UCL Kathleen Lonsdale Building Refurbishment

External Noise Assessment Report

March 2016

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Introduction

Kathleen Lonsdale Building (KLB) is a Grade II listed building owned by the University College of London (UCL), located on Gower Place in the borough of Camden.

It is understood that the KLB was built in the early 1900's as a Chemistry Building for UCL, however, over the years it has been adapted to suit different UCL departments. To improve the utilisation of the space, it is proposed that the building will undergo extensive refurbishment. The existing cellular laboratories and offices will be transformed into open-plan multifunctional areas including shared studios, break out spaces and student hubs.

As part of the refurbishment works a number of mechanical plant items be replaced and additional items installed, these include:

- replacement of the two existing chillers located on the roof
- the installation of new mechanical plant within a new plant room on the first floor, and
- the installation of four external DX condenser units in a light well in the south-west corner of the building.

Atkins Acoustics, Noise and Vibration has been appointed to carry out a background noise survey at the site to allow noise limits to be set in accordance with Camden Borough Council requirements and perform a Noise Impact Assessment to support the Planning Application in relation to the refurbishment of Kathleen Lonsdale Building.

This document details the methodology and results of the noise survey, sets out noise limits to which the proposed mechanical plant will need to adhere and describes the assessment of the plant noise impact.

1. Ambient Noise Survey

1.1. Unattended noise measurements

A 24 hours, unattended ambient noise survey was undertaken by Atkins Acoustics, Noise and Vibration (ANV) on Wednesday 18th and Thursday 19th June 2014. Due to difficulties in accessing the roof of the Kathleen Lonsdale Building, a measurement location was chosen on the rooftop area of the adjacent Health Centre building. A rooftop location for the acoustic measurements was chosen as the noise data obtained would be representative of noise levels and climate incident upon the facades of the building and external windows of the adjacent noise sensitive receptors, which are principally subject to noise generated by plant equipment located on all the nearby rooftops. The logger position is shown in Figure 1-1.

Continuous noise measurements were taken over a 24 hour period using a Rion NL-52 sound level meter (SLM) and external microphone mounted in a free field position, on a tripod 1.5m above the roof level. The SLM was field-calibrated using a Rion NC-74 both before and on completion of the survey, with no significant drift observed. Equipment details and full certificates are included in Appendix B.

The roof top area contained a number of items of plant which were operational during the monitoring period. While the noise from the KLB plant items did have an influence on the noise measurements, based on observations while at the site, plant noise from beyond the site was dominant. To provide a degree of verification of the unattended noise measurements further attended noise measurements were undertaken in March 2016 (described in Section 1.2)

1.2. Attended noise measurements

A further external, short-term ambient noise survey was undertaken at street level by Atkins ANV at four locations (refer to Figures 1-1 and 1-2) around the Kathleen Lonsdale Building to:

- provide a degree of verification of the noise measurements undertaken in June 2014, and;
- provide an understanding of the noise environment at ground level

In addition to the noise measurements undertaken around the KLB, sample measurements were also undertaken at a location on Gordon Square beyond the site. The measurements were undertaken to assist in the understanding of the noise environment around the KLB and to determine the likely contribution from extraneous sources (e.g. mechanical plant, traffic noise etc.), in the vicinity of the building. Furthermore, the Gordon Square noise measurements also assist in assessing the likely noise impact from mechanical plant beyond the site (i.e. without the influence of surrounding plant noise).

The attended noise survey was carried out on 17th-18th March 2016 between 23:00 and 01:00 and 22nd March 2016 between 09:00 and 15:00.

The attended measurements were undertaken using a Norsonic 118 SLM mounted on a tripod 1.5m above the ground. Measurement positions 1-4 were undertaken at the building within 3.5m of the façade and position 5 was undertaken under free field conditions. Façade positions were used at positions 1-4 as no suitable free field measurement position was available.

The SLM was field-calibrated using a Norsonic 1251 calibrator both before and on completion of the survey, with no significant drift observed. Equipment details and full certificates are included in Appendix B.

At each noise monitoring location, one 15 minute measurement was obtained during the night-time survey and three sets of 15 minutes measurements were obtained in rotation during the daytime survey for measurement positions 3-5 only). Only one 15 minute measurement was undertaken at position 1 and 2 as noise from external mechanical plant from UCL KLB and UCL Physics Building respectively was dominant and constant.

Based on site observations, Atkins ANV understands that the nearest noise sensitive receivers to the Kathleen Lonsdale Building are shown in Figure 1-1 and Figure 1-2 and are referenced below.

- Wellcome Trust
- UCL KLB Student Union on Gower Place,
- UCL Physics Building,
- UCL Bartlett Faculty of the Built Environment.

It is assumed that the nearest residential accommodations are located on Gordon Square, approximately 270m from the development site.

Figure 1-1 Noise Monitoring Positions at the development site

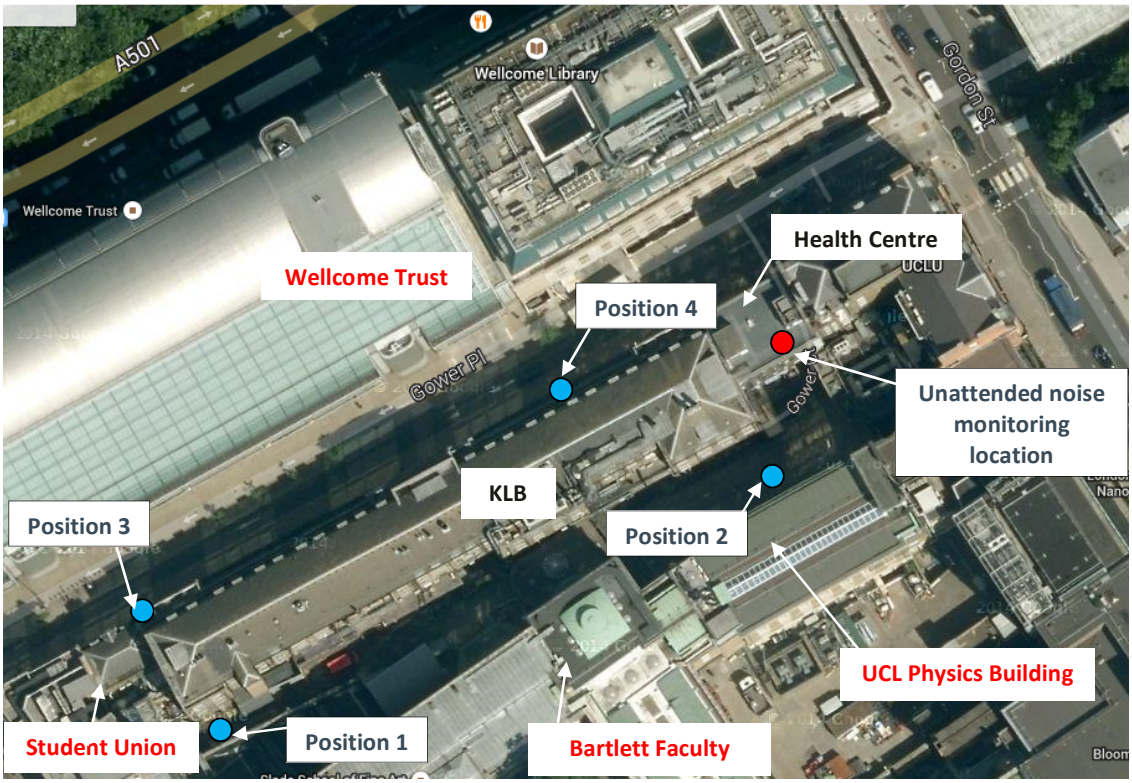
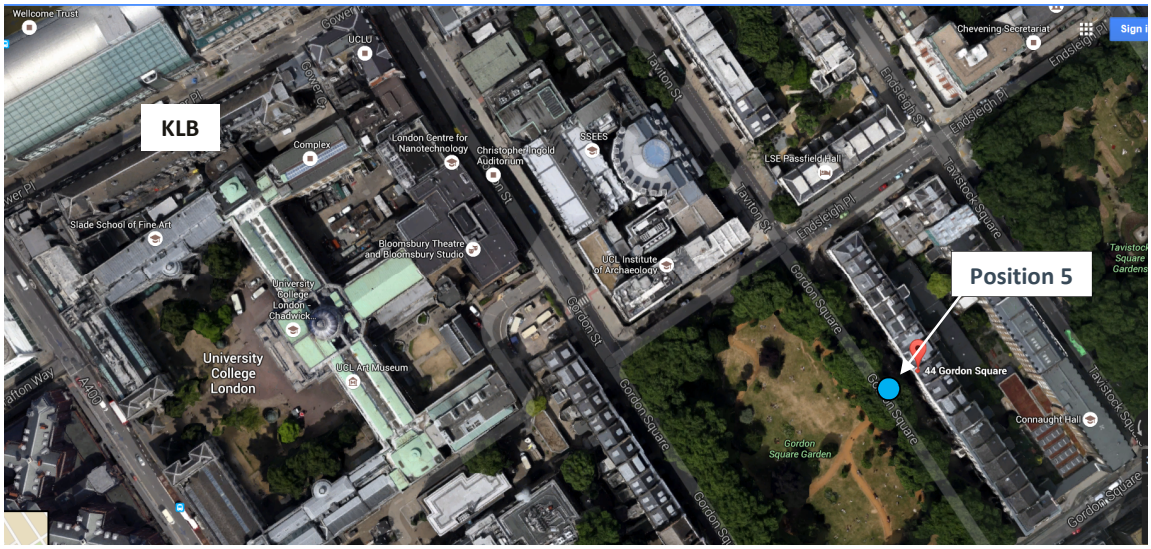


Figure 1-2 Noise Monitoring Position on Gordon Square



1.3. Survey Observations

1.3.1. Unattended measurements

At the beginning and the end of the unattended noise monitoring period, the dominant noise sources were noted to be rooftop plant noise from the nearby UCL buildings, local road traffic noise from Gower Place and Gordon Street and distant road traffic noise from Euston Road.

Weather conditions were observed and recorded at the beginning and the end of the measurement period. Based on observations it is considered that the weather conditions were suitable to obtain representative long term noise measurements.

1.3.2. Attended measurements

The weather was clear during both the night-time and daytime survey. Wind speeds were negligible, as verified periodically during the survey using a digital anemometer. The overall weather conditions were considered suitable to obtain representative short-term noise measurements.

During each of the measurements, the noise sources and local noise event observed were noted and are summarised in Table 1-1 below.

Table 1-1 Survey observations – summary of noise sources and events

Position	Noise sources and events	
	Daytime	Night-time
1	•mechanical plant noise from UCL Slade School of Fine Arts workshop, •mechanical plant noise from UCL KLB •construction noise from KLB site	•mechanical plant noise from UCL KLB •music and noise from UCL Student Union
2	•mechanical plant noise from UCL Physics Building •construction activities on KLB site	•mechanical plant noise from UCL Physics Building

3	•mechanical plant noise from UCL KLB •road traffic noise on Gower Place and Gower Street •pedestrians	•mechanical plant noise from UCL KLB •occasional road traffic on Gower Place
4	•mechanical plant noise from UCL KLB •mechanical plant noise from the Wellcome Trust •road traffic noise on Gower Place •pedestrians on Gower Street	•mechanical plant noise from UCL KLB •pedestrians on Gower Place •occasional road traffic on Gower Place
5	•road traffic noise on Gordon Square •construction works on Gordon Street	•occasional road traffic on Gordon Square •pedestrians on Gordon Square

1.4. Survey Results

Although a range of statistical noise data were recorded, the $L_{Aeq,15min}$ and $L_{A90,15min}$ indices are reported here:

- dB L_{Aeq} – The A weighted equivalent continuous sound pressure level over a period of time, T. Representative of the 'average' sound pressure level over a given period, in this case 15 minutes.
- dB L_{A90} – The L_{A90} is defined as the 90th percentile level or noise level that is exceeded for 90% of the measurement period, and is commonly referred to as the Background Noise Level.

1.4.1. Unattended Noise Survey

A summary of the logarithmic mean of the L_{Aeq} measurements and linear mean of the L_{A90} measurements is presented in Table 1-2 below for day, evening and night time periods. Full measurement details and octave band sound pressure levels can be found in Appendix A as requested by the Local Authority.

Table 1-2 Unattended noise survey results - summary

Day-time (07:00 – 19:00)		Evening (19:00 – 23:00)		Night time (23:00 – 07:00)	
dB L_{Aeq}	**dB L_{A90}**	**dB L_{Aeq}**	**dB L_{A90}**	**dB L_{Aeq}**	**dB L_{A90}**
60.9	59.6	59.7	59.1	58.9	58.2

The measured noise survey data show fairly constant noise levels both during the day, evening and night-time. This likely to be due to the building services plant from the surrounding buildings and continuous distant road traffic noise from Euston Road.

1.4.2. Short Term Noise Survey

Although a range of statistical noise data was recorded, the $L_{Aeq,15min}$ and $L_{A90,15min}$ indices are reported in Table 1-3 for measurements carried out during the night-time short term survey and in Table 1-4 for measurements carried out during the daytime short term survey. Full measurements details and octave band sound pressure levels can be found in Appendix A as requested by the Local Authority.

Table 1-3 Night-time short term noise survey results

Position	Measurement	Time	Duration (min)	dB L_{Aeq}	dB L_{A90}
1	Façade	23:07	15	55.5	54.4
2	Facade	23:33	15	61.6	60.2
3	Facade	00:18	15	65.2	63.5
4	Facade	00:00	15	61.6	59.1
5	Free field	00:46	15	52.1	44.5

Table 1-4 Daytime short term noise survey results

Position	Measurement	Time	Duration (min)	dB L_{Aeq}	dB L_{A90}
1	Facade	10:28	15	71.7	68.0
2	Facade	09:57	15	62.9	61.1
3	Facade	11:11	15	68.2	65.4
	Facade	12:12	15	67.9	65.2
	Facade	14:03	15	68.4	65.6
4	Facade	10:54	15	72.4	70.6
	Facade	11:55	15	71.6	70.1
	Facade	13:45	15	74.4	70.3
5	Free field	11:34	15	59.1	51.9
	Free field	13:23	15	58.0	53.0
	Free field	14:23	15	57.4	52.4

As previously stated, due to site constraints it was not possible to take free field[1] measurements at Positions 1 through 4. BS4142:2014 "*Methods for rating and assessing industrial and commercial sounds"* states that *"when measurements for distant sources are made at 1m from a façade, the measured level can be adjusted to an equivalent free-field level by subtracting a 3dB correction factor. For sources that are relatively close or not perpendicular to the façade the correction may be 1dB or 2dB, in which case the reasons for not using a correction of 3dB ought to be explained".*

Measurements at Positions 1 and 2 were taken in the narrow internal courtyard of Kathleen Lonsdale Building approximately 2 meters from the building facade. Due to site constraints and to the presence of scaffolding and temporary metal barriers in the courtyard, it was not possible to take the short term measurements at free field locations nor at 1m from building façade (as specified in BS4142).

The measurements at Positions 3 and 4 were taken approximately 2 meters from the Kathleen Lonsdale building façade. This was due to presence of a railing along the building façade and road traffic on Gower Place, which prevented the measurement from being taken at free field or at 1m from the building façade (as

[1] BS8233:2014 "*Guidance on sound insulation and noise reduction for buildings*" defines free field measurements as "*measurements made 1.2 to 1.5m* above the ground and at least 3.5m away from other reflecting surfaces".

per BS4142:2014). Therefore, a correction of -2dB has been applied to all short-term measurements for Position 1 through 4.

A summary of the logarithmic mean of the L_{Aeq} measurements and linear mean of the L_{A90} measurements, including the free field correction, is presented in Table 1-5 for daytime and night-time survey.

Table 1-5 Short term noise survey results - summary

Position	Daytime		Night-time	
	dB L_{Aeq}	**dB L_{A90}**	**dB L_{Aeq}**	**dB L_{A90}**
1	69.7	66.0	53.5	52.4
2	60.9	59.1	59.6	58.2
3	66.2	63.4	63.2	61.5
4	71.0	68.3	59.6	57.1
5	58.2	52.4	52.1	44.5

The background noise data measured during the short term night-time survey at Position 2-4 show little variation from the noise data obtained during the night period of the unattended monitoring survey. For the daytime period the difference is greater, with background noise data from the short term survey being higher than the ones recorded during the long term monitoring. This likely to be due to the measurement positions being closer to road traffic movements.

It is assumed that all adjacent receptors that are part of the UCL campus and the Wellcome Trust would be occupied during the daytime (07:00 to19:00) and evening (19:00 to 23:00) periods only. Therefore, for the purpose of this assessment, the background noise level measured during the evening period of the unattended noise survey (59.1dB L_{A90}) has been used as it can be considered representative of the background noise levels at the nearest noise sensitive receptors at the UCL site. For the residential properties on Gordon Square, the assessment has been undertaken using noise data from the night-time attended measurements, when the measured background noise levels are at their lowest (44.5 dB L_{A90}).

Table 1-6 summarises the background noise levels (dB L_{A90}) chosen as representative of each noise sensitive receptor which have been used for this assessment.

Table 1-6 Proposed environmental noise criteria

Receptor	**dB L_{A90}**
UCL Slade School of Fine Art	59.1
UCL The Bartlett Faculty for the Built Environment	59.1
UCL Physics Laboratory	59.1
UCL Health Centre	59.1
UCL Student Union	59.1
The Wellcome Trust	59.1
Gordon Square	44.5

2. Environmental Noise Emissions

As part of the proposed development, two air cooled packaged chillers located on the roof are to be replaced with new units in order to meet the requirements of the refurbished space below. In addition, a new plant room will be created on the first floor for the ventilation plant of the Earth Science laboratories and four external DX condenser units are proposed to be located in a light well in the south-west corner of the building.

This section considers the noise issues relating to the operational airborne noise generated by the new chillers, the first floor plant room and the condenser units, as well as the impact these may have on persons living or working in the vicinity.

2.1. Description of Environmental Noise Criteria

The operational noise impacts of the chillers and condenser units have been assessed in accordance with BS 4142:2014 "*Methods for rating and assessing industrial and commercial sound"*.[2] This is a comparative standard which can be used in assessing the measured or calculated noise levels from sources of an industrial nature. This standard is only applicable to residential receptors, however, for the purposes of this assessment it has also been used in order to provide an indicative assessment of noise impacts at all buildings in the vicinity of the Kathleen Lonsdale building.

BS 4142:12014 defines a number of noise level descriptors in order to calculate and assess the effects of industrial noise. The *"specific sound level"* is defined as the constant noise level over the given duration produced by the specific noise source under investigation which contains the same energy as the time varying noise level. For day time periods, BS 4142 defines the reference time interval over which the impact should be assessed as being 1 hour for daytime, 15 minutes for night-time. A correction of between 0 and +6dB may be added to this noise level for sounds whose nature ranges from not tonal to prominently tonal. The resulting noise level, either with or without the correction, is described as the "rating level". The "residual noise level" is therefore defined as the ambient noise level remaining when the specific noise source is suppressed to a degree that it does not contribute to the ambient noise.

BS 4142 advises that a difference of around +10dB or more between rating level and background noise level is likely to be an indication of a significantly adverse impact, a difference of around +5db between rating level and background noise levels is likely to be an indication of an adverse impact, and where the rating level does not exceed the background noise level it is an indication of the specific sound source to have a low impact.

Camden Development Policy 28 2010 requires noise levels arising from new plant or machinery to be at least 5dB below the lowest background L_{A90} at 1 m from the external façade of noise sensitive premises during the typical operational period of the plant. Noise sensitive developments include housing, schools and hospitals as well as offices, workshop and open spaces. The development is located on a UCL site that houses higher education facilities as well as offices, with residential dwellings approximately 270m away. Therefore, noise levels from the proposed KLB mechanical plant must comply with the Camden Policy criteria set for these noise sensitive receptors.

Table 2-1 below lists the target environmental noise criteria in line with the Camden Development Policy at each noise sensitive receptors which have been used for this assessment. Measured background noise levels (dB L_{A90}), at each receptor have been included for reference.

Table 2-1 Proposed environmental noise criteria

Receptor	**dB L_{A90}**	**Criteria dB L_{A90} -5dB**
UCL Slade School of Fine Art	59.1	54.1

[2] BS4142:2014 supersedes BS4142:1997 "*Method for rating industrial noise affecting mixed residential and industrial areas"* which was used for the acoustic assessment in the previous noise impact assessment report dated November 2014. Whilst part of the standard has been updated, the assessment methodology has remained broadly unchanged.

UCL The Bartlett Faculty for the Built Environment	59.1	54.1
UCL Physics Laboratory	59.1	54.1
UCL Health Centre	59.1	54.1
UCL Student Union	59.1	54.1
The Wellcome Trust	59.1	54.1
Gordon Square	44.5	39.5

For the purpose of this assessment, the effect of each mechanical plant item of KLB on the noise sensitive receptors has been considered in isolation. This is due to the plant items not being located in close proximity and being mutually screened by the KL building and therefore their cumulative impact on each receptor can be considered negligible.

2.1.1. Noise assessment – Roof mounted chillers

Atkins ANV understands that the replacement roof mounted chillers will have the same footprint as the existing chillers and be installed on the same steel supports. Due to the difference in height between the roof top area where the chillers will be located and adjacent building elements, the chillers will be screened to all receptors located adjacent to the Kathleen Lonsdale Building on Gower Place (i.e. The Wellcome Trust) and the rear façade of the UCL Health Centre building. Partial screening will be provided to the rear façade of the UCL Union building.

Data supplied by the chiller manufacturer, shown in Appendix C, indicates that during operation, the airborne sound pressure level of the proposed chiller unit at a distance of 5m will be 67 dB(A)[3].

Noise levels from the chillers have been assessed at a number of adjacent noise sensitive receptors using the ambient noise measurement data shown in Table 1-6. For each identified receptor, the approximate distances from the chillers have been calculated from Google Maps plan views of the site and are shown in Table 2-2.

Table 2-2 Assumed distance between the chillers and adjacent receptors

Receptor	Receptor Type	Distance (m)
UCL Slade School of Fine Art	Higher Education Facility	20
UCL The Bartlett Faculty for the Built Environment	Higher Education Facility	20
UCL Physics Laboratory	Higher Education Facility	24
UCL Health Centre	Health Centre	35
UCL Student Union	Commercial/Office	72
The Wellcome Trust	Office/Library/Gallery	30
Gordon Square	Residential	270

For the purposes of this assessment it has been assumed, as a working approximation, that if the existing building features surrounding the chillers screen the view from receivers, 10dB attenuation could be expected. If the chillers are partially screened from receivers, 5dB attenuation has been assumed. If there is a direct line of sight between the chillers and receiver no screening attenuation has been considered.[4]

Assuming hemispherical propagation, noise levels from the operation of the chillers at the noise sensitive receptors have been calculated and are shown in Table 2-3.

[3] Sound pressure values calculated in accordance with ISO 3744.

[4] Source: BS5228-1:2009+A1:2014 "*Code of practice for noise and vibration control on construction and open sites*"

Table 2-3 Predicted noise levels from the chillers at noise sensitive receptors

Receptor	Overall SPL from 2 units	Distance (m)	Attenuation due to distance	Barrier Correction	Resulting noise level at receptor dB(A)
UCL Slade School of Fine Art	70	20	12	0	58
UCL The Bartlett Faculty for the Built Environment		20	12	0	58
UCL Physics Laboratory		24	14	0	56
UCL Health Centre		35	17	-10	43
UCL Student Union		72	23	-10	37
The Wellcome Trust		30	16	-10	44
Gordon Square		270	35	-10	25

Sound pressure data supplied by the manufacturer (refer to Appendix C) have been used for the purpose of this assessment. The supplier of mechanical plant and equipment must provide equipment that do not generate clearly audible tonal elements or other distinct noise during operation, therefore no correction for distinct acoustic features have been assumed in calculating the rating level at receptors. Moreover, roof chiller units must be appropriately vibration isolated from the building structure to minimise noise transfer via the structure.

Please note that, should different chiller units be selected for installation, acoustic calculations will need to be revised to reflect the new units. Using the information described above, an indicative BS 4142 assessment is shown in Table 2-4.

Table 2-4 BS4142 assessment summary – chiller units

Receptor	Resulting noise level at receptor dB(A)	Acoustic feature correction (dB)	Rating Level (dB)	Measured dB L_{A90}	Level Difference
UCL Slade School of Fine Art	58	0	58	59	-1
UCL The Bartlett Faculty for the Built Environment	58		58	59	-1
UCL Physics Laboratory	56		56	59	-3
UCL Health Centre	43		43	59	-16
UCL Student Union	37		37	59	-22
The Wellcome Trust	44		44	59	-15
Gordon Square	25		25	44	-19

The assessment shows that for receptors with a direct line of sight to the chillers (UCL Slade School of Fine Art, UCL The Bartlett Faculty for the Built Environment, UCL Physics Laboratory), the rating level is approximately -1dB lower than the measured background noise level. This indicates that the noise levels resulting from the operation of the chillers will have a low impact at these receptors.

For all other receptors, the rating level is lower than 5dB below the measured background level and therefore complies with Camden Development Policy 28.

The predicted rating noise level from the rooftop plant does not meet the Camden Policy requirement of 5dB below the background noise level at all the nearest noise sensitive receptors. However, since the noise sensitive receptors where the Camden Policy criteria are not met are part of the UCL campus, it can be assumed that the only receptors that should comply with the criteria are The Wellcome Trust and the residential properties on Gordon Square.

At both the Wellcome Trust and the properties at Gordon Square the predicted rating noise level from the rooftop plant are more than 5dB lower than the existing background noise level.

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2.1.2. Noise assessment – First Floor plant room

Noise from new mechanical plant should be considered such that the predicted noise level measured at building façade is 5dB below the measured background noise level L_{A90} to comply with Camden Policy criteria.

Calculations have been performed in general accordance with the BS4142:2014 methodology to define the maximum permissible noise level from building plant at building façade. The results are shown in Table 2-5 below.

All mechanical plant and equipment to be installed in the plantroom should be selected such that there are no acoustic characteristics that contain clearly audible tonal elements. However, for the purpose of this assessment, and considering the numerous plant items that might be installed, a +4dB character correction, denoted in BS4142 as a "clearly perceptible tone at the noise receptor", has been assumed in determining rating noise levels.

Table 2-5 Building service plant noise level limit from the new first floor plant room

BS4142 calculation step	Noise level or correction
Background Noise L_{A90} Measured[5]	59
Target 'excess of rating level over background noise level', dB(A)	-5
Target 'specific noise level' dB $L_{Ar,Tr}$ at building facade	54
'Acoustic feature correction', dB(A)	+4
Target 'rating level' dB $L_{Aeq,T}$ at building facade	50

From the results shown in Table 2-5, it can be concluded that building services need to be specified such that predicted noise levels from all plant at any external ventilation louver, stack or opening in the Kathleen Lonsdale Building facade does not exceed 50dB $L_{Aeq,T}$.

Please note that this assessment specifies an external target noise level to comply with the Camden planning policy, the calculations will need to be revisited to assess the target internal noise levels within the KL building.

2.1.3. Noise assessment – DX Condenser units

Atkins ANV understands that four external DX condenser units are proposed to be installed at ground level in a light well in the south-west corner of the Kathleen Lonsdale Building, at the rear of the Student Union (refer to Figure 2-1). The condenser units will be visible from the rear of the UCL Student Union, the west façade of the Kathleen Lonsdale Building and the north wing of the UCL Slade School of Fine Art. The units will be screened to all other noise sensitive receptors.

[5] It is assumed that the KLB and other UCL buildings in the vicinity of the new first floor plant room would be occupied during the daytime (07:00 to19:00) or evening (19:00 to 23:00) periods only. As a consequence the assessment has been undertaken for the evening period when the measured background noise levels are at their lowest.