

Kildare County Library

Acoustics Design Statement

Kildare County Council

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Quality information

Prepared by	Checked by	Verified by	Approved by
Georgia Zepidou, MSc MIOA Principal Acoustics Consultant	Jon Casey, BSc(Hons) MIOA Principal Acoustic Engineer	Jon Casey BSc(Hons) MIOA Principal Acoustic Engineer	Yuyou Liu Regional Director, Acoustics

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Prepared for:

Kildare County Council

Prepared by:

Georgia Zepidou, MSc MIOA
Principal Acoustics Consultant
E: georgia.zepidou@aecom.com

AECOM Limited
Sunley House
4 Bedford Park, Surrey
Croydon CRO 2AP
United Kingdom

T: +44 20 8639 3500
aecom.com

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1. Introduction

AECOM Acoustics have been commissioned by Kildare County Council (KCC) to provide acoustics support for the Kildare County Library (KCL) in Newbridge and, as part of the planning application for the development, prepare an acoustics statement to address the following comment by KCC:

“The site is located adjacent to the R445 and R416 Regional Roads and these are designated “Major Roads” as defined under the European Communities Environmental Noise Regulations 2018, S.I. No. 549 / 2018. The applicant is requested to submit an Acoustic Design Statement by a suitably qualified acoustic specialist assessing on-site noise exposure levels having reference to the Kildare County Council Third Noise Action Plan 2019 - 2023 L_{den} threshold of 70 dB (A). This Acoustic Design Statement is also to have reference to the British Standards BS 8233:2014 in achieving internal ambient noise levels in a non-domestic building having consideration to the building envelope”

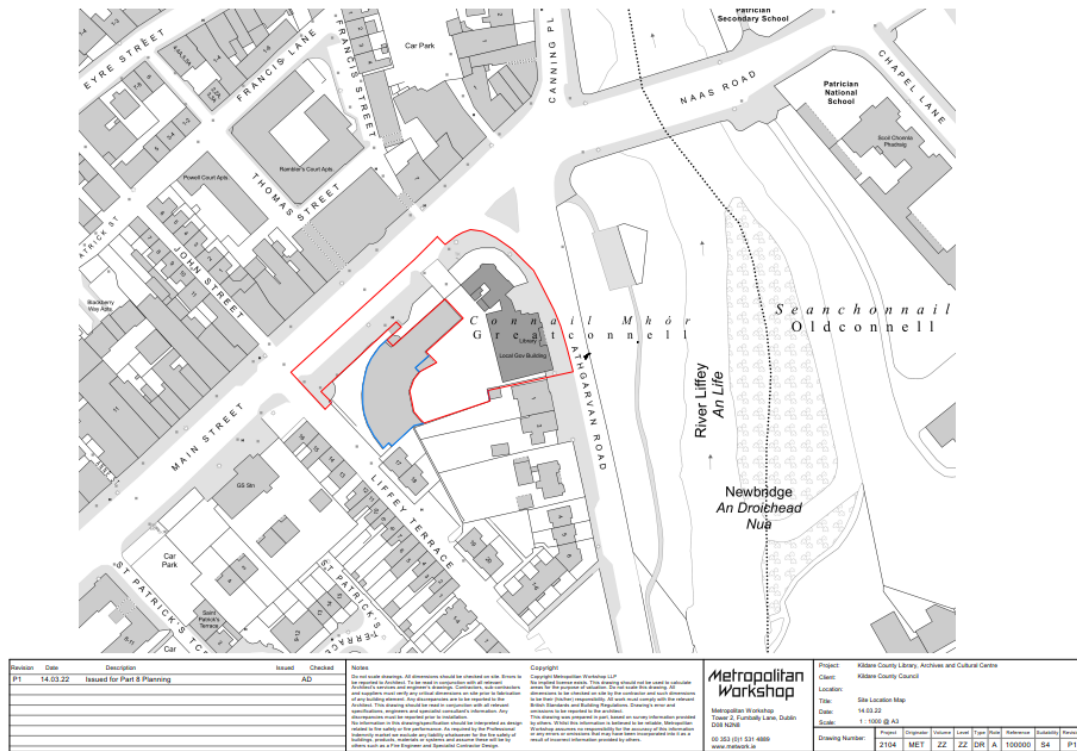
The following sections set out the proposed acoustic performance criteria in terms of internal ambient noise levels for the proposed development and the acoustic measures to achieve these based on current levels of noise incident upon the proposed development facades.

A glossary of acoustic terminology is included at the end of this report in Appendix A.

2. Site Description

The proposed development is located in Newbridge, Kildare Country. Main traffic routes surrounding the site are regional roads R445 (Main Street) and R416 (Athgarvan Road) which are designated ‘Major Roads’ as defined under the European Communities Environmental Noise Regulations 2018, S.I. No. 549 / 2018. These are located to the north-west and east side of the development respectively; see Figure 2-1.

Figure 2-1 Site location



Development proposals include the demolition of an existing 1970’s extension to the existing Newbridge Library which is a protected structure, with refurbishment of the existing protected structure and a new build extension to

provide a new Kildare County library, cultural centre and archives. The proposed structure will range from one to three storeys in height with a floor area of 2,320 m².

3. Noise Guidance and Acoustic Design Criteria

3.1 Kildare County Council Third Noise Action Plan 2019-2023

The Kildare County Council Third Noise Action Plan 2019-2023¹ has been developed by Kildare County Council in place of the revoked Environmental Noise Regulations 2006, S.I. No. 140 / 2006. This plan aims to provide an overview of the requirements of the Regulations, to review the results of the strategic noise mapping completed in 2017 within County Kildare and to set out an approach to the strategic management and control of environmental noise over the next five years.

The Regulations set out a requirement for the assessment of noise impact through the use of strategic noise maps. In Kildare, for “Major Roads”, revised Strategic Noise Maps for national roads were completed in 2017 by the Transport Infrastructure Ireland (TII). Revised Strategic Noise Maps for non-national roads were completed by Kildare County Council / TII and for “Major Railways” by the Iarnród Éireann (Irish Rail) in 2017. The results have been presented as maps and summary tables of statistics showing the estimated area, number of dwellings and people exposed to noise from “Major Roads” and “Major Railways” within the area covered by the noise mapping.

The Noise Action Plan 2019 - 2023 primarily considers the longterm environmental noise impact from “Major Road” and “Major Rail” traffic noise sources and proposes noise levels thresholds for this assessment of 70 dB (A) L_{den} , and 57 dB (A) L_{night} for both “Major Roads” and “Major Railways” set in accordance with the Environmental Protection Agency (EPA) “Guidance Note for Noise Action Planning, July 2009”.

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

BS 8233:2014 ‘Guidance on Sound Insulation and Noise Reductions for Buildings’² provides guidance on internal and external noise levels for various uses including dwellings and commercial properties. The standard provides criteria and guidance on the design of non-domestic buildings and recommends typical internal ambient noise levels that should be achieved.

Those of relevance to the proposed Kildare County Library are reproduced below in Table 1.

Table 1. BS 8233 internal ambient noise level limits (guideline values)

Proposed Room/Area in new Library	BS 8233 Classification	Upper limit for indoor ambient noise level $L_{Aeq,T}$ (dB)
Children Library, Teen Library, Adult Library	Library	50
Multipurpose Room	Training Room	45
Community Meeting Room	Meeting Room	45
Remote Working	Meeting Room/Training Room	45
Local Studies Reading Room, Archive Reading Room	Meeting Room/Training Room	45
Local Studies Office, Processing Room, Consultation Room, Archive Office	Meeting Room/Training Room	45
Corridor, Circulation	Corridor, Circulation	55

¹ Kildare County Council Third Noise Action Plan 2019-2023, Kildare County Council (2019)

² BS 8233:2014 ‘Guidance on Sound Insulation and Noise Reductions for Buildings’, British Standards Institution, 2014

In order to meet the BS 8233 guideline values for each space, the building envelope must provide sufficient control of external noise intrusion so that it does not exceed the levels set out in Table 1.

BS 8233 also provides guidance on the levels of noise generated by road traffic and provides noise levels for initial design purposes for three common situations, as per Table 2 below.

Table 2. Typical traffic noise levels measured approximately 1 m from the facade

Situation	dB $L_{Aeq,16h}$
At 20 m from the edge of a busy motorway carrying many heavy vehicles; average traffic speed 100 km/h; intervening ground turfed	78
At 20 m from the edge of a busy main road through a residential area; average traffic speed 50 km/h; intervening ground paved	68
On a residential road parallel to a busy main road and screened by the houses from the main road traffic; free flowing traffic	58

Source: BS 8233:2014 Table 1

The values given in Table 2 are for dry road surfaces.

4. External Noise Levels

The noise climate in the vicinity of the proposed KCL was established based on information contained within the 2017 Strategic Noise Mapping for 'Major Roads' included within Appendix C of the Kildare Council Third Noise Action Plan 2019-2023 document³.

A copy of the relevant mapping information is provided in Appendix B of this report.

According to the results of the 2017 noise mapping, the typical external noise incident upon the facades of KCL is below the noise level threshold of 70 dB (A) L_{den} for 'Major Roads'. The site of the the proposed Kildare County Library appears to be within the zone identified in the noise mapping identified as $L_{den} = 65 - 69$ dB. This is also consistent with the guidance from Table 1 of BS 8233 which suggests road traffic noise levels at a façade 20 m from a busy main road with a 50 kph speed limit would be 68 dB L_{Aeq} . Based on this and the proposed site layout and GA information provided by Metropolitan Workshop, existing and future facades of the proposed KCL building which face the R445 and R416 road are expected to be exposed to noise levels of 68 dB $L_{Aeq,16hour}$.

5. Assessment of External Noise Intrusion to Building

5.1 New building

Based on the predicted incident external noise levels presented in Section 4 and proposed design information provided by Metropolitan Workshop, the following minimum sound insulation performance for the glazed system is required to mitigate against external ambient noise and achieve the BS 8233 internal ambient noise levels given in Table 1 to satisfy the requirements of Kildare County Council. An example glazing configuration is also provided in Table 3.

Table 3. Glazed element sound reduction performance requirements

	Typical construction	Sound Reduction Index (dB) @ Octave Band Centre Frequency (Hz)							R_w (C_{tr}) dB
		63	125	250	500	1000	2000	4000	
Glazed elements	4mm float glass/ 12mm argon / 6mm flat glass	22	25	24	27	36	41	44	33 (-3)

³ Kildare County Council Third Noise Action Plan 2019-2023, Appendix C, Kildare County Council (2019)

The above minimum sound insulation requirements for the glazed elements are based on the use of a masonry (brick) cavity with SFS external wall and mechanical ventilation for year-round ventilation⁴.

Note that the glazing performance requirements apply to the whole window unit. Window performance is dependent on elements of the glazing unit including the frames, seals, wall interface, etc. Weak non-glass elements will require the use of higher performance glass units to maintain the required sound insulation.

It is our understanding that, based on proposed ventilation and overheating strategy, openable windows are proposed but do not form part of the year-round ventilation strategy and are only provided for use during summer overheating. During these times, internal noise levels within building areas that face the two regional roads to the north and east of the site, are expected to exceed the internal noise guideline values of BS 8233. The worst-case internal noise levels predicted when these windows are open are 55dB L_{Aeq} , which is 5-10 dB above the guideline values depending on the space).

The guidance in BS 8233 does not specifically consider ventilation and overheating and, as such, does not reflect recent trends in sustainable development and the need to balance the requirements of air quality, acoustics and energy consumption. However, more recent guidance published by the Association of Noise Consultants⁵ recognises the need to strike a balance between these often competing factors. This guidance recognises that periods where noise levels exceed the BS 8233 levels due to a requirement for increased ventilation to combat over-heating can be acceptable and that the likelihood of disturbance is related to the duration and frequency of these events, rather than the overall level.

Although the guidance is intended to relate to residential dwellings, the principles of balancing the requirements of acoustics, ventilation and overheating are equally applicable here. An analysis of the estimated predicted windowing opening durations in summer months has been carried out using an industry standard IWEC3 weather file, which is based on average climatic data from 1990-2020, as well as a typical hot year. This analysis shows that, with the exception of July (and August in a typical hot year), the windows are not estimated to be required to open for the majority of occupied hours in these summer months and in July they are estimated to be open for 55% of occupied hours based on the industry standard IWEC3 average climatic weather file.

Although the requirement to occasionally open windows during summertime overheating does impact the noise environment within the library, the chosen overheating mitigation strategy is understood to have the support of the library operator on the basis that it provides the best balance between acoustics, air quality and energy consumption/carbon emissions to achieve the project objectives (see ventilation and overheating strategy for further details).

5.2 Protected structure

It is understood that the design proposals are not expected to include significant work to the building envelope of the retained protected structure of Newbridge Library or changes to the existing natural ventilation strategy as retrofitting mechanical ventilation to the protected structure would not align with the conservation approach/strategy and as such not possible. However, modifications to the junction of Athgarvan Road and Main Street public realm with a proposed expansion of external space and increase of the distance between the protected building façade and traffic lanes mean there is likely to be a small decrease in the existing levels of external noise intrusion to the protected building (currently unknown) experienced by current users.

It is therefore considered that, provided that the client is satisfied that there are no current issues with the control of external noise intrusion to the building, is not an issue likely to require further consideration.

6. Conclusions

AECOM Acoustics were appointed to prepare an acoustics statement to support a planning application for the proposed KCL in Newbridge. The statement is also to address a comment from KCC in relation to external on-site noise exposure levels being below the as well as achieving relevant BS8233 internal ambient noise levels.

Noise levels at the façades of the proposed development have been established based on information contained within the 2017 Strategic Noise Mapping for 'Major Roads' included within Appendix C of the Kildare Council

⁴ Option 2 of the ventilation and overheating strategy within AECOM report, 'Energy and Sustainability Strategy, Kildare County Library, Newbridge, Co. Kildare' dated 30 September 2022.

⁵ Association of Noise Consultants, Acoustics Ventilation and Overheating – Residential Design Guide, January 2020

Third Noise Action Plan 2019-2023 document. These identified typical external noise below the noise level threshold of 70 dB (A) L_{den} for 'Major Roads' defined within the Action Plan.

Based on predicted external noise levels, outline sound insulation performance requirements for glazed elements were determined for the new building to meet the BS 8233 internal noise guideline values for the proposed library uses. Minimum sound insulation requirements assume the use of mechanical ventilation for year-round ventilation and masonry cavity external wall construction for the façade. Example configuration for glazing has also been provided in order to mitigate against external ambient noise and achieve BS 8233 internal ambient noise guideline values. With regards to the protected structure of the development, as the proposals do not include changes to the existing natural ventilation method or significant work to the building envelope, internal noise levels will remain unchanged.

During overheating conditions in summertime period, internal noise levels within spaces particularly towards the R445 and R416 regional roads are expected to occasionally exceed the BS 8233 guideline noise values as a result of windows being opened to mitigate overheating. Nevertheless, it is considered that in line with guidance on balancing the requirements of air quality, acoustics and energy consumption, these limited periods of exceedance of the BS 8233 are acceptable to the client and considered the most appropriate means of balancing these competing requirements to achieve the project objectives .

On this basis, the site is considered suitable for the intended use.

Appendix A Glossary of Acoustic Terminology

L_p	The instantaneous sound pressure level (L_p)
L_{pA} (or L_A)	The A-weighted instantaneous sound pressure level (L_{pAp} or L_A) This is the root mean square size of the pressure fluctuations in the air. This level can fluctuate wildly even for seemingly steady sounds. To make sound level meters easier to read the values on the display are smoothed or damped out. This is effectively done by taking a rolling average of the previous 0.125 s (FAST time constant) or the previous 1 s (SLOW time constant).
L_{AF} , L_{AS}	The letters F or S are added to the subscripts in the notation to indicate when the FAST or SLOW time constant has been used. These are often omitted but it is good practice to include them.
L_{max}	The maximum instantaneous sound pressure level (L_{max}),
L_{Amax}	The A-weighted maximum instantaneous sound pressure level (L_{Amax})
L_{AFmax}	The A-weighted maximum instantaneous sound pressure level with a FAST time constant (L_{AFmax}). This is the highest instantaneous sound pressure level reached during a measurement period. The opposite of the L_{max} is the minimum instantaneous sound pressure level or L_{min} etc.
L_{min} , L_{Fmin}	It is good practice to include the letter which identifies the time constant used as this can make a significant difference to the value.
$L_{N,T}$	The percentage exceedence sound pressure level ($L_{N,T}$),
$L_{AN,T}$, $L_{AFN,T}$	The A-weighted percentage exceedence sound pressure level ($L_{AN,T}$), the A-weighted percentage exceedence sound pressure level with a FAST time constant ($L_{AFN,T}$).
$N = \%$ age value, 0-100	This is the sound pressure level exceeded for $N\%$ of time period T . E.g. If an A-weighted level of x dB is exceeded for a total of 6 minutes within one hour, the level will have been above x dB for 10% of the measurement period. This is written as $L_{A10,1hr} = x$ dB.
$T =$ measurement time	L_{A0} (the level exceeded for 0 % of the time) is equivalent to the L_{Amax} and L_{A100} (the level exceeded for 100 % of the time) is equivalent to the L_{Amin} .
e.g. L_{A90} , L_{A10} , $L_{AF90, 5 min}$	It is good practice to include the letter which identifies the time constant used as this can make a significant difference to the value.
$L_{eq,T}$	The equivalent continuous sound pressure level over period T ($L_{eq,T}$),
$L_{Aeq,T}$	The A-weighted equivalent continuous sound pressure level over period T ($L_{Aeq,T}$).
$T =$ measurement time	This is effectively the average sound pressure level over a given period. As the decibel is a logarithmic quantity the L_{eq} is not a simple arithmetic mean value.
e.g. $L_{Aeq,5min}$	The L_{eq} is calculated from the raw sound pressure data. It is not appropriate to include a reference to the FAST and SLOW time constants in the notation
L_n	The normalised impact sound pressure level
(NB. different from L_N see above)	The value is a measure of the performance of a floor system and its ability to attenuate foot fall or impact noise under laboratory conditions. The L_n is the level of noise produced by a standard tapping machine measured in the room below the floor being tested. The <u>lower</u> the L_n the better the impact isolation achieved. L_n values are measured and quoted in third-octaves between 100 Hz and 3.15 kHz
L'_{nT}	The standardized impact sound pressure level The value is a measure of the performance of an in situ floor system and its ability to attenuate foot fall or impact noise. The value takes into account the quantity of acoustic absorption within the receiving room. The <u>lower</u> the L'_{nT} the better the impact isolation achieved. L'_{nT} values are quoted in third-octaves between 100 Hz and 3.15 kHz
$L'_{nT,w}$	The normalised weighted impact sound pressure level A single value of the L'_{nT} derived from the third octave values using the method described in BS EN ISO 717-2.
D	The level difference The difference between two measured sound pressure levels. In building acoustics this is usually the difference between the levels in two adjacent rooms measured to determine the sound insulation performance of the partition between them. In this context D values are usually quoted in third-octave bands between 100 and 3150 Hz.
R	The sound reduction index This a measure of the sound insulation performance a material or construction measured under laboratory conditions in accordance with BS EN ISO 140-3. R differs from D in that it takes account of the area of the construction under test as well as the absorption in the receiving room, both of these factors influence the measured D . Taking into account these factors allows the R for different constructions to be compared on a like for like basis. R values are quoted in third-octaves between 100 Hz and 3150 Hz
R_w	The weighted sound reduction index

	A single value of the R derived from the third octave values of R using the method described in BS EN ISO 717-1. Partitioning and building board manufacturers commonly use this index to describe the inherent sound insulation performance of their products.
D_{nT}	The standardised level difference There are occasions when neither D nor R are the most appropriate descriptors for in situ measurements. An alternative is the D_{nT} , which is D corrected to allow for the reverberation time within the receiving room. Measurements are made in accordance with BS EN ISO 140-4.
D_{nTw}	The weighted standardised level difference A single value of the D_{nT} derived from the third octave values using the method described in BS EN ISO 717-1.
Absorption Coefficient α	The ratio of the sound absorbed by a surface to the sound incident upon it. A value of 0 means that no sound is absorbed and a value of 1 means that all sound is absorbed. The sound absorption of a surface is frequency dependent so it is usual to quote values of α in octave or third-octave bands
Reverberation Time T T_{60}, T_{30}, T_{20} RT	The length of time in seconds it takes for the sound pressure level to decay by 60 dB in an enclosed space after the source has stopped. It is not always possible to measure a full 60 dB sound decay, so reverberation time is often measured by multiplying the times taken to decay by 20 dB or 30 dB to give the equivalent of 60 dB decay time (these are often called T_{20} and T_{30} values). The longer the reverberation time the more reverberant the space. Different types of spaces have different ideal reverberation times.
T_{mf}	The reverberation time is frequency dependant and is usually presented in octave or third-octave bands. On some occasions it is useful average the level in several frequency bands. The mid frequency reverberation time is the arithmetical average of the T_{60} values in the 500, 1000 and 2000 Hz octave bands.

Appendix B Ireland Strategic Noise Mapping Round 3 (2017) – Kildare County L_{den} (dB)

