MILLER GOODALL
ACOUSTICS AND AIR QUALITY

NOISE ASSESSMENT

on behalf of

IMD AND ASSOCIATES LTD

for the site at

CHERRY TREE CRICKET CLUB, PRESTON OLD ROAD, BLACKBURN, BB2 5ND

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Summary

A noise assessment was undertaken to mitigate the potential noise impact of a proposed one storey vertical extension at Cherry Tree Cricket Club, Preston Old Road, Blackburn, BB2 5ND.

Background noise measurements have been taken at the site and the measured levels have been presented in this report.

The initial assessment of the site with the proposed plans would have created an adverse impact and therefore the assessment has looked at mitigation measures to provide sufficient protection to local residents.

Computer noise modelling using CadnaA software was utilised in addition to background noise measurements, and the potential noise impact on existing residents has been mitigated by specifying a suitable building façade construction such that the noise limits in section 7.3 of this report may be achieved. A noise management plan has also been recommended to actively manage the potential for noise impact from patron noise.

With the implementation of the recommendations in this report, it is considered that a suitable level of protection against noise from the proposed development will be provided to the nearby residences in the vicinity of the proposed site.

Record of changes

Prepared By	Michael Rickard AMIOA	Reviewed By	Jo Miller MIOA
Signed		Signed	
Date	17th November 2017	Date	17th November 2017

Version	Date	Change	Initials
1	17th November 2017	Draft issue	MR

Contents

1 Introduction

1.1 Miller Goodall Ltd has, on behalf of IMD and Associates Ltd, undertaken a noise assessment in respect of the potential impact of noise from a proposed redevelopment at Cherry Tree Cricket Club to nearby residential receptors.

2 Site Description

2.1 The site is located at Cherry Tree Cricket Club, Preston Old Road, Blackburn, BB2 5ND. The site location is shown outlined in red in Appendix 1.

2.2 To the north west of the site, approximately 25 m from the front of the proposed redevelopment, are the nearest noise sensitive receptors (NSRs) on Preston Old Road. Beyond Preston Old Road is further residential, while to the north east is the Woodlands URC Church with carparking to the rear. The tennis courts and cricket pitch lie to the east and south of the proposed redevelopment. The nearest NSRs to the south (rear) are the row of houses on Fir Trees Drive, approximately 150 m to the south east, beyond the cricket pitch and on the opposite side of the canal. To the southwest of the site is St Francis C of E Primary School.

3 Proposed Development

3.1 The proposal is to redevelop the existing Cherry Tree Cricket Club building, retaining the bar and decking on the ground floor and creating a function room, stage, dance floor and balcony on the new first floor extension.

3.2 The hours of operation for functions are proposed to be 12pm to 12:30am on a Friday or Saturday (usually Saturday - one per week).

4 Policy Context

4.1 Noise Policy Statement for England

4.1.1 The Noise Policy Statement for England (NPSE[1]), published in March 2010, sets out the long-term vision of Government noise policy. The Noise Policy aims, as presented in this document, are:

"Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- avoid significant adverse effects on health and quality of life;
- mitigate and minimise adverse effects on health and quality of life; and
- where possible, contribute to the improvement of health and quality of life."

[1] Noise Policy Statement for England, Defra, March 2010

4.1.2 The NPSE makes reference to the concepts of NOEL (No Observed Effect Level) and LOAEL (Lowest Observed Adverse Effect Level) as used in toxicology but applied to noise impacts. It also introduces the concept of SOAEL (Significant Observed Adverse Effect Level) which is described as the level above which significant adverse effects on health and the quality of life occur.

4.1.3 The first aim of the NPSE is to avoid significant adverse effects, taking into account the guiding principles of sustainable development (as referenced in Section 1.8 of the Statement). The second aim seeks to provide guidance on the situation that exists when the potential noise impact falls between the LOAEL and the SOAEL, in which case:

"…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".

4.1.4 Importantly, the NPSE goes on to state:

"This does not mean that such adverse effects cannot occur".

4.1.5 The Statement does not provide a noise-based measure to define SOAEL, acknowledging that the SOAEL is likely to vary depending on the noise source, the receptor and the time in question. NPSE advises that:

"Not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available"

4.1.6 It is therefore likely that other guidance will need to be referenced when applying objective standards for the assessment of noise, particularly in reference to the SOAEL, whilst also taking into account the specific circumstances of a proposed development.

4.2 National Planning Policy Framework

4.2.1 The National Planning Policy Framework (NPPF[2]) was published in March 2012. One of the documents that the NPPF replaces is Planning Policy Guidance Note 24 (PPG 24) "Planning and Noise"[3].

4.2.2 Paragraph 109 of the NPPF states that the planning system should contribute to and enhance the natural and local environment by, (amongst others) "preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, water or noise pollution or land stability".

4.2.3 The NPPF goes on to state in Paragraph 123 "planning policies and decisions should aim to:

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

[2] National Planning Policy Framework, DCLG, March 2012

[3] Planning Policy Guidance 24: Planning and Noise, DCLG, September 1994

- Recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restrictions put on them because of changes in nearby land use since they were established, and
- Identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value".

4.2.4 The NPPF document does not refer to any other documents regarding noise other than NPSE.

4.3 Planning Practice Guidance – Noise

4.3.1 As of March 2014, a Planning Practice Guidance[4] for noise was issued which provides additional guidance and elaboration on the NPPF. It advises that when plan-making and decision-taking, the Local Planning Authority should consider the acoustic environment in relation to:

- Whether or not a significant adverse effect is occurring or likely to occur;
- Whether or not an adverse effect is occurring or likely to occur; and
- Whether or not a good standard of amenity can be achieved.

4.3.2 In line with the Explanatory Note of the NPSE, the PPG goes on to reference the LOAEL and SOAEL in relation to noise impact. It also provides examples of outcomes that could be expected for a given perception level of noise, plus actions that may be required to bring about a desired outcome. However, in line with the NPSE, no objective noise levels are provided for LOAEL or SOAEL although the PPG acknowledges that:

"…the subjective nature of noise means that there is not a simple relationship between noise levels and the impact on those affected. This will depend on how various factors combine in any particular situation".

4.3.3 Examples of these factors include:

- The source and absolute noise level of the source along with the time of day that it occurs;
- Where the noise is non-continuous, the number of noise events and pattern of occurrence;
- The frequency content and acoustic characteristics of the noise;
- The effect of noise on wildlife;
- The acoustic environment of external amenity areas provided as an intrinsic part of the overall design;
- The impact of noise from certain commercial developments such as night clubs and pubs where activities are often at their peak during the evening and night.

4.3.4 The PPG also provides general advice on the typical options available for mitigating noise. It goes on to suggest that Local Plans may include noise standards applicable to proposed developments within the Local Authority's administrative boundary, although it states that:

"Care should be taken, however, to avoid these being implemented as fixed thresholds as specific circumstances may justify some variation being allowed".

[4] Planning Practice Guidance – Noise, http://planningguidance.planningportal.gov.uk/blog/guidance/noise/, 06 March 2014

4.3.5 The PPG was amended in December 2014 to clarify guidance on the potential effect of noise from existing businesses on proposed new residential accommodation. Even if existing noise levels are intermittent (for example, from a live music venue), noise will need to be carefully considered and appropriate mitigation measures employed to control noise at the proposed accommodation.

5 Acoustic Standards and Guidance

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

5.1.1 This standard provides recommended guideline values for internal noise levels within dwellings which are similar in scope to guideline values contained within the World Health Organisation (WHO) document, Guidelines for Community Noise (1999)[5]. These guideline noise levels are shown in Table 1, below.

Table 1: BS 8233: 2014 guideline indoor ambient noise levels for dwellings

Location	Activity	07:00 to 23:00	23:00 to 07:00
Living Room	Resting	35 dB $L_{Aeq,16hr}$	-
Dining room/area	Dining	40 dB $L_{Aeq,16hr}$	-
Bedroom	Sleeping (daytime resting)	35 dB $L_{Aeq,16hr}$	30 dB $L_{Aeq,8hr}$

5.1.2 BS 8233:2014 advises that:

> *"regular individual noise events…can cause sleep disturbance. A guideline value may be set in terms of SEL[6] or $L_{Amax,F}$ depending on the character and number of events per night. Sporadic noise events could require separate values".*

5.1.3 BS 8233:2014 adopts guideline external noise values provided in WHO for external amenity areas such as gardens and patios. The standard states that it is "desirable" that the external noise does not exceed 50 dB $L_{Aeq,T}$ with an upper guideline value of 55 dB $L_{Aeq,T}$ whilst recognising that development in higher noise areas such as urban areas or those close to the transport network may require a compromise between elevated noise levels and other factors that determine if development in such areas is warranted. In such circumstances, the development should be designed to achieve the lowest practicable noise levels in external amenity areas.

[5] World Health Organisation Guidelines for Community Noise, 1999

[6] Sound exposure level or L_{AE}

5.2 World Health Organisation (WHO) Guidelines for Community Noise 1999

5.2.1 The WHO Guidelines 1999 recommends that to avoid sleep disturbance, indoor night-time guideline noise values of 30 dB L_{Aeq} for continuous noise and 45 dB L_{AFmax} for individual noise events should be applicable. It is to be noted that the WHO Night Noise Guidelines for Europe 2009[7] makes reference to research that indicates sleep disturbance from noise events at indoor levels as low as 42 dB L_{AFmax}. The number of individual noise events should also be taken into account and the WHO guidelines suggest that indoor noise levels from such events should not exceed approximately 45 dB L_{AFmax} more than 10 – 15 times per night.

5.2.2 The WHO document recommends that steady, continuous noise levels should not exceed 55 dB L_{Aeq} on balconies, terraces and outdoor living areas. It goes on to state that to protect the majority of individuals from moderate annoyance, external noise levels should not exceed 50 dB L_{Aeq}.

5.3 BS 4142: 2014 'Methods for rating and assessing industrial and commercial sound'

5.3.1 BS 4142: 2014[8] provides guidance on the assessment of the likelihood of complaints relating to noise from industrial sources. It replaced the 1997 edition of the Standard in October 2014. The key aspects of the Standard are summarised below.

5.3.2 The standard presents a method of assessing potential noise impact by comparing the noise level due to industrial sources (the Rating Level) with that of the existing background noise level at the nearest noise sensitive receiver in the absence of the source (the Background Sound Level).

5.3.3 The Specific Noise Level - the noise level produced by the source in question at the assessment location - is determined and a correction applied for certain undesirable acoustic features such as tonality, impulsivity or intermittency. The corrected Specific Noise Level is referred to as the Rating Level.

5.3.4 In order to assess the noise impact, the Background Sound Level is arithmetically subtracted from the Rating Level. The standard states the following:

- *Typically, the greater this difference, the greater the magnitude of the impact,*
- *A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context,*
- *A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context,*
- *The lower the Rating Level is relative to the measured Background Sound Level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the Rating Level does not exceed the Background Sound Level, this is an indication of the specific sound source having a low impact, depending on the context.*

[7] WHO Night Noise Guidelines for Europe 2009

[8] BS 4142:2014 Methods for rating and assessing industrial and commercial sound

5.3.5 In addition to the margin by which the Rating Level of the specific sound source exceeds the Background Sound Level, the 2014 edition places emphasis upon an appreciation of the context, as follows:

> *An effective assessment cannot be conducted without an understanding of the reason(s) for the assessment and the context in which the sound occurs/will occur. When making assessments and arriving at decisions, therefore, it is essential to place the sound in context.*

5.3.6 The 2014 edition of BS 4142 also introduces a requirement to consider and report the uncertainty in the data and associated calculations and to take reasonably practicable steps to reduce the level of uncertainty.

5.4 Institute of Acoustics: Good Practice Guide on the Control of Noise from Pubs and Clubs 2003

5.4.1 The Institute of Acoustics (IOA) Good Practice Guide gives guidance to prevent noise disturbance from the operation of public houses, clubs, restaurants etc.

5.4.2 The document was intended to provide objective criteria for assessing noise from all the main sources of noise associated with pubs and clubs etc. However the criteria proposed within the document were not subjected to a satisfactory validation process following the withdrawal of a number of parties from the working group. The guidance is nevertheless generally recognised as a good source for determining suitable assessment criteria for noise sources of this nature.

5.4.3 The criteria presented below are taken from the original Good Practice Guide and were published in a later article in the IOA acoustics bulletin in 2003.

Table 2: IOA Good Practice Guide on Control of Noise from Pubs and Clubs

Event Frequency	Suggested Regulations	Outcome if Criteria met
Entertainment < 30times/ year	L_{Aeq} (EN) should not exceed L_{A90} (WEN) by more than 5dB.	EN will generally be audible but not overly obtrusive inside noise sensitive properties.
Entertainment > 30 times/year	L_{Aeq} (EN) should not exceed L_{A90} (WEN) by more than 5dB and the L_{10} (EN) should not exceed L_{90} (WEN) by more than 5dB in any 1/3 octave band between 40Hz and 160Hz.	EN will generally be audible but not overly obtrusive inside noise sensitive properties.
Entertainment > once/week or continues beyond 2300hrs	L_{Aeq} (EN) should not exceed L_{90} (WEN) and L_{10} (EN) should not exceed L_{90} (WEN) in any 1/3 octave band between 40Hz and 160Hz	EN will be virtually inaudible inside noise sensitive properties.

EN = Entertainment noise level

WEN = Representative background sound level without entertainment noise

5.4.4 The guidance also suggests that "if noise levels produced outside a noise-sensitive property due to the general us of gardens and play areas regularly exceed 55 dB $L_{Aeq,5min}$ when measured at least 3.5 meter from a building façade (or in external amenity areas) this may indicate that unacceptable disturbance is occurring. This guidance is derived from PPG 24, and ultimately WHO criteria" (p.13, A3. Noise from Gardens and Play Areas).

5.5 The Little Red Book of Acoustics – A Practical Guide, Third Edition – R.Watson & O.Downey (2013)

5.5.1 An IOA diploma approved text book providing guidance relating to the principles of acoustics, acoustic parameters and descriptors, sound propagation and transmission, acoustic measurement factors and standards and regulations, with examples of calculations and look-up tables.

6 Assessment Criteria

6.1 Local Authority Consultation

6.1.1 Andy White has been consulted at Blackburn with Darwen Borough Council (BDBC) and he has expressed his concerns over the function room and balcony at first floor. He is very concerned with the development and concerned that any mitigation we proposed would not resolve the noise problems. Mr White stated that there were ongoing noise complaints at the site relating to live bands and functions and he was concerned that the development would exaggerate these issues. Mr White also requested that consideration was given to ventilation to the new function rooms to avoid the need for opening of windows.

6.2 Assessment Criteria

6.2.1 BDBC have not stated any specific criteria for noise from the proposed development and therefore we have provided a suggested criteria below, based on the guidance available in the IOA Good Practice Guide on the Control of Noise from Pubs and Clubs.

Table 3: Suggested criteria for assessment of noise from the proposed site

Entertainment Noise				External Patron Noise	
Low Frequency		L_{Aeq}		Criteria	Reasoning
Criteria	Reasoning	Criteria	Reasoning		
L_{eq} (EN) ≤ L_{90} – 3 dB (WEN) in 63 Hz and 125 Hz octave bands	L_{eq} (EN) assumed approx. 3 dB below L_{10} (EN) (based on previous measurements). Octave-band data available for typical construction materials (one-third data not available).	L_{Aeq} (EN) ≤ L_{A90} – 3 dB (WEN)	L_{eq} (EN) assumed approx. 3 dB below L_{10} (EN) (based on previous measurements).	≤ 55 dB L_{Aeq}	IOA guidance

EN = Entertainment noise level

WEN = Representative background sound level without entertainment noise

7 Noise Survey

7.1 Measurements of Existing Background Noise

7.1.1 Noise measurements were undertaken in accordance with BS 7445-1: 2003[9] by Michael Rickard of Miller Goodall Ltd. The calibration of the sound level meter was checked before and after measurements with negligible deviation (<0.1 dB). Details of the equipment used are shown in Table 4, below. The location of the monitoring position is shown in Appendix 1.

[9] BS 7445-1: 2003 Description and measurement of environmental noise - Part 1: Guide to quantities and procedures

Table 4: Noise monitoring equipment

Equipment Description	Type Number	Manufacturer	Serial No.	Date Calibrated	Calibration Certification Number
Class 1[10],[11] Integrating Real Time 1/3 Octave Sound Analyser	NOR 140	Norsonic	1406017	23/05/17	03238/2
Microphone	NOR 1225	Norsonic	151206	23/05/17	03238/2
Class 1 Calibrator[12]	Type 4231	Brüel & Kjær	2478249	18/05/17	03238/1
Outdoor microphone housing	NOR 1217	Norsonic	12175146	N/a	N/a

7.1.2 Background noise monitoring was undertaken at the times specified in Table 5 below. A met station was installed on site so that weather conditions could be recorded throughout the survey period. It is considered that meteorological conditions were generally acceptable for environmental noise measurements. Some precipitation occurred during the following times: Friday night/Saturday morning 23:30 - 00:30 and 02:00 – 03:00, Sunday morning 01:00 – 01:30 and 03:30 – 04:00. Periods of precipitation have been removed from any subsequent analysis of noise levels.

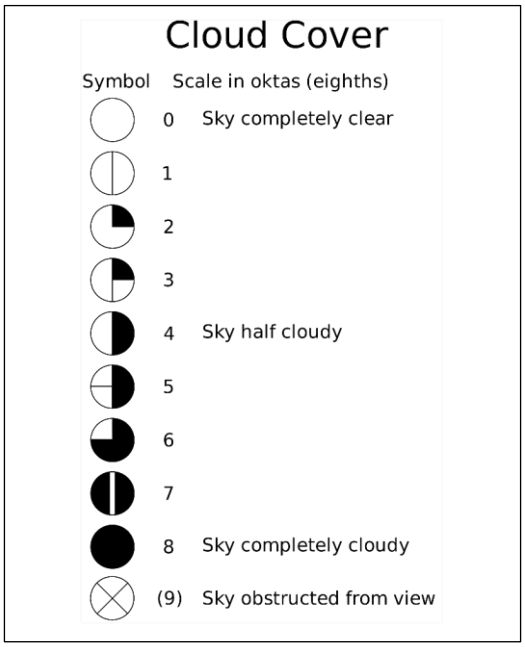
7.1.3 Half hourly recorded weather data is presented in Appendix 2 of this report.

[10] IEC 61672-1 (2002) Electroacoustics – Sound level meters Part 1: Specifications

[11] IEC 61260 (1995) Electroacoustics – Octave-band and fractional-octave-band filters

[12] IEC 60942 (2003) Electroacoustics – Sound calibrators

Table 5: Dates, times and weather conditions at start and end of survey

Measurement Locations	Start Date/Time	End Date/Time	Weather conditions		
			Description	At Start of Survey	On Completion
P1	10/11/2017; 16:30	13/11/2017; 12:00	Temperature:	8 ºC	5 ºC
			Precipitation:	Dry	Dry
			Cloud cover (oktas – see opposite):	8	0
			Any fog/snow/ice?	No	No
			Any damp roads/wet ground?	Slight	Slight
			Wind speed:	< 1 m/s	< 1 m/s
			Wind direction:	W	NE
			Any conditions that may cause temp. inversion (e.g. calm nights with no cloud):	No	No

7.1.4 The measurement periods covered both a Friday and a Saturday night and are considered to be representative of times when background noise levels are quietest while noise from the proposed development would be at its highest levels. Measurements were made under free-field conditions at a height of 1.5 m above the ground.

7.1.5 The noise sources in the local vicinity consisted primarily of distant road traffic noise, birdsong and playground noise from the adjacent school.

7.1.6 There was an event on the Saturday night – “Members’ band night”, but this did not have any effect on the background sound level used in our assessment (see 7.2 below).

7.2 Monitoring Results

7.2.1 Although monitoring was recorded over the full weekend period the main periods of interest are the Friday and Saturday night periods running up to the proposed closing time. The last 1.5 hours of proposed operating time (11pm – 12.30am) have been looked at on the Friday and Saturday night as the most sensitive times during which functions would operate. The Friday night period included rain and had higher background sound levels so the Saturday night noise levels have been used to determine a suitable background sound level for the assessment.

7.2.2 A summary of the broadband measurement data on Saturday night is provided in Table below. All data are sound pressure levels in dB re 20 μPa.

Table 6: Summary of noise measurements Saturday night (23:00 – 00:30 hrs)

Start Time	Elapsed Time (hr:min:sec)	$L_{Aeq,T}$ (dB)	$L_{AFmax,T}$ (dB)	$L_{AF90,T}$ (dB)
23:00*	0:15:00:000	45	54	42
23:15*	0:15:00:000	45	60	38
23:30*	0:15:00:000	41	54	37
23:45	0:15:00:000	41	51	38
00:00	0:15:00:000	40	49	37
00:15	0:15:00:000	41	55	37

* Measurements taken while members' band night in operation

7.2.3 Each measurement period consisted of sequential 15 minute samples which allowed the variation in noise level over time to be assessed. This data was subsequently used to determine a suitable $L_{AF90,15m}$ noise level and octave band spectrum considered representative of levels at the nearby residential dwellings.

7.3 Entertainment Noise Limits

7.3.1 The mode average background sound level recorded on the Saturday night for the final 1.5 hours of proposed operating time is 37 dBA (this is also the mode average background sound level during the final 45 minutes during which the member's band night event had ceased). 37 dBA is therefore considered a suitable background sound level against which to assess noise from the proposed development. The background L_{90} levels at 63 Hz and 125 Hz were the same for both the 00:00hrs and 00:15hrs measurement periods (63Hz = 45 dB and 125 Hz = 40 dB) and therefore these levels have been used to set the 63 Hz and 125 Hz criteria.

Table 7: Assessment Criteria for Entertainment Noise (from the music system)

Measurement Descriptor	Sound Pressure Level, dB in Octave Band Centre Frequency		dB(A)
	63 Hz	125 Hz	
Representative background ($L_{90,15m}$) level	45	40	37
L_{eq} noise limit at NSRs	≤ 42	≤ 37	≤ 34

8 Impact of Noise from Proposed Development

8.1 Computer Modelling

8.1.1 Predictions of noise levels on the site due to activities associated with the proposed development have been undertaken using the CadnaA noise modelling package.

8.1.2 The general horizontal plan information of the area surrounding and including the proposed development site was imported from Google Earth. This was used to determine existing building footprint areas and relative locations. Building height information was based on site observations.

8.1.3 Specific model parameters were applied as follows:

- Propagation of noise using algorithms within ISO 9613: 1993 *Acoustics - Attenuation of sound during propagation outdoors*;
- Default ground absorption G = 0 (hard surfaces), with G = 1 (porous soil) mapped where appropriate
- Ground attenuation: spectral all sources;
- No adverse meteorological effects;
- Two orders of reflection.

8.1.4 Assessment receiver positions have been set in the model based on highest predicted noise levels to the front and rear of the proposed development. NSR 1 is located to the rear of one of the properties on Preston Old Road and is set at a height of 1.5m as it is next to a single storey façade. NSR 2 is located to the rear of one of the properties on Old Gates Drive to the south of the proposed development and is set at 4m high.

8.1.5 The location of both NSRs is shown in Appendix 1.

8.2 Internal Noise Levels at the Development

8.2.1 The proposed development will include a bar with dance area on the ground floor (existing) as well as function room with stage/dance area on the first floor (proposed). As such it is intended to incorporate amplified music into the amenity of the building. We have been advised that the noisy events will typically be on a Saturday night using the upstairs function room. Noise levels in the downstairs bar at this time will be typical for a busy bar but will not include amplified music. Assumed noise levels in these two internal spaces have been determined using guidance noise spectra in *The Little Red Book of Acoustics – A Practical Guide, Third Edition – R.Watson & O.Downey* (*2013)* as described in table 8 below.

Table 8: Assumed internal reverberant sound pressure levels, $L_{eq,T}$ (dB)

Internal Space	'Reb Book' Noise Type	Reverberant Sound Pressure Level, dB in Octave Band Centre Frequency, Hz								dB(A)
		63	125	250	500	1k	2k	4k	8k	
Bar (ground floor)	Busy Pub/Bar	80	85	85	85	85	80	70	70	88
Function room (first floor)	Music Bar/Nightclub	110	110	100	100	95	90	85	85	101

8.3 External Patron Noise Levels at the Development

8.3.1 Patrons on the outside decking have been modelled as individual point sources of noise. We have been advised that 30 people at any one time externally during a weekend event is a reasonable assumption. We have spread the people out to include 12 at first floor balcony, 12 at ground floor terrace, 2 on the end terrace and 4 in the smoking shelter. We have also assumed that the external patrons are all talking with a mix of 'normal' and 'raised' voices.

8.3.2 Our model assumes that half of the patrons are talking with 'normal' levels of speech for 50% of the time and that the other half of patrons are talking with 'raised' levels of speech for 50% of the time, which we feel is a worst case assumption.

8.3.3 The octave band sound power levels for 'normal' and 'raised' vocal effort are derived from the document 'Guidance on computer prediction models to calculate the Speech Transmission Index for BB93' published by the UK government Department for Education and Skills, Schools Capital and Building Division 2004. The sound power level data used within the model are provided in Table 9 below.

Table 9: Human voice sound power levels used in noise model, dB L_W

Description	Sound Power Level, dB in Octave Band Centre Frequency, Hz								dB(A)
	63	125	250	500	1k	2k	4k	8k	
Normal Human Voice	60.7	60.9	65.3	69.0	63.0	55.8	49.8	44.5	68.4
Raised Human Voice	65.0	65.0	69.6	74.4	71.8	63.8	57.3	48.5	75.3

8.4 Mitigation Measures

8.4.1 The model indicates that the highest noise levels from entertainment noise will be experienced at NSR 1. The more onerous aspect of the assessment has therefore been in insuring noise levels to NSR 1 are suitably mitigated. Nevertheless the noise levels to NSR 2 have also been carefully considered and mitigated. The computer model has been used to determine the required sound insulation performance for the external building fabric of the proposed development.

8.4.2 "Insul 9.0" sound insulation prediction software was used to assess the various building fabric options.

8.4.3 The model indicates that the highest noise levels from external patron noise will be experienced at NSR 2. Some physical mitigation from patron noise to NSRs has been included, namely the existing smoking shelter which provides screening to the houses to the north, however some remedial work will be required to effectively mitigate noise by this means (see below). Noise from patron noise will also require active mitigation in the form of a suitable and effectively enforced noise management plan. An example noise management plan has been provided in section 9.

8.4.4 The mitigation advice provided is based on achieving the assessment criteria from 6.2 and the noise limits from section 7.3.

8.4.5 The advice relates to acoustics only and expert advice must be taken from others in regards to the suitability of the proposals in relation to other design considerations (e.g. fire, stability, durability etc). In particular, the addition of building materials may add significant additional loads to the existing structure of the building, and these loads must be checked and approved by a qualified structural engineer.

8.4.6 Ventilation requirements have not been considered in our assessment. It is important that the methods used to ventilate the building do not negatively impact the sound insulation performance of the building fabric. Specialist advice should be sought at the appropriate stage to assess any such ventilation strategies. The aim shall be that the ventilation system negates the need to open windows during a function.

8.4.7 Our assessment of the proposed development incorporates busy bar noise from the existing ground floor so as to determine the cumulative noise levels likely to occur. Our model incorporates the existing ground floor structure of the cricket club building in the form of cavity masonry external walls with standard thermal double glazed windows and doorsets.

8.4.8 It should be noted that the octave band criteria require sufficiently attenuating noise at discrete octave bands down to 63 Hz. Low frequency noise is especially difficult to attenuate due to the need for either very high mass partitions or particularly dense partitions with wide cavities.

8.4.9 Build up advice assumes good workmanship throughout. Good detailing principles should be followed such as ensuring that all partition perimeters are fully sealed off using appropriate methods and materials, build ups should contain no gaps, partition cavities should be kept clean and bridging between partition layers must be avoided.

8.4.10 Build up descriptions are listed progressively inwards starting from the external skin and working to the innermost lining.

8.4.11 Building Envelope Requirements

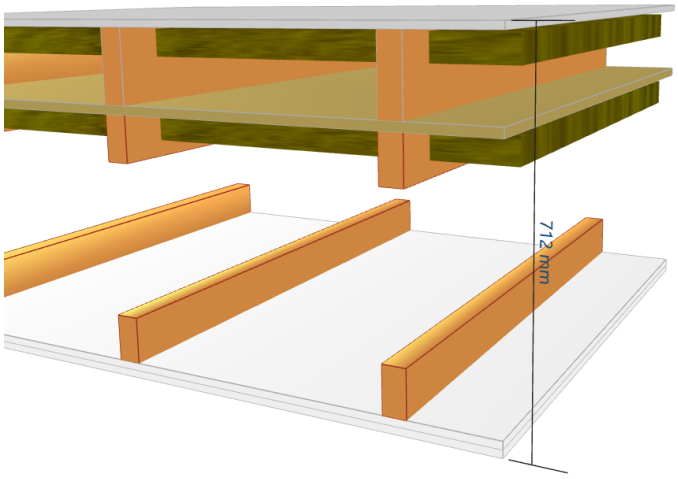
8.4.12 The following façade build-ups will be required in order to sufficiently mitigate noise from within the proposed development.

8.4.13 Our façade construction advice is based on the proposed drawings and assumes a tiled pitched timber roof and timber frame façade construction with glazed areas as shown in the elevations (Appendix 5).

8.4.14 **Roof (Outside to Inside)**

- Roof tiles (min. mass 33 kg/m^2)
- 150mm timber rafters with 50mm mineral wool insulation (10 kg/m^3 density) in between
- 1 x 18mm cement particle board (min. mass 23 kg/m^2) fixed to underside of rafters
- Min. 500mm clear void with 50mm mineral wool insulation (10 kg/m^3 density)
- 2 x 15mm high density plasterboard (min. mass 12.6 kg/m^2) independent ceiling

Figure 1: Roof Construction



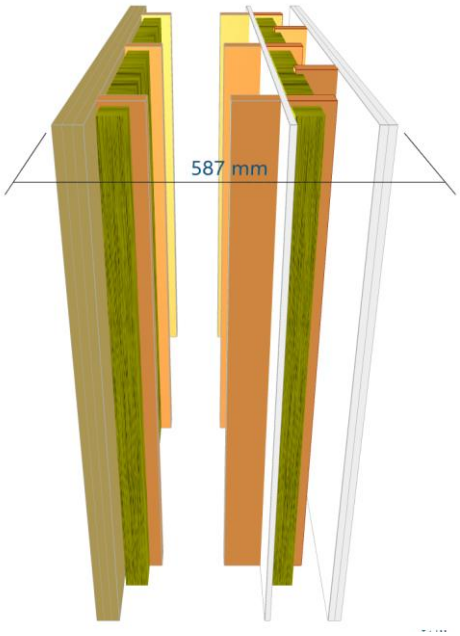
8.4.15 **Function Room Front Façade (Outside to Inside) (Facing Preston Road)**

8.4.16 There shall be no glazing in this façade, which should comprise of the following construction:

- 3 x 18mm cement particle board (min. mass 23 kg/m^2)
- 350mm clear cavity double studs with 50mm mineral wool insulation (10 kg/m^3 density)
- 1 x 12.5mm plasterboard (min. mass 8 kg/m^2)

- 140mm clear cavity staggered studs with 50mm mineral wool insulation (10 kg/m^3 density)
- 2 x 15mm high density plasterboard (min. mass 12.6 kg/m^2)

Figure 2: Function Room Front Façade Construction

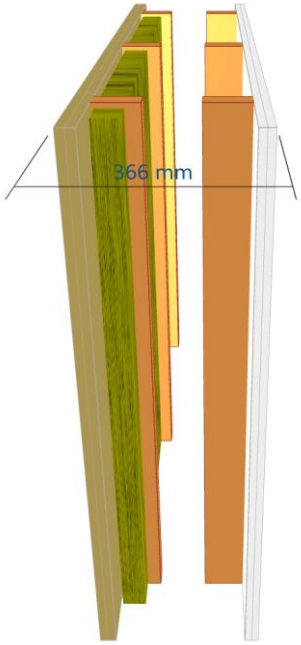


8.4.17 **Function Room Rear Façade (Outside to Inside) (Facing the cricket pitch)**

8.4.18 There shall be no doorsets in this façade, which should comprise of the following construction:

- 2 x 18mm cement particle board (min. mass 23 kg/m^2)
- 300mm clear cavity double studs with 50mm mineral wool insulation (10 kg/m^3 density)
- 2 x 15mm high density plasterboard (min. mass 12.6 kg/m^2)

Figure 3: Function Room Rear Façade Construction



8.4.19 High specification, secondary glazed acoustic glazing meeting the following sound insulation performance should be applied on this façade.

Table 10: Function Room Rear Glazing Specification

Glazing Type	Sound Reduction Index, dB in Octave Band Centre Frequency, Hz								R_w
	63	125	250	500	1k	2k	4k	8k	
Secondary glazed window assembly*	32	39	47	49	55	57	62	62	54

* e.g. 6/10/6, 200mm lined cavity with 6mm horizontal sliding secondary pane (to remain closed)

8.4.20 **Smoking Shelter (existing)**

Double board or refurbish the existing walls and roof to form a solid, continuous barrier with no gaps, holes or other penetrations.

Figure 4: Smoking Shelter Upgrade Requirements

8.5 Noise Model Predictions

8.5.1 Music Noise from Inside the Proposed Development

8.5.2 The criteria for entertainment noise is predicted to be fully achieved at all NSRs with the above mitigation in place.

8.5.3 Noise contours showing the predicted L_{Aeq} noise levels with the recommended façade constructions in place are provided in Appendix 4.

8.5.4 External Patron Noise

8.5.5 The highest noise levels due to noise from external patrons is predicted to be 36 dBA at NSR 2. This is 19 dBA below the stated criteria derived from Noise from Pubs and Clubs guidance. However the noise should be considered in context, wherein it has the potential to occur into the night time when people are trying to sleep. Patrons also have the potential to create a noise nuisance after they have left the proposed development and therefore patron noise should be actively managed and monitored with a suitable noise management plan. An example noise management plan is provided in section 9 below.

8.5.6 Noise contours showing the predicted L_{Aeq} noise levels from external patrons are provided in Appendix 4.

9 Noise management plan

9.1 Management Controls

9.1.1 It is recommended that the following measures are taken by the manager of the proposed venue to assist in reducing the noise levels to local residents:

- Locate signs within the smoking area and external areas to promote awareness of potential local residential noise disturbance e.g. ‘This is a residential area, please refrain from making excessive noise’.

- The contact numbers of management staff at the site provided to local residents. In the unlikely event where a noise nuisance can be heard at these locations the site manager shall be contactable on the number during the opening hours.
- No external speakers shall be operated from the premises.
- All doors on automatic closers, or manned during events to ensure doors remain closed when access is not immediately required.
- Windows to remain closed during all functions.
- A formal arrangement made with a local taxi operator(s) to ensure adequate taxis are available for patrons leaving the site.
- Carry out regular monitoring checks to ensure noise is being adequately controlled.
- Periodic review of current practices with an effort to improve them wherever possible.

10 Conclusions

10.1 A noise assessment was undertaken to mitigate the potential noise impact of a proposed one storey vertical extension at Cherry Tree Cricket Club, Preston Old Road, Blackburn, BB2 5ND.

10.2 Background noise measurements have been taken at the site and the measured levels have been presented in this report.

10.3 The initial assessment of the site with the proposed plans would have created an adverse impact and therefore the assessment has looked at mitigation measures to provide sufficient protection to local residents.

10.4 Computer noise modelling using CadnaA software was utilised in addition to background noise measurements, and the potential noise impact on existing residents has been mitigated by specifying a suitable building façade construction such that the noise limits in section 7.3 of this report may be achieved. A noise management plan has also been recommended to actively manage the potential for noise impact from patron noise.

10.5 With the implementation of the recommendations in this report, it is considered that a suitable level of protection against noise from the proposed development will be provided to the nearby residences in the vicinity of the proposed site.

APPENDICES

Appendix 1: Site Location and Survey Measurement Positions

Appendix 2: Weather Data

Date	Time	Temp	Wind ($m.s^{-1}$)	Wind Dir.	Rain (mm)
10/11/2017	16:30	7.6	0.1	W	0
10/11/2017	17:00	7.9	0.1	W	0
10/11/2017	17:30	7.9	0.1	W	0
10/11/2017	18:00	8.1	0.3	W	0
10/11/2017	18:30	7.7	0.1	W	0
10/11/2017	19:00	7.3	0.3	W	0
10/11/2017	19:30	7.4	0.3	W	0
10/11/2017	20:00	7.7	0.3	W	0
10/11/2017	20:30	7.6	0.3	W	0
10/11/2017	21:00	7.8	0.3	W	0
10/11/2017	21:30	7.8	0.3	W	0
10/11/2017	22:00	7.8	0.3	W	0
10/11/2017	22:30	7.4	0.3	W	0
10/11/2017	23:00	7.2	0.1	W	0
10/11/2017	23:30	7.1	0.1	W	0.2
11/11/2017	00:00	7.2	0.0	W	0.4
11/11/2017	00:30	7.3	0.1	W	0
11/11/2017	01:00	7.2	0.1	W	0
11/11/2017	01:30	7.1	0.1	W	0
11/11/2017	02:00	7	0.0	W	0.2
11/11/2017	02:30	6.9	0.0	W	0.2
11/11/2017	03:00	6.8	0.0	W	0
11/11/2017	03:30	6.8	0.0	W	0
11/11/2017	04:00	6.7	0.0	---	0
11/11/2017	04:30	6.6	0.0	---	0
11/11/2017	05:00	6.6	0.0	W	0
11/11/2017	05:30	6.6	0.0	W	0
11/11/2017	06:00	6.4	0.0	---	0
11/11/2017	06:30	6.5	0.0	---	0
11/11/2017	07:00	6.6	0.0	W	0
11/11/2017	07:30	6.4	0.0	NNE	0
11/11/2017	08:00	6.3	0.0	N	0
11/11/2017	08:30	6	0.0	---	0
11/11/2017	09:00	6.2	0.0	---	0
11/11/2017	09:30	6.3	0.0	NNW	0
11/11/2017	10:00	6.5	0.0	W	0
11/11/2017	10:30	7.1	0.0	W	0
11/11/2017	11:00	7.1	0.0	W	0
11/11/2017	11:30	7.1	0.0	W	0
11/11/2017	12:00	7.7	0.0	W	0
11/11/2017	12:30	7.8	0.1	W	0

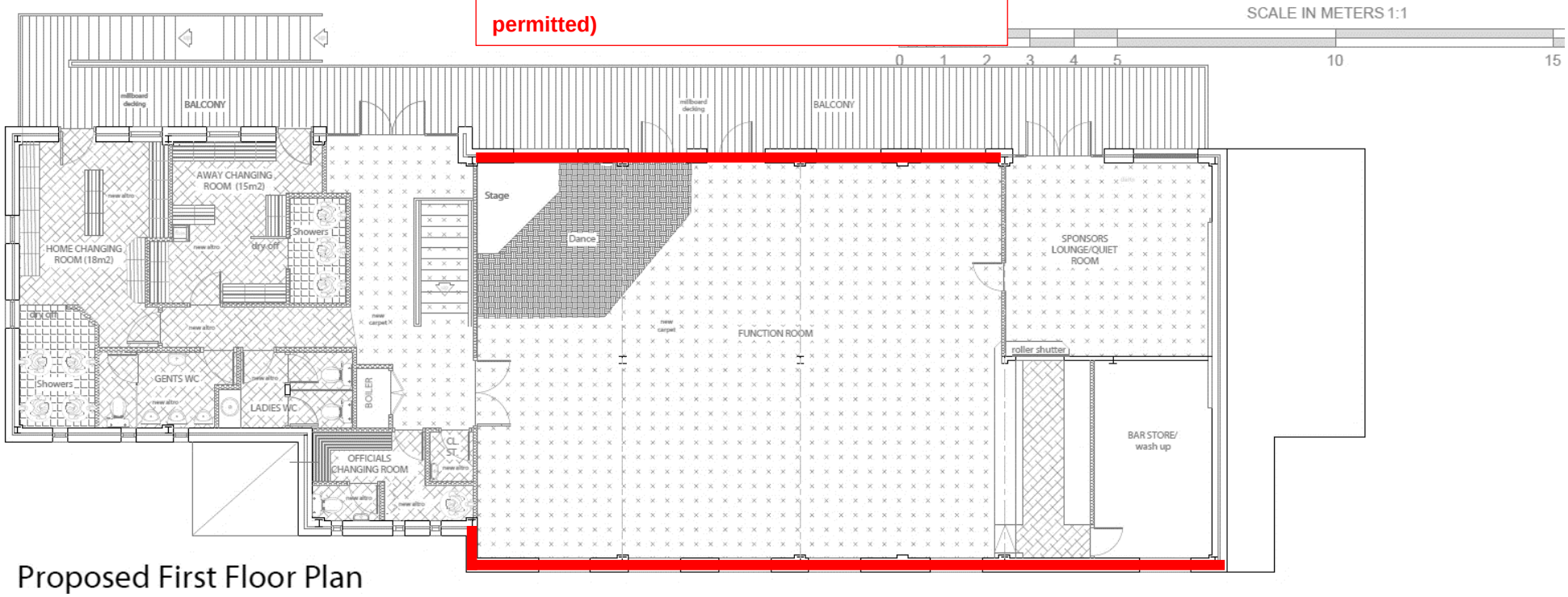
Date	Time	Temp	Wind ($m.s^{-1}$)	Wind Dir.	Rain (mm)
11/11/2017	13:00	8	0.1	W	0
11/11/2017	13:30	7.9	0.0	W	0
11/11/2017	14:00	8	0.0	W	0
11/11/2017	14:30	8	0.0	N	0
11/11/2017	15:00	7.8	0.0	NNW	0
11/11/2017	15:30	7.4	0.0	NW	0
11/11/2017	16:00	7.1	0.0	---	0
11/11/2017	16:30	6.9	0.0	---	0
11/11/2017	17:00	6.6	0.0	---	0
11/11/2017	17:30	6.5	0.0	---	0
11/11/2017	18:00	6.1	0.0	---	0
11/11/2017	18:30	5.9	0.0	---	0
11/11/2017	19:00	5.9	0.0	---	0
11/11/2017	19:30	5.4	0.0	---	0
11/11/2017	20:00	5.3	0.0	---	0
11/11/2017	20:30	4.7	0.0	---	0
11/11/2017	21:00	4.2	0.0	---	0
11/11/2017	21:30	3.6	0.0	---	0
11/11/2017	22:00	3.8	0.0	---	0
11/11/2017	22:30	3.9	0.0	---	0
11/11/2017	23:00	3.9	0.0	---	0
11/11/2017	23:30	3.9	0.0	---	0
12/11/2017	00:00	3.6	0.0	---	0
12/11/2017	00:30	4.1	0.0	---	0
12/11/2017	01:00	4.6	0.0	---	0.4
12/11/2017	01:30	4.7	0.0	---	0
12/11/2017	02:00	4.8	0.0	---	0
12/11/2017	02:30	4.8	0.0	WNW	0
12/11/2017	03:00	4.9	0.0	W	0
12/11/2017	03:30	4.5	0.0	W	0.2
12/11/2017	04:00	4.3	0.0	W	0
12/11/2017	04:30	4.1	0.0	W	0
12/11/2017	05:00	4	0.0	W	0
12/11/2017	05:30	3.9	0.0	W	0
12/11/2017	06:00	3.8	0.0	W	0
12/11/2017	06:30	3.5	0.0	WSW	0
12/11/2017	07:00	3.3	0.0	W	0
12/11/2017	07:30	3.2	0.0	NNE	0
12/11/2017	08:00	3.2	0.0	N	0
12/11/2017	08:30	3.4	0.1	N	0
12/11/2017	09:00	4	0.0	NNW	0
12/11/2017	09:30	4.2	0.0	NNW	0

Date	Time	Temp	Wind ($m.s^{-1}$)	Wind Dir.	Rain (mm)
12/11/2017	10:00	4.6	0.0	NNW	0
12/11/2017	10:30	5.1	0.1	N	0
12/11/2017	11:00	5.7	0.3	N	0
12/11/2017	11:30	5.9	0.4	NNW	0
12/11/2017	12:00	6.3	0.5	NNW	0
12/11/2017	12:30	6.6	0.4	NNW	0
12/11/2017	13:00	6.8	0.4	N	0
12/11/2017	13:30	7.1	0.5	N	0
12/11/2017	14:00	6.6	0.4	NNW	0
12/11/2017	14:30	6.7	0.4	N	0
12/11/2017	15:00	6.4	0.4	N	0
12/11/2017	15:30	6.2	0.3	N	0
12/11/2017	16:00	5.9	0.1	N	0
12/11/2017	16:30	5	0.0	W	0
12/11/2017	17:00	4.4	0.0	W	0
12/11/2017	17:30	4.3	0.1	N	0
12/11/2017	18:00	3.7	0.0	N	0
12/11/2017	18:30	3.7	0.0	W	0
12/11/2017	19:00	3.1	0.0	W	0
12/11/2017	19:30	3.3	0.0	SW	0
12/11/2017	20:00	3.4	0.0	WSW	0
12/11/2017	20:30	3.1	0.0	WSW	0
12/11/2017	21:00	2.7	0.0	W	0
12/11/2017	21:30	2.2	0.0	W	0
12/11/2017	22:00	2.6	0.0	W	0
12/11/2017	22:30	1.8	0.0	W	0
12/11/2017	23:00	1.9	0.0	W	0
12/11/2017	23:30	0.6	0.0	NE	0
13/11/2017	00:00	-0.2	0.0	---	0
13/11/2017	00:30	-0.7	0.0	NE	0
13/11/2017	01:00	-0.7	0.0	NE	0
13/11/2017	01:30	0.8	0.0	N	0
13/11/2017	02:00	0.7	0.0	N	0
13/11/2017	02:30	0.1	0.0	W	0
13/11/2017	03:00	0.1	0.0	W	0
13/11/2017	03:30	-1.1	0.0	W	0
13/11/2017	04:00	-2	0.0	N	0
13/11/2017	04:30	-1.9	0.0	---	0
13/11/2017	05:00	-2.6	0.0	---	0
13/11/2017	05:30	-2.3	0.0	N	0
13/11/2017	06:00	-2.4	0.0	---	0
13/11/2017	06:30	-2.9	0.0	N	0

Date	Time	Temp	Wind ($m.s^{-1}$)	Wind Dir.	Rain (mm)
13/11/2017	07:00	-2.4	0.0	---	0
13/11/2017	07:30	-1.9	0.0	ENE	0
13/11/2017	08:00	-1.1	0.0	ENE	0
13/11/2017	08:30	-0.5	0.0	---	0
13/11/2017	09:00	0.2	0.0	---	0
13/11/2017	09:30	0.8	0.0	ENE	0
13/11/2017	10:00	2.2	0.0	ENE	0
13/11/2017	10:30	2.9	0.0	ENE	0
13/11/2017	11:00	3.6	0.0	ENE	0
13/11/2017	11:30	4.6	0.0	NE	0
13/11/2017	12:00	5.3	0.0	E	0
13/11/2017	12:30	8.3	0.0	E	0
13/11/2017	13:00	13.5	0.0	---	0
13/11/2017	13:30	16.4	0.0	WNW	0
13/11/2017	14:00	18.7	0.0	---	0

Appendix 3: Function Room Façade Construction Extents

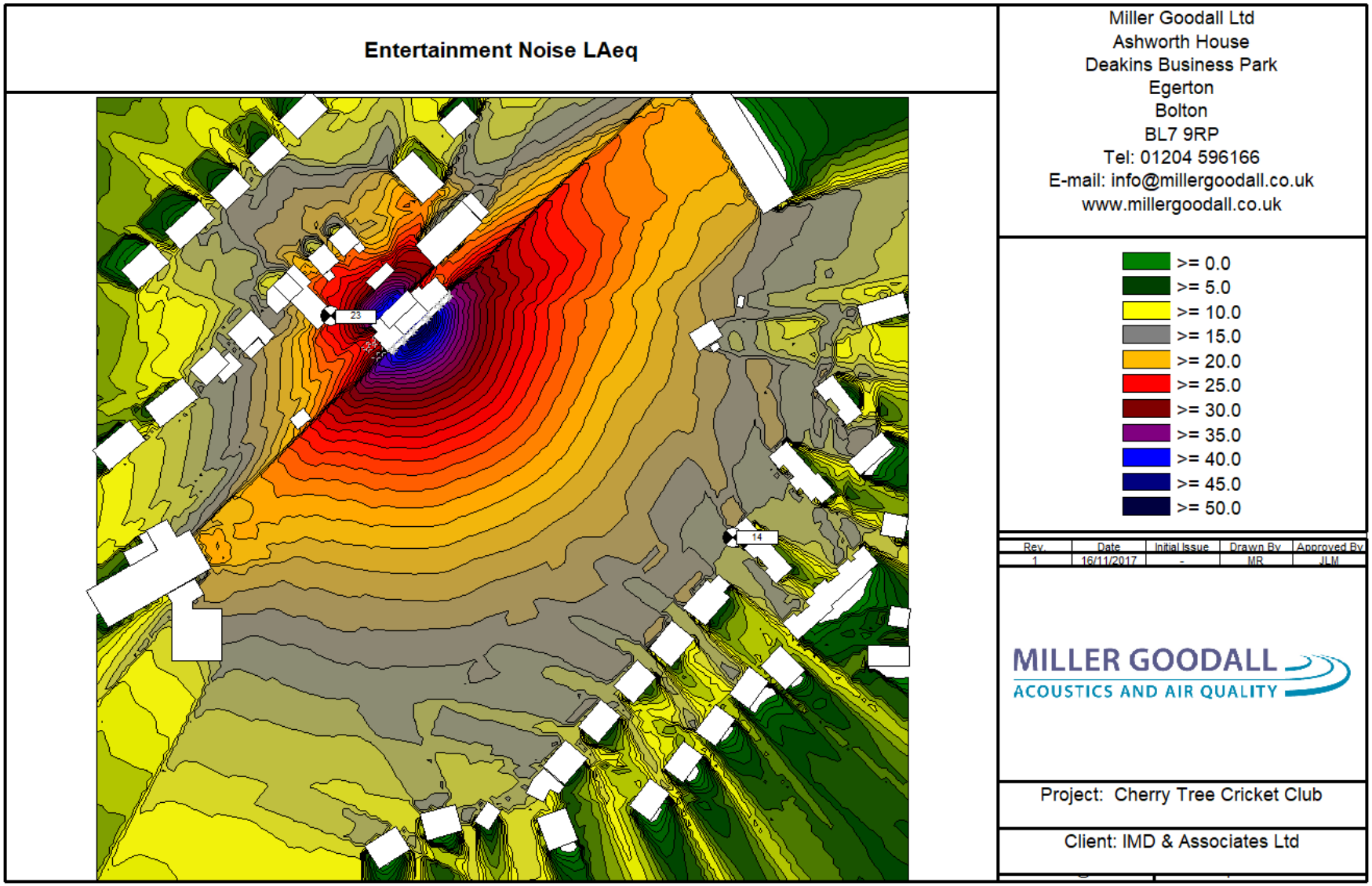
Rear Façade Construction Extents (doorsets not permitted)



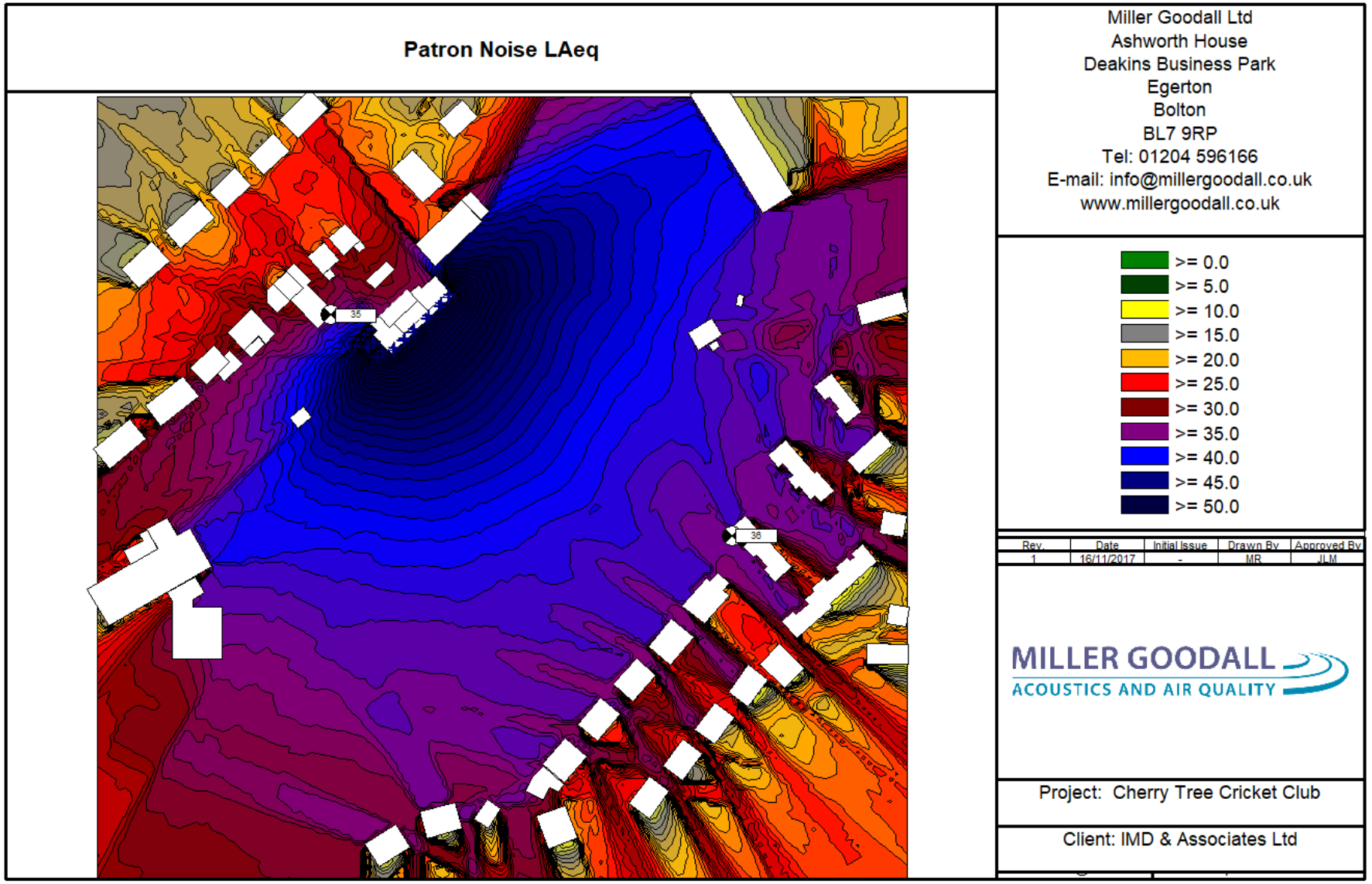
Proposed First Floor Plan

Front Façade Construction Extents (glazing not permitted)

Appendix 4a: Noise Propagation (Entertainment Noise) 4m grid height



Appendix 4b: Noise Propagation (Patron Noise) 4m grid height



Appendix 5: Proposed Front and Rear Elevations

DESIGNERS RISK ASSESSMENT

Project:	Cherry Tree Cricket Club, Preston Old Road, BB2 5ND	**Job No.**	101663
		By/Date	16/11/2017
		Approved (Acoustic Consultant)	MR/ JM

Checklist of potential operations and hazards					
Potential Hazards	**Present**		**Potential Hazards/Operation**	**Present**	
Installing Gyproc planking	YES ☒	NO ☐	Overloading of structures	YES ☒	NO ☐
Noise	YES ☒	NO ☐	Manual handling	YES ☒	NO ☐
Vibration	YES ☒	NO ☐	Electricity	YES ☐	NO ☒
Fall from height	YES ☒	NO ☐	Water	YES ☐	NO ☒
Gas	YES ☐	NO ☒	Services	YES ☐	NO ☒
Falling material	YES ☒	NO ☐	Use of caulking or sealants	YES ☒	NO ☐
Unstable structure	YES ☒	NO ☐	Use of mineral wool	YES ☒	NO ☐
Dust	YES ☒	NO ☐		YES ☐	NO ☐
	YES ☐	NO ☐		YES ☐	NO ☐
	YES ☐	NO ☐		YES ☐	NO ☐
	YES ☐	NO ☐		YES ☐	NO ☐
	YES ☐	NO ☐		YES ☐	NO ☐
	YES ☐	NO ☐		YES ☐	NO ☐
	YES ☐	NO ☐		YES ☐	NO ☐
	YES ☐	NO ☐		YES ☐	NO ☐
	YES ☐	NO ☐		YES ☐	NO ☐
	YES ☐	NO ☐		YES ☐	NO ☐

Project:	Cherry Tree Cricket Club, Preston Old Road, BB2 5ND	**Job No.**	101663
		By/Date	16/11/2017
		Approved (Acoustic Consultant)	MR/ JM

Stage: Construction		
Hazard	**Action By Designer**	**Residual Hazard**
Installing plasterboard	**1. To eliminate hazard** Cannot eliminate.	
	2. To reduce hazard Advise the main contractor/ builder to undertake a detailed risk assessment and develop a suitable method statement in respect of installing plasterboard, in particular installing plasterboard ceilings at height. Use of board lifters and board handling equipment.	Follow manufacturers recommended safety guidelines during construction. Refer to data sheets from suppliers for more information. Risk of stability and durability issues. Client to seek further guidance from qualified and competent building designers on suitability of plasterboard constructions.
Overloading of structures	**1. To eliminate hazard** Do not exceed the maximum weight and loading restrictions, as advised by an experienced, competent and qualified structural engineer.	
	2. To reduce hazard Keep within recommended guidelines of acoustic design criteria and available construction products to achieve desired design output. Select products with lightest weights that can achieve required acoustic requirements.	Collapse of structure or falling materials through overloading. Client to seek advice and calculations from an experienced, competent and qualified structural engineer to ensure acoustic materials selected will not overload the structure.

Stage: Construction		
Hazard	**Action By Designer**	**Residual Hazard**
Dust	**1. To eliminate hazard** Cannot eliminate.	
	2. To reduce hazard Main contractor/ builder to keep materials in packaging until ready for use. Consider the use of face masks when cutting. See material data sheet for minimum FFP requirement. Operative must be face fit tested. Consider use of EN 166 eye protection to avoid dust in eyes. Carry out CoSHH assessment.	Cutting of Gyproc planking is generally low risk. However it may be an irritant to skin or respiratory system.
Noise	**1. To eliminate hazard** Cannot eliminate.	
	2. To reduce hazard Manual Handling Main contractor/ builder to undertake a detailed risk assessment and develop a suitable method statement in respect of construction phase noise and impact upon construction workers and surrounding areas. Consider establishing soundproofed areas for cutting and other noisy operations.	Risk of hearing damage. Risk of loss of acoustic amenity to neighbouring areas.
Manual Handling	**1. To eliminate hazard** Cannot eliminate.	
	2. To reduce hazard Main contractor/ builder to undertake a detailed risk assessment and develop a suitable method statement in respect of manual handling during construction. Consider use of smaller sizes of plasterboard to reduce weights.	Risk of musculoskeletal damage.

Stage: Construction		
Hazard	**Action By Designer**	**Residual Hazard**
Vibration	**1. To eliminate hazard** Cannot eliminate.	
	2. To reduce hazard Main contractor/ builder to undertake a detailed risk assessment and develop a suitable method statement in respect of construction phase vibration.	Risk of Hand Arm Vibration Syndrome to workers
Use of caulking or sealants	**1. To eliminate hazard** Cannot eliminate.	
	2. To reduce hazard Main contractor/ builder to undertake a detailed risk assessment and develop a suitable method statement in respect of use of caulking and sealants.	Follow manufacturers recommended safety guidelines during construction. Refer to data sheets from suppliers for more information. Consider wearing gloves
Falls from height	**1. To eliminate hazard** Cannot eliminate.	
	2. To reduce hazard Main contractor/ builder to undertake a detailed risk assessment and develop a suitable method statement in respect of falls from height. Consider the use of scaffolding, suitable work platforms and fall arrest systems.	Risk of injury and death.
Use of Mineral Wool	**1. To eliminate hazard** Cannot eliminate.	
	2. To reduce hazard Main contractor/ builder to undertake a detailed risk assessment and develop a suitable method statement in respect of use of mineral wool. Consider wearing gloves	Follow manufacturers recommended safety guidelines during construction. Refer to data sheets from suppliers for more information.

Stage: Construction		
Hazard	**Action By Designer**	**Residual Hazard**
Falling Material	**1. To eliminate hazard** Cannot eliminate.	
	2. To reduce hazard Main contractor/ builder to undertake a detailed risk assessment and develop a suitable method statement in respect of falling material Consider use of platforms, scaffold or similar to catch any falling materials.	Risk of injury from falling materials.
Unstable Structure	**1. To eliminate hazard** Cannot eliminate.	
	2. To reduce hazard Competent and qualified structural engineer to undertake calculations and determine if structure is capable of supporting additional weights associated with the acoustic design elements such as plasterboard ceilings to top floor and acoustic rated glazing.	Follow manufacturers recommended safety guidelines during construction. Refer to data sheets from suppliers for more information. Risk of stability and durability issues. Client to seek further guidance from qualified and competent building designers on suitability.

Glossary of Terms

Decibel (dB) The unit used to quantify sound pressure levels; it is derived from the logarithm of the ratio between the value of a quantity and a reference value. It is used to describe the level of many different quantities. For sound pressure level the reference quantity is 20 µPa, the threshold of normal hearing is in the region of 0 dB, and 140 dB is the threshold of pain. A change of 1 dB is usually only perceptible under controlled conditions.

dB L_A Decibels measured on a sound level meter incorporating a frequency weighting (A weighting) which differentiates between sounds of different frequency (pitch) in a similar way to the human ear. Measurements in dB L_A broadly agree with an individual's assessment of loudness. A change of 3 dB L_A is the minimum perceptible under normal conditions, and a change of 10 dB L_A corresponds roughly to halving or doubling the loudness of a sound. The background noise level in a living room may be about 30 dB L_A; normal conversation about 60 dB L_A at 1 meter; heavy road traffic about 80 dB L_A at 10 meters; the level near a pneumatic drill about 100 dB L_A.

$L_{A90,T}$ The A weighted noise level exceeded for 90% of the specified measurement period (T). In BS 4142: 1997 it is used to define background noise level.

$L_{Aeq,T}$ The equivalent continuous sound level. The sound level of a notionally steady sound having the same energy as a fluctuating sound over a specified measurement period (T). $L_{Aeq,T}$ is used to describe many types of noise and can be measured directly with an integrating sound level meter.

L_{Amax} The highest A weighted noise level recorded during the time period. It is usually used to describe the highest noise level that occurred during the event.

$L_{A10,T}$ The A weighted noise level exceeded for 10% of the specified measurement period (T).

R_w Single number rating used to describe the sound insulation of building elements and is defined in BS EN ISO 10140-2: 2010 (formerly BSEN ISO 140-3:1995). It is derived by measurement under laboratory conditions and does not take into account the effects of flanking transmissions.

$D_{nT,w}$ The weighted standardized level difference is a single figure rating used to describe the sound insulation of a construction separating two rooms, for example a wall or floor, and is defined in BS EN ISO 16283-1:2014 (formerly BSEN ISO 140-4:1998). It is derived by measurement of an in-situ construction and therefore takes into account the effects of flanking transmissions, workmanship etc.

C_{tr} A single-number spectrum adaptation term used to characterise the sound insulation rating with respect to urban traffic. It is defined in ISO 717-1:20-13.

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