}$)



4.19 The assessment has been completed for a worst-case scenario in that it has been assumed all plant would be operating simultaneously and at full-duty (i.e. 100% on-time and capacity) during the quietest daytime periods without mitigation.

4.20 In the context of the existing noise climate and limiting criteria, and the plant units presenting no tonal noise elements, an acoustic penalty correction has not been applied.

Table 4-5 - Summary of Assessed Specific Noise Levels at the NSR – No Mitigation, dB

Assessment Parameter	NSR 1 (Daytime Period)	NSR 2 (Daytime Period)	NSR 3 (Daytime Period)	NSR 4 (Daytime Period)	Relevant BS 4142 Clause
Specific noise level at NSR	36	40	36	28	7.3.5
Acoustic feature correction	0[1]	0[1]	0[1]	0[1]	9.2
Rating Level	36	40	36	28	9.2
Lowest background noise level, dB$L_{A90,1\text{-}hr}$	50	50	50	53	8
Adopted MCC criteria (-5dB)	45	45	45	48	-
Difference	-9	-5	-9	-20	-
BS 4142 Impact	**Low Impact**	**Low Impact**	**Low Impact**	**Low Impact**	-

Notes:

* Calculation based upon modelling, which takes into consideration any short and long-distance attenuation, and site-specific screening attenuation. Assessment based on the typical representative measured $L_{A90,1hour}$ levels whilst source data derived from source noise levels stipulated in supplier/manufacturers data sheet.

[1] Based on previous experience of the type of speed-controlled plant utilised on similar schemes, it is known that they emit noise that is broadband in nature and therefore no acoustic feature correction/penalty has been applied.

4.21 From review of **Table 4-5**, it can be seen that, for a worst case scenario, a cumulative plant rating noise level of 40 dB $L_{Ar,Tr}$ is predicted during the daytime periods at the NSR 2. The plant noise level is some -5 dB below the daytime criteria, taking into consideration the adopted MCC criteria. As such, no further mitigation is required.

Uncertainty

4.22 Reasonably practicable steps have been taken to reduce the level of uncertainty with respect to the measurements and assessment calculation methodology. The level of uncertainty of the measurement is considered low given the length of the measurement period and intervals, and the non-differing weather condition. It should be noted that the specific noise source is significantly low in the context of the existing noise climate, therefore the risk of uncertainty causing adverse impact is considered very unlikely.

4.23 The level of uncertainty from the calculation is considered low. The resultant levels have been derived using acoustic modelling software, which uses industry recognized standard IOS 9613-2 calculation method. Sound power levels stated on manufacturers/suppliers' datasheets were used as input data in the model which is representative of both the source and the conditions under which the source is expected to operate. Notwithstanding this, uncertainty in the operation or sound emission characteristics of the specific source remains, albeit a low risk for this particular assessment given the greater margin for non-compliance.

5. CONCLUSIONS

5.1 A noise assessment has been undertaken for the restoration and refurbishment of the Rylands Building, including a four-storey roof-top extension.

5.2 This study has shown that to achieve the internal noise level design criteria within proposed offices noise would be controlled via the existing building fabric, subject to the existing frame being in good condition, as to not undermined the performance of the glazing package. During the detailed design phase of the project, a more detailed assessment will be undertaken.

5.3 Vibration results indicate that a maximum VDV of 0.15 $m/s^{1.75}$ (z-axis) during the daytime period and a maximum VDV of 0.09 $m/s^{1.75}$ (z-axis) during the night-time period was recorded, which fall below the threshold criteria for 'low probability of adverse comment' set out in BS 6472:2008. Rail induced ground-borne vibration is predicted to typically give rise to first floor SBN levels of between the adopted design limit of 35dB $L_{ASmax,S}$.

5.4 Based on assessment findings, it is considered that noise levels can be satisfactorily controlled to within recommended acoustic design standards so that a suitable acoustic environment is provided to future occupants.

5.5 The results of the plant noise assessment indicate that the cumulative plant noise emissions at sensitive receptors is predicted to be below background noise levels during the day and night-time periods, demonstrating *'low impact'* and therefore compliant with MCC's noise policy.

APPENDICES

APPENDIX A: Glossary of Terms

Noise

Noise is defined as unwanted sound. Human ears are able to respond to sound in the frequency range 20 Hz (deep bass) to 20,000 Hz (high treble) and over the audible range of 0 dB (the threshold of perception) to 140 dB (the threshold of pain). The ear does not respond equally to different frequencies of the same magnitude but is more responsive to mid-frequencies than to lower or higher frequencies. To quantify noise in a manner that approximates the response of the human ear, a weighting mechanism is used. This reduces the importance of lower and higher frequencies, in a similar manner to the human ear.

Furthermore, the perception of noise may be determined by several other factors, which may not necessarily be acoustic. In general, the impact of noise depends upon its level, the margin by which it exceeds the background level, its character and its variation over a given period of time. In some cases, the time of day and other acoustic features such as tonality or impulsiveness may be important, as may the disposition of the affected individual. Any assessment of noise should give due consideration to all of these factors when assessing the significance of a noise source.

The most widely used weighting mechanism that best corresponds to the response of the human ear is the 'A'-weighting scale. This is widely used for environmental noise measurement, and the levels are denoted as dB(A) or L_{Aeq}, L_{A90} etc., according to the parameter being measured.

The decibel scale is logarithmic rather than linear, and hence a 3 dB increase in sound level represents a doubling of the sound energy present. Judgement of sound is subjective, but as a general guide a 10 dB(A) increase can be taken to represent a doubling of loudness, whilst an increase in the order of 3 dB(A) is generally regarded as the minimum difference needed to perceive a change under normal listening conditions.

Acoustic Terminology

Term	Description
dB (decibel)	The scale on which sound pressure level is expressed. Sound pressure level is defined as 20 times the logarithm of the ratio between the root-mean-square pressure of the sound field and a reference pressure (2x10-5Pa).
dB(A)	A-weighted decibel. This is a measure of the overall level of sound across the audible spectrum with a frequency weighting (i.e. 'A' - weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies.
$L_{Aeq,T}$	L_{Aeq} is defined as the notional steady sound level which, over a stated period of time (T), would contain the same amount of acoustical energy as the A - weighted fluctuating sound measured over that period.
L_{Amax}	L_{Amax} is the maximum A - weighted sound pressure level recorded over the period stated. L_{Amax} is sometimes used in assessing environmental noise where occasional loud noises occur, which may have little effect on the overall L_{eq} noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response.
L_{10} and L_{90}	If a non-steady noise is to be described it is necessary to know both its level and the degree of fluctuation. The L_n indices are used for this purpose, and the term refers to the level exceeded for n% of the time. Hence L_{10} is the level exceeded for 10% of the time, and the L_{90} is the level exceeded for 90% of the time.
Free-field Level	A sound field determined at a point away from reflective surfaces other than the ground with no significant contributions due to sound from other reflective surfaces. Generally, as measured outside and away from buildings.
Façade Level	A sound field determined at a distance of 1m in front of a large sound reflecting object such as a building façade.

APPENDIX B: Consultation

From: Graeme Souter <g.souter@manchester.gov.uk>
Sent: 18 June 2020 15:52
To: Sarah Gilston <Sarah.Gilston@bwbconsulting.com>
Subject: Re: Consultation for Rylands Building Redevelopment - Manchester City Centre

Hi Sarah

Many thanks for your email and proposals for the assessment of the redevelopment.

I agree with your assessment of likely existing noise sources. With regard to receptors, depending on the use then (leisure and retail uses) other neighbouring commercial premises should also be considered as a receptor in terms of noise breakout and the noise criteria. If the lower basement use for leisure includes a gym for example then assessment of noise and vibration transfer through the building to office space or other adjoining use should be considered. This will need to include an assessment of free weights areas or impact machines and details of insulating these areas to prevent noise and vibration sound transmission. This is likely to require an acoustic floor build up in free weights areas, details of how impact machines can be insulated and musliple use machines will be controlled to prevent noise breakout (banks of spin bikes for example) Normal gym activities such as instruction classes and amplified music will need to be considered as well especially for other adjoining uses.

If retail is proposed then noise breakout will also need to be considered and again if music is proposed then consideration to closer commercial or office receptors may need to be considered.

I can accept your proposals for slightly amended noise monsiting given the current situation and using existing data from previous applications in the vicinity found on the portal to verify or benchmark against your own monitoring.. Please run these locations by us though before adopting them and if you can include the times, dates and noise level being adopted from previous reports that would be really helpful, just to ensure we agree they are representative, but other than that I think its a good solution.

I appreciate that plant has yet to be selected so we can agree that plant limits can be supplied prior to assessment of the equipment once confirmed. Again, consider potentially closer receptors who may be impacted during the day such as upper floor office space or neighbouring businesses who may have either line of site or located close to the equipment.

We may have additional comments to make upon receipt and assessment of the full application and subsequent report but i hope the above helps in the meantime

Kind regards

1

Graeme Souter
Neighbourhood Officer - Environmental Protection
Citywide Support Team - Environmental Health
Growth and Neighbourhoods
Manchester City Council
Hammerstone Road
Gorton
Manchester
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Direct Dial: 0161 234 1387
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Website: www.manchester.gov.uk

For the latest support and information about the coronavirus visit www.manchester.gov.uk/coronavirus

On Wed, 17 Jun 2020 at 09:56, Sarah Gilston <Sarah.Gilston@bwbconsulting.com> wrote:

> Hi Graeme,
>
> I am writing on behalf of BWB Consulting who have been instructed to undertake a noise assessment to support a planning application for the redevelopment of the Rylands Building, on the corner of Market Street and High Street in Manchester. The development proposals are understood to comprise commercial office use over 10 floors, with provision for retail uses at ground floor and basement level and leisure use at sub-basement level.
>
> Please could you review our proposed methodology and queries below and respond with any comments you may have?
>
> **Please note** that we have had to rethink our normal approach based on current measures around coronavirus.
>
> **Site Setting**
>
> The proposed development site comprises the Rylands Building currently operating as the Debenhams department store.

It is anticipated that the main noise sources to be considered in the assessment will be tram movements along Market Street and High Street, road traffic noise from High Street, and potential noise from the surrounding commercial premises, which may include fixed plant and patron noise.

Any noise generating uses associated with the proposed development will also need to be assessed at existing noise sensitive receptors. It is considered that the nearest existing noise sensitive receptors are dwellings along Bridgewater Place and Sacha's Hotel on Tib Street.

Noise Impact Assessment – in light of the current climate

The IOA and ANC have recently published guidance on the impact of COVID-19 on baseline noise monitoring and noise impact assessments. This states that a pragmatic approach may be needed in relation to the information required. It is recognised that changes will be required in the way monitoring and reporting is undertaken, and the document recommends a number of changes to ensure that noise impact assessments can be undertaken in a timely manner, allowing planning authorities to maintain momentum in the planning system.

Alternative Methodology – mix of noise and vibration survey and using existing data

- Tram movements: It is proposed that representative noise and vibration data can still be captured for tram movements.
- Road Traffic: It is expected that noise along High Street will be lower, and therefore we would look to use noise data captured at nearby sites that already in the planning system, subject to agreement.
- Background noise levels: It is considered that these are likely to be lower than usual in the city centre, however, it is proposed to undertake background noise measurements at site, and to support this, we will undertake a review of the Manchester City Council planning portal for nearby sites with existing baseline noise data, with a view to using this as verification data in our assessment.

Noise and Vibration Survey

A baseline noise and vibration survey will be required to determine potential noise impact onto the proposed offices and also the potential noise impact of any new fixed plant equipment associated with the redevelopment of the building.

Semi-attended noise monitoring will be undertaken to cover the daytime and night-time periods, at the closest points of the proposed development to the identified noise sources over a typical mid-week period.

Monitoring is intended to be undertaken at 6 locations:

The proposed noise and vibration monitoring locations are presented in the figure below.

Noise Measurement Locations 1 and 2 (Long-term)

Long-term noise measurements are outlined in blue, which is intended to be deployed at first-floor level with the equipment located internally with mic sticking out of the window.

>Location chosen to determine existing noise levels from any fixed plant and equipment in the vicinity of the site, during the daytime and night-time periods, and to determine existing baseline noise levels, at locations representative of the identified nearest noise sensitive receptors (NSRs) to the site.

Noise Measurement Locations 3 and 4 (Short-term)

Supplementary short-term attended noise measurements will be undertaken in locations outlined in orange.

>Location chosen to gather existing ambient noise climate and any noise levels produced by specific items of plant/machinery associated with the nearby buildings. Also, to best capture tram movements and road traffic noise along Market Street and High Street.

Vibration Measurement Locations 5 and 6

Attended vibration measurements will be taken at ground, first, and second floor level at set distances from the Metro Tram Line running parallel to the existing building as outlined in green.

>Locations chosen to gather a representative sample of tram events on both facades.

Noise Assessment Guidance and Standards

The noise assessment will consider the following:

1. National Planning Policy Framework (NPPF);
2. Noise Policy Statement for England (NPSE);
3. Planning Practice Guidance (PPG);
4. British Council for Offices (BCO) guidance;
5. BS8233:2014 Guidance of Sound Insulation and Noise Reduction for Buildings;
6. BS4142:2014 Methods for Rating and Assessing Industrial and Commercial Sound; and
7. Manchester City Council's 'Planning & Noise Technical Guidance' (Dec 2015).

Summary Methodology

In summary, we propose to undertake the following:

7. Assess the existing noise levels at the proposed development, in accordance with the above guidance;
8. Assess the potential impact of noise from the proposed commercial uses at the nearest noise sensitive receptors, in accordance with the above guidance;
9. Where appropriate, mitigation measures will be considered, to reduce the noise to within acceptable levels at the proposed development and at existing sensitive receptors; and
10. Provide a noise report summarising our findings.

It should be noted that at this early stage in the design of the Development, specific details of the type, number and configuration of building services plant are not developed. Consequently, we will look to setting suitable limits to which plant should adhere, in accordance with the guidance stipulated within MCC's 'Planning & Noise Technical Guidance'.

Please can you confirm that you are happy with the above scope?

Please do not hesitate to contact me should you require any further information or wish to discuss anything further.

Many thanks for your time and I look forward to hearing from you.

Kind Regards,

Sarah

Sarah Gilston

Acoustic Consultant | BWB Consulting Limited

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APPENDIX C: Suppliers/Manufacturers Datasheet

HEAT PUMPS

FOCS-N

Reversible unit, air source for outdoor installation

2022 - 4822 440,7-1162 kW

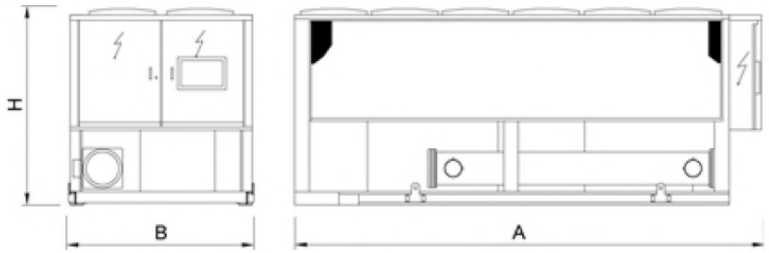
FOCS-N / SL-CA			2022	2222	2422	2622	2722	3222	3622	4222	4822
Power supply		V/ph/Hz	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50	400/3/50
PERFORMANCE											
COOLING ONLY (GROSS VALUE)											
Cooling capacity	(1)	kW	440,7	487,9	519,6	558,6	648,7	771,5	895,0	1004	1119
Total power input	(1)	kW	162,6	171,6	184,8	208,7	221,5	264,5	285,2	336,2	375,4
EER	(1)	kW/kW	2,710	2,843	2,812	2,677	2,929	2,917	3,138	2,986	2,981
ESEER	(1)	kW/kW	3,840	3,910	3,910	3,930	4,360	4,200	4,240	4,270	4,290
COOLING ONLY (EN14511 VALUE)											
Cooling capacity	(1)(2)	kW	439,6	486,6	518,0	557,4	647,1	769,4	892,8	1001	1116
EER	(1)(2)	kW/kW	2,690	2,810	2,780	2,660	2,900	2,890	3,110	2,950	2,950
ESEER	(1)(2)	kW/kW	3,740	3,810	3,790	3,840	4,240	4,080	4,130	4,130	4,160
Cooling energy class			D	C	C	D	B	C	A	B	B
HEATING ONLY (GROSS VALUE)											
Total heating capacity	(3)	kW	461,0	514,4	546,4	578,1	674,3	794,3	910,8	1039	1151
Total power input	(3)	kW	141,8	154,5	165,5	175,3	194,5	228,6	254,3	295,6	327,9
COP	(3)	kW/kW	3,251	3,329	3,302	3,298	3,467	3,475	3,582	3,515	3,510
HEATING ONLY (EN14511 VALUE)											
Total heating capacity	(3)(2)	kW	462,3	516,0	548,2	579,4	676,1	796,6	913,1	1042	1154
COP	(3)(2)	kW/kW	3,230	3,310	3,280	3,280	3,440	3,450	3,560	3,490	3,490
Cooling energy class			A	A	A	A	A	A	A	A	A
ENERGY EFFICIENCY											
SEASONAL EFFICIENCY IN COOLING (Reg. EU 2016/2281)											
Ambient refrigeration											
Prated,c	(10)	kW	-	-	-	-	647	769	893	1001	1116
SEER	(10)(11)		-	-	-	-	4,32	4,19	4,27	4,28	4,31
Performance ηs	(10)(12)	%	-	-	-	-	170	165	168	168	170
SEASONAL EFFICIENCY IN HEATING (Reg. EU 813/2013)											
PDesign	(4)	kW	337	368	361	389	-	-	-	-	-
SCOP	(4)(13)		3,44	3,49	3,46	3,61	-	-	-	-	-
Performance ηs	(4)(14)	%	135	137	135	142	-	-	-	-	-
Seasonal efficiency class	(15)		-	-	-	-	-	-	-	-	-
EXCHANGERS											
HEAT EXCHANGER USER SIDE IN REFRIGERATION											
Water flow	(1)	l/s	21,08	23,33	24,85	26,71	31,02	36,90	42,80	48,01	53,53
Pressure drop	(1)	kPa	28,8	32,5	36,8	24,0	31,2	34,9	31,8	40,3	35,3
HEAT EXCHANGER USER SIDE IN HEATING											
Water flow	(3)	l/s	22,25	24,83	26,37	27,90	32,55	38,34	43,96	50,17	55,56
Pressure drop	(3)	kPa	32,1	36,8	41,5	26,2	34,3	37,7	33,6	44,0	38,0
REFRIGERANT CIRCUIT											
Compressors nr.		N°	2	2	2	2	2	2	2	2	2
No. Circuits		N°	2	2	2	2	2	2	2	2	2
Refrigerant charge		kg	211	233	248	267	276	340	470	466	520
NOISE LEVEL											
Sound Pressure	(5)	dB(A)	69	70	70	70	70	71	70	71	71
Sound power level in cooling	(6)(7)	dB(A)	89	91	91	91	91	92	92	94	94
Sound power level in heating	(6)(8)	dB(A)	90	92	92	92	92	93	93	95	95
SIZE AND WEIGHT											
Operating weight	(9)	kg	6190	6680	6770	7010	7650	9820	10890	11510	11950
A	(9)	mm	4900	5800	5800	5800	7000	7900	10000	11800	11800
B	(9)	mm	2260	2260	2260	2260	2260	2260	2260	2260	2260
H	(9)	mm	2430	2430	2430	2430	2430	2430	2430	2430	2430

Notes

1 Plant (side) cooling exchanger water (in/out) 12°C/7°C; Source (side) heat exchanger air (in) 35°C.
2 Values in compliance with EN14511
3 Plant (side) heat exchanger water (in/out) 40°C/45°C; Source (side) heat exchanger air (in) 7°C - 87% R.H.
4 Parameter calculated for LOW-TEMPERATURE application in AVERAGE climate conditions according to [REGULATION (EU) N. 813/2013]
5 Average sound pressure level at 1m distance, unit in a free field on a reflective surface; non-binding value calculated from the sound power level.
6 Sound power on the basis of measurements made in compliance with ISO 9614.
7 Sound power level in cooling, outdoors.
8 Sound power level in heating, outdoors.
9 Unit in standard configuration/execution, without optional accessories.
10 Parameter calculated according to [REGULATION (EU) N. 2016/2281]
11 Seasonal energy efficiency ratio
12 Seasonal space cooling energy efficiency
13 Seasonal coefficient of performance
14 Seasonal space heating energy efficiency
15 Energy efficiency class referred to LOW-TEMPERATURE application in AVERAGE climate conditions according to [REGULATION (EU) N. 811/2013]

The units highlighted in this publication contain HFC R134a [GWP_{100} 1430] fluorinated greenhouse gases.
Certified data in EUROVENT

Dimensional drawing



TECHNICAL SELECTION - EN 14511 - EN 14825 Page 2 / 2

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Database version: 1.5.4.0
User: Dean Ward
Print data: 21/08/2020 12:07
Calculation type: EN 14511 - EN 14825

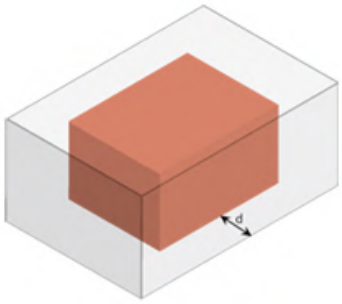
Check ongoing validity of certificate: www.eurovent-certification.com

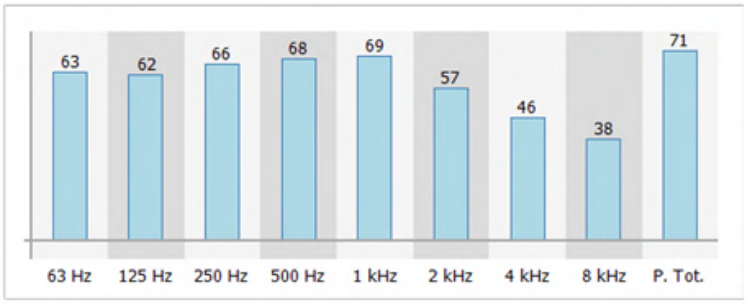
HEATING COOLING AXIAL SCREW R513A

NOISE DATA

SOUND DATA COLD

Frequencies	Hz	63	125	250	500	1000	2000	4000	8000
Sound power (spectrum)	dB	86	85	89	91	92	80	69	61
Sound power level in cooling	dB(A)					94			
Sound pressure level (spectrum)	dB	63	62	66	68	69	57	46	38
Sound Pressure	dB(A)					71			





SOUND DATA OUTDOOR HOT

Sound power level in heating	dB(A)	95

Note

Distance	m	1
Note		Average sound pressure level at 1 m distance, unit in a free field on a reflective surface; non-binding value calculated from the sound power level. Sound power on the basis of measurements taken in compliance with ISO 9614.

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