SHARPS REDMORE

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Acoustic Report

Social Space, University of Hertfordshire

Acoustic Planning Report

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Appendices

1.0 Introduction

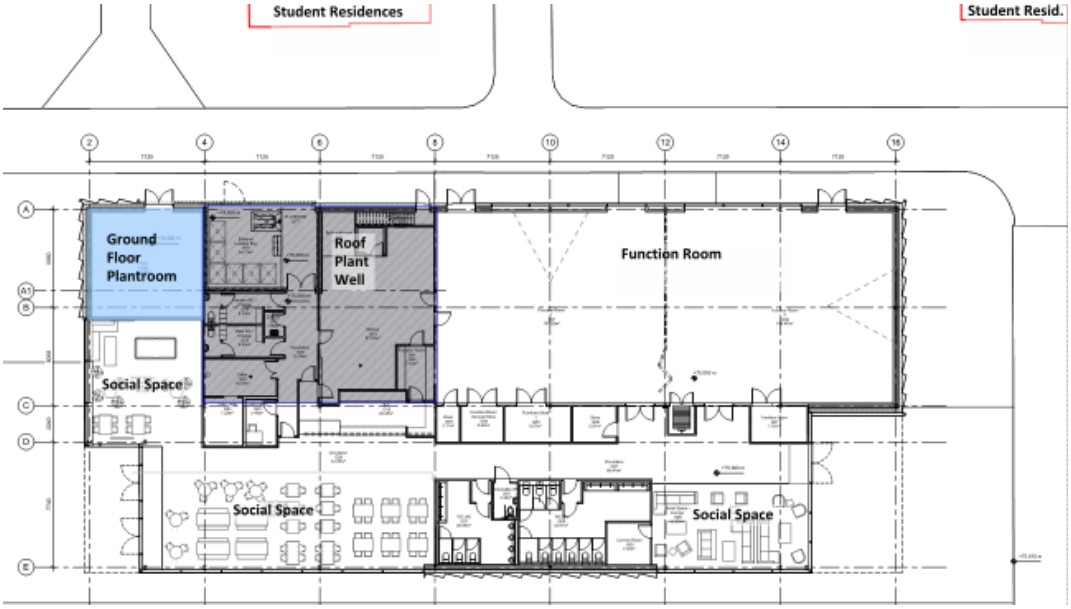
1.1 Sharps Redmore have been instructed by University of Hertfordshire to provide an acoustic assessment for the proposed new Social Space at the University of Hertfordshire.

1.2 This proposed building provides an on campus venue for students to socialise, relax, meet and study and includes a food outlet and function space. The building in part replaces an existing social building on the corner of the existing sports centre. This new building has typical uses defined by the University User Group as follows:

- Alcoholic refreshments/beer drinking etc.
- Snacks/burgers etc.
- Table top games facilities
- Daytime conferencing
- Small volume controlled bands
- Watch sports events on TV

1.3 The building is proposed to be located within the centre of the existing De Havilland campus. The proposed structure is a single storey building to be located on existing lawns in front of the LRC (to the south east); between the Weston auditorium (to the south west); the law building (to the north east), with the student accommodation to the north west. See Appendix A for a location plan.

1.4 Internally, the building includes a tall function space which can be separated in half with a moveable wall, and a long single façade seating area. One bar/food servery is included to service the function space and seating area. There is a large kitchen, a small cellar/cold cellar room, cash office, staff and student toilets, plantroom and external bin store. The function space has an option for a small stage. The roof includes an external plant well area, proposed to include AHU's, air conditioning units and other supply/extract plant including kitchen plant. The building is to be fully mechanically serviced (see diagram below).



Building Use

1.5 The operating times of the building are expected to be from early morning, say 8 am, until late evening, up to midnight on some weekends, If the function space is in use all plant could also be operate until midnight. Some plant within the plantroom would be expected to operate through the night probably at a lower duty.

1.6 The space is not designed for high volume music events or external amplified events - at most 'small volume controlled bands,' limited to the function space. Background music may be in use in the general social space.

Noise Sensitive Properties

1.7 The nearest noise sensitive properties are the student halls of residences. The rear façade of the proposed building; front façade of the ground floor plantroom; and the nearest perimeter of the roof top plant well are approximately 14 metres from the nearest student residential windows. The centre of the roof plant zone is approximately 20 metres from the nearest student room window. However these window are unlikely to have a direct line of sight for approximately 37 metres, as the closest initial windows are at approximately 90 degrees to the proposed building, and the end windows of the student residences are corridors.

1.8 Buildings in other directions are at further distances and university premises, and therefore compliance with noise limits at the student residences are considered sufficient for elsewhere. The image above shows the ground floor layout of the Social Space including the function room, social areas, line of the roof plant well above and location of ground floor plantroom.

1.9 Section 2 of the report outlines the proposed criteria; Section 3 outlines the noise survey; Section 4 provides an assessment and Section 5 concludes the report.

2.0 Acoustic Design Criteria

2.1 The National Planning Policy Framework (NPPF) sets out the Government's economic, environmental and social planning policies for England and "these policies articulate the Government's vision of sustainable development." In respect of noise, Paragraph 123 of the NPPF states the following:

"Planning policies and decisions should aim to:

- *avoid noise from giving rise to significant adverse impacts[27] on health and quality of life as a result of new development*
- *mitigate and reduce to a minimum other adverse impacts[27] on health and quality of life arising from noise from new development, including through the use of conditions,*
- *recognise that development will often create some noise and existing businesses wanting to develop in continuance of their business should not have unreasonable restriction put on them because of changes in nearby land uses since they were established;[28] and*
- *identify and protect areas of tranquillity which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason"*

27 See Explanatory Note to the Noise Policy Statement for England (Department for the Environment, Food and Rural Affairs).

28 Subject to the provisions of the Environmental Protection Act 1990 and other relevant law.

2.2 The NPPF reinforces the March 2010 DEFRA publication, "Noise Policy Statement for England" (NPSE), which states three policy aims, as follows:

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

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

2.3 Together, the first two aims require that no significant adverse impact should occur. Where a noise level falls between a level which represents the lowest observable adverse effect and a level which represents a significant observed adverse effect, then according to the explanatory notes in the statement:

"… all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life whilst also taking into consideration the guiding principles of sustainable development. This does not mean that such effects cannot occur."

2.4 It is possible to apply objective standards to the assessment of noise and the design of new dwellings should seek to achieve these objective standards. Such guideline values are given in the World Health Organisation document 'Guidelines for Community Noise':1999 and these were replicated within a British Standard, BS 8233:1999, which has now been

superseded by BS 8233:2014 'Guidance on sound insulation and noise reduction for buildings.'

2.5 The W.H.O. guideline values are appropriate to what are termed "critical health effects". This means that the limits are at the lowest noise level that would result in any psychological, physiological or sociological effect. They are, as defined by NPSE, set at the Lowest Observed Adverse Effect Level (LOAEL), but do not define the level above which effects are significant (the SOAEL). Compliance with the LOAEL should, therefore, be seen as a robust aim.

2.6 The W.H.O. LOAEL guideline values are summarised in the following table:

Value	Guidance	Location
$L_{Aeq,T}$ = 55 dB	Few seriously annoyed, Daytime and evening.	Continuous noise, outdoor living areas
$L_{Aeq,T}$ = 50 dB	Few moderately annoyed, Daytime and evening.	Continuous noise, outdoor living areas
$L_{Aeq,T}$ = 35 dB	Acceptable level to avoid speech interference, daytime and evening.	Continuous noise, Dwellings, indoors
$L_{Aeq,T}$ = 30 dB	To avoid sleep disturbance at night.	Continuous noise, Bedrooms, indoors
L_{Amax} = 45 dB	To avoid sleep disturbance at night.	Noise peaks, Bedrooms, indoors

2.7 BS 8233:2014 Table 4 recommends the following internal ambient noise levels for steady external noises, previously so called 'anonymous noises', which do not indicate any strong character. These are stated as based on existing W.H.O. guidelines assuming normal diurnal fluctuations in external noise.

	07.00-23.00 hrs	23.00-07.00 hrs
Living rooms	35 dB $L_{Aeq\ 16hr}$	-
Dining room / areas	40 dB $L_{Aeq\ 16hr}$	-
Bedrooms (day-time resting)	35 dB $L_{Aeq\ 16hr}$	30 dB $L_{Aeq\ 8hr}$

2.8 Note 4 of Table 4 states - *Regular individual noise events (for example, scheduled aircraft or passing trains) can cause sleep disturbance. A guideline value may be set in terms of SEL or LAmax, F depending upon the character of the noise and the number of events per night. Sporadic noise events could require separate values.*

2.9 For intermittent night-time noise events, these could therefore be viewed in respect to the W.H.O. guidance provided 45 dB L_{Amax}. This values been used for this assessment for night-time activity, where considered regular.

2.10 Note 7 of BS8233:2014 states: *Where development is considered necessary or desirable, despite external noise levels above WHO guidelines, the internal target levels may be relaxed by up to 5 dB and reasonable internal noise levels still achieved.*

2.11 Note 7 therefore offers some flexibility but such allowance itself would not be assumed by default as this might imply criteria moving closer to the SOAEL, without considering other contextual factors.

Building Services Atmospheric Noise Emissions

2.12 The building is to be mechanically ventilated in occupied areas and such plant needs to be controlled atmospherically in level to the nearest noise sensitive properties. In this case such sensitive properties are considered to be the student residential premises. Compliance here will indicate sufficient compliance for the rest of the surrounding environment.

2.13 The standard for the assessment of such plant is BS 4142: 2014 "Methods for the assessment of industrial and commercial sound"

2.14 This standard provides a method by comparison of the existing background noise level, L_{A90}, with the specific rating noise level, L_{Ar}, defined by the L_{Aeq} parameter. The rating level, L_{Ar} is the L_{Aeq} noise level plus a correction if the noise source if judged to have any characteristics which draw attention to itself at the receiver (up to + 6 dB is may be applied for tonality, + 9 dB for impulsivity, + 3 dB for other features and + 3 dB for intermittency). The method of assessment states that if the difference between the rating level of plant is 5 dB greater than the background level, then this is likely to be an indication of an adverse impact. If the rating level is 10 dB above the background level, then this is likely to be an indication of significant adverse impact. If the rating level is equal to or less than the background level, this indicates a low impact. The lower the rating level below the background level, the lower the likelihood of adverse impact. However context is now a significant aspect of the assessment, as well as the uncertainty factor within the process in reaching any conclusion.

2.15 In line with NPPF guidance we would expect that any new noise from the normal operating plant associated within the building will be designed such that at most it indicates a marginal/low impact to neighbouring noise sensitive properties.

2.16 On this basis we would propose the following criteria:

> *The cumulative rated noise level 'L_{Ar}' of building services plant under normal operation is to typically not exceed the pre-existing background noise level, relative to its time of operation, 1 metre from the halls of residence student windows.*

Welwyn & Hatfield District Council's

2.17 The scheme is within the borough of Welwyn and Hatfield District Council. Policy R19 – Noise & Vibration Pollution of the council's District Plan 2005 - Supplementary planning guidance states:

> *Proposals will be refused if the development is likely:*
>
> *(i) To generate unacceptable noise or vibration for other land uses; or*
>
> *(ii) To be affected by unacceptable noise or vibration from other land uses.*
>
> *Planning permission will be granted where appropriate conditions may be imposed to ensure either:*
>
> *(iii) An adequate level of protection against noise or vibration; or*
>
> *(iv) That the level of noise emitted can be controlled. Proposals should be in accordance with the Supplementary Design Guidance.*

2.18 Initial communications have been made with the Karl Riahi at local authority environmental services department. Karl has indicated that the local authority consider each scheme on its own merits, and utilise current guidance.

Activity Noise Emissions

2.19 There is no specific British Standard or guidance document which proposes noise limits at residential premises from music events; which in this case may occur on occasion with the function space. Documents which do exist are the Code of Practice on Environmental Noise Control at Concerts, 1995, published by the Noise Council; and the Good Practice Guide on the Control of Noise from Pubs and Clubs, March 2003 published by the Institute of Acoustics. However the former mainly relates to large music events of one to twelve per year and notes indoor events up to 30 per year but stopped at 23.00 hours (i.e. not extending into the night period). The latter document provides no noise limits; draft versions did but these were not adopted within the final version.

2.20 The use of the facility should be viewed based on the user requirements. It is not a facility for which high levels of music will be regularly generated, but some music activity is possible, running up to 23.00 hours or potentially midnight on occasion.

2.21 It is fairly common to design such events to a criterion considered to be barely audible at the nearest residential premises, where it could operate after 11 pm. What is inaudible is subjective, and therefore a guide definition for design purposes and to be used for the establishment of noise limiter and potential monitoring is proposed.

> *The L_1 sound level of the activity in each octave band from 63 Hz to 4 kHz will be as appropriate - targeted, designed, measured or judged - to be at least 5 dB below the pre-existing L_{90} sound level, 1 metre from the nearest residential window; unless it is predicted that this level will already be below the threshold of hearing within that residence, when calculated through a partially open window.*

Internal Noise Levels

2.22 In terms of the internal noise environment, mechanical noise limits will be set as part of the design development of the scheme. External noise intrusion would not be expected to add noticeably to meeting those limits. It would be expected that the internal noise environment will not be higher than 35 dB L_{Aeq} from the general day-time external environment, excluding student activity.

3.0 Noise Survey

Preamble

3.1 As part of the assessment for the proposed building a noise survey was undertaken to determine the levels at the building line and at the student halls of residence.

3.2 In this case because the residences are close to the building all survey locations provided essentially gave a good indication for both needs.

3.3 Sharps Redmore have also undertaken a noise survey on the site in 2011 for the adjacent relatively new Law Building, and this information is also summarised to provide a wider informed view of the site.

Methodology

3.4 The noise survey was undertaken 1st September 2016, during the day-time with night-time measurements undertaken on 25th August 2016.

3.5 Measurements were taken with Bruel & Kjaer Class 1 Type 2260 sound level meters which have full traceable calibration histories. The meters were calibrated before and after use and showed no significant drift.

3.6 The measurements locations are shown in Appendix A at the four corners of the proposed building line (Locations 1-4) and at the halls of residence (Location 5). All measurements were taken in free field locations between 1-1.5 m above ground level.

3.7 Weather conditions were dry with wind speeds less than 5 m/s.

Results

3.8 Measurements were taken typically in 15 minute samples. The results of the survey are presented in Appendix A.

3.9 The main parameters provides are the ambient (L_{Aeq}), background (L_{A90}), maximum (L_{Amax}) and minimum (L_{Amin}) levels which are defined in Appendix B.

3.10 The noise survey was undertaken under good conditions and was not affected significantly by people passing or using the lawn. These was some plant noise just noticeable but predominantly noise across the site is controlled by distant A1(M) traffic and local road traffic on Mosquito Way, plus traffic at the entrance road to the University car park and generally.

3.11 Measurements indicate typical ambient day-time levels around the building line of 46-53 dB L_{Aeq}, irrespective of position (and background levels of 39-46 L_{A90}). Maximum noise levels are typically between 63-70 dB L_{Amax}, and occasionally louder, which is mainly from persons talking and passing the site, and from some local vehicles.

3.12 The noise level at the halls of residence during the morning (9-10 am), as very close to the other measurements location indicating a steady 47-48 dB L_{Aeq}, and an underlying background noise level of 44-46 dB L_{A90}. During the middle of night (2-3 am) a steady 37-38 dB L_{Aeq}, and a background of 33-34 dB L_{A90} were measured.

3.13 Sharps Redmore also have survey data for the last building completed in this vicinity of the Social Space, the Law Building (completed in summer 2011). The noise survey indicated levels at the closest measurement location to the residences, never falling below 39 dB L_{Amin} / 43 dB L_{A90} in the middle of the night, and closer to 45 L_{Amin} /47 dB L_{A90} around 11 pm. The reason for the difference is not clear. It may be that the residences may now have greater screening from local roads than in earlier years by the introduction of the Law building, though this may not be the case at high window levels, so a view is taken ahead.

4.0 Assessment

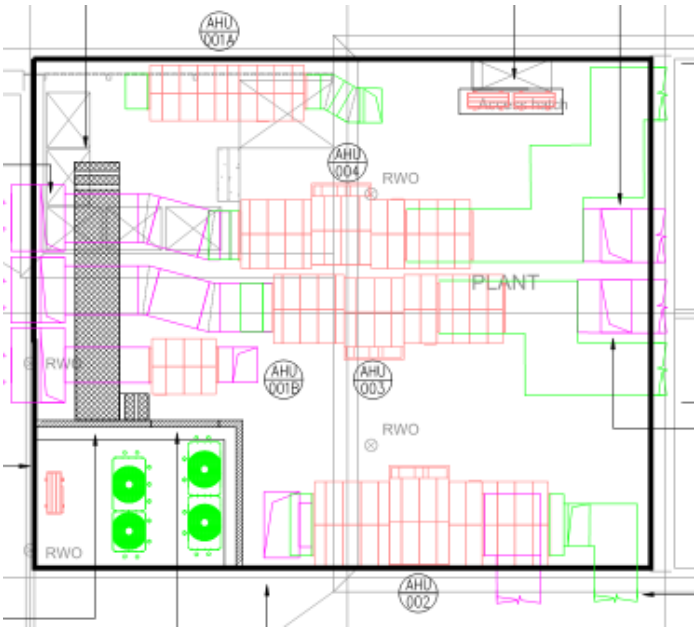
Preamble

4.1 The assessment considers the noise emissions to neighbours from potential activities within the space and from atmospheric emissions from the building services.

4.2 Noise intrusion to the building is not considered to be a concern as external noise levels are low, i.e. now higher than 53 dB L_{Aeq}, such that any standard building envelope will achieve acceptable internal noise levels. This is not therefore a determining factor to consider further.

Building Services: Atmospheric Noise Emissions

4.3 The building is proposed to include its building services plant predominantly within a roof well, as illustrated by the plan image. The location of the roof well is shown on the architect's roof plan drawings (and in Section 1). The well is indicated to include 5 No. air handling units, 3 No. small air conditioning units, and 2 No. larger condenser units. It is expected that this plant will only operate during occupied periods of the building.



4.4 There is also a ground floor plantroom facing the student residences. This is expected to include boilers and pumps. It is expected that this plant may operate 24 hours a day at lower duty.

4.5 The locations of the plant areas relative to the student residences are outlined in Section 1.

4.6 It would be expected that the ground and first floor windows of the halls of residence will be acoustically screened from roof plant by the edge of the plant well, however lines of sight to possibly the second and certainly the third (top) floor windows of the student residents would be visible to most of the plant.

4.7 For the plant information provided it is recommended that:

- All air handling plant of any size (i.e. AHU's supply and extract, toilet or kitchen systems) will require atmospheric side attenuation and space should be made available for this.
    - It is recommended that all such plant does not each exceed 47 dB L_{Aeq} at 1 metre / per unit.
- The plantroom will be expected to require atmospheric attenuation, e.g. it may require attenuated inlets/outlets (high and low) in the wall, and a blanked-over (non-louvered) plantroom door.

- It is recommended that the plantroom does not each exceed 50 dB L_{Aeq} at 1 metre.

- The smaller A/C units have noise levels not exceeding 59 dBA at 1 metre but do not need additional treatment. The two closest units are against the wall of the plant well nearest the residences - these are facing away and will be fairly well screened from the residences.

- The two twin fan A/C units are expected to need to be controlled, based on final selections. These are therefore are expected to be attenuated, as indicated on the diagram above.

  - This will include an acoustic louvres around the two units to attenuate the inlets, and cylindrical attenuators on top to reduce the discharge noise. The airflow will be controlled between inlet and outlet by horizontal closure from the top of the acoustic louvres to the top of the units at the base of the attenuators.

4.8 In this respect we would expect that any new plant from the social space will be designed such that at most they have a marginal/low impact to the neighbouring noise sensitive residents.

4.9 Calculations indicate that cumulative noise level from this plant will achieve of the order of between 35-40 dB $L_{Aeq\ (free\ field)}$ at the student windows, at the latest operating time likely around midnight. Through the night, only the plantroom will be operating, with predicted noise of less than 30 dB $L_{Aeq\ (free\ field)}$ at the student windows. These levels are considered suitable as:

- Internal noise levels within nearest residences will be less than 30 dB L_{Aeq}, *with windows open* during the day-time (estimated as 23-28 dB L_{Aeq}), when all the plant is operating, and less than 20 dB L_{Aeq} during the middle of the night. Compared against BS 8233: 2014 this is within criteria.

- The plant is not expected to exhibit significant character at the receiver when all plant is operating and against the existing ambient environment. Character which may result in a rating correction would be more likely from the plantroom, however after applying a correction it is still likely to be of the order of equal to the existing background environment.

- In this case the nearest noise sensitive receiver are students at the University and so will be both using the facility and have means of compliant through the University to address any issues. In this respect 'context' under BS 4142:2014 should be considered, when taking a view.

Activity / Amplified Noise Emissions

4.10 The noise levels from activities, as defined by the University User Group, for the proposed Social Space have been considered in term of disturbance to students at the halls of residence.

4.11 In terms of operating times it is assumed that students will not use the facility before 8 am, and on weekdays its last use will be typically 11 pm for the function room and 11.30 pm for

the bar. The function room may on occasion be used after 11 pm, but it is proposed that this will not be regular and will not be later than midnight.

4.12 Noise emissions from the building has been separated into two for the purposes of assessment:

Social Spaces

- The social spaces are considered to have a relatively low/medium noise environment, with TV's , games tables and background music, controlled through in-house mid-range speakers by the bar staff. There is no intention to use the social space for live music or to introduce any bass or sub-woofer system within this areas. This is as much as transitory space and as a social/resting/eating space, with circulation doors at both ends.
- No significant noise control measures are considered necessary due to the anticipated activities and because this aspect of the building, generally faces away from the student residences towards the university buildings, which provides some inherent screening.

Function Space

- The function space, as the largest space has greater opportunity to offer flexibility of use. To the make this as flexible as possible, the envelope sound reduction will be substantive compared to the rest of the building. It is proposed to include:
  - A minimum 150 mm thick concrete slab roof.
  - The external walls will be an enhanced dry-wall structural framing system, with an example make-up of 2 No. cement particle board on the outside face with an independent inner stud lined with 3 x 15 mm dense plasterboard and the cavity between inclusive of acoustic insulation; or a structure providing equivalent performance.
  - Any external doorsets from this function space are to have a minimum laboratory sound reduction of 50 dB R_w.
  - The windows are to have a minimum laboratory sound reduction of 50 dB R_w. This is likely to be a wide cavity system to gain the best practical performance at low frequency.
- The space has been assessed in terms of comparison with real noise data for other uses, i.e. busy bars, with food/TV and background in-house music. This should be accommodated at most times, and therefore by definition this should also accommodate any conference or quieter uses. Calculations have been based on the following levels:

	Awgt	1/1 Octave Band Centre Frequencies (Hz) – Linear dB							
	(dBA)	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
Typical Lmax	93	86	81	89	93	88	85	76	70
Leq	77	65	69	72	75	73	70	61	50
Music Lmax Limit	104	95	95	95	100	100	95	95	85

4.13 Considering the *typical* operating levels given, i.e. with maximum typical noise levels around 93 dB L_{Amax}*:*

- This would be a busy social space environment, it is unlikely with the envelope design proposed that noise from the function room will be particularly noticeable at the nearest residents on a typical night. If there is music in the function space i.e. an amplified live singer or semi-acoustic set using the in-house system or one with control/no strong bass, then this is likely also to acceptable particularly up to 11 pm.

4.14 Considering the space offering *maximum flexibility*:

- Calculations indicate the function space may struggle during the late evening to play music with a strong bass component without being noticeable to the nearest student residents, but this is not its intended use.

- Therefore as a 'guide' a maximum operating limit is provided in the table for any music system that is installed. At these levels, during the late evening, this is likely to be noticeable at the residences at the bass frequencies but may be acceptable if only on known occasions to the students, i.e. stopping no later than midnight. At these levels it is estimated that regular maximum noise levels i.e. L_1 (highest 1% levels) may exceed the background level at bass frequencies at times of late evening use (say by 5 dB), but the overall dBA level may not significantly change.

Controls

4.15 As controls on the use of the space it is recommended that:

- A noise limiter is included within the facility, at least within the function room.

- If a planning condition is desired by the Council to control amplified noise emissions, that the noise limiter settings form part of the commissioning process and consent. The Council's Environmental Health Officer may wish to attend to agree final operating limits.

5.0 Conclusions

5.1 Sharps Redmore have undertaken an assessment of the proposed new Social Space building, to be located on the university grounds.

5.2 Noise emissions from building services plant and amplified/activity within the building have been considered, as it may impact on the occupants of the adjacent student halls of residence.

5.3 In respect to building services, noise limits have been provided and/or recommended noise control measures where needed. The plant is expect to operate at levels typical of the existing background noise environment; and below BS 8233: 2014 internal noise limits within the halls of residence via openable windows.

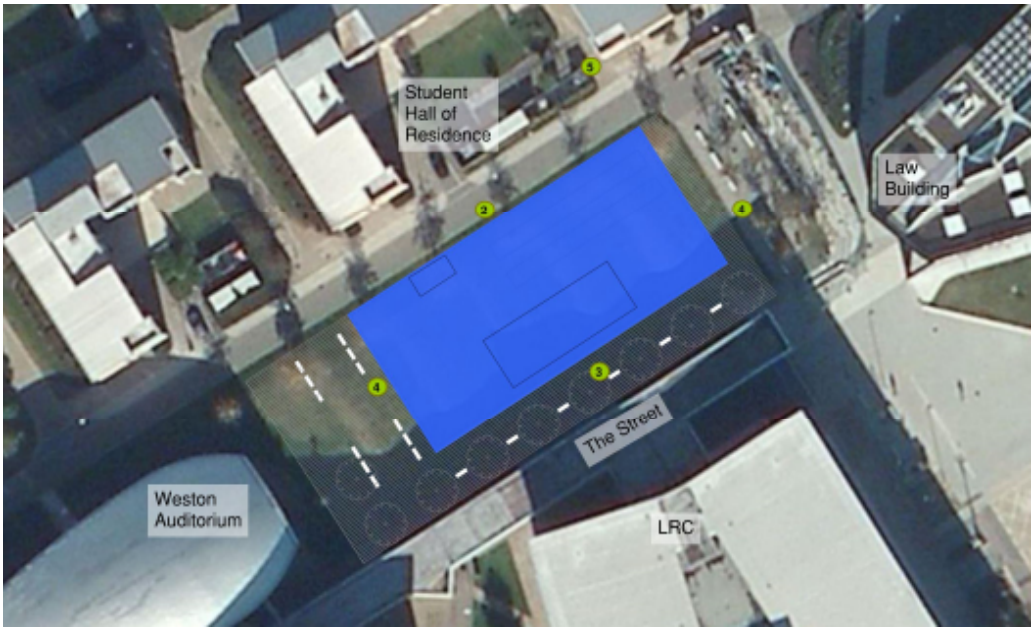
5.4 Activity and potential amplified uses have been reviewed and controls put in place with a high sound reduction envelope around the function room plus a concrete roof, alongside a noise limiter.

5.5 The Social Space is not expected to operate at high noise outputs or be occupied regularly into the night period, but measures have been included to offer a flexibility of use whilst protecting the nearby student residents who have the ability to benefit from the facility.

5.6 Considering the context of the location, use and relationship between operator and students these criteria and controls are considered a suitable level of protection.

Appendix A: Noise survey results

Location	Time	L_{Aeq} (dB)	L_{Amax} (dB)	L_{Amin} (dB)	L_{A90} (dB)
01.09.16					
1	14.04	53.4	70.0	41.9	45.6
2	14.23	49.8	72.4	42.1	44.2
3	14.40	49.9	62.8	40.4	43.2
1	14.56	57.2	75.0	42.9	47.0
2	15.15	47.2	65.2	40.5	42.6
3	15.31	47.1	64.8	41.1	43.6
4	15.47	44.8	59.2	37.2	39.0
1	16.13	48.6	68.5	40.8	43.8
2	16.29	47.0	63.7	40.8	43.0
3	16.45	48.2	65.9	39.9	42.2
4	17.01	45.7	62.6	39.7	41.4
5	20.58	47.9	63.3	44.2	45.6
5	21.14	47.5	63.5	43.7	45.6
5	21.29	47.4	66.1	44.1	45.6
5	21.44	46.9	64.8	41.7	44.4
25.08.16					
5	02.00	37.8	67.1	33.0	34.3
5	02.15	37.2	68.7	31.5	32.9
5	02.30	37.0	67.7	32.0	33.5
5	02.45	36.5	60.1	32.1	33.8



Frequency Data for background (L_{90}) and ambient (L_{eq}) measurements.

L90 (linear)	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz
01.09.16							
1	55.7	47.6	42.6	40.8	40.2	33.9	26.1
2	55.3	45.9	40.1	39.8	38.8	32.6	25.1
3	53.3	44.3	38.1	39.5	38.2	32.6	22.0
1	56.4	48.3	43.2	42.5	40.8	35.1	29.9
2	54.2	43.9	38.1	38.8	38.2	30.4	<20
3	53.3	43.6	38.1	39.5	38.8	32.0	21.0
4	51.2	41.1	35.6	35.1	35.0	26.5	<20
1	56.3	46.1	40.1	37.8	39.2	32.0	21
2	54.6	44.4	39.5	39.1	39.2	30.9	<20
3	53.2	43.6	37.5	38.1	38.2	30.0	<20
4	52.3	42.6	37.3	36.5	37.2	28.5	<20
5	54.4	46.4	39.8	40.0	42.2	33.4	<20
5	54.4	46.4	39.8	39.5	42.2	33.4	<20
5	53.0	45.4	39.1	40.3	42.6	34.2	<20
5	53.4	45.4	38.8	39.5	41.0	32.5	<20
25.08.16							
5	47.3	42.4	33.2	30.7	28.6	21.0	<20
5	42.2	39.0	34.2	29.7	26.8	<20	<20
5	42.7	39.4	35.2	30.2	27.2	20.0	<20
5	43.0	39.6	35.7	30.5	27.5	20.4	<20

Leq (Linear)	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz
01.09.16							
1	61.4	54.4	50.4	52	49.4	42.4	37.5
2	64.4	54.5	49.9	46.7	43.9	39.8	39.4
3	63.3	53.0	49.1	46.6	44.9	42.5	34.9
1	62.5	56.6	53.2	56.2	51.5	48.9	43.5
2	59.7	52.8	47.9	45.3	42.4	35.3	30.5
3	58.4	49.5	43.7	44.4	43.5	37.8	29.1
4	57.5	54.3	47.4	42.0	38.1	31.3	25.3
1	62.9	54.6	49.9	45.4	43.0	39.0	32.8
2	60.2	53.2	46.9	44.0	42.4	35.4	32.7
3	58.4	53.8	50.4	47.1	42.5	33.4	<20
4	57.6	50.2	46.6	43.9	40.7	34.6	26.3
5	60.1	52.3	46.6	43.3	44.9	38.4	28.4
5	59.7	52.3	45.9	43.1	44.5	36.8	29.2
5	58.7	50.7	44.3	43.1	45.0	36.7	27.6
5	59.6	54.2	46.5	42.5	43.6	35.4	25.0
25.08.16							
5	52.6	45.5	35.6	33.9	32.7	28.2	25.0
5	50.9	43.9	36.3	32.6	31.9	29.3	24.5
5	49.2	42.9	37.6	32.8	30.4	25.4	23.6
5	49.0	43.1	37.9	33.5	31.0	26.1	20.6

Appendix B Common acoustic parameters for environmental surveys

These are the main noise indices in use in the UK:

L_{A90} :The sound level (in dBA) exceeded for 90% of the time. This unit gives an indication of the sound level during the quieter periods of time in any given sample. It is used to describe the "background noise level" of an area.

$L_{Aeq,T}$:The equivalent continuous sound level over a period of time, T. This unit may be described as "the notional steady noise level that would provide, over a period, the same energy as the varying noise in question". In other words, the energy average level. This unit is now used to measure a wide variety of different types of noise of an industrial or commercial nature, as well as road traffic, aircraft and trains.

L_{A10} :The sound level (in dBA) exceeded for 10% of the time. This level gives an indication of the sound level during the noisier periods of time in any given sample. It has been used over many years to measure and assess road traffic noise.

L_{A1} :The sound level (in dBA) exceeded for 1% of the time. This unit can give an indication of a regular maximum noise level from such activities as dance music.

SEL :The sound exposure level, (often denoted LAE) is the noise level of an event, such as a train or aircraft event, normally expressed in a 1 second time period.

L_{Amax} :The maximum level of sound, i.e. the peak level of sound measured in any given period. This unit is used to measure and assess transient noises, i.e. gun shots, individual vehicles, etc.