CAHILL DESIGN CONSULTANTS
FIRE ENGINEERING | ACOUSTIC DESIGN

FOLKESTONE HARBOUR AND SEAFRONT
PLOTS F-1, F-2, G-1, G-2 & H, FOLKESTONE, KENT
CT20 1PS

NOISE IMPACT ASSESSMENT

CLIENT: FOLKESTONE HARBOUR & SEAFRONT DEVELOPMENT COMPANY

REVISION 1.4 – MAR-24

NOTICE

This document and its contents have been prepared for Folkestone Harbour & Seafront Development Company and are intended for their information only in relation to the proposed development Plot F-1, F-2, G-1, G-2 and H at Folkestone Seafront, Folkestone, Kent, CT20 1PS.

Cahill Design Consultants Limited will assumes no responsibility to any other party in respect of, or arising out of, this document or its contents.

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1.3	Roof Top Plant	NA	MS	MS	25/1/2024
1.4	Legal Review Comments	NA	MS	MS	21/3/2024

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1. EXECUTIVE SUMMARY

1.1 This report sets out the acoustic requirements for the proposed mixed-use developments at Plots F-1, F-2, G-1, G-2 and H of the Folkestone Seafront development project in Folkestone, Kent.

1.2 The requirements have been developed to ensure that the scheme will achieve modern acoustic design standards both in terms of the indoor conditions of the development and its impact on the environment.

1.3 This report is developed to be submitted as support documentation of the project's planning application.

1.4 As a minimum, the scheme shall comply with the following:

- BS 8233: 2014 – Guidance on sound insulation and noise reduction for buildings. Design proposals to achieve criterion as a minimum.
- Building Regulations Approved Document E (ADE): 2003 (amended 2004, 2010, 2013 and 2015) – Resistance to the passage of sound. In accordance with the Client's requirements, the development is to achieve at least a 5 dB enhancement for party walls and party floors compared with ADE 2003 requirements.
- Reverberation control will be in accordance with ADE 2003 where applicable. In accordance with the Client's requirements, apartment entrance doors will be enhanced in lieu of providing sound absorbent treatment to common residential circulation areas.
- Noise emissions from building services will be controlled to achieve acceptable levels of environmental noise in accordance BS 4142: 2014 + A1: 2019.
- Noise emissions from building services within the development shall be controlled to achieve levels commensurate with the quality expectations of this development. These are outlined within this document.

2. INTRODUCTION

2.1 This report identifies the acoustic considerations that need to be addressed in the design and construction works for F-1, F-2, G-1, G-2 and H of the Folkestone Harbour and Seafront Development in Folkestone, Kent.

2.2 This document shall be considered as the base specification of the acoustic performance requirements for the development. It is to be read in conjunction with the Employer's Requirements, specifications and all other design documentation.

2.3 The Contractor shall undertake all works in order to satisfy the specified performance criteria. No deviation from the specifications will be permitted without the Client's approval. Any, and all conflicts between the specifications herein and other project documents must be brought to the Client's attention at the earliest opportunity.

2.4 Additional requirements regarding the delivery of acoustic quality have also been set out along with a list of items which the Client will wish to review and approve, and finally, conditions for the scheme to be tested prior to handover.

2.5 A glossary of acoustics terms is included in Appendix A.

Overview

2.6 Proposals are in place to redevelop the Folkestone Seafront and Harbour into a mixed-use development. This report refers to Plots F, G and H of the scheme only.

2.1 Plots F, G and H consist of new-build residential buildings including retail/commercial spaces and an inside entertainment space (the Goods Yard), landscaping and external space.

2.2 There are broadly four acoustic design issues to be addressed as part of the development:

- Control of noise intrusion.
- Control of internal noise transfer.
- Control of reverberation.
- Building services noise emission to the environment and within the building.

Contractor's acoustic consultant

2.3 The Contractor shall employ the services of a suitably qualified and experienced Acoustic Consultant which shall review and advise on all aspects of the development required to ensure compliance with the acoustic provisions of the contract.

2.4 The Contractor's proposals, detailed design, and installation will each need to demonstrate that the acoustic requirements of this report are implemented. The Acoustic Consultant shall issue an acoustic design report demonstrating how the

Contractor's design complies with the requirements of this specification. This shall be submitted within a reasonable period to be agreed following contract commencement date in its original form, and shall be revised and re-submitted, as appropriate, documenting the design development.

2.5 The Acoustic Consultant shall also be required to attend site and undertake reviews of the construction progress, detailing and construction quality. Such inspections shall not absolve the Contractor, or their Acoustic Consultant of any responsibility detailed herein.

2.6 The Contractor shall advise of their intended Acoustic Consultant at the time of tender and shall include a CV of their preferred Acoustic Consultant clearly demonstrating their experience on this type of development. If the Contractor has not selected their consultant at the time of tender, they shall nominate three consultants and include associated CVs.

3. SITE DESCRIPTION

3.1 The proposed site location is currently used by the Folkestone Harbour and Seafront Development Company and includes the Harbour Arm Car Park. Plots F, G and H will cover the entire area of the Folkestone Harbour and also slightly extend into the beach area.

3.2 The proposed development is intended for the following use:

Plot F: Plot Building 1 consists of one to three bed apartments, one & two bed duplex apartments, two to four bed townhouses and commercial properties.

Plot F1 Building 2 consists of one and two bed apartments and commercial properties.

Plot F1 Building 3 consists of commercial units and one to three bed apartments on the 2nd to 5th floor.

Plot F1 Building 4 consists of one and two bed apartments and commercial properties.

Plot G: Plot G1 building 1 consists of four bed duplex apartments and two to three bed apartments from level 0 to 4 and commercial units on level 0.

PlotG1 Buildings 2 and 3 consists of two to three bed duplex apartments and commercial units on 0 and M (including the Good Yards), and two to three bed apartment and duplex apartments on level 1 to 7.

Plot G1 Building 4 consists of commercial units on 0, and two to three bed apartment and duplex apartments on level 1 to 4.

Plot G1 Building 5 consists of one and two bed apartments and duplexes and commercial units on levels 0 and 09.

Plot G1 Building 6 consists of commercial units on -01 to 01, and one to three bed apartments and duplex apartments on level 02 to 11. There is a viewing gallery on level 12.

PlotG1 Building 7 consists of one, two and four bed apartments on levels 1 to 4 and commercial units on level 0 and M (including a Creche).

Plot G1 Building 8 consists of one to four bed apartments and duplex from level 0 to 8 and commercial units on levels 0 and M.

Plot G1 Building 9 consists of one and two bed apartments from level 01 to 10 and commercial units on levels 0 and 0.5.

Plot H: Plot H1 buildings 1&2 contains 4 retail units and 15 one-bed and two-bed

	D2-Assembly and leisue (GIA)			D1-Non-residential Institutions			A1-Shops (GIA)			A3-Food and Drink (GIA)			A4-Dirinking Establishment (GIA)			B1-Business (GIA)			Total		
	(Sqm)	(Sqft)	Units No.	(Sqm)	(Sqft)	Units No.	(Sqm)	(Sqft)	Units No.	(Sqm)	(Sqft)	Units No.	(Sqm)	(Sqft)	Units No.	(Sqm)	(Sqft)	Units No.	(Sqm)	(Sqft)	Units No.
Plot H	0	0	0	0	0	0	273.4	2943	4	0	0	0	0	0	0	0	0	0	273.4	2943	4
Plot F1	0	0	0	0	0	0	436.2	4695	3	0	0	0	0	0	0	0	0	0	436.2	4695	3
Plot F2	0	0	0	0	0	0	187.8	2021	3	0	0	0	0	0	0	0	0	0	187.8	2021	3
Plot F3	0	0	0	0	0	0	453.9	4886	6	0	0	0	0	0	0	0	0	0	453.9	4886	6
Plot F4	0	0	0	0	0	0	0	0	0	534.7	5756	2	598.7	6444	2	0	0	0	1133.4	12200	4
Plot G1	0	0	0	0	0	0	116.8	1257	1	0	0	0	0	0	0	128.1	1379	2	244.9	2636	3
Plot G2	0	0	0	0	0	0	678.3	7301	5	0	0	0	0	0	0	186.1	2003	3	864.4	9304	8
Plot G3	1334.3	14362	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1334.3	14362	1
Plot G4	0	0	0	0	0	0	35.9	386	1	0	0	0	0	0	0	112.3	1209	2	148.2	1595	3
Plot G5	0	0	0	0	0	0	129.4	1393	3	0	0	0	0	0	0	180.2	1940	2	309.6	3333	5
Plot G6	0	0	0	210.6	2267	1	0	0	0	581.5	6259	1	0	0	0	0	0	0	581.5	6259	1
Plot G7	193.3	2081	2	0	0	0	168.4	1813	1	252	2713	1	0	0	0	0	0	0	613.7	6606	4
Plot G8	0	0	0	0	0	0	0	0	0	335.9	3616	3	0	0	0	0	0	0	335.9	3616	3
Total	1527.6	16443	3	210.6	2267	1	2480.1	26696	27	1704.1	18343	7	598.7	6444	2	606.7	6531	9	6917.2	74457	48

apartments.

Figure 1: Area Schedule

3.3 In between plots G3 and G6 will be an area called The Goods Yard which will be a F&B offer providing a space for low key outdoor markets, showing live sports matches and seasonal activities such as Christmas fairs.

3.4 The site is bounded to the north by the Folkestone port, to the east and south by the sea and to the west by the Harbour Approach Road, the Marine Parade and the beach.

3.5 Mechanical ventilation and cooling are specified for all buildings, with openable windows available to provide purge ventilation at the occupant's discretion.

3.6 Plots F, G and H are presented in Figure 2 below, highlighted in red.

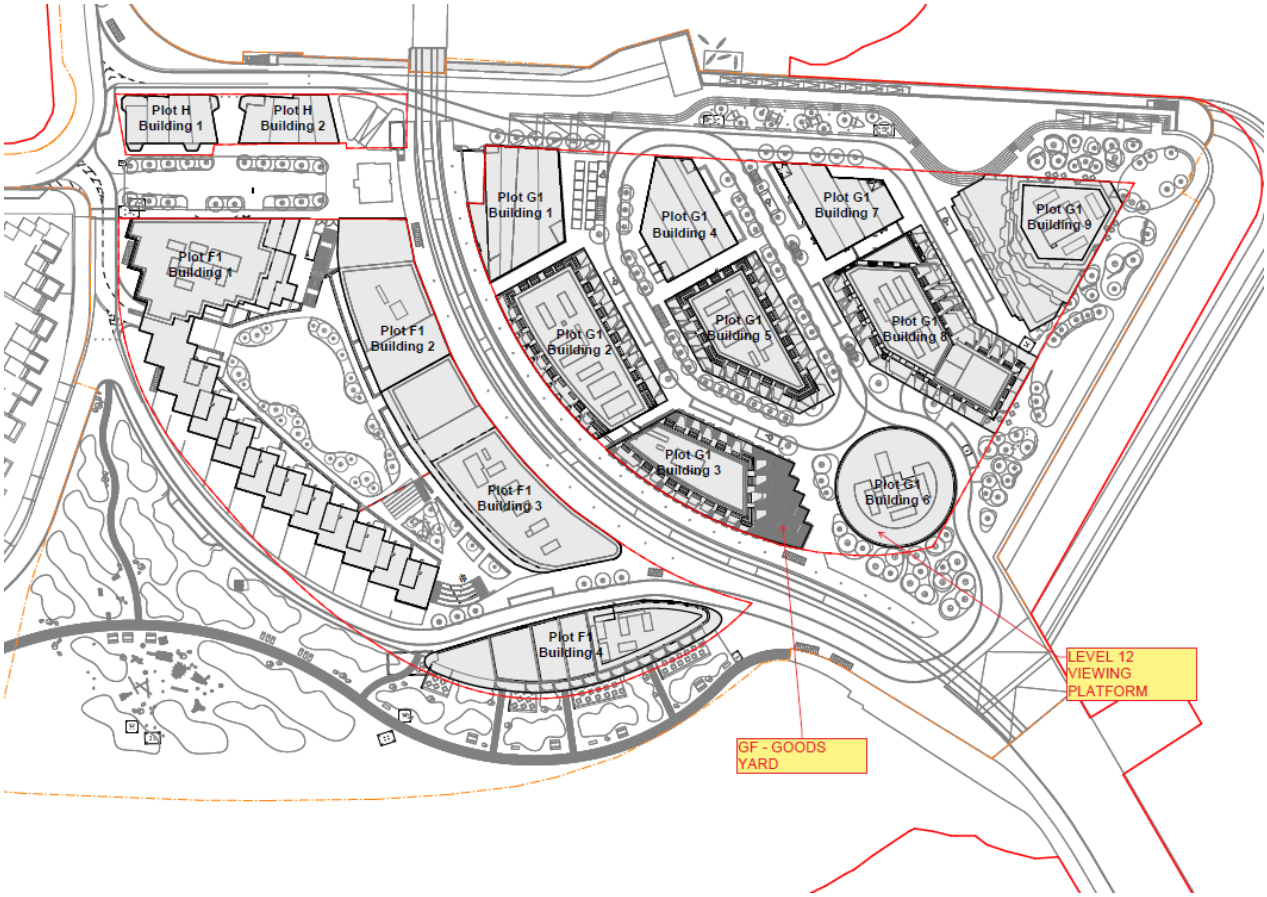


Figure 2: Site location.

3.7 The following figure displays the ground floor plan of the proposed site.

Figure 3: Proposed ground floor plan.

4. ACOUSTIC DESIGN CRITERIA

Relevant acoustic design standards

4.1 Appropriate and well-established guidance on the assessment of noise and vibration and acoustic design relevant to the development are available from a variety of references including, but not limited to, the following:

- National Planning Policy Framework (NPPF), adopted December 2023.

4.2 The National Planning Policy Framework 2023 (NPPF) sets out the government planning requirements and supersedes previous versions and guidance notes such as PPG24. No specific noise criteria are set out in the NPPF, or in the Noise Policy Statement for England (NPSE) to which it refers. The NPPF. Includes the following statements relating to noise and the requirement to take it into account in the planning process.

4.3 Paragraph 180 advises that:

- *180 - Planning policies and decisions should contribute to and enhance the natural and local environment by:*
- *E) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans; and*

4.4 Paragraph 191 advises that:

- *191. Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:*
- *A) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;*
- *B) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; and*

4.5 Paragraph 193 of NPPF further elaborates on the consideration of existing businesses in all planning applications, as follows:

- *193. Planning policies and decisions should ensure that new development can be integrated effectively with existing businesses and community facilities (such as places of worship, pubs, music venues and sports clubs). Existing businesses and facilities should not have unreasonable restrictions placed on them as a result of development permitted after they were established. Where the operation of an existing business or community facility could have a significant adverse effect on*

new development (including changes of use) in its vicinity, the applicant (or 'agent of change') should be required to provide suitable mitigation before the development has been completed.

4.6 The NPPF sets out the "need to ensure that developments do not give rise to significant adverse impacts on health and the quality of life". In addition, the operations of existing businesses are also protected, with reference to ensuring new developments do not have an adverse effect on their operations.

4.7 In order to comply with the above, the following standards and guidance documents have been used.

- British Standard 8233:2014 Sound insulation and noise reduction in buildings – code of practice.
- ProPG: Professional Practice Guidance on Planning & Noise 2017
- British Standard 4142:2014 +A1: 2019 Methods for rating and assessing industrial and commercial sound.
- World Health Organisation Guidelines for Community Noise, 2018.
- British Standard 7445:1991 Description and measurement of environmental noise.
- Approved Document E: Resistance to the passage of sound, ODPM, UK.
- CIBSE Guide A 2015.
- IOA Good Practice Guide on the control of Noise from Pubs and Clubs
- Code of Practice for Environmental Noise Control from Concerts

4.8 At the time of writing, a planning application has not been submitted; therefore, there are not any planning conditions relating to the internal ambient noise levels of the dwellings and the plant noise levels emitted from the development. However, existing criteria required to be achieved by the development are presented in the relevant sections of this report.

4.9 This report and the guidance included are intended for submission along the planning application.

External building services noise

4.10 Although it should be confirmed with the local authority, sound levels from building services shall be controlled to 5dB below the background sound level at 1m from the façade/balcony of the nearest noise sensitive receptors, including the development itself.

4.11 Noise from building services shall be controlled to achieve a level of no more than 40 dB L_{Aeq} on roof terraces.

5. BASELINE DATA COLLECTION

5.1 An environmental sound survey was carried out on the 29th and 30th of March 2023 to establish the existing acoustic conditions on the site. The survey consisted of short-term attended measurements at four locations across the site as shown in Figure 4.

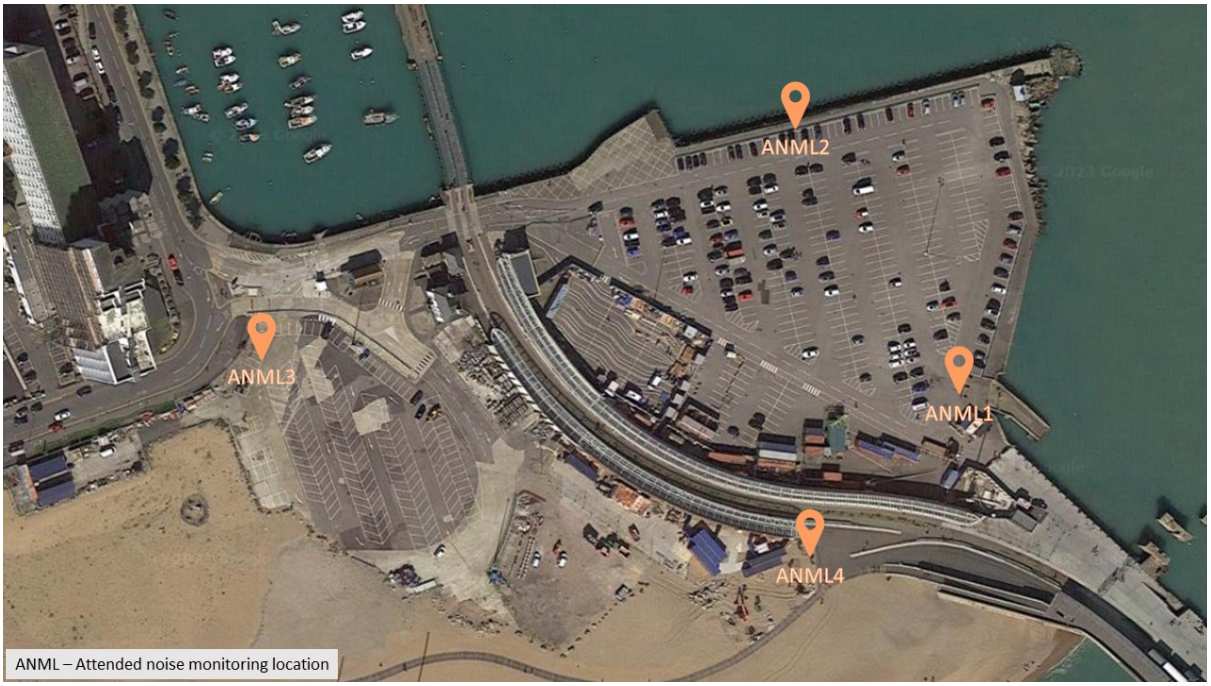


Figure 4: Short-term attended noise monitoring locations.

5.2 Due to the exposed nature of the site, long term logging was not practicable for this project.

5.3 A summary of the results is presented in Table 1. Further details of the survey work undertaken, including the equipment information and weather data are presented in Appendix B.

Table 1: Summary of the environmental measurement results.

Monitoring location	Morning/ Afternoon (10:00am-04:00pm)		Evening (07:00pm-11:00pm)		Night-time (11:00pm-07:00am)		
	$L_{Aeq,T}$	$L_{A90,10min}$	$L_{Aeq,T}$	$L_{A90,10min}$	$L_{Aeq,T}$	$L_{A90,10min}$	$L_{AFmax,10min}$
ANML1	47.9	44.4	46.7	44.3	48.9	47.0	58.9
ANML2	50.2	46.1	48.4	43.4	49.5	47.3	57.2
ANML3	58.5	47.7	52.7	41,4	49.2	44.1	67.9
ANML4	48.2	43.8	45.4	42.5	51.0	49.3	68.5

6. CONTROL OF NOISE INTRUSION

6.1 There are generally two sources of noise to address in order to provide suitable ambient noise conditions within the proposed development:

- External noise (e.g., road noise, external building services plant, goodsyard events).
- Building services noise i.e., mechanical ventilation and cooling.

Internal sound criteria

6.2 According to the criteria agreed with the client and based on BS8233:2014 guidance and the ventilation strategy, the building envelope shall be designed and constructed such that the indoor ambient noise levels of Table 2 are achieved in all relevant spaces.

Table 2: Indoor Ambient Noise Targets (from external environmental sources).

Use	Space/ Location	Period	IANL (L_{Aeq})	IANL (L_{Amax})
Residential	Living Room	07:00-23:00	35 dB	-
Residential	Bedroom	07:00-23:00	35 dB	-
Residential	Bedroom	23:00-07:00	30 dB	45 dB
Commercial	Retail	07:00-23:00	40 dB	-
Commercial	F & B and Goods Yard	07:00-23:00	40 dB	-

6.3 It should be noted that the night-time criteria of 45dB L_{AFmax} for bedrooms is the limit not to be exceeded more than 10 times by external individual events.

6.4 If additional spaces are added or detailed information provided about the uses of the development, appropriate noise criteria will need to be defined accordingly.

6.5 All target indoor ambient noise levels shall be achieved in unfurnished and unoccupied spaces upon completion of the development.

6.6 Appendix C provides full details of the façade specification.

Laboratory testing

6.7 To confirm the suitability of the proposed glazed elements (windows & doors), evidence of the laboratory sound insulation performance will be required for the entire unit as it will be installed (including glass, frame, seals, mullions, and transoms).

6.8 If dedicated laboratory tests need to be undertaken to provide this evidence, these should be completed at the earliest opportunity to minimise the risk of delaying the construction schedule. All test data are required to be in octave bands from 63Hz to 8kHz.

6.9 All acoustic testing shall be undertaken in controlled laboratory conditions in accordance with ISO 10140-2:2021 "Acoustics – Laboratory Measurement of Sound Insulation of Building Elements. Part 2: Measurement of Airborne Sound Insulation"

and BS EN ISO 717-1: 2013 "Acoustics – Rating of Sound Insulation in Buildings and of Building Elements. Part 1: Airborne Sound Insulation."

6.10 Additionally, the flanking sound insulation performance of all façade elements forming a flanking path must be proven to achieve the requirements described below.

Flanking transmission of residential façade elements

6.11 The building envelope should not degrade the overall performance of separating structures (i.e., party walls and floors). On the basis of the targeted sound insulation performance, the minimum weighted normalised flanking level difference ($D_{nF,w} + C_{tr}$) should follow guidance outlined in BS EN ISO 10848-2, which is thereby outlined in Table 3.

Table 3: Proposed minimum flanking sound insulation requirements for party walls & floors.

Adjacencies		Minimum horizontal and vertical flanking sound insulation performance, dB $D_{nF,w} + C_{tr}$
Apartment	Apartment	55
	Plant room	65
	Retail	50
	F & B	50
	Goods Yard	60
	Circulation	55

Pre-completion testing – Internal sound levels

6.12 Indoor ambient noise levels within demises are required to be measured in unfurnished spaces prior to completion of the development to ensure achievement of the noise intrusion criteria stated in Table 2.

6.13 Measurements should be undertaken in the living rooms and bedrooms of at least 2 apartments.

Roof constructions

Residential balconies/ terraces above apartments

6.14 In order to minimise disturbance, the roof and ceiling construction between balconies/terraces and the apartments below shall achieve a minimum sound insulation performance of 50 dB $D_{nT,w} + C_{tr}$.

6.15 An impact resistant layer shall also be integrated into the roof build-up in the terrace areas specified to provide a minimum impact transmission performance of 17 dB ΔL_w to address footfall and furniture noise.

6.16 If it is not possible to install an impact resilient layer within the terrace build-up acoustic spring ceiling hangers may be required for residential areas below balconies or terraces.

External rooftop plant above apartments

6.17 In order to minimise disturbance, the roof and ceiling construction between the rooftop external plant areas and the residential apartments below should achieve a minimum on-site sound insulation performance 60 dB $D_{n,Tw}$ + C_{tr}.

6.18 The ceiling within the residential apartment below the roof plant areas shall be formed of two layers of 15mm dense plasterboard (minimum 25 kg/m^2 total mass per unit area) on high performance spring ceiling hangers with a 160mm cavity and 50mm of acoustic insulation in the cavity.

Ventilation for residential dwellings

6.19 The current ventilation proposals provided by the mechanical consultant of the development is as follows:

- Mechanical ventilation with heat recovery units (MVHR) for Building Regulations Part F only.
- Allow doors and windows to be open for purge ventilation on the residents' discretion.
- Cooling via fan coil units (FCU).

6.20 Noise generated by ventilation systems shall ensure compliance with the project's internal noise criteria and must not exceed the NR levels stated in Table 9 of Section 9 of this report.

7. INTERNAL SOUND INSULATION

Residential areas – Approved Document E & Client criteria

7.1 It is a statutory requirement that internal building elements are designed in full compliance with requirements E1 and E2 of the Building Regulations 2010 Part E Schedule 1, as a minimum. The usual way to satisfy these requirements is to achieve the performance standards given in Approved Document E (ADE).

7.2 Plots F, G, and H will be designed to achieve a 5dB enhancement over the minimum requirements of the Building Regulations for party walls and floors in accordance with the Client's quality aspirations.

7.3 The residential apartments at the development will be classed as purpose built "dwelling-houses and flats" under ADE.

Party walls and floors

7.4 Table 4 presents the requirements for residential party walls and floors.

Table 4: Proposed minimum sound insulation requirements for party walls and floors.

Purpose built 'dwelling-houses and flats'	Airborne sound insulation dB $D_{nT,w} + C_{tr}$	Impact sound insulation dB $L'_{nT,w}$
Party walls	≥50	-
Party floors & Stairs	≥50	≤57

7.5 An impact resilient layer shall be integrated into the party floor build-up specified to provide a minimum impact transmission performance of 17 dB ΔL_w (e.g., CDM Stravitec or similar approved).

Internal walls and floors

7.6 Requirement E2 refers specifically to internal partitions within dwellings and gives performance standards for internal walls and floors. To satisfy Requirement E2, internal walls and floors within dwelling-houses and flats shall be capable of achieving a sound insulation performance of 40 dB R_w.

7.7 To follow the client's quality aspirations Plots F, G, and H will be designed to achieve a 5dB enhancement over the minimum requirements of the Building Regulations for internal party walls and floors as 45 dB R_w.

7.8 Requirement E2 does not apply to:

- Internal walls which contain a door.
- Internal walls which separate an ensuite toilet from the associated bedroom.

7.9 While requirement E2 does not apply to the walls mentioned above, all internal walls shall achieve a minimum sound reduction of 45 dB R_w. Walls to utility cupboards are excluded from this requirement but they are addressed in the following section.

Walls to utility cupboards

7.10 Utility cupboards should be located as far away from habitable spaces within apartments as reasonably possible and should not open onto habitable spaces, especially bedrooms.

7.11 The minimum sound insulation performances for walls and doors to utility cupboards are set out in Table 5. Although there is no ADE requirement, the below levels are based on adequately controlling noise breakout from MVHR systems to adjacent areas.

Table 5: Minimum sound insulation requirements for utility cupboard walls and doors.

Utility cupboard location	Minimum airborne sound insulation performances for utility cupboards, dB R_w	
	Walls	Doors
Adjacent to circulation or bathrooms	40	25
Adjacent to living rooms (See paragraph 7.13)	45	30
Adjacent to bedrooms	50	*

* Utility cupboards must not open onto bedrooms

7.12 If a utility room containing an MVHR unit abuts a party wall, then an independent wall lining consisting of two layers of plasterboard shall be installed in front of the party wall.

7.13 It should be noted that utility cupboards opening onto living rooms will require an acoustically rated door set including a full perimeter and threshold seals and not align with the mechanical ventilation strategy to the utility cupboard. These should be avoided if possible.

7.14 Further guidance on MVHR units serving the residential areas is provided in Appendix D.

Doors

7.15 The sound insulation requirements for doors are set out in the following table.

Table 6: Minimum sound insulation requirements for doors.

Location	Laboratory sound insulation performance, dB R_w	Comments
Internal (apartment)	>20	-
Apartment access	35	Perimeter seals required
Plant room	40	Perimeter seals required
External	-	See Appendix C

7.16 The door sound insulation requirements of any other uses confirmed on a later stage will need to be reviewed.

Sound insulation criteria for other areas

7.17 The minimum required on-site airborne sound insulation performances ($D_{nT,w}$ + C_{tr}) between apartments and non-residential areas and between commercial areas have been agreed with the client and are presented in Table 7.

Table 7: Additional details on the minimum sound insulation requirements of the development.

Adjacencies (Vertical and horizontal, where applicable)		Minimum airborne sound insulation performance
Apartments	Plant room	≥55 dB $D_{nT,w}$ + C_{tr}
Apartments	Retail	≥50 dB $D_{nT,w}$ + C_{tr}
Apartments	F&B	≥55 dB $D_{nT,w}$ + C_{tr}
Apartments	Good Yard	≥60 dB $D_{nT,w}$ + C_{tr}
Retail / F&B	Retail / F&B	≥55 dB R_w

Linings to lift shafts and stair cores in residential apartments

7.18 Where apartments back on to lift or stair cores, an independent wall lining is required to reduce the risk of structure-borne noise from lifts being transferred to apartments.

- Linings to lift shafts and stair cores in residential apartments are required to comprise the following:
- Two 15mm dense plasterboard layers (total mass per unit area of 25 kg/m^2)

7.19 On a minimum of 50mm independent studs spaced off the lift shaft or stair core Wall by at least 10mm with 25mm mineral wool (nominal density 10-15kg/m^3) in the void.

Lining to the building envelope

7.20 Flanking sound insulation at party walls and floors will need to be controlled at the façade junctions with appropriate linings.

7.21 Soil vent pipes (SVPs) and rainwater pipes (RWPs) can have a negative impact on the perceived acoustic quality of the development. As a result, mitigation measures will be required to ensure their impact on residential apartments is minimised as far as reasonably possible. For instance, SVPs and RWPs passing through habitable areas (living rooms and bedroom) should be avoided as far as possible.

7.22 All drainage pipes are required to be supported on their own independent framework (e.g., uni-strut) with no connection to any partitions or party walls.

7.23 There should be no instances where a drainage pipe penetrates through a residential-to-residential party wall.

Access panels

7.24 All access panels are required to provide at least the same acoustic performance as the ceiling/wall lining they are located in. This is achievable using a construction with at least the same density as the ceiling/wall lining plasterboard.

7.25 The perimeter of the panel must be positively sealed such that the installed construction maintains the required performance.

7.26 The access panel construction is required to achieve an acoustic performance of at least 35 dB R_w.

General considerations for partitions

Partition head and base details

7.27 Head and base details of all walls shall be designed such that they do not undermine the sound insulation performance of the wall. Consideration will need to be given to the need for deflection head details, the provision of steel angles at the head, resilient edge details to the full perimeter of floating floors, etc.

7.28 All party walls are required to be full height (i.e., from floor slab below to the underside of the floor slab above).

Plasterboard partitions

7.29 The following is to be considered when specifying and building plasterboard walls:

7.30 Joints between plasterboard layers shall be staggered, both horizontally and vertically, and be taped.

7.31 Socket boxes in walls shall be designed to ensure they do not undermine the sound insulation performance of the partitions they are installed in. When installed on both sides of acoustically rated walls, they shall be at least one stud bay apart and provided with a baffle box or putty pad where performances greater than 50 dB R_w have been specified. When installed as part of the lining to a structural element (e.g., column or shear wall) in a wall, sockets shall be independent of the concrete.

7.32 Shadow recesses (and recessed skirting, where applicable) shall be designed to not undermine the sound insulation performance of the wall.

7.33 Rigid thermal insulation cannot be used as a replacement to the mineral wool recommended for sound insulation within wall cavities.

7.34 Junction detailing shall follow the manufacturer's guidance.

Plywood layers

7.35 There may be some areas where plywood layers are required within partitions to allow strong fixings for art, audio-visual equipment, furniture etc.

7.36 When this is the case, the plywood layer shall be provided in addition to the layers of plasterboard required for the wall constructions detailed above. This applies for all partitions where a plywood layer is required.

Building services penetrations through walls and floors

7.37 Penetrations through walls, floors, and ceilings for building services (e.g., pipes, ductwork, cable trays) shall be as small as possible and be designed in such a way as to ensure the sound insulation of the elements they are crossing is not in any way undermined.

8. CONTROL OF REVERBERATION

8.1 Sound absorbent finishes will be required to control reverberation in the common internal parts of the building to satisfy Requirement E3 of the Building Regulations 2010. This applies to corridors, , stairwells, hallways and entrance halls that give unbuffered access to the residential apartments.

8.2 Requirement E3 sets out methods for determining the appropriate area requirements of sound absorptive materials which are summarised in Table 8 below.

Table 8: Acoustic criteria relating to reverberation control in common internal areas.

Common area	ADE method to satisfy E3	ADE advice
Entrance halls	Method A	Cover a specified area with an absorber of an appropriate class that has been rated according to BS EN ISO 11654:1997
	Method B	Provide a minimum of 0.20m^2 total absorption are per cubic metre of the area's volume
Corridors / Hallways	Method A	Cover a specified area with an absorber of an appropriate class that has been rated according to BS EN ISO 11654:1997
	Method B	Provide a minimum of 0.25m^2 total absorption are per cubic metre of the area's volume

9. BUILDING SERVICES NOISE

Internal building service noise criteria

9.1 Noise emissions from all mechanical plant equipment into rooms should not exceed the specified Nr levels outlined in Table 9 below. The limits specified for building services noise should include the cumulative noise from all sources of mechanical noise including breakout noise through ductwork and/or equipment casing.

Table 9: Maximum building services noise within rooms.

Use	Space/ Location	Period	Noise Rating (Leq NR)
Residential	Living Room	07:00-23:00	30
Residential	Bedroom	23:00-07:00	25
Residential	Circulation/ Lobby	07:00-23:00	35
Commercial	Retail	07:00-23:00	35
Commercial	F & B	07:00-23:00	35
Commercial	Goods Yard	07:00-23:00	45
General	Plant rooms	24 hours	65

9.2 The NR criteria for bedrooms include MVHR and FCU operating at normal duty. Boost mode may be up to 5dB higher.

9.3 The NR criteria for living rooms include dining rooms and kitchens but excludes cooker hood noise. The noise from the cooker hood extract should not exceed 55dB(A) at 1m.

9.4 All noise levels stated in Table 9 are to be achieved with rooms fully furnished. A +2 dB allowance is acceptable for commissioning in non-furnished rooms as might be expected at the end of construction. No further allowance will be acceptable.

9.5 For testing of emergency life-saving equipment a relaxation of 10 dB on the noise limits is Table 9 is acceptable for weekday periods between 9:00 and 17:00. Planned testing should not occur outside of these periods.

9.6 Noise generated by plant in plant rooms and roof plant shall be designed to achieve a level in adjacent spaces at least 10 dB less than stated in Table 9.

Building services noise emission limits to the atmosphere

9.7 If no specific planning conditions will need to be achieved, the guidance from BS4142:2014+A1:2019 is proposed for environmental plant noise emission limits.

9.8 BS4142:2014 indicates that if the plant rating noise level (dB $L_{Ar,\ Tr}$) from the development does not exceed a level that is equal to the existing background noise levels (expressed as dB L_{A90}), at the nearest defined receiver, it can be considered an indication of the specific sound source having a low impact. When the context of the site is considered, along with the absolute noise levels resulting from the plant, this criterion is considered reasonable for the proposed plant installation.

9.9 Included in the plant rating noise level ($L_{Ar, Tr}$) further penalties shall be applied if there are any acoustic characteristics to the plant noise (e.g., tonality, impulsivity, intermittency, etc.), following guidance from BS4142:2014+A1:2019.

9.10 Table 10 below indicates the plant noise rating limits that must be achieved at the nearest noise-sensitive receptors. It is assumed that there will be no acoustic character penalties to be applied at this stage, but this may change once the specific plant selections are confirmed.

Table 10: External plant noise emission limits at the nearest noise sensitive receivers (outside and within the development).

Noise Sensitive receptor	Period	Background noise level, dB $L_{A90,10min}$	BS4142 noise rating limit, dB $L_{Ar,Tr}$
Part of the development around ANML1	Daytime (07:00-23:00)	44	44
	Night-time (23:00-07:00)	47	47
Part of the development around ANML2	Daytime (07:00-23:00)	45	45
	Night-time (23:00-07:00)	47	47
Nearby properties and part of the development around ANML3	Daytime (07:00-23:00)	45	45
	Night-time (23:00-07:00)	44	44
Part of the development around ANML4	Daytime (07:00-23:00)	43	43
	Night-time (23:00-07:00)	49	49

9.11 These are the combined operational noise levels of the proposed fixed plant at the nearest noise sensitive façades.

9.12 Should a proposed new plant contain a specific acoustic character (i.e., tonality, impulsivity, intermittency), then this unit should achieve a noise levels 5dB more onerous than those set out in Table 10.

9.13 The current proposals are to have the main heating and cooling plant on the roof of Plot F1 Building 1&3 and Plot G1 Building 2, 5, 6, 8 and 9. Full details of the plant and mitigation will be coordinated at the next stage of design.

9.14 At this stage allowance has been made for plant enclosures as follows:

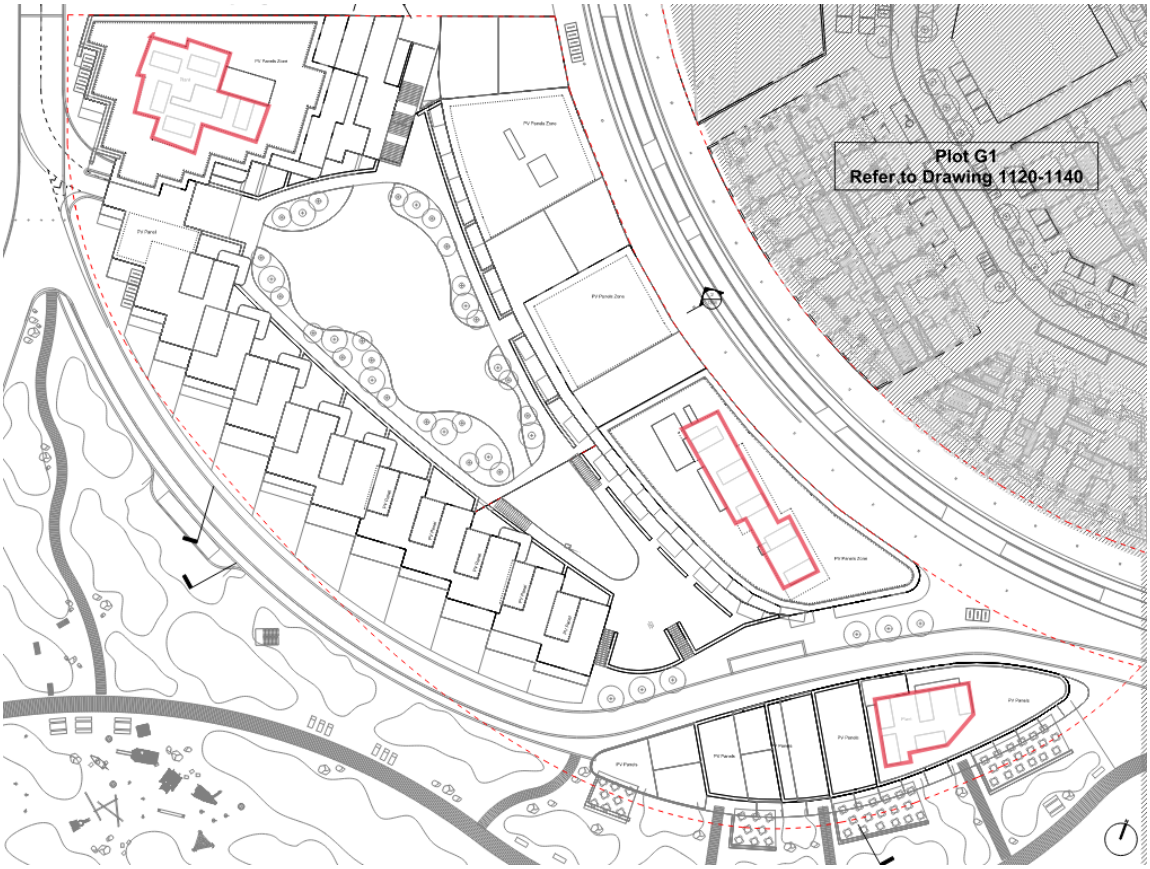


Figure 5: Plot F1 Indicative Roof Top Plant Enclosures.

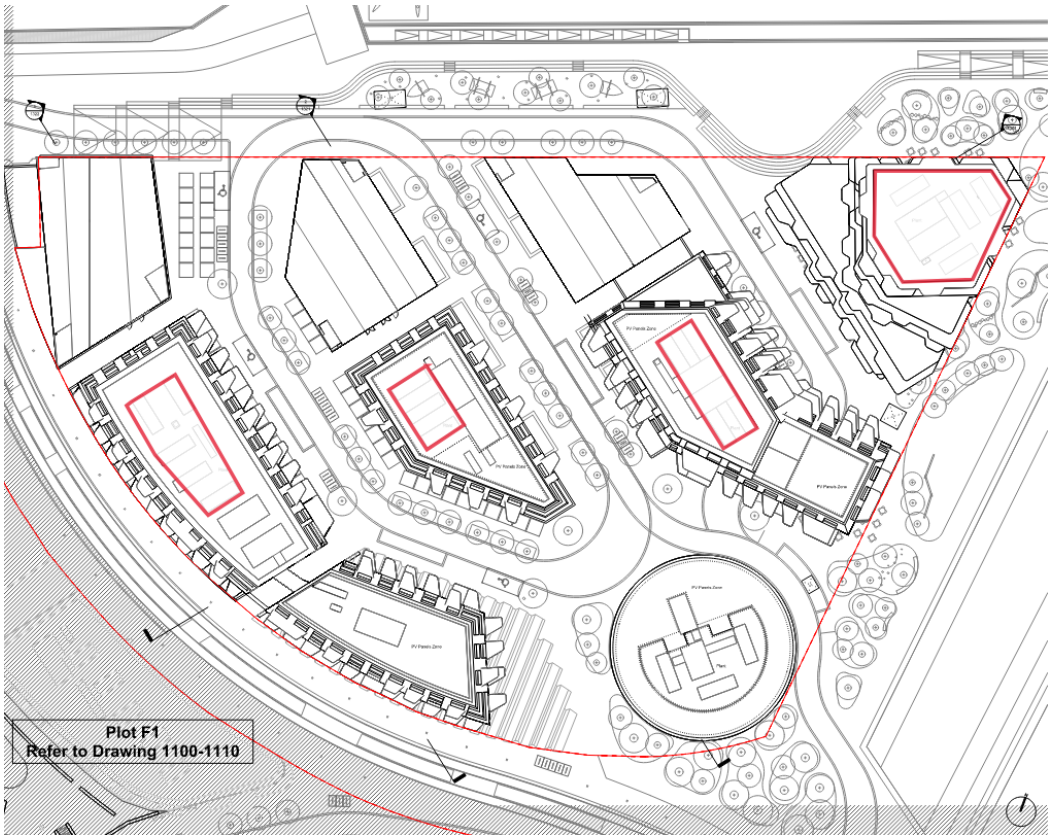


Figure 6: Plot G1 Indicative Roof Top Plant Enclosures.

Residential balconies and terraces

9.15 Noise from building services shall be controlled to achieve a level of no more than 45 dB L_{Aeq} on the residential balconies/terraces.

Building services vibration

9.16 All building services plant and associated ductwork and pipework will be required to be mounted on appropriate anti-vibration mounts and/or structurally isolated such that there is no perceptible vibration or associated re-radiated airborne noise in any occupied parts of the development.

9.17 An allowance is made for the following as a minimum:

- Polymeric pads or similar under extract units approximately 25mm thick.
- Suitable anti-vibration mounts to any roof mounted plant units.
- All pipe work within plant rooms on anti-vibration hangers.
- Pumps on inertia bases with associated spring anti-vibration mounts.
- All fans on suitable manufacturer approved AV mounts.
- No rigid connections of pipe work, cabling, or any building services in any area.

Control of noise transfer

9.18 In order to control noise levels from mechanical services the following is required as a minimum:

- Where cooling units are proposed in ceiling voids, they shall be selected to run at low speed.
- Any services penetrations shall be fully sealed to avoid deterioration of the sound insulation integrity of the separation.
- Air velocities within ductwork shall comply with CIBSE Guide B5.
- Undercut or transfer grilles on doors for make-up air shall not be permitted except where these are required as part of the MVHR ventilation strategy.

Life safety plant

9.19 All emergency operating plants are required to achieve the criteria set out in Table 11 below.

9.20 The limit applies at one metre from the nearest noise sensitive premises and is based on the lowest daytime background noise levels measured across the site on the basis that testing is only conducted for short periods on weekdays between 9:00 and 17:00.

Table 11: External emergency plant noise limits at the nearest noise sensitive receivers.

Noise Sensitive receptor	Period	BS4142 noise rating limit, dB $L_{Ar,Tr}$
Part of the development around ANML1	Daytime (07:00-23:00)	54
Part of the development around ANML2	Daytime (07:00-23:00)	55

Nearby properties and part of the development around ANML3	Daytime (07:00-23:00)	55
Part of the development around ANML4	Daytime (07:00-23:00)	53

Life safety generator

9.21 Noise from the life safety generator shall be controlled to no more than 70 dB(A) at 1 m from the unit. This will require a full acoustic enclosure around the generator set with attenuation to the inlet and discharge.

9.22 Without a full acoustic enclosure to the generator set, significant enhancement will be required to the generator room, including independent wall linings and a full mass barrier ceiling on high performance acoustic spring hangers.

9.23 Connections to the external environment shall be controlled to no more than 53 dB(A) at 1 m from louvres within the façade of the building, to achieve the emergency plant noise limits outlined in Table 11.

Passenger lifts

9.24 Passenger lifts should not exceed the noise and vibration levels outlined in Table 12.

Table 12: Noise and vibration limits for passenger lifts.

Noise (airborne & structure-borne) limits		Weighted vibration limits	
In lift car	55dB L_{AFmax}	Horizontal	0.10m/s^2
In lift lobby	55dB L_{AFmax}	Vertical	0.12m/s^2
Into apartments	25dB L_{AFmax}	Max acceleration	1.0m/s^2

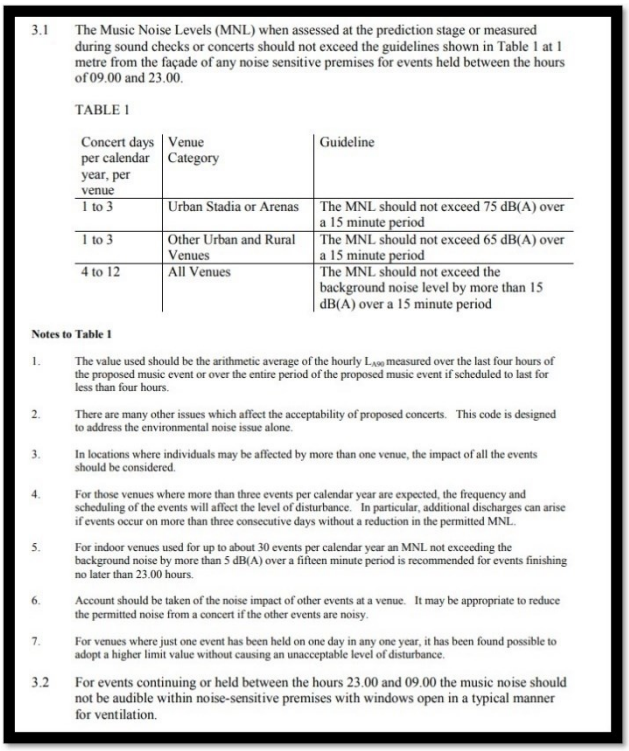
9.25 Measurements to be undertaken in accordance with the guidance in Association of Noise Consultants Guidelines for Noise Measurement in Buildings Part 1: Noise from Building Services and British Standard 6472-1: 2008.

9.26 To achieve the above requirements, the lift gear and associated framework shall be isolated from the surrounding structure.

10. GOODS YARD

10.1 Part of the Masterplan includes a space called The Good Yard which will be an internal venue for small scale events such as Christmas fairs, televised sports events, etc. Details of the usage are not confirmed at this stage.

10.2 The operation and management of the space shall be in line with the PopCode (Code of Practice for Environmental Noise Control from Concerts). The guidance is as follows:



3.1 The Music Noise Levels (MNL) when assessed at the prediction stage or measured during sound checks or concerts should not exceed the guidelines shown in Table 1 at 1 metre from the façade of any noise sensitive premises for events held between the hours of 09.00 and 23.00.

TABLE 1

Concert days per calendar year, per venue	Venue Category	Guideline
1 to 3	Urban Stadia or Arenas	The MNL should not exceed 75 dB(A) over a 15 minute period
1 to 3	Other Urban and Rural Venues	The MNL should not exceed 65 dB(A) over a 15 minute period
4 to 12	All Venues	The MNL should not exceed the background noise level by more than 15 dB(A) over a 15 minute period

Notes to Table 1

1. The value used should be the arithmetic average of the hourly L_{A90} measured over the last four hours of the proposed music event or over the entire period of the proposed music event if scheduled to last for less than four hours.
2. There are many other issues which affect the acceptability of proposed concerts. This code is designed to address the environmental noise issue alone.
3. In locations where individuals may be affected by more than one venue, the impact of all the events should be considered.
4. For those venues where more than three events per calendar year are expected, the frequency and scheduling of the events will affect the level of disturbance. In particular, additional discharges can arise if events occur on more than three consecutive days without a reduction in the permitted MNL.
5. For indoor venues used for up to about 30 events per calendar year an MNL not exceeding the background noise by more than 5 dB(A) over a fifteen minute period is recommended for events finishing no later than 23.00 hours.
6. Account should be taken of the noise impact of other events at a venue. It may be appropriate to reduce the permitted noise from a concert if the other events are noisy.
7. For venues where just one event has been held on one day in any one year, it has been found possible to adopt a higher limit value without causing an unacceptable level of disturbance.

3.2 For events continuing or held between the hours 23.00 and 09.00 the music noise should not be audible within noise-sensitive premises with windows open in a typical manner for ventilation.

Figure 7: PopCode acoustic guidance.

10.3 It is recommended that the space operates to the following guideline values:

- For typical weekday/evenings activities AND any event after 23:00 should be inaudible in dwellings. Music noise of no more than 40 dBA at residential facades.
- For typical weekend/evenings music noise of no more than 45 dBA at residential facades
- For loud events 4 to 12 times per year music noise levels of no more than 55 dBA at residential facades

10.4 The space will be designed such that it can operate with doors closed to prevent noise breakout.

10.5 It is recommended that for the majority of events, the sound levels are limited to 85 dB $L_{Aeq,\ 15\ minutes}$ internally, with appropriate low frequency noise limits.

10.6 An allowance for at least 1500 m2 of Class B acoustic absorption has been made to help limit reverberation in the space.

11. CONTRACTOR MONITORING AND COMMISSIONING

Approvals

11.1 The Contractor shall submit the following information for approval prior to final selection and procurement of materials, systems, and equipment:

- Details and supporting acoustic performance documentation (e.g., laboratory test certificates) for partition constructions.
- Details and supporting acoustic performance documentation demonstrating solutions to limit flanking noise across separating walls and floors.
- Details and supporting acoustic performance documentation for sound absorbing materials.
- Services penetration details.
- Test certificates for acoustically rated door sets and glazed screens (inclusive of frames and seals).
- Details of all noise generating mechanical & electrical equipment including acoustics data in the form of test certificates and calculations demonstrating compliance with the criteria.

Site visits

11.2 The Contractor shall allow the 'Client Team' to inspect the wall, floor, MEP and acoustic finishes installations on site, and to comment on the implementation of the acoustic design and workmanship.

11.3 The Contractor shall implement the recommendations made in the site visit reports.

Off-site testing

11.4 Prior to the delivery of plant to site, the Contractor shall ensure that all building services items are tested off-site to demonstrate compliance with the sound limits set out in Section 9. The testing shall be undertaken to the satisfaction of the Client's acoustic consultant and if non-compliance is achieved, alternative plant and / or design shall be developed by the Contractor.

11.5 The 'Client Team' shall be given a minimum of two weeks' notice to witness the tests, and review and comment on the proposed method statement and testing schedule.

Acoustic testing requirements

11.6 It shall be the Contractor's responsibility to demonstrate compliance with the criteria set out in the present document through commissioning testing.

11.7 Acoustic commissioning test results shall be issued in a report no later than five working days following the tests. The Contractor shall carry out any remedial work that may be necessary to bring the acoustic performance in compliance with the specifications of this document and repeat the testing.

11.8 The Contractor shall employ an ANC or UKAS registered acoustic consultant to carry out the acoustic commissioning tests. The scope of the testing shall include:

- Laboratory testing of façade elements
  - Laboratory test data is required for all proposed glazed (windows and doors) and non-glazed elements.
  - Test data shall be provided for the window and door system (including glass, frame, seals, mullions and transoms) and tested in accordance with ISO 10140-2:2021 *"Acoustics – Laboratory Measurement of Sound Insulation of Building Elements. Part 2: Measurement of Airborne Sound Insulation"* and BS EN ISO 717-1: 2013 *"Acoustics – Rating of Sound Insulation in Buildings and of Building Elements. Part 1: Airborne Sound Insulation."*
  - *It should be noted that the sound reduction 'R' in each octave band is required.*
- Flanking transmission testing of façade elements
  - The flanking sound insulation performance of all façade elements forming a noise flanking path must be proven to ensure the sound insulation requirements are not compromised.
  - The minimum weighted normalised flanking level difference ($D_{nF,w}$ + C_{tr}) of all façade elements shall be tested in accordance with BS EN ISO 10848-2: 2006 *"Acoustics – Laboratory Measurement of the Flanking Transmission of Airborne and Impact Sound between Adjoining Rooms. Part 2: Application to Light Elements when the Junction has a Small Influence."*
- Pre-completion testing – noise intrusion levels
  - Testing shall be carried out in two locations for each glazing type to demonstrate compliance with the specific values. The locations shall represent the most exposed element of each glazing type.
  - Testing shall be conducted in accordance with ANC guidelines – *Noise Measurements in Buildings – Part 2: Noise from External Sources within buildings*.
  - A full method statement shall be provided prior to testing no later than 10 days beforehand.
- Pre-completion sound insulation testing
  - There is a requirement to undertake airborne and impact sound insulation testing to demonstrate compliance with Building Regulations Approved Document E and the project acoustic requirements.
  - As a minimum it is expected that 10% of the number of dwellings with the same construction details will be tested in accordance with Approved Document E.
- Building services noise testing
  - There is a requirement to undertake noise level measurements of all ventilation systems to confirm compliance with the internal and external noise criteria for this project.
  - This will require internal noise level measurements to determine the NR level and external measurements to determine the dB(A) noise level.

- External noise measurements
  - The noise level of external plant shall be measured and reported in accordance with the requirements of the Local Authority. The measurements and procedures shall be generally in accordance with BS 4142: 2014 + A1: 2019.
  - A comprehensive method statement shall be submitted no later than 10 days prior to testing.

APPENDIX A

GLOSSARY: ACOUSTIC TERMINOLOGY

AIRBORNE SOUND

Sound in the air is generated by a material vibrating which in turn causes air molecules to vibrate and create a sound wave. For example, the sound produced by a loudspeaker in a room can be classified as an 'airborne' sound.

AIRBORNE SOUND INSULATION

Airborne sound insulation is the ability of a material or room to contain sound within it or exclude sound from it. This is commonly measured in terms of sound reduction index (in dB) being the ratio of sound transmitted by the material to that incident upon it.

AMBIENT AND BACKGROUND NOISE LEVEL, $L_{A90,T}$

The A-weighted sound pressure level of non-specific noise in decibels exceeded 90% of the given time, T.

A - WEIGHTING dB(A)

The sound pressure level is determined when using the frequency-weighting network A. The A-weighting network modifies the electrical response of a sound level meter so that the sensitivity of the meter varies with frequency in approximately the same way that the sensitivity of the human hearing system varies with frequency.

The human ear has a non-linear frequency response; it is less sensitive at low and high frequencies and most sensitive in the range of 1 to 4 kHz. The A-weighting is applied to measured or calculated sound pressure levels so that these levels correspond more closely to the response of the human ear. A-weighted sound levels are often denoted as dB(A).

DECIBEL

The ratio of sound pressures which we can hear is a ratio of 10^6:1 (one million: one). For convenience, therefore, a logarithmic measurement scale is used. The resulting parameter is called the 'sound pressure level' (L_p) and the associated measurement unit is the decibel (dB). As the decibel is 10 times the logarithmic ratio, the laws of logarithmic addition and subtraction apply.

EQUIVALENT CONTINUOUS A-WEIGHTED SOUND PRESSURE LEVEL (LAeq)

Value of the A-weighted sound pressure level of a continuous, steady sound that, within a specified time interval T starting at t1 and ending at t2 and measured in decibels, has the same mean square sound pressure as the sound under consideration whose level varies with time.

FREQUENCY

The rate of repetition of a sound wave. The subjective equivalent in music is pitch. The unit of frequency is the Hertz (Hz), which is identical to cycles per second. A thousand hertz is often denoted kHz, eg 2 kHz = 2000 Hz. The human hearing generally ranges approximately from 20 Hz to 20 kHz.

IMPACT SOUND

The sound is produced by a vibrating material or panel due to direct impact. The vibrating material or panel causes the air molecules to vibrate which leads to an airborne sound wave being created. For example, footsteps on a floor can be classified as 'impact' sound.

IMPACT SOUND INSULATION

Impact sound insulation is the ability of a material to dampen sound. This is commonly determined by measuring the sound pressure level (in dB) on the receiver side of the material being excited by a sound source on the source site.

OCTAVE BANDS AND OCTAVE BAND SOUND PRESSURE LEVEL

The octave-band pressure level of a sound is the band pressure level for a frequency band corresponding to a specified octave. (The location of the octave-band pressure level on a frequency scale is usually denoted by the geometric mean of the upper and lower frequencies of the octave.) The ISO standard octave centre frequencies are 31.5, 63, 125, 250, 500, 1k, 2k, 4k, 8k, 16k Hz (etc.). For design purposes, the octave bands between 63 Hz to 8 kHz are generally used.

PERCENTILE LEVEL (STATISTICAL SOUND LEVEL INDICES, LAN, LA90)

L_{AN} is the dB(A) level exceeded N% of the time measured on a sound level meter with Fast(F) time weighting, eg L_{A90} the dB(A) level exceeded 90% of the time, is commonly used to estimate background noise level. L_{A10}, the dB(A) level exceeded 10% of the time, is commonly used in the assessment of road traffic noise.

REVERBERATION AND REVERBERATION TIME (RT60)

The time, in seconds, taken for a sound within a space to decay by 60 dB after the sound source has stopped. An important indicator of the subjective acoustic within an auditorium. The symbol T_{mf} represents the mid-frequency arithmetic average of the reverberation time in the 500 Hz, 1 kHz and 2 kHz octave bands. Reverberation time can be measured using the procedures set out in BS EN ISO 3382. The symbols T20 and T30 are the reverberation times extrapolated from a 20 or 30 dB dynamic range, starting at the -5 dB point, in order not to introduce errors due to irregularities in the early reflections

SIGNAL-TO-NOISE RATIO (S/N)

This is the difference between the source noise level and the background (or ambient) noise level. The higher the difference, the better the speech intelligibility of the PA/VA system. For PA/VA system announcements, it is preferable to have an S/N ratio of at least 15 dB(A) and preferably 25 dB(A) for the hearing impaired.

SOUND ABSORPTION AND SOUND ABSORPTION COEFFICIENT

When sound waves strike a material, some of the sound energy is absorbed and the remaining energy is reflected. The ability of a material to absorb sound is expressed in terms of the sound absorption coefficient. The sound absorption coefficient (α) is the percentage of sound absorbed by the material. If the material has $\alpha = 0.8$ at 500 Hz it means that 80% of the sound is absorbed at this frequency.

Sound absorption can be measured using the procedures set out in BS EN 20354. Single figure descriptors include the practical sound absorption coefficient (α_p) and weighted sound absorption coefficient (α_w) as defined in BS EN ISO 11654. Other commonly used terms (in the USA) are NRC (Noise Reduction Coefficient) which is the arithmetic average of α at 250 Hz, 500 Hz, 1 kHz and 2 kHz rounded to the nearest 5%.

SOUND POWER LEVEL (Lw)

The sound power level of a sound source, in decibels, is 10 times the logarithm to the base 10 of the ratio of sound power radiated by the source to a reference power. The reference power is 1 picowatt (1×10^{-12} watt).

The sound power level is the fundamental measure of the total sound energy radiated by a source per unit of time.

SOUND LEVEL DIFFERENCE (D)

The sound insulation required between two spaces may be determined by the sound level difference (D) needed between them. Single figure descriptors include the weighted sound level difference (D_w) and the normalised weighted sound level difference (D_{nTw}) as defined in BS EN ISO 717-1.

SOUND PRESSURE LEVEL (SPL)

The level of the pressure of the sound above the internationally accepted reference value of 20 µPa ($2x10^{-5}$ Pa), corresponds to the pressure of the quietest sound an average person can hear at the frequency of 1000 Hz. It is a quantity that can be measured; thus the quantity of a sound can be derived from it.

A value equal to 10 times the logarithm to the base 10 of the ratio of the root-mean-square pressure of a sound to a reference pressure, which is normally taken to be $2x10^{-5}$ Pa.

SOUND REDUCTION INDEX (R)

The sound reduction index, R, (or transmission loss) of a building element is a measure of the loss of sound through the material, ie its attenuation properties. It is a property of the component, unlike the sound level difference which is affected by the common area between the rooms and the acoustic of the receiving room. The weighted sound reduction index, R_w, is a single figure description of the sound reduction index which is defined in BS EN ISO 717-1. The R_w is calculated from measurements in an acoustic laboratory. Sound insulation ratings derived from the site (which are invariably lower than the laboratory figures) are referred to as the R'_w ratings.

SPEECH TRANSMISSION INDEX (STI)

A physical quantity represents the transmission quality of speech for intelligibility, ie the ability to understand the spoken word.

VIBRATION LEVEL

Vibration is generally measured in terms of the velocity (in mm/s or m/s) or the acceleration (in mm/s^2 or m/s^2) but can also be measured in terms of amplitude (in mm or m). These values are often converted into dB values on a logarithmic scale.

VIBRATION DOSE VALUE (VDV)

A measure of the amount of vibration as experienced by a person. It is a dosage based on both the total exposure time and the vibration acceleration level experienced. Only vibrations in the range of 1 Hz to 80 Hz are considered and these are weighted following BS 6472.

WEIGHTED SOUND REDUCTION INDEX (R_w)

The weighted sound reduction index, R_w, is a single figure description of the sound reduction index which is defined in BS EN ISO 717-1: 1997. The R_w is calculated from measurements in an acoustic laboratory. Sound insulation ratings derived from a site (which are invariably lower than the laboratory figures) are referred to as the R'_w.

APPENDIX B

ENVIRONMENTAL SOUND SURVEY

Methodology

The survey consisted of short term attended measurements at four locations across the site to determine the variability of the ambient noise levels.

The measurement locations are illustrated in Figure 4.

A description of all measurement locations and the corresponding sound environment is provided below:

- ANML1: Located along the east boundary of the proposed site facing the sea. The microphone is positioned approximately 1.5m above ground level and away from any reflecting surfaces (free-field). This location is representative of Plot G. The dominant sources of noise in this location are nature sounds (sea waves, seagulls), people walking by talking and cars using the car park.
- ANML2: Located along the north boundary of the proposed site facing the Folkestone port. The microphone is positioned approximately 1.5m above ground level under free-field conditions. This location is representative of Plot G. The dominant sources of noise in this location are nature sounds (sea waves, seagulls) and cars using the car park.
- ANML3: Located along the west boundary of the proposed site facing Marine Parade. The microphone is positioned approximately 15m from the main road edge and 1.5m above ground level under free-field conditions. This location is representative of Plot H and F. The dominant sources of noise in this location are road traffic noise on Marine Parade and nature sounds (seagulls).
- ANML4: Located along the south boundary of the proposed site facing the Folkestone beach. The microphone is positioned approximately 1.5m above ground level under free-field conditions. This location is representative of Plot F and G. The dominant sources of noise in this location are nature sounds (sea waves, seagulls) and people walking by talking.

Survey instrumentation

The equipment used during the survey is detailed in Table B1. All equipment used was within the calibration dates and calibration certificates are available upon request.

The sound level meter and microphone were calibrated before and after the measurements and no significant calibration drift was observed.

Table B1: Equipment details.

Type	Manufacturer	Model	Serial Number	Last Calibration Date	Calibration Certificate No.
Sound Level Meter	Svantek	971A	113204	12/08/2021	Factory Cal
Microphone	ACO PACIFC	7152	80678	12/08/2021	Factory Cal
Preamplifier	Svantek	SV18A	113706	12/08/2021	Factory Cal
Calibrator	Svantek	SV33B	116283	31/10/2022	Factory Cal

Weather information

The morning/ afternoon sound measurements were undertaken from 13:10 to 16:01 29/03/2023. The evening measurements covered from 19:14 to 20:54 29/03/2023, and the night-time measurements from 23:11 29/03/2023 to 00:57 30/03/2023.

Meteorological conditions were noted during the time of the surveys. The air temperature ranged between 10°C and 12°C, with minimum to moderate cloud cover over the measurement period. Although the data provided by the local weather station indicate wind speeds above 5m/s at times between 13:00-16:00, no wind affected the measurements during the morning/afternoon survey. Wind speeds during the evening survey (19:00-21:00) were always below 5m/s and therefore measurements were not affected by weather. During the night-time survey (23:00-01:00am), wind speeds exceeded 5 m/s. However, measurement locations were slightly altered to avoid strong gusts while measuring the same ambient noise. Data were also assessed, and it was found that the wind did not impact the night-time measurement data. Therefore, the measurement locations were unaffected by weather conditions.

Table B2 below summarises the weather during the survey period.

Table B2: Weather information

Time	Temperature (°C)	Weather	Wind speed (m/s)	Wind direction
Wednesday 29 March 2023				
13:00	10	Cool	8	N
14:00	10	Cool	5	NNE
15:00	10	Cool	6	NNE
16:00	11	Cool	6	NE
19:00	12	Cool	5	NE
20:00	10	Cool	4	NE
21:00	10	Cool	5	NE
23:00	11	Cool	11	NE
Thursday 30 March 2023				
00:00	10	Cool	10	NE
01:00	10	Cool	10	NE

Survey Measurements

The attended monitoring results are presented in Table B3 below.

Table B3: Attended monitoring results

Monitoring Position	Date	Start time (hh:mm)	Duration (mm:ss)	Measured L_{Aeq} (dB)	Measured L_{A10} (dB)	Measured L_{A90} (dB)	Measured L_{AFmax} (dB)
Morning/ Afternoon							
1	23/09/2023	13:00	10:00	47.2	49	44.3	63.1
	23/09/2023	14:00	10:00	48.6	48.8	43.9	73.6
	23/09/2023	15:05	10:00	47.7	48.5	45.1	69.2

Monitoring Position	Date	Start time (hh:mm)	Duration (mm:ss)	Measured L_{Aeq} (dB)	Measured L_{A10} (dB)	Measured L_{A90} (dB)	Measured L_{AFmax} (dB)
2	23/09/2023	13:25	10:00	51.5	53.5	47.9	63.3
	23/09/2023	14:22	10:00	48.9	51.1	44.9	65.8
	23/09/2023	15:28	10:00	49.8	51.5	45.4	68.3
3	23/09/2023	13:37	10:00	56.4	59.7	47.8	66.0
	23/09/2023	14:35	10:00	60.8	61.9	47.9	78.5
	23/09/2023	15:41	10:00	56.8	60.2	47.5	67.8
4	23/09/2023	13:53	10:00	47.1	48.4	44.9	66.9
	23/09/2023	15:00	10:00	45.8	47.4	42.7	61.8
	23/09/2023	16:01	10:00	50.3	49.1	43.7	77.8
Evening							
1	23/09/2023	19:14:42	10:00	47.7	49.5	45.3	63.5
	23/09/2023	20:13:02	10:00	45.3	46.4	43.3	63.8
2	23/09/2023	19:26:51	10:00	48.1	49.1	43.5	65.4
	23/09/2023	20:26:30	10:00	48.7	49.1	43.3	70.9
3	23/09/2023	19:40:24	10:00	52.1	56.5	42.3	65.3
	23/09/2023	20:40:19	10:00	53.2	57.7	40.5	72.1
4	23/09/2023	19:53:37	10:00	45	47	42.5	61
	23/09/2023	20:54:38	10:00	45.7	47.7	42.4	60.1
Night-time							
1	23/09/2023	23:11:33	10:00	48.6	49.7	47.3	59.2
	30/09/2023	00:13:04	10:00	49.1	51.1	46.6	58.6
2	30/09/2023	23:25:39	10:00	49.7	51.4	47.6	58.3
	30/09/2023	00:27:45	10:00	49.2	50.9	47	56
3	30/09/2023	23:40:41	10:00	50.3	54.1	44.4	63.4
	30/09/2023	00:42:30	10:00	47.8	48.4	43.8	72.4
4	30/09/2023	23:59:22	10:00	50.3	51.5	48.8	63.1
	30/09/2023	00:57:43	10:00	51.6	52	49.8	73.9

The $L_{Aeq,T}$ values for the monitoring positions are calculated as the energy average (logarithmic average) for the daytime and night-time periods. This approach assumes that noise levels from 07:00 to 23:00 are represented by the levels measured from 13:00-16:00 and 19:00-21:00, and that noise levels during the period 02:00 to 07:00 are not expected to be higher than the acquired data during 23:00 to 01:00.

Table B4 below outlines the calculated daytime $L_{Aeq,16hr}$ and night-time $L_{Aeq,8hr}$ for each location.

Monitoring location	Daytime (07:00-23:00) dB $L_{Aeq,16hour}$	Night-time (23:00-07:00) dB $L_{Aeq,8hour}$
1	47.4	48.9
2	49.6	49.5
3	57.0	49.2
4	47.2	51.0

In the absence of long-term data, the highest measured maximum value measured during the period 23:00 – 01:00 has been taken as the representative maximum sound level. The average measured L_{A90} has been taken as the representative background.

The typical noise spectra derived from the measured data and used in the acoustic assessment is included in the table below:

Table B5: Typical external noise spectra from the measurement data.

Monitoring location	Period	Sound Pressure Level (dB) at Octave Band Centre Frequency (Hz)							Total
		63	125	250	500	1000	2000	4000	dB(A)
1	Daytime L_{Aeq} (dB) (07:00-23:00)	55.7	50.6	46.0	44.0	43.4	39.2	32.9	47.4
	Night-time L_{Aeq} (dB) (23:00-07:00)	52.5	48.1	46.7	46.8	44.3	41.2	35.2	48.9
	Night-time L_{ZFmax} (dB) (23:00-07:00)	68.5	58.2	61.3	57.2	53.1	52.6	47.7	58.9
2	Daytime L_{Aeq} (dB) (07:00-23:00)	55.2	49.7	47.1	46.2	46.0	41.4	34.2	49.6
	Night-time L_{Aeq} (dB) (23:00-07:00)	55.4	48.3	45.6	46.6	45.4	42.1	35.1	49.5
	Night-time L_{ZFmax} (dB) (23:00-07:00)	72.9	60.2	56.3	55.9	54.7	52.1	47.3	57.2
3	Daytime L_{Aeq} (dB) (07:00-23:00)	58.4	53.8	54.1	52.4	53.7	49.7	41.8	57.0
	Night-time L_{Aeq} (dB) (23:00-07:00)	54.4	49.7	48.9	45.9	44.9	41.5	35.4	49.2
	Night-time L_{ZFmax} (dB) (23:00-07:00)	73.5	65.3	62.3	63.6	60.9	60.2	61.5	67.9
4	Daytime L_{Aeq} (dB) (07:00-23:00)	52.1	48.9	43.5	43.6	42.8	40.1	35.6	47.2
	Night-time L_{Aeq} (dB) (23:00-07:00)	51.5	48.5	46.5	47.7	46.9	43.8	38.7	51.0
	Night-time L_{ZFmax} (dB) (23:00-07:00)	68.0	57.3	53.5	62.6	61.6	60.5	55.7	68.5

APPENDIX C

BUILDING ENVELOPE DESIGN CONSIDERATIONS (FOR INFORAMTION ONLY)

Building Envelope

The sound insulation performance of the building envelope, including the ventilation strategy, depends upon the external noise levels incident at each façade as well as the design criteria for the internal noise levels of specific rooms according to their use.

Outline calculations have been undertaken in line with the method set out in BS8233:2014, based on the measured and calculated noise levels. The results determine the sound insulation performance for the façade.

Further calculations to determine refined octave band specification for the building fabric and the glazing will be undertaken once long-term noise monitoring is carried out and finalised plans / elevations and room details (volume, use, etc.) are available.

Glazing and external doors

The colour-coded mark-up (figure C1) and Table C1 below outline guidance on the level of sound reduction performance needed by the glazing systems for a typical floor in order to meet the internal ambient noise level criteria set out in Section 6.

Figure C1: Façade sound insulation performance zones.

Table C1: Minimum façade sound insulation performances.

Façade zone	Room Type	Minimum Required $R_w + C_{tr}$ (dB) *
Zone 1 (Facades exposed to the area's soundscape excluding traffic and Goodsyard noise**)	Living Room	17
	Bedroom	28
	Commercial	12
Zone 2 (Facades exposed to levels from evening events in the Goodsyard***)	Living Room	27
	Bedroom	35
	Commercial	22
Zone 3 (Facades exposed to noise levels represented by ANML3)	Living Room	25
	Bedroom	30
	Commercial	20

* For information only – further calculations needed when room details are available.
** Calculated as an energy average between ANML1, ANML2, and ANML4.
*** Calculations assume a 65dBA level at the façade of buildings surrounding the Goodsyard.

The sound insulation performances set out in Table C1 apply to the entire façade of each room. However, as the glazing / doors are the 'acoustically weak' element of a façade limiting its performance, the windows / external doors on the various facades will need to achieve the performance given as a minimum.

The performance requirements for the windows and doors apply to the configuration as a whole i.e., glass / door, frame and seals.

Examples of typical glazing configurations capable of achieving the recommended performance are given in Table C2

Table C2: Examples of suitable glazing configurations (for information only)

Minimum Required $R_w + C_{tr}$ (dB)	Typical glazing configuration
28	6mm glass – 12mm cavity – 4mm glass (28dB $R_w + C_{tr}$)
35	10mm glass – 12mm cavity – 6.4mm acoustic laminate (35 dB Rw + Ctr)
30	10mm glass – 12mm cavity - 6mm glass (30dB Rw + Ctr)

Solid façade

Solid elements of the façade should achieve a performance at least 10 dB higher than that of the windows / external doors. Table C3 below sets out the minimum sound insulation performance requirements for the solid sections of the façade for the different façade zones.

Façade zone	Minimum Required $R_w + C_{tr}$ (dB)
Zone 1	38
Zone 2	45
Zone 3	50

The Goods Yard

At this stage layout and construction details of The Goods Yard are not known. However, the sound insulation, internal sound levels and operational management will be detailed to limit

façade noise levels at residential dwellings to no more than 65 dB $L_{Aeq,\ 15\ minutes}$ between 7am and 11pm and 60 dB $L_{Aeq,\ 15\ minutes}$ between 11pm and 7am.

Details of the construction and operations must be provided to CDC for review.

APPENDIX D

BUILDING SERVICES DESIGN CONSIDERATIONS (FOR INFORAMTION ONLY)

Fan coil units

It should be noted that the residential NR ratings stated within Table 9 of Section 9 include contributions from the fan coil units (FCU) in each space.

In order to achieve these limits, spatial allowance for a 600mm length attenuator (minimum) and cross-section similar to the FCU should be provided on both the supply and return air paths (at the back of the return grille plenum or shadow gap) of all fan coil units.

In addition to the silencers, acoustic treatment of the fan coil units is required to prevent noise break-out into the room and to prevent any structural connections between the fan coil unit and any adjacent linings (including party walls, internal partitions, joinery and ceilings).

For horizontal units, this treatment is limited to the provision of a ceiling formed from at least a single layer of dense plasterboard. However, all horizontal FCU are required to be resiliently mounted from the soffit via appropriate manufacturer approved anti-vibration mounts.

Where FCUs are installed within the ceiling voids in residential apartments, the ceiling should be at least 50 mm to the underside of the FCU and 25 mm mineral wool should be placed between the unit and the ceiling. If fibre migration is a concern, the mineral wool can be replaced with open cell foam.

For vertical units, the joinery package cannot be relied on to provide a suitable acoustic enclosure between the fan coil unit and the room, as it will have gaps in and not provide suitable separation. Additionally, if there is a rigid connection between the fan coil unit and any adjacent linings (party walls, internal partitions, joinery etc.), then noise and vibration will be able to transmit which will in turn vibrate, manifesting itself as re-radiated noise within the room. The only effective method of preventing re-radiated noise is to prevent vibration transmitting into any adjacent structure.

As such, an independent solid dense plasterboard lining is required to enclose all vertical fan coil units. Any joinery must then be provided in addition to the acoustic treatment.

In addition, all vertical FCU are required to be resiliently supported from the floor slab above and below, via a suitable steel structure (for example, uni-strut system). Under no circumstances shall it be acceptable to mount fan coil units to any party walls or internal partitions

MVHR units

Noise emanating from MVHR units (duct-borne and casing radiated) shall not exceed the noise limits set out within Table 9 of Section 9.

All MVHR units must achieve the various room noise criteria during boost operation. This is critically important as noise during the boost mode can be significantly higher than the normal background mode of operation. Boost mode will usually cut in when entering a bathroom or to limit summertime overheating. The time period during boost operation can therefore vary, however it is considered unacceptable to increase noise levels within the apartments beyond the building services internal limits set out in Table 9.

This will require careful selection of plant alongside an installation strategy that allows the maximum level of sound insulation with minimum space.

In order to reduce noise from the MVHR units, the following outline strategy is proposed:

- MVHR units should be in a dedicated utility cupboard and are required to be floor mounted on resilient mounts or resiliently supported from the soffit via a suitable steel structure with no contact to any party walls or internal partitions. Under no circumstances shall it be acceptable to mount MVHR units to any party walls or internal partitions.
- Spatial provision is required for 900 - 1200mm length attenuators (minimum) on the air intake, supply, extract and exhaust air paths within the utility cupboard, depending on the plant selection.
- Flexible ducting which allows noise breakout should be avoided between mechanical plant and attenuators. If these connections are located between the MVHR and silencer, then they will require acoustic lagging due to noise breakout and this is not advised.
- Provide an enclosure around the MVHR unit that ensures noise levels in adjacent spaces, including the space immediately adjacent to the cupboard doors, do not exceed the various room criteria. Provisions on similar projects include either one of the following:
    - Provide a proprietary acoustic enclosure designed for MVHR units and manufactured by Nuaire, Vent-Axia and Vectaire. It should be noted that this solution restricts the client to a limited number of MVHR manufacturers; or
    - Provide an enclosure formed of plasterboard / MDF with a suitable access panel; or
    - Provide acoustically rated doors and seals to the utility cupboard.