

Noise Impact Assessment – Blossom Markets

27 Gun Street, Ancoats, Manchester, M4 5DN

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This report has been prepared based upon a scope of works and associated resources agreed between the client and Philip Dunbavin Acoustics Ltd (PDA). This report has been prepared with all reasonable skill, care and diligence and has been based upon the interpretation of data collected. This has been accepted in good faith as being accurate and valid at the time of the collection. This report has been based solely on the specific design assumptions and criteria stated herein.

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1.0 SUMMARY

PDA Ltd has carried out a noise impact assessment in relation to the proposed Blossom Market development on Gun Street, Ancoats in Manchester City Centre.

The proposal is to apply for a change of use to convert the existing MOT garage into an Arcade / Market space. The final use of the units within the market space is yet to be confirmed however, we are informed that it will likely be comparable to a food hall / arcade with some units likely to be utilised for more generic retail use i.e. clothing, barber shops etc.

A noise survey has been conducted at site to establish the existing acoustic climate at the nearest noise sensitive receivers (NSRs).

Noise egress from proposed development has been calculated at the NSRs and compared against the existing ambient noise climate in accordance with the IEMA Guidelines for Environmental Noise Impact Assessment.

The worst case noise level is predicted to be low relative to the existing noise climate and below the WHO guideline level considered to be the threshold for the onset of 'serious annoyance'. With reference to the guidance contained within the IEMA Guidelines for Environmental Noise Impact Assessment the increase in noise level is calculated to be between 0.6-1.5 dB this would suggest that the proposed development is likely to have a negligible impact.

The National Planning Policy Framework (NPPF) requires that significant adverse impacts due to a new development should be avoided and other adverse impact should be mitigated and reduced to a minimum. Based upon the above assessment it is concluded that the sound levels arising from the operations of the Proposed Development will not result in an adverse impact and will therefore comply with the requirements of the NPPF.

2.0 SITE DESCRIPTION

The site is located at 27 Gun Street, Ancoats in Manchester City Centre and is currently occupied by the Blossom Motor Co MOT garage. The proposal is to apply for a change of use to convert the MOT garage into an Arcade / Market space.

The existing garage comprises solid brick external walls with open sides and a light weight single ply roof. It is understood that the existing structure is to be retained and will remain as an unheated space housing a number of self-contained units.

The final use of the units within the market space is yet to be confirmed however, we are informed that it will likely be comparable to a food hall / arcade with some units likely to be utilised for more generic retail use i.e. clothing, barber shops etc.

We understand that the proposed operational hours for the market are between 08:00 – 23:00 Monday – Sunday.

The site location and its surroundings can be seen in the Figure below:

Figure 1. Site location and surroundings.



The site is bound by Henry Street to the north and Gun Street to the south. The area immediately surrounding the site is of mixed use and comprises a number of residential apartment blocks and existing retail/commercial units, bars and pubs.

The nearest noise sensitive residential receivers relative to the development are summarised as follows:

- NSR1 – Apartment building to the south of the site on Gun Street.
- NSR2 – Apartment building immediately to the east of the site on Blossom Street.
- NSR3 – Apartment building to the north of the site on Henry Street.
- NSR4 – Apartment building to the south of the site on Gun Street.

During our survey it was noted that there are a number of non-residential uses in the vicinity of the site as summarised below:

- SiP Pay & Display Carpark – Located immediately to the west of the site.
- Edinburgh Castle Public House – Located to the north of the site on the corner of Henry Street and Blossom Street.
- Various commercial units located to the north west of the development on junction of Henry Street and George Leigh Street.

It was also noted that there are a number of existing retail units and a wine bar located on the ground floor level of the apartment building on Henry Street (NSR3).

3.0 ASSESSMENT CRITERIA

3.1 National Planning Policy Framework

National Planning Policy is guided by the National Planning Policy Framework (NPPF) updated in December 2023. With regard to Noise the Framework states the following;

Planning policies and decisions should contribute to and enhance the natural and local environment by:

- *preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability.*

Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

- *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.*

The terms ‘significant adverse impact’ and ‘adverse impact’ are defined in the explanatory notes of the ‘Noise Policy Statement for England (NPSE)’ which states;

There are two established concepts from toxicology that are currently being applied to noise impacts, for example, by the World Health Organisation. They are:

NOEL – No Observed Effect Level

This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.

LOAEL – Lowest Observed Adverse Effect Level

This is the level above which adverse effects on health and quality of life can be detected.

Extending these concepts for the purpose of this NPSE leads to the concept of a significant observed adverse effect level.

SOAEL – Significant Observed Adverse Effect Level

This is the level above which significant adverse effects on health and quality of life occur.

The notes also offer an explanation of the term ‘adverse impacts’ as follows;

... refers to the situation where the impact lies somewhere between LOAEL and SOAEL. It requires that all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life while also taking into account the guiding principles of sustainable development (paragraph 1.8). This does not mean that such adverse effects cannot occur.

Although no specific noise limits for LOAEL and SOAEL have been defined, in 2014 the UK Government published a planning practice guidance document for noise which indicates where these limits fall with relation to the perception of noise. A summary is reproduced in Section 3.2 below, and the full document

is published at <https://www.gov.uk/guidance/noise--2>. It is considered that guidance from other acoustic standards may be employed to determine suitable levels within the overall principal of the National Planning Policy Framework.

The National Planning Policy Framework also states:

Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed.

The focus of planning policies and decisions should be on whether proposed development is an acceptable use of land, rather than the control of processes or emissions (where these are subject to separate pollution control regimes). Planning decisions should assume that these regimes will operate effectively. Equally, where a planning decision has been made on a particular development, the planning issues should not be revisited through the permitting regimes operated by pollution control authorities.

3.2 Planning Practice Guidance – Noise

In March 2014 (updated July 2019) the UK Government published further guidance on the assessment of noise for planning purposes in the form of the on-line publication, Planning Practice Guidance on noise (<http://www.gov.uk/guidance/noise--2>). This document offers further guidance on the typical levels which constitute the NOEL, LOAEL and SOAEL. The relevant section is reproduced in the table below;

Table 1. Planning Practice noise level guidance

Perception	Examples of Outcomes	Increasing Effect Level	Action
No Observed Effect Level			
Not present	No Effect	No Observed Effect	No specific measures required
No Observed Adverse Effect Level			
Present and not intrusive	Noise can be heard, but does not cause any change in behaviour, attitude or other physiological response. 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	No specific measures required
Lowest Observed Adverse Effect Level			
Present and intrusive	Noise can be heard and causes small changes in behaviour, attitude or other physiological response, 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 small actual or perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
Significant Observed Adverse Effect Level			
Present and disruptive	The noise causes a material change in behaviour, attitude or other physiological response, 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	Avoid
Present and very disruptive	Extensive and regular changes in behaviour, attitude or other physiological response and/or an inability to mitigate effect of noise leading to psychological stress, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Adverse Effect	Prevent

It is notable from the above planning guidance that development should not normally be permitted above Significant Observed Adverse Effect Levels, and should aim to minimise other Adverse Effect Levels (below SOAEL but above LOAEL). However, it is clear that noise is permitted to approach and/or exceed the Lowest Observed Adverse Effect Level, providing that noise is mitigated and reduced to a minimum.

3.3 WHO Guidelines for Community Noise

In 1999, the WHO (World Health Organisation) published Guidelines for Community Noise, stating the following noise levels are applicable to residential dwellings.

Table 2: WHO Guidelines for Community Noise criteria

Specific Environment	Critical Health Effect(s)	L_{Aeq} dB	Time Base (hours) *
Dwelling, indoors	Speech intelligibility & moderate annoyance, daytime & evening	35	16
Inside bedrooms	Sleep disturbance, night time	30	8
Outdoor Living Area	Serious annoyance, daytime & evening	55	16
Outdoor Living Area	Moderate annoyance, daytime & evening	50	16

* Typically taken to be daytime/evening - 07:00 – 23:00 hours and night time 23:00 – 07:00 hours.

3.4 Institute of Environmental Management and Assessment (IEMA) Guidelines for Environmental Noise Impact Assessment, Version 1.2, 2014

The Institute of Acoustics of Environmental Management and Assessment has produced a guidance document regarding noise impact assessments. The values given in Table 3 below are taken from the document that sets out a guide as to how changes in noise level may be assessed.

Table 3. IEMA Impact from the Change in Sound Levels

Long-term impact classification	Short-term impact classification	Sound Level Change dBA
Negligible	Negligible	> 0 dB and < 1 dB
	Minor	> 1 dB and < 3 dB
Minor	Moderate	> 3 dB and < 5 dB
Moderate	Major	> 5 dB and < 10 dB
Major		> 10 dB

The above criteria reflect key benchmarks of human response to changes in noise level. For example, a 3dB change is generally taken to be the smallest change perceptible to the human ear and a 10dB change is heard as a doubling or halving of loudness.

4.0 SURVEY DETAILS AND RESULTS

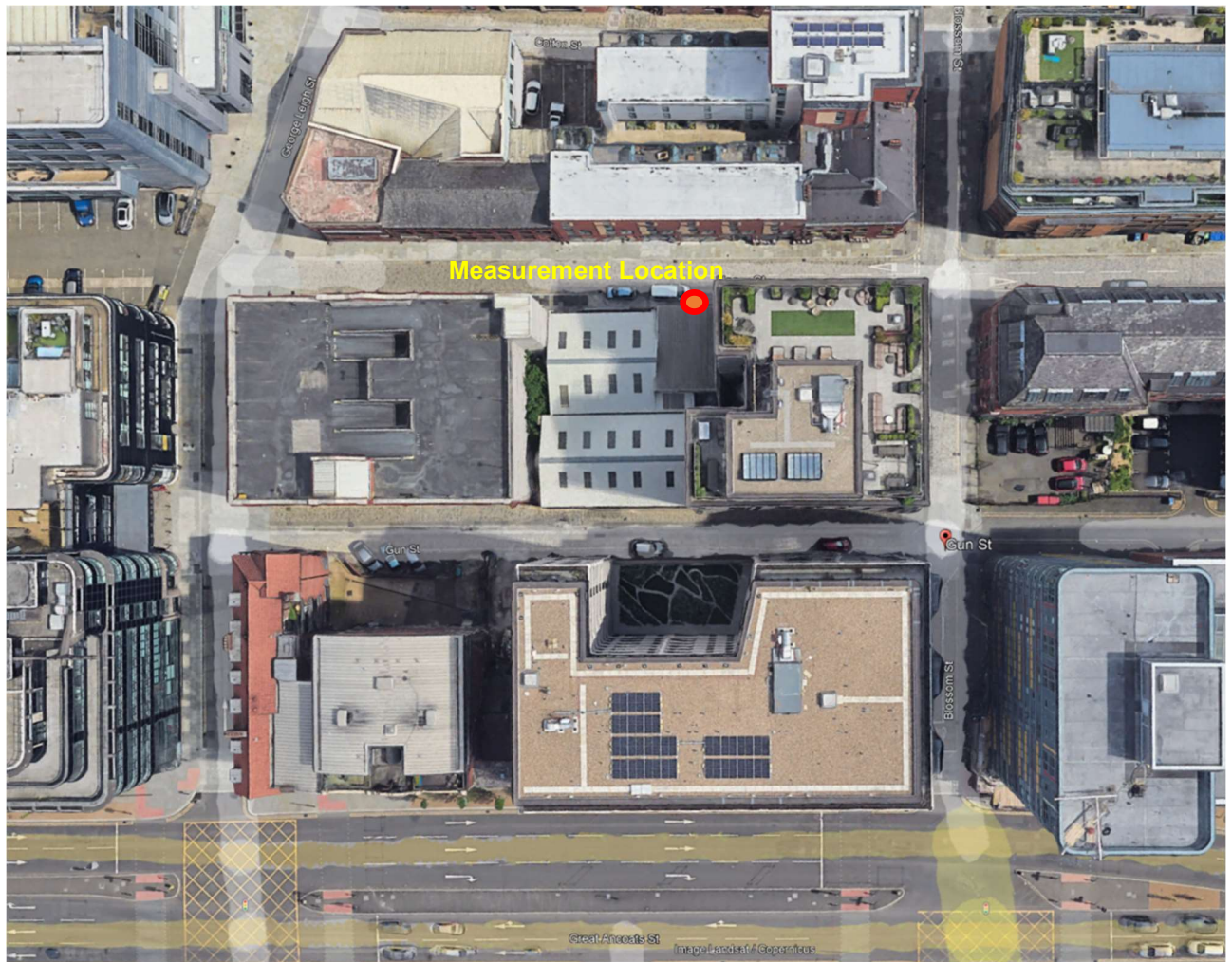
4.1 Noise Survey Details

In order to determine the existing ambient noise climate in the vicinity of the site a survey was undertaken over a period of approximately 72 hours. Measurements were undertaken over an entire weekend period between 13:10 hours on Friday 8th until 07:00 hours on Monday 11th November 2024.

Measurements were undertaken from a single location on Henry Street mounted on the existing building approximately 4m above ground level. The measurement location was deemed to be representative of the noise climate for the closest residential receivers to the proposed development.

The location of which can be seen in Figure 3 below.

Figure 3. Noise Survey Monitoring Position



Measurements were made and partially attended by Mr C Wright of PDA Ltd. All measurements were undertaken with a fast time-weighting and broadband statistics were measured throughout. In addition, octave band frequency spectra and audio were recorded. Measurements were of continuous 5 minute samples.

The noise survey was conducted using an NTi XL2 sound level meter for which a valid calibration certificates is held. In addition, the meter was field calibrated both before and after the measurement period, during which time no significant deviation from the calibrated level was observed. The NTi XL2

has a Class 1 frequency response as per BS EN 61672-1:2003 and was fitted with a windshield at all times.

Weather

Weather conditions varied throughout the survey however typical conditions were as followed:

Temperature- 7-12°C
Wind - 0 – 4 m/s (NE / E)
Events - Generally dry with some intermittent periods of rain

Weather conditions were deemed to be conducive to noise measurements, note that our observations are based on Weather Underground Station 'IMANCH162' located approximately 300m from the development site.

4.2 Noise Sources

The noise climate in the vicinity of the site was considered to be typical for an urban city centre environment.

Based on our observations the ambient noise climate was dominated by distant road traffic on Great Ancoats Street. Vehicle movements on the road network immediately surrounding the site also had an intermittent contribution.

Distant plant noise associated with the surrounding residential and commercial uses was also audible in the vicinity of the NSR's.

It was noted that during the evening period noise due to pedestrians and patrons gathering outside the nearby pubs had a contribution to the noise climate.

4.3 Noise Survey Results

The full results of the noise survey are available in the Appendix. A summary of the results is provided below.

Table 4. Summary of noise survey results

Period ¹	L _{Aeq,T} (dB)	Range of L _{A90} (dB)	Typical L _{A90} ²
Friday	62	47 – 59	50
Friday Night	55	39 – 48	42
Saturday	62	44 – 53	50
Saturday Night	57	38 – 51	43
Sunday	58	42 – 52	50
Sunday Night	54	36 – 50	39

Notes:

- 1 It is understood that the proposed development is likely to operate between 08:00 – 23:00 as such, for the purposes of this assessment measurements undertaken outside of this period have not been considered.
- 2 The modal L_{A90} was taken to be representative of the typical background noise climate.

It can be noted from the measured noise levels above that during the daytime period when the proposed development is expected to operate (08:00 – 23:00 hours) the existing ambient noise level ranges from 58 – 62 dB L_{Aeq}.

The typical background noise level was found to be 50 dB L_{A90} during the daytime and between 39 – 43 dB L_{A90} during the night time.

5.0 NOISE IMPACT ASSESSMENT

5.1 Noise Sources Associated With Development

The proposal is to form a market / arcade space by constructing a number of self-contained units within the existing structure which is currently occupied by an MOT garage.

The final use of the units within the market space is yet to be confirmed however, we are informed that it will likely be comparable to a food hall / market with some units likely to be utilised for more generic retail use i.e. clothing, barber shops etc.

We would not consider there to be any significant sources of noise associated with the development if all units are to be utilised for retail use. The most significant noise source associated with the development would be the potential use as a food hall / market. On this basis, to ensure that our assessment is conservative we have assumed that the development is to be used as a food hall.

We note that there are a number of other similar developments within the greater Manchester area including the Mackie Mayor food hall in the city centre and Altrincham Markets which would expect are likely to be representative of noise levels generated within the proposed Blossom Market development.

In order to determine likely source noise levels associated with the proposed development PDA Ltd have undertaken an internal measurement within Altrincham Markets. During the measurement period the internal seating area was reasonably busy, the dominant noise source was due to people talking and it was noted that background music was playing.

The measured sound pressure levels are summarised in the Table below:

Table 5. Reference Noise levels for Typical Food Hall

Description	Sound Pressure Level dB, Octave Band Centre Frequency Hz								dBA
	63	125	250	500	1k	2k	4k	8k	
Internal food hall measurements including background music	81	78	73	72	71	68	63	61	75

5.2 Building Envelope Noise Egress

The existing garage comprises solid brick external walls with open sides and a light weight single ply roof. It is understood that the existing structure is to be retained and will remain unchanged as an unheated space housing a number of self-contained units.

The dominant paths for noise egress through the building envelope of the proposed market development will be via the open sides and light-weight roof.

Our assessment has been undertaken based on the following assumptions:

External Walls

For the masonry wall sections a high level of sound insulation is predicted. Therefore, noise transmission through the walls will be dominated by the open sides which we have assumed provide no reduction.

Roof

The existing roof appeared to be light-weight single ply construction (no internal lining), assumed to be 100mm Kingspan KS1000 RT or similar.

The sound insulation performance for the light-weight roof has been taken from manufacturer's data and is summarised in the table below. Note that for the external walls noise transmission will be dominated by the open sides which we have assumed does not provide any attenuation. The performance of the cladding and roller shutter is summarised below:

Table 6. Sound insulation performance external envelope

Element	Sound Insulation R, dB							R _w , dB
	63	125	250	500	1000	2000	4000	
Roof	20	19	21	22	22	32	38	25

Based on the measured internal noise levels as presented in Table 5 we have calculated the noise level radiating from the external walls and roof by applying corrections to account for the sound insulation properties of each surface element and to account for transfer from the reverberant to direct sound field. The sound power per m² for the roof and opening side within the external walls are presented in the Table below.

Table 7. Sound power per m² of external envelope

Element	Octave Band L _w per m ² dB							L _{WA} , dB
	63	125	250	500	1000	2000	4000	
Roof	55	53	46	44	43	30	19	47
Walls (open sides)	75	72	67	66	65	62	57	70

As would be expected, it can be seen from the calculated sound power levels above that noise egress through the facade will be dominated by the openings to either side of the building.

5.3 Predicted Noise Levels at Receivers

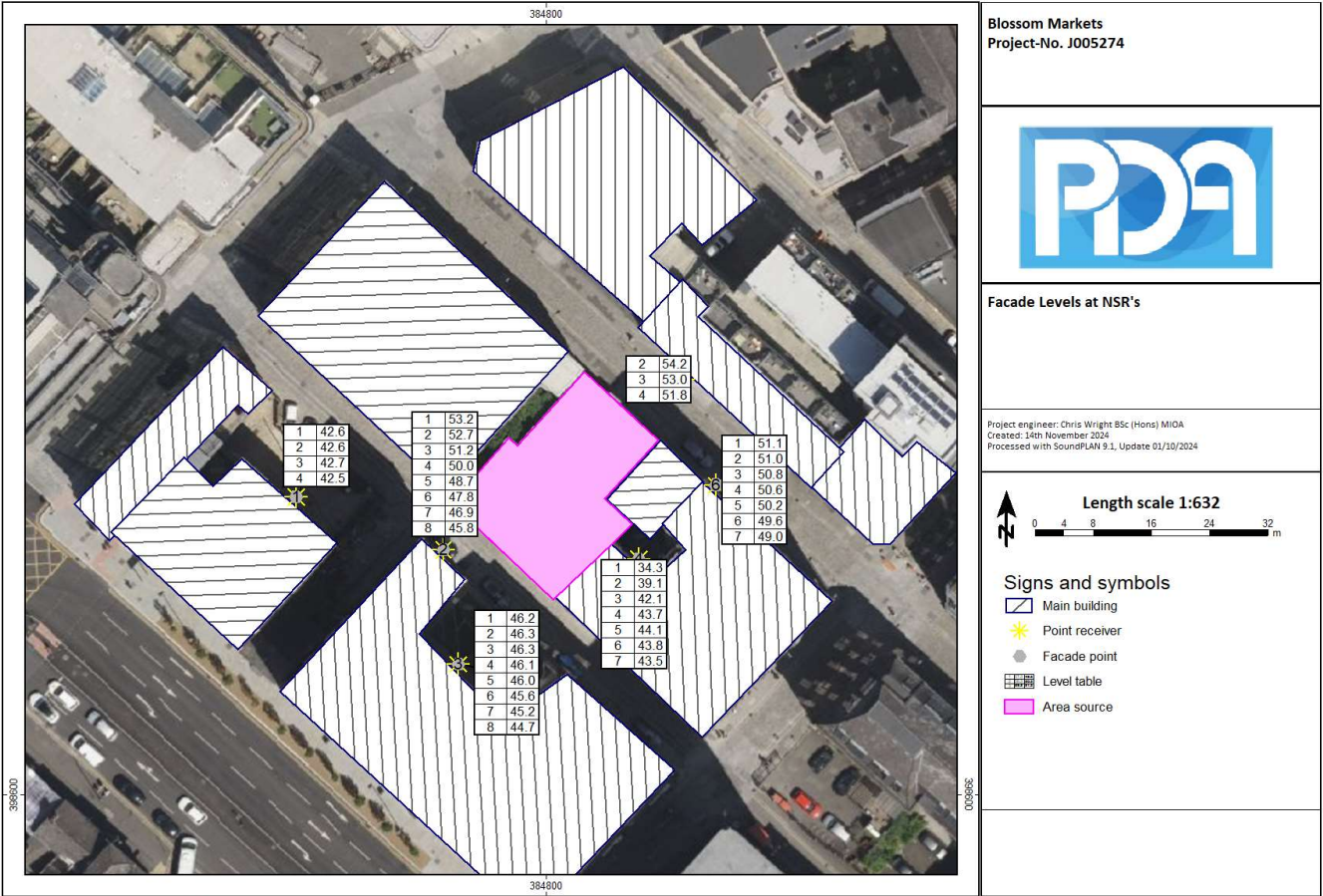
Using the sound power levels calculated in Section 5.2 above we have modelled noise emissions from the site using SoundPLAN V9.1 noise modelling software.

The software uses the method of ISO 9613 ‘Acoustics – attenuation of sound during propagation outdoors – general method of calculation’ and takes into account geometric spreading, ground effects, air absorption, barrier attenuation and reflections from the surroundings to calculate the noise levels incident at various points.

The roof and openings on the external walls have been modelled as area sources at their respective locations. A ground absorption coefficient of 0 has been used representative of hard surfaces (hardstanding, roads, etc.) which would likely provide a worst-case assessment.

The results of the noise model can be seen in the Figure below. Note that the level tables in the Figures below relate to the floor level (1st column) and the facade noise level (2nd column).

Figure 4. SoundPLAN Noise Model Results



5.4 Discussion of Results

The results of our noise model suggest that the noise level is likely to be 54 dB L_{Aeq} at the facade of the worst affected residential receivers on Henry Street. It can be seen that lower noise levels are predicted at all other receivers due to increased distance and shielding.

The results of our survey indicate that the existing ambient noise level in the vicinity of the residential receivers is between 58 – 62 dB L_{Aeq} during periods when the markets are expected to operate. As such, it is unlikely that the proposed development will have a significant contribution to the ambient noise level.

In accordance with the IEMA Guidelines for Environmental Noise Impact Assessment, to determine the noise impact associated with the proposed development it is necessary to consider how the changes will affect the existing noise levels at the nearby dwellings.

Comparison is made in the Table below, note that the increase is determined by logarithmically summing the existing and predicted noise levels to determine the change in noise level as a step change.

Table 8. Comparison of Noise Emissions with Existing Noise Level

Period	Existing noise climate $L_{Aeq,T}$ (dB)	Worst-case Predicted Noise Level $L_{Aeq,T}$ (dB)	Cumulative Noise Level $L_{Aeq,T}$ (dB)	Sound Level Change dBA	Magnitude of Impact
Friday	62	54	62.6	+0.6	'Negligible'
Saturday	62		62.6	+0.6	'Negligible'
Sunday	58		59.5	+1.5	'Negligible'

With reference to the guidance contained with the IEMA Guidelines for Environmental Noise Impact Assessment it can be seen that the increase in noise level is calculated to be between 0.6 – 1.5 dB this would suggest that the proposed development is likely to have a negligible impact.

We note that noise emissions from the proposed development are predicted to be below the 55 dB L_{Aeq} WHO guideline level considered to be the threshold for the onset of 'serious annoyance'. In addition, we would consider a noise level of 54 dB L_{Aeq} to be relatively low during the daytime in a city centre urban environment such as this.

It should also be borne in mind that our assessment assumes that the proposed development is to be used as food hall and is therefore, representative of likely worst case noise emissions from the scheme. If the units are to be used for more general retail use it is expected that noise levels at the nearby dwellings would be significantly lower than predicted above.

When determining noise impact associated with a specific sound source it is necessary to consider not only the absolute level but the character of the noise and the context in which it occurs.

The primary noise source associated with the proposed development (assuming use as a food hall) will be due to people talking. We note that the development is located in a mixed use urban area which includes a number of existing retail units, pubs and bars, namely The Edinburgh Castle Public House and Kerb Wine Bar both on Henry Street. Therefore, the proposed development would not be considered out of character for the area.

During our noise survey it was noted that noise due to both pedestrians passing by and patrons of the existing bars had a contribution to the noise climate. As such, the character of the noise associated with the proposed market will not be significantly different to that of the existing noise climate. We would consider this to further reduce the noise impact (which is already predicted to be low).

The National Planning Policy Framework (NPPF) requires that significant adverse impacts due to a new development should be avoided and other adverse impact should be mitigated and reduced to a minimum. Based upon the above assessment it is concluded that the sound levels arising from the

operations of the Proposed Development will not result in an adverse impact and will therefore comply with the requirements of the NPPF.

6.0 PLANT NOISE LIMITS

We are not aware of any proposed external plant items associated with the development however, where this is the case plant noise emissions will need to be controlled to achieve the criteria set out in the '*Planning and Noise Technical Guidance*' document published by Manchester City Council in October 2022.

The MCC document indicates that an assessment should be undertaken in accordance with the methodology of BS4142:2014 and stipulates that:

'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 (L_{Aeq}) below the typical background (L_{A90}) level at the nearest noise sensitive location'.

With reference to the results of our noise survey the measured noise levels on-site are considered to be representative of typical noise levels at the nearest noise sensitive properties. Therefore it is recommended that any external plant items are designed to achieve the following limits at the nearby noise sensitive receivers.

Table 9. External Plant Noise Limits at Facade of Nearest Noise Sensitive Receivers

Daytime Noise Level (07:00 – 23:00 hours) L_{eq} dBA	Night time noise Level (23:00 – 07:00 hours) L_{eq} dBA
45	34

7.0 CONCLUSION

PDA Ltd has carried out a noise impact assessment in relation to the proposed Blossom Market development on Gun Street, Ancoats in Manchester City Centre.

The proposal is to apply for a change of use to convert the existing MOT garage into an Arcade / Market space. The final use of the units within the market space is yet to be confirmed however, we are informed that it will likely be comparable to a food hall / arcade with some units likely to be utilised for more generic retail use i.e. clothing, barber shops etc.

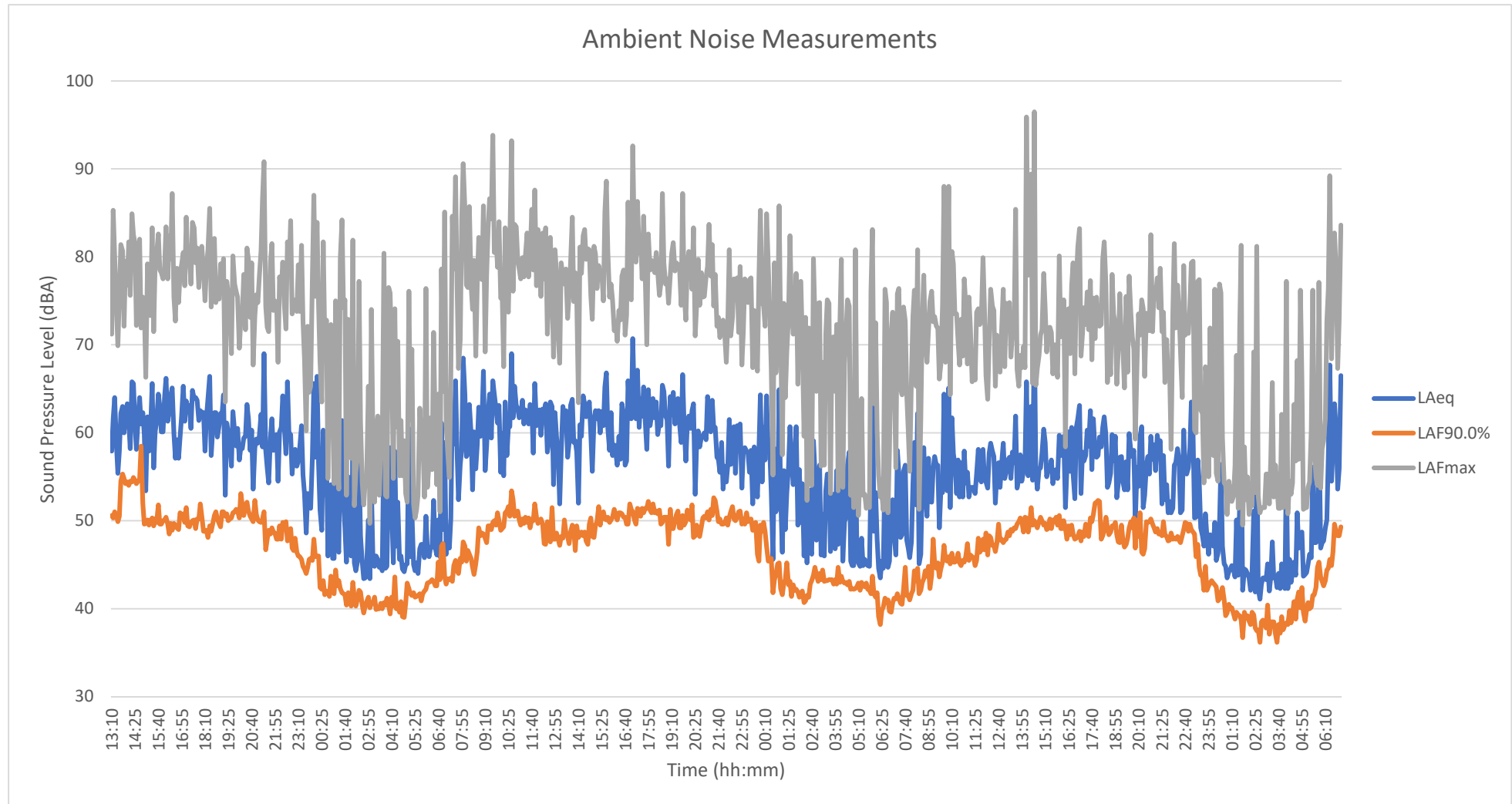
A noise survey has been conducted at site to establish the existing acoustic climate at the nearest noise sensitive receivers (NSRs).

Noise egress from proposed development has been has calculated at the NSRs and compared against the existing ambient noise climate in accordance with the IEMA Guidelines for Environmental Noise Impact Assessment.

The worst case noise level is predicted to be low relative to the existing noise climate and below the WHO guideline level considered to be the threshold for the onset of 'serious annoyance'. With reference to the guidance contained with the IEMA Guidelines for Environmental Noise Impact Assessment the increase in noise level is calculated to be between 0.6-1.5 dB this would suggest that the proposed development is likely to have a negligible impact.

The National Planning Policy Framework (NPPF) requires that significant adverse impacts due to a new development should be avoided and other adverse impact should be mitigated and reduced to a minimum. Based upon the above assessment it is concluded that the sound levels arising from the operations of the Proposed Development will not result in an adverse impact and will therefore comply with the requirements of the NPPF.

APPENDIX I - NOISE SURVEY FULL RESULTS



APPENDIX II – DEFINITION OF ACOUSTIC TERMS

The decibel

This is the basic unit of noise, denoted dB.

A Weighting

This is a weighting process which simulates the human ear's different sensitivity at different frequencies. A weighting can be shown two typical ways, 50 dB(A) L_{eq} or 50 dB L_{Aeq} . Both mean the same thing. (See below for a definition of L_{eq}). The dB(A) level can be regarded as the overall level perceived by human beings.

L_{eq} and $L_{eq(s)}$

This is the equivalent continuous noise level which contains the same acoustic energy as the actual time-varying sound. In other words it is a kind of average noise level. It is denoted dB L_{eq} or, for A-weighted figures dB(A) L_{eq} or dB L_{Aeq} . It can also be expressed in terms of frequency analysis (see later). $L_{eq(s)}$ is the sample L_{eq} level.

L_n

This is the level exceeded for n% of the time. It is denoted dB L_n or, for A-weighted figures dB(A) L_n or dB L_{An} . It can be expressed in terms of frequency analysis (see later). L_{90} is the level exceeded for 90% of the time and is a measure of the lowest level typically reached. L_{10} is the level exceeded for 10% of the time and is the highest level typically reached. L_{50} is the level exceeded for 50% of the time and, mathematically, it is the median.

L_{max}

This is the maximum level reached during a measurement period. The "time constant", or the ability of the equipment to respond to impulses is usually expressed along with it, e.g. "Fast", "Slow", etc. It is denoted dB L_{max} or, for A-weighted figures dB(A) L_{max} , dB L_{Amax} , etc. It can also be expressed in terms of frequency analysis.

Frequency Analysis

Whereas dB(A) gives a very useful overall figure, it has its limitations in that it cannot be used to model or predict the effect of noise control and mitigation as this nearly always has radically different performance at different frequencies.

Frequency analysis expresses an overall noise level at each frequency or band of frequencies in the audible range. Octave band analysis divides the audible range into 10 bands from 31.5 Hz to 16 kHz and the noise level in each band can be expressed in any form e.g. L_{eq} , L_{90} , L_{max} etc. One third octave band analysis uses 30 bands.

Narrow band analysis takes the process to resolutions of less than 1 Hz. This is useful for identifying the existence of tones (whines, hums, etc.) and in pin-pointing the sources.