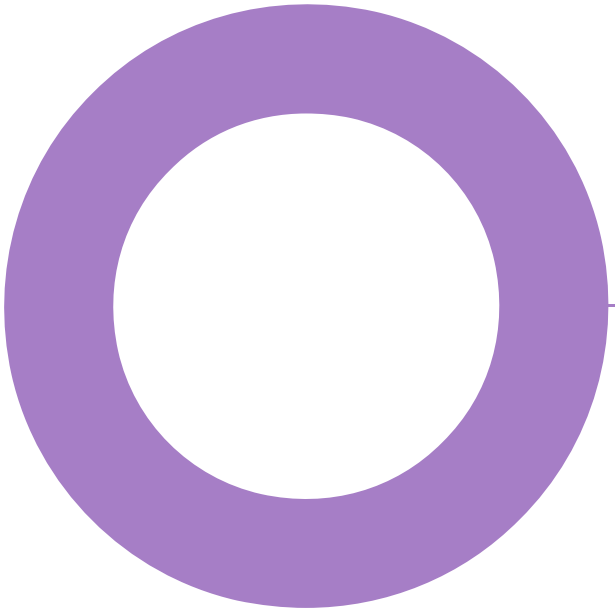
HOARE LEA

Merchant Place and Cory's Building. Cardiff. Expedite.

ACOUSTICS
NOISE ASSESSMENT REPORT

REVISION 01 – 07 JULY 2022



Audit sheet.

Rev.	Date	Description of change / purpose of issue	Prepared	Reviewed	Authorised
00	06/07/2022	Draft issue	JH	AS	JB
01	07/07/2022	Minor corrections following DWD review	AS	JB	JB

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Contents.

Executive summary.

This report has been compiled by Hoare Lea LLP to provide a noise assessment to accompany the planning application for new teaching accommodation for Cardiff Sixth Form College.

The existing Merchant Place and Cory's Building are to be refurbished and an extension is to be built.

An acoustic survey has been carried out in the area to quantify the existing general sound climate at nearby sensitive receptors and on the proposed development facades.

External building services plant is the only noise source considered capable of generating meaningful levels of noise liable to adversely impacting on nearby sensitive receptors. Noise limits for plant have been derived based on the results of the acoustic survey and Local Authority requirements. An indicative assessment of the development proposals has been carried out; complying with the relevant noise limits is considered achievable through appropriate design.

Noise levels incident on the proposed development facades have been predicted and the acoustic performance requirements for facades have been specified. These are high, which is expected given the location of the proposed development with respect to surrounding roads. Nevertheless, they are manageable and achievable through 'off the shelf' products.

Therefore, the proposed development is considered to be suitable acoustically, provided the necessary provisions highlighted in this report are adopted.

1. Introduction

Hoare Lea has been appointed by Expedite to carry out a noise assessment for a development situated between Bute Street and Docks Lane (hereafter referred to as the "proposed development").

The proposed development is to be a new teaching accommodation for Cardiff Sixth Form College. The noise from operation of the proposed development on nearby noise sensitive receptors has been considered, as well as noise impacts on occupants of the proposed development from existing sources of noise.

For the proposed development, existing buildings are to be refurbished and repurposed. An extension is also to be constructed.

The following are contained in this report:

- A description of the site and proposed development, from an acoustics perspective.
- A summary of the policy and guidance documents informing the assessment.
- The results of an acoustic survey carried out on site to quantify the general sound climate in the area.
- Assessments of noise from the proposed development on nearby noise sensitive receptors.
- An assessment of the noise levels incident on the proposed development and a summary of the likely necessary provisions to protect against adverse noise impacts.

This assessment serves to be submitted to the Local Planning Authority to accompany the planning application for the proposed development.

2. Site description.

2.1 The proposed development.

The proposed development is to comprise:

- Classrooms
- Study rooms
- Entrance lobby
- Café
- Homework Hub
- A Winter Garden
- Plantrooms
- Cycle storage
- Supplies room
- Admissions room
- Art room
- Reception
- Toilets
- Circulation spaces
- Bin store
- Canteen
- Kitchen
- Servery
- Offices
- Meeting rooms
- Changing rooms
- Fridge/freezers
- Pastoral hub

- 150 seat auditorium
- Exhibition space
- Atrium

The existing Merchant Place and Cory's Building are to be refurbished and an extension is to be built. Figure 1 below is a visual depiction of the proposed development in operation.

Figure 1: The proposed development

The only source of operational noise generated by the proposed development warranting assessment is external fixed building services plant noise.

The teaching spaces are notably noise sensitive and so the predicted noise impacts of noise from existing surrounding sources on occupants of these areas have been assessed. The noise impacts on any other internal uses would be lower.

2.2 Site context.

Figure 2 below shows the proposed development site in the context of the surrounding area, including the nearest noise sensitive receptors.

The nearest noise sensitive receptors are a nursery to the north and apartments to the south. Although currently not understood to contain any residences, it is possible that residential accommodation could be located above commercial uses to the west - on the opposite side of Bute Street. Therefore, these receptors are assessed accordingly.

Located between James Street, Bute Street and Lloyd George Avenue the prevailing sound climate is dominated by road traffic along these roads. Maximum events were mainly the result of emergency services vehicles and passing vehicles.

A substation building is located to the east of the site. However, the substation was not observed to contribute to the general sound climate in the presence of road traffic noise.

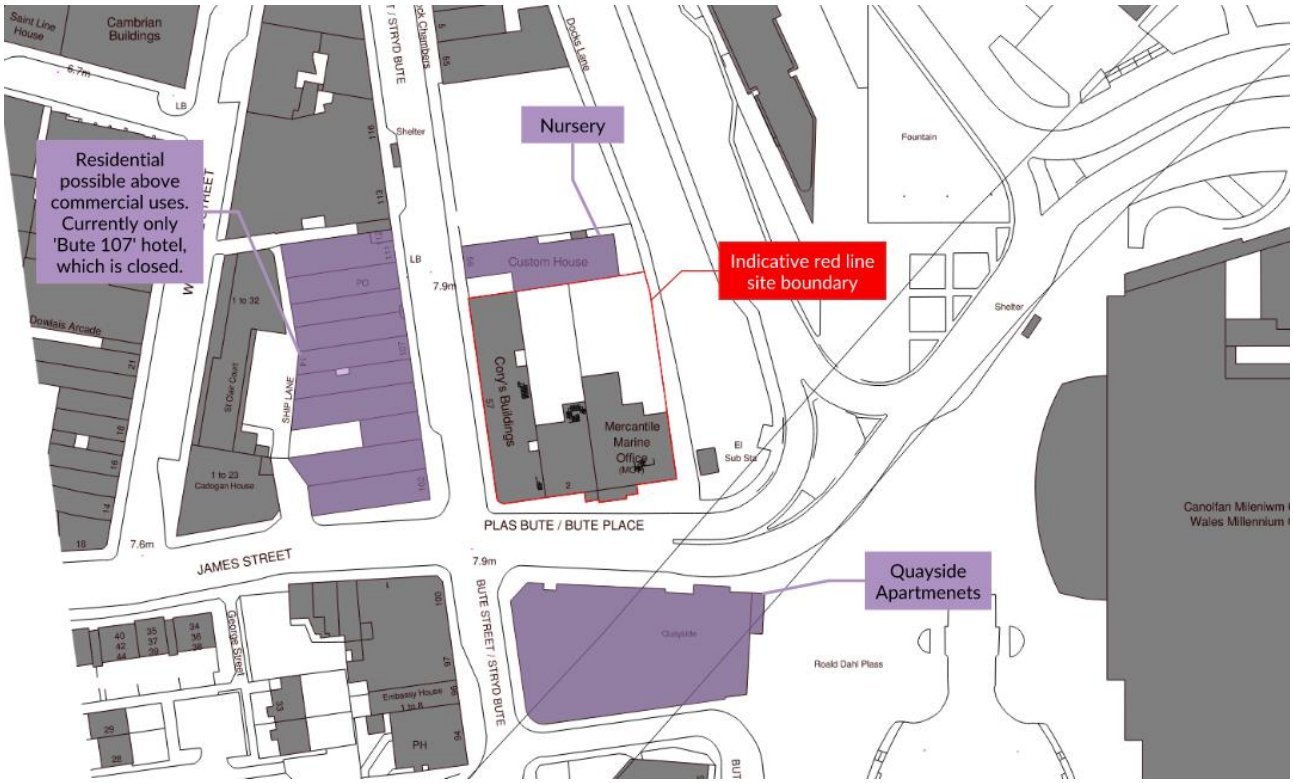

Figure 2: Site context

3. Policy and Guidance

3.1 National Policy

3.1.1 Planning Policy Wales (PPW) Edition 11 2021

Planning policy Wales (PPW) includes several sections related to noise generating developments and their proximity to sensitive receptors.

Paragraph 6.7.6

In proposing new development, planning authorities and developers must, therefore:

• address any implication arising as a result of its association with, or location within, air quality management areas, noise action planning priority areas or areas where there are sensitive receptors;

• not create areas of poor air quality or inappropriate soundscape; and

• seek to incorporate measures which reduce overall exposure to air and noise pollution and create appropriate soundscapes.

Paragraph 6.7.7

To assist decision making it will be important that the most appropriate level of information is provided and it may be necessary for a technical air quality and noise assessment to be undertaken by a suitably qualified and competent person on behalf of the developer.

3.1.2 Technical Advice Note 11: Noise (1997)

Technical Advice Note 11: Noise elaborates on the above regarding noise-sensitive development:

Noise generating development

Paragraph 8

"Local planning authorities must ensure that noise generating development does not cause an unacceptable degree of disturbance. They should also bear in mind that if subsequent intensification or change of use results in greater intrusion, consideration should be given to the use of appropriate conditions."

Paragraph 9

"Noise characteristics and levels can vary substantially according to their source and the type of activity involved. In the case of industrial development, for example, the character of the noise should be taken into account as well as its level. Sudden impulses, irregular noise or noise which contains a distinguishable continuous tone will require special consideration. In addition to noise from aircraft landing and taking off, noise from aerodromes is likely to result from engine testing as well as ground movements. The impact of noise from sport, recreation and entertainment will depend to a large extent on frequency of use and the design of facilities..."

Noise-sensitive development

Paragraph 10

"Local planning authorities should consider whether proposals for new noise-sensitive development would be incompatible with existing activities, taking into account the likely level of noise exposure at the time of the application and any increase that may reasonably be expected in the foreseeable future. Such development should not normally be permitted in areas which are, or are expected to become, subject to unacceptably high levels of noise and should not normally be permitted where high levels of noise will continue throughout the night."

3.2 Local planning policy

3.2.1 Cardiff Local Development Plan 2006 - 2026

The Cardiff Local Development Plan 2006 – 2026 includes the following reference to noise generating developments:

EN13: AIR, NOISE, LIGHT POLLUTION AND LAND CONTAMINATION

Paragraph 5.181

"Noise can have a harmful impact on people's health and quality of life. Developments such as housing, schools and hospitals can be particularly sensitive to noise, as can areas of landscape, nature or built heritage importance. Where possible, new developments that are particularly noise-sensitive should be located 5 Detailed Policies 156 Cardiff Local Development Plan 2006 - 2026 Adopted Plan away from existing or proposed sources of significant noise. This assessment can be informed by information on noise complaints being collated by the Council as part of an on-going initiative to reduce noise nuisance."

Paragraph 5.182

"Major transport routes (road, rail and air) and some industrial and commercial activities can generate particularly high noise levels. There is specific guidance within TAN 11 that specifies Noise Exposure Categories that assists with proposed residential development near transport related noise."

3.3 Recognised Guidance.

British Standard 4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound.
BS 4142 provides guidance for assessing commercial operations and fixed building services plant noise. The British Standard provides an objective method for rating the significance of impact from industrial and commercial operations based on subtracting the pre-existing background sound level ($L_{A90,T}$) from the rating level ($L_{Ar,Tr}$).

The standard does not give a definitive method for determining the background sound level but instead, as a commentary, states that *"the objective is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during particular time periods"*.

Clause 8.1.4, which discusses the monitoring duration, states *"there is no "single" background sound level as this is a fluctuating parameter. However, the background sound level used for the assessment should be representative of the period being assessed."* As a note to this clause the following commentary is given on obtaining a representative backgrounds sound level:

"To obtain a representative background sound level a series of either sequential or disaggregated measurements ought to be carried out for the period(s) of interest, possibly on more than one occasion. A representative level ought to account for the range of background sound levels and ought not automatically to be assumed to be either the minimum or modal value."

The rating level is defined objectively as the specific source noise level in question (either measured or predicted) with graduated corrections for tonality (up to +6 dB), impulsivity (up to +9 dB), intermittency (+3 dB) and other sound characteristics (+3 dB) which may be determined either subjectively or objectively, if necessary.

The background sound level is subtracted from the rating level and the difference used to assess the impact of the specific noise source:

- A difference of around +10 dB is likely to be an indication of a significant adverse impact, depending on context;
- A difference of around +5 dB is likely to be an indication of an adverse impact, depending on context; and
- A difference of +0 dB or less is an indication of the specific sound source having a low impact, depending on the context.

Building Bulletin 93 (BB93).

The Department for Education published the latest version of BB93 in 2015, which denotes performance standards for the acoustic design of schools. Table 1 below is taken from BB93 and shows the upper limits for indoor ambient noise levels in terms of $L_{Aeq,30mins}$ during normal teaching hours.

Type of room	Room classification for the purpose of airborne sound insulation in Tables 3a and 3b		Upper limit for the indoor ambient noise level $L_{Aeq,30mins}$ dB	
	Activity noise (Source room)	Noise tolerance (Receiving room)	New build	Refurbish-ment
Nursery school rooms *Primary school:* classroom, class base, general teaching area, small group room *Secondary school:* classroom, general teaching area, seminar room, tutorial room, language laboratory	Average	Medium	35	40

Open plan: (See also section 1.8) Teaching area Resource/breakout area	Average	Medium	40	45
Primary music room	High	Medium	35	40
Secondary music classroom[1] Small and large practice/group room[1] Performance/recital room[1]	Very high	Low	35	40
Ensemble room [1] Recording studio[1]	Very high	Low	30	35
Control room - for recording[1] Control room - not for recording	High Average	Low Medium	35	40
Lecture room	Average	Medium	35	40
Teaching space intended specifically for students with special hearing and communication needs[2]	Average	Low	30	35
SEN calming room	High	Low	35	35
Study room (individual study, withdrawal, remedial work, teacher preparation)	Low	Medium	40	45
Libraries: Quiet study area Resource area	Low Average	Medium	40 40	45 45
Science laboratory	Average	Medium	40	45
Design and technology: Resistant materials, CADCAM area Electronics/control, textiles, food, graphics, design/resource area, ICT room, art	High Average	High Medium	40 40	45 45
Drama studio, assembly hall, multi-purpose hall (drama, PE, audio/visual presentations, assembly, occasional music)	High	Low	35	40
Atrium, circulation space not intended for teaching and learning	Average	Medium	45	50
Sports hall Dance studio	High	Medium	40	45

Gymnasium/Activity studio				
Swimming pool	High	High	50	55
Meeting room, Interviewing/counselling room, video conference room	Low	Medium	40	45
Dining room	High	High	45	50
Administration and ancillary spaces: Kitchen Office, medical room, staff room Corridor, stairwell, coats and locker area Changing area Toilet	High Low Average High Average	High Medium High High High	50 40 45 50 50	55 45 55 55 55

Table 1: BB93 indoor ambient noise level criteria

For the purposes of assessing site suitability and quantifying the viability of the proposed development acoustically, the assessment focusses on classrooms, which are the most onerous type of space contained in the proposed development, as classrooms are located on all facades.

BB93 also references L_{A01} criteria, stating the following:

"*In order to protect students from regular discrete noise events, eg, aircraft or trains, indoor ambient noise levels should not exceed 60 dB* $L_{A1, 30mins}$*. This is achieved by default for spaces with IANLs up to 40 dB* $L_{Aeq, 30min}$*, but requires assessment in spaces with higher IANL limits, eg, 45 and 50 dB.*"

4. Local Environmental Health Consultation.

Hoare lea has reached out to the Cardiff Council Environmental Health Team to confirm an agreed assessment approach. The relevant correspondence is summarised below.

Query:

"For plant, what rating level compared to the typical background level is required by Cardiff Council?"

Response:

"Typically, the start point is 10dB below which has been accepted through committee and inspectorate on a number of cases, in that view that if it can be achieved sustainably then it should be done so – however we equally must consider context in line with 4142 so if there are specifics as to why this cannot be achieved then the next default is achieving the lowest possible below background."

Query:

"For educational buildings is it acceptable to Cardiff Council to assess the internal levels against the requirements set out in BB93?

Response:

"We do not have specific oversight of educational spaces, it's something that has dropped off the edge whilst there is so much residential that needs focus. That said, my view is the BB93 is the most appropriate and any application received to that standard would be supported."

5. Acoustic survey.

An environmental acoustic survey has been conducted to characterise the prevailing sound climate across the site and at the nearest noise sensitive residential receptors. The survey locations were chosen to be representative of the worst affected façades of the proposed development and to quantify propagation of road traffic noise levels in the area.

The survey locations are shown in Figure 3 below.

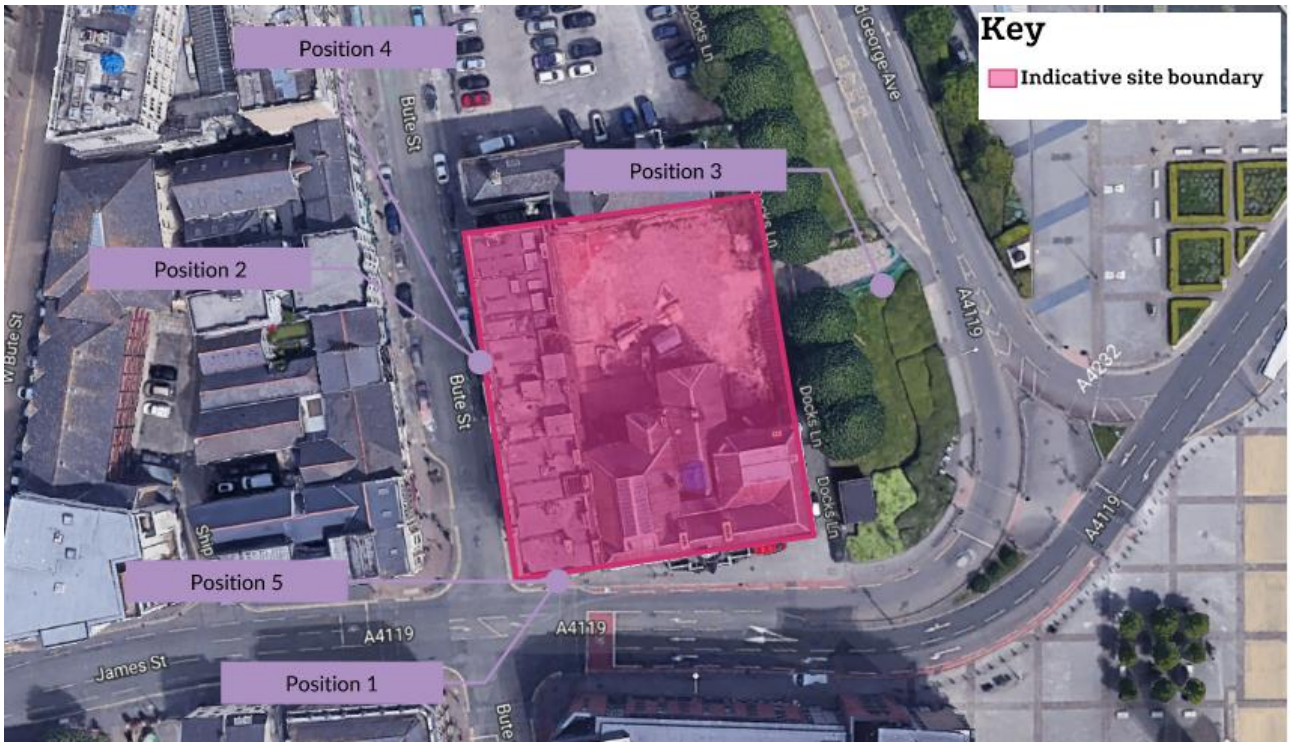

Figure 3: Acoustic survey measurement positions.

Unattended survey measurements were undertaken at Position 1 and Position 2 from Thursday 12th May 2022 to Thursday 19th May 2022. Attended survey measurements were undertaken at Position 3, Position 4 and Position 5 on Thursday 12th May 2022 and Thursday 19th May 2022.

The purpose of measuring at Position 1 was to quantify road traffic noise levels incident at the worst-case proposed development buildings closest to James Street. The measurements at Position 1 included continuous 15-minute duration samples of broadband A-weighted ambient sound levels ($L_{Aeq,15\ min}$), maximum sound levels ($L_{Amax(fast),15\ min}$), and background sound levels ($L_{A90,15\ min}$). The measurements also recorded instantaneous sound pressure levels from which $L_{Aeq,30\ min}$ values have been derived. Measurements were made at one-third octave band resolution.

The purpose of measuring at Position 2 was to quantify road traffic noise levels incident at the worst-case proposed development buildings closest to the Bute Street. The measurements at Position 2 included continuous 15-minute duration samples of broadband A-weighted ambient sound levels ($L_{Aeq,15\ min}$), maximum sound levels ($L_{Amax(fast),15\ min}$), and background sound levels ($L_{A90,15\ min}$). The measurements also recorded instantaneous sound pressure levels from which $L_{Aeq,30\ min}$ values have been derived. Measurements were made at one-third octave band resolution.

The purpose of measuring at Position 3 was to quantify levels of road traffic noise along the facades of the proposed development facing Lloyd George Avenue. The Calculation of Road Traffic Noise shortened measurement procedure was used to assess the road traffic noise at these positions.

Short duration measurements were undertaken at Position 4 and 5 to quantify road traffic noise levels at ground level. The measurements included continuous one-minute duration samples of broadband A-weighted ambient sound levels ($L_{Aeq,1min}$) and maximum sound levels ($L_{Amax(fast),1min}$). Measurements were in one-third octave band resolution. Measurements were simultaneously made with the logging sound level meters running.

Measurements at Position 1 and 2 were taken at 4 meters above ground level out of the windows of the existing buildings within the site boundary. Measurements at Position 3,4 and 5 were taken at 1.5m above ground level.

Weather conditions were not measured on site but were monitored remotely and were dry and fair throughout.

The survey equipment was field calibrated immediately before and immediately after the measurement period; no significant drift in level was found to have occurred. The measurement instrumentation used is listed in Appendix A.

5.1 Results

5.2 Unattended Measurements

The below figures and tables summarise the relevant measurements made at the unattended measurement locations (Position 1 and Position 2). The ranges of values shown in the tables below exclude the atypical contributions of sirens (visible as peaks in the time history graphs shown below), as designing the proposed development facades based on these infrequent short-lived events that are contextually accepted is not considered appropriate.

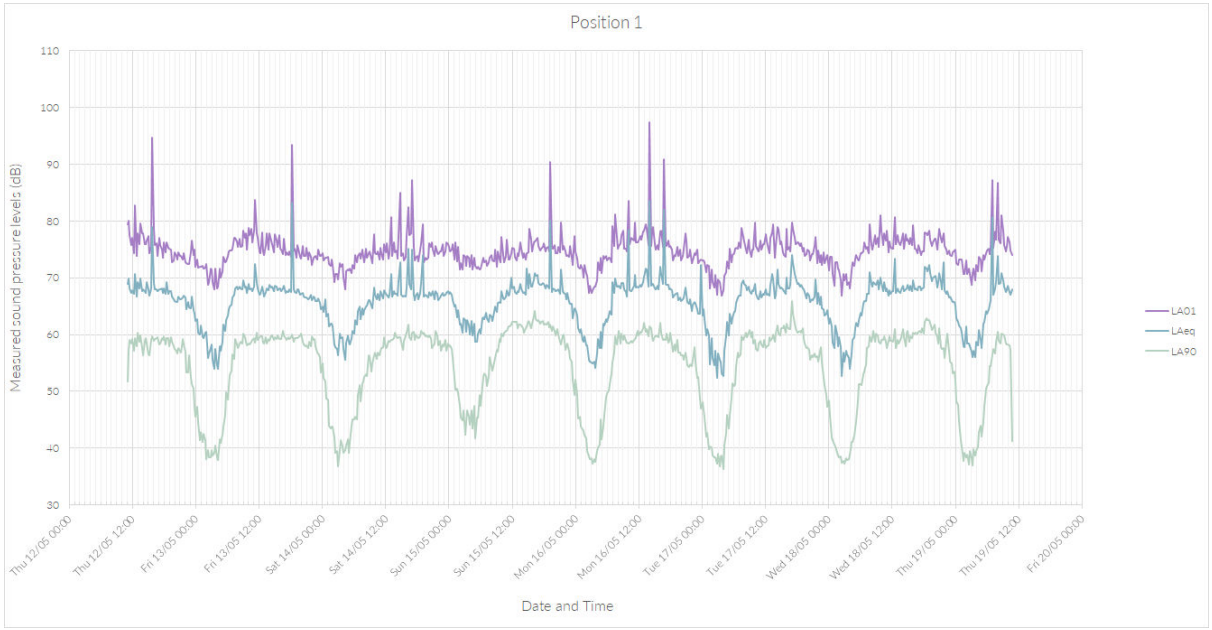

Figure 4: Survey time history chart (Position 1)

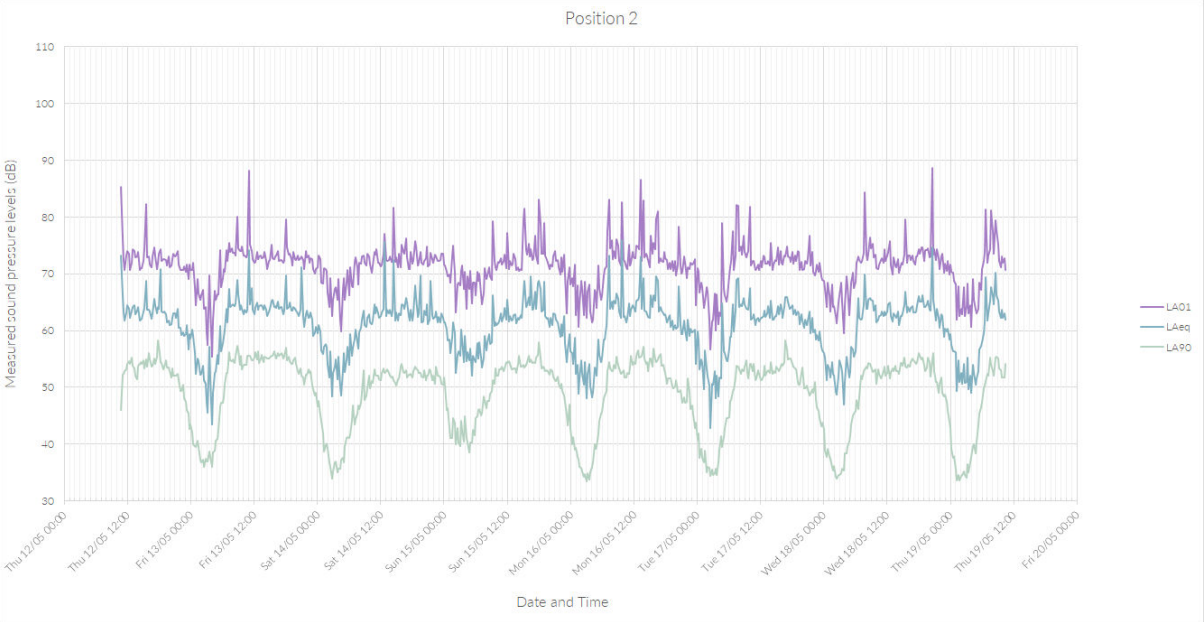

Figure 5: Survey time history chart (Position 2)

Date	$L_{Aeq,30\ min}$ range	$L_{A10,15}$ range
Thursday 12th May 2022	67 dB – 76 dB	74 dB – 95 dB
Friday 13th May 2022	67 dB – 80 dB	74 dB – 84 dB
Saturday 14th May 2022	65 dB – 75 dB	73 dB – 87 dB
Sunday 15th May 2022	63 dB – 70 dB	72 dB – 79 dB
Monday 16th May 2022	67 dB – 81 dB	75 dB – 97 dB
Tuesday 17th May 2022	66 dB – 73 dB	74 dB – 80 dB
Wednesday 18th May 2022	68 dB – 71 dB	74 dB – 81 dB
Thursday 19th May 2022	67 dB – 72 dB	74 dB – 87 dB

Table 2: Summary of noise levels measured at unattended survey Position 1.

Date	$L_{Aeq,30\ min}$ range	$L_{A10,15}$ range
Thursday 12th May 2022	62 dB – 69 dB	71 dB – 82 dB
Friday 13th May 2022	63 dB – 72 dB	71 dB – 88 dB
Saturday 14th May 2022	60 dB – 73 dB	70 dB – 82 dB
Sunday 15th May 2022	57 dB – 68 dB	69 dB – 83 dB
Monday 16th May 2022	62 dB – 73 dB	71 dB - 87 dB
Tuesday 17th May 2022	62 dB – 66 dB	71 dB – 82 dB
Wednesday 18th May 2022	62 dB – 66 dB	70 dB – 80 dB

Date	$L_{Aeq,30\ min}$ range	$L_{A10,15}$ range
Thursday 19th May 2022	62 dB – 69 dB	71 dB – 80 dB

Table 3: Summary of noise levels measured at unattended survey Position 2.

5.2.1 Background sound levels.

The following is stated in BS 4142:

"In using the background sound level in the method for rating and assessing industrial and commercial sound it is important to ensure that values are reliable and suitably represent both the particular circumstances and periods of interest. For this purpose, the objective is not simply to ascertain a lowest measured background sound level, but rather to quantify what is typical during particular time periods… "

To "quantify what is typical during particular time periods", a statistical analysis of the measured background sound levels has been undertaken.

The periods of interest for this development are daytime and night-time. Daytime is taken as between the hours of 07:00 and 23:00. Night-time is taken as between the hours of 23:00 and 07:00.

In place of using a 1-hour reference time interval for daytime periods recommended in BS 4142, a 15-minute sample has been used instead. As the metric used to determine background levels is a percentile of level exceeded, using a shorter reference period is a conservative approach.

The below figures show the range of background sound levels for the daytime and night-time periods measured at Position 1 and Position 2 respectively, as well as the number of measurements made of each integer value as a percentage (i,e. proportion) of the total number of readings at that location.

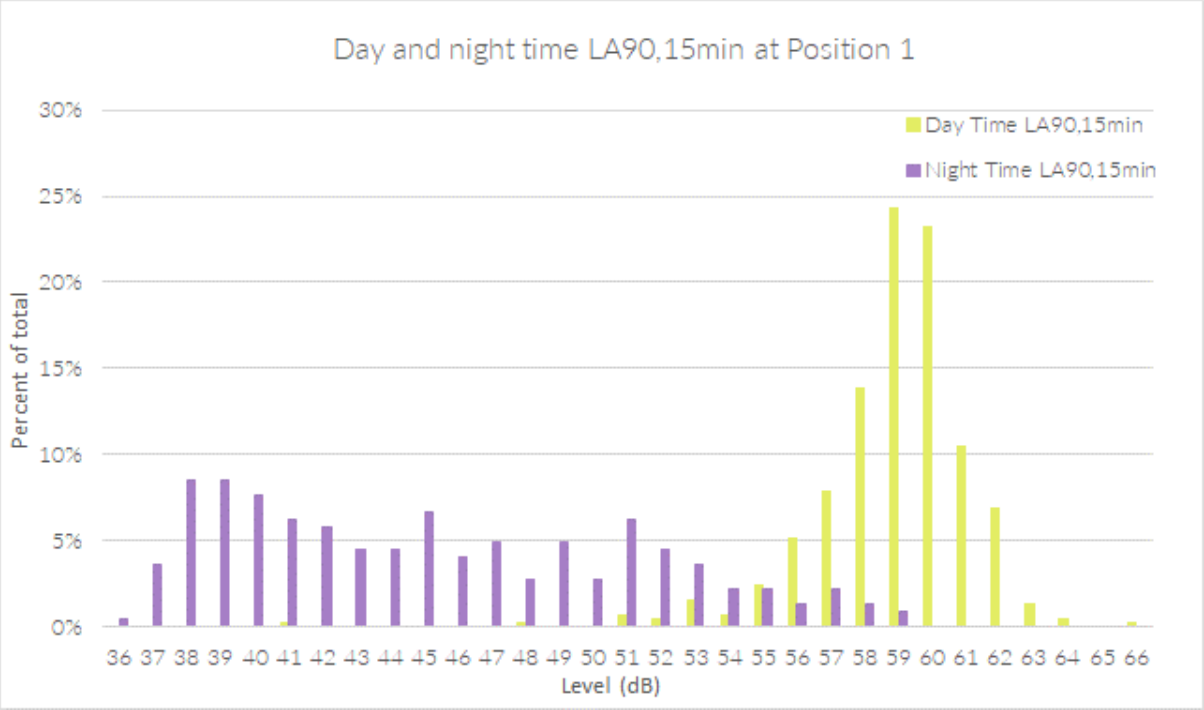

Figure 6: Measured background sound levels (Position 1).

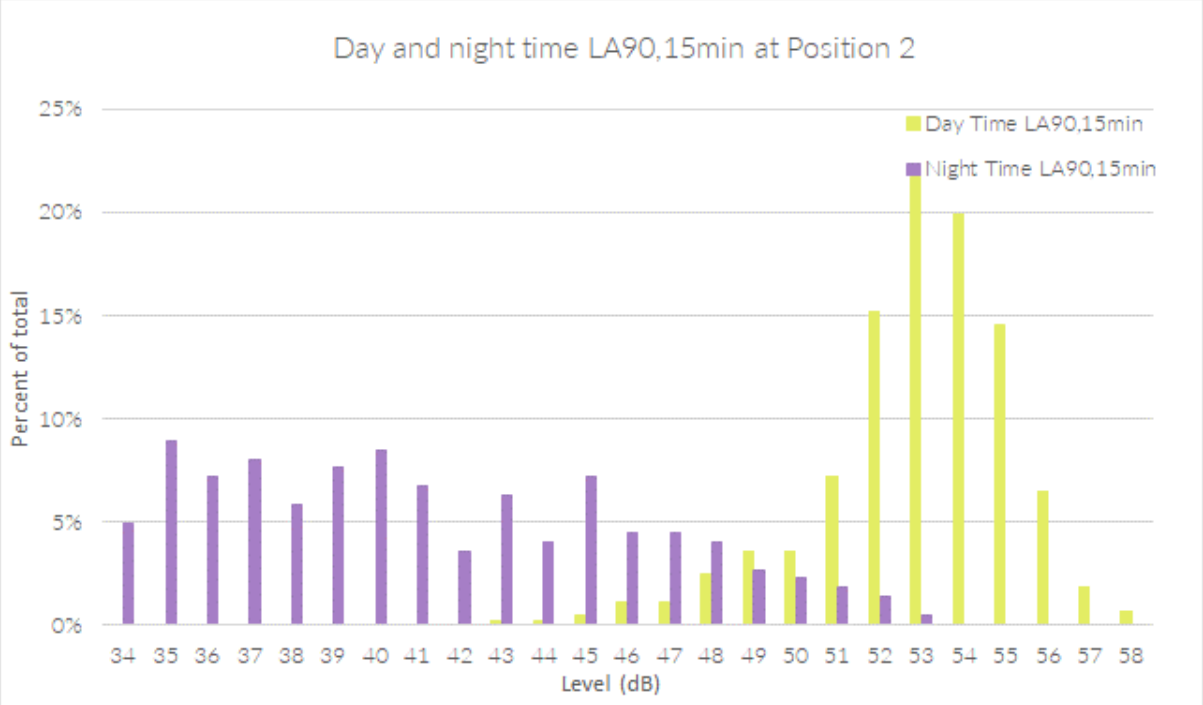

Figure 7: Measured background sound levels (Position 2).

Based on the values shown in Figure 5 and Figure 6, typical lowest background sound levels have been derived in the table below.

Receptors	Typical lowest background sound level	
	Daytime (07:00 – 23:00)	Night-time (23:00 – 07:00)
Position 1	$L_{A90,15min}$ 57 dB	$L_{A90,15min}$ 39 dB
Position 2	$L_{A90,15min}$ 52 dB	$L_{A90,15min}$ 36 dB

Table 4: Typical lowest background levels at Position 1 and Position 2.

6. Plant noise assessment.

6.1 Plant noise limits.

Table 5 shows the noise limits for building services plant noise. These limits are:

- Applicable to the facades of the nearest sensitive locations shown in Figure 2.
- Applicable to the total noise from all plant operating concurrently. Therefore, the noise contributions of individual plant require consideration separately to facilitate compliance with the total limits.
- Rating levels as defined in BS 4142, meaning that they should include for any warranted character corrections, such as tonality.
- Derived based on the typical background sound levels summarised in Section 5 and Cardiff Council requirements summarised in Section 4.

Location	Daytime noise limit, dB $L_{Ar,Tr}$	Night-time noise limit, dB $L_{Ar,Tr}$
Quayside apartments	47	29
Future residential receptors above commercial uses (on opposite side of Bute Street) and Nursery to the north	42	26

Table 5: Plant noise limits

6.2 High level assessment.

Ultimately, the proposed development is to be designed to achieve the plant noise limits in Table 5. Nevertheless, a high-level assessment has been carried out to provide an indication of the likely measures necessary to facilitate compliance with these limits.

There are various plant rooms located on the ground floor of the proposed development. These are to be fully enclosed. However, they will require ventilation. Therefore, upon confirmation of finalised plant selections, the mitigation measures (i.e. acoustic louvres, attenuators or splitters on the back of louvres) necessary to facilitate compliance with the limits in Table 5 will require design.

Fixed building services plant are to be contained on the roof of the proposed development extension. Based on the proposed layouts, and the limits in Table 5, a provisional maximum sound power level of 75 dB L_w from the roof plant is expected to facilitate compliance with the limits in Table 5. This single level represents the total sound power level of all plant summed, based on a noise model compiled in the software CadnaA, assuming sound propagates in accordance with the guidance contained in international standard ISO 9613-2. Therefore, individual plant will need to be selected so that the total sum of all sound power levels does not exceed this level. This level allows for night-time operation. Therefore, if plant is to only operate during daytime hours, this limit could be increased to 91 dB L_w. Figure 6 below shows a snapshot of the acoustic model.

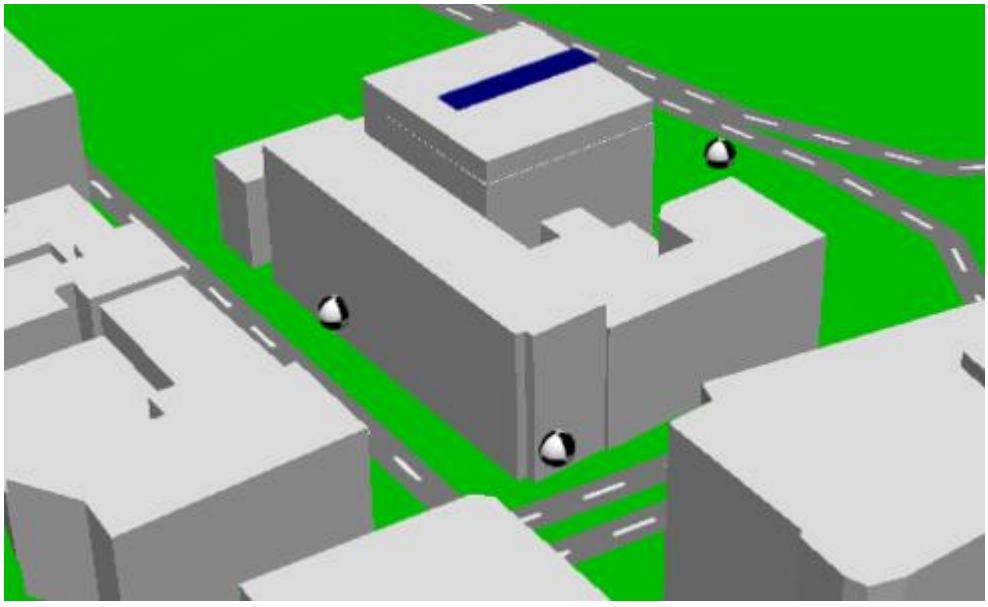

Table 6: Picture of acoustic model geometry

7. Noise levels on proposed development.

Based on the results on the acoustic survey, a CadnaA noise model has been calibrated to predict the noise levels incident on the proposed development facades. As noise levels in the area were observed to be

dominated by road traffic, the noise model assumes sound propagates in accordance with Calculation of Road Traffic Noise (Department for Transport Welsh Office, 1988).

Figures 7 and 8 below show the predicted noise levels incident on the proposed development facades during operational hours (assumed to be between 08:00 and 18:00).

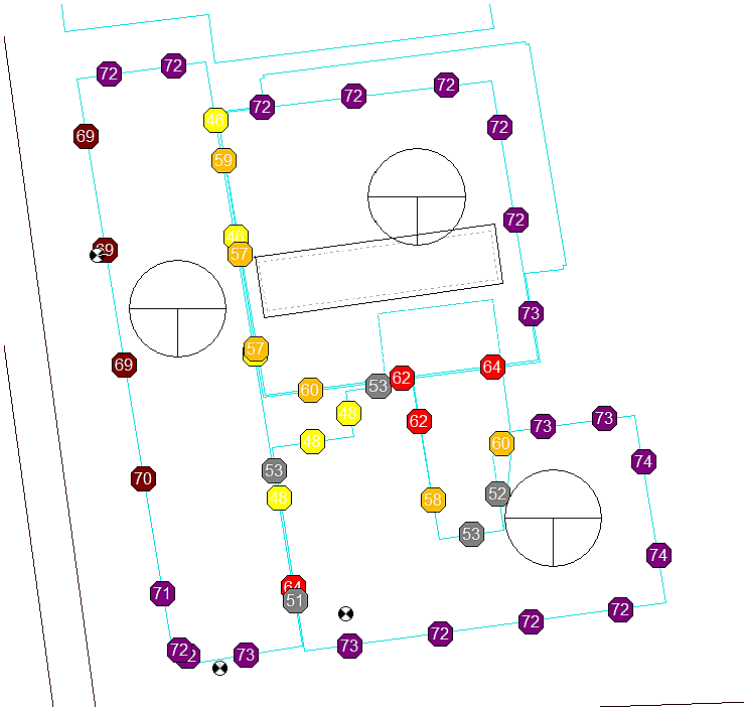

Figure 8: Predicted $L_{Aeq,\ 30min}$ values (in dB) incident on proposed development facades

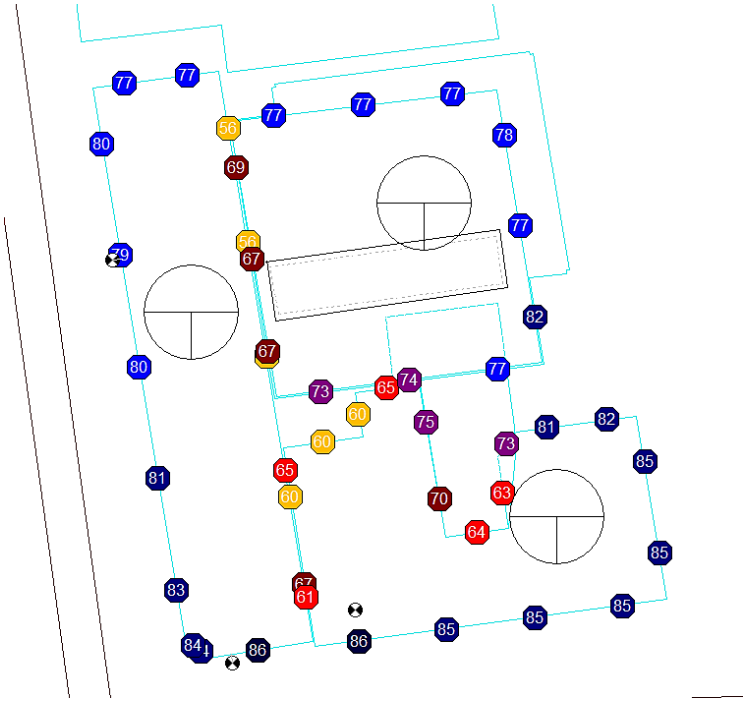

Figure 9: Predicted $L_{A01,\ 15min}$ values (in dB) incident on proposed development facades

For the facades of both the existing buildings and proposed extension, the glazed elements will be the weakest path acoustically. During detail design, the other aspects of the façade will warrant review. Nevertheless, indicative advice for glazing is provided below, to contextualise the acoustic performance requirements of the proposed development facades.

Based on the highest results shown in Figures 8 & 9, the indoor ambient noise criteria (and L_{A01} criteria) for classrooms, reverberation times being in accordance with BB93 criteria, the dimensions of classrooms, and the proportions of the facades comprising glazed elements (a relevant example of which is shown below in Figure 10), the most onerous glazed elements of the proposed development facades would be required to achieve R_w 42 dB. Some facades may facilitate suitable internal noise levels with lower acoustic performance requirements, particularly where internal uses are less noise sensitive. Nevertheless, a considerable portion of the proposed development facades will be required to meet this acoustic standard. Therefore, given that an open window would compromise the acoustic performance of a façade, the ventilation strategy and strategy for management of overheating should be designed based on windows closed. Nevertheless, this does not mean that occupants should not be given the option to open windows.

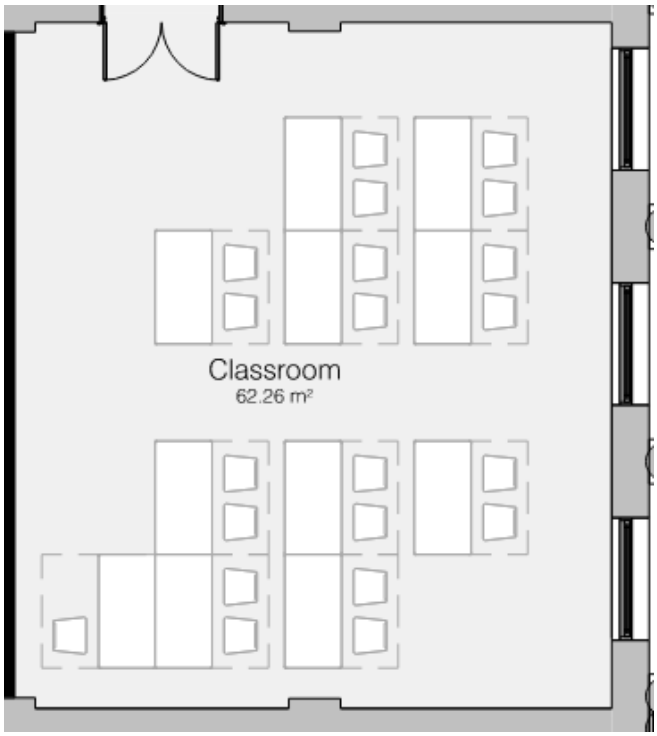

Figure 10: Classroom dimensions

8. Conclusion.

Hoare Lea has carried out an acoustic assessment of a proposed Sixth Form Hub development in Cardiff (the proposed development).

Noise limits have been derived for fixed building services plant serving operation of the proposed development. A high-level assessment of the viability of achieving these limits has been carried out and shown to be achievable through standard means.

Noise levels incident on the proposed development façade have been predicted and the likely measures to facilitate suitable internal noise levels have been specified. As the proposed development is located close to fairly busy roads, high performance acoustic glazing is required.

Whilst both the plant noise and noise incident on the proposed development facades will require more attention during the detailed design of the proposed development, the indicative assessments carried out show that the current proposed development can be suitable acoustically, provided the design measures specified are implemented.

This assessment is informed by the results of an acoustic survey carried out in the area.

Appendix A: Acoustic survey equipment.

- Rion microphone: UC-59 (serial number 07371)
- Rion pre-amplifier: NH-25 (serial number 43577)
- Rion sound: NL-52 (serial number 01143560)
- Rion microphone: UC-59 (serial number 10623)
- Rion pre-amplifier: NH-25 (serial number 65307)
- Rion sound: NL-52 (serial number 01265405)
- Brüel and Kjær - Microphone: 4189 (serial number 3196389)
- Brüel and Kjær - Pre-amplifier: ZC 0032 (serial number 29117)
- Brüel and Kjær - Sound Level Meter: 2250 (serial number 3003702)
- Brüel and Kjær - Sound Calibrator: 4231 (serial number 3014189)

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