



Architectural & Environmental Acousticians
Noise & Vibration Engineers

PART 2 ACOUSTIC DESIGN REPORT

CLARENDON ROAD PHASE 3A

ST WILLIAM HOMES LLP

W257-CAS-DD-XX-RP-AC-77-0003-P3

PART 2 ACOUSTIC DESIGN REPORT

PROJECT: CLARENDON ROAD PHASE 3A

CLIENT: ST WILLIAM HOMES LLP

CLIENT ADDRESS: BERKELEY HOUSE
19 PORTSMOUTH ROAD
COBHAM
LONDON
KT11 1JG

COMPANY ADDRESS: CASS ALLEN ASSOCIATES LTD
BEDFORD I-LAB
PRIORY BUSINESS PARK
BEDFORD
MK44 3RZ

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1. INTRODUCTION

1.1 This report outlines the acoustic design of the Clarendon Road (Phase 3a) development.

1.2 The assessment has been carried out in accordance with the requirements of the 'Part 2 brief', and also noise-related Planning Conditions 9 & 30 (Planning Application Ref. no. HGY/2017/3117) that have been imposed on the development. The conditions are:

Condition 9

COMPLIANCE – Development in accordance with Noise and Vibration Report

The development shall be completed in accordance with the approved Noise and Vibration Report (Chapter 10 ES, Watermans dated October 2017), and the noise and vibration limits contained therein, unless otherwise approved by the local planning authority. Noise from fixed building services plant shall comply with the levels shown below and be designed to a level no less than 10 dB below the existing background noise level at a position 1m from the façade of the nearest sensitive receptors (i.e. Plant LAeq,T = LA90,T -10dB).

Location	Period	Representative LA90,5min	Plant Noise Emission Limit (LAeq,T) ¹⁺²
SR – A & B	Daytime (07:00 and 23:00)	52	42
	Night-time (23:00 and 07:00)	38	35
SR – C	Daytime (07:00 and 23:00)	46	36
	Night-time (23:00 and 07:00)	38	35
SR – D & E	Daytime (07:00 and 23:00)	52	42
	Night-time (23:00 and 07:00)	38	35

Upon request by the local planning authority a noise report shall be produced by a competent person and shall be submitted to and approved by the local planning authority to demonstrate compliance with the above criteria.

Reason: In order to protect the amenities of residential occupiers consistent with Policy 7.15 of the London Plan (2016).

Condition 30

PRE-COMMENCEMENT – Development in accordance with Noise and Vibration Report

- Prior to the commencement of each phase of the development hereby approved, except for Site Preparation Works, details of the sound attenuation to protect against externally generated (environmental) noise sources including rail transport so as to achieve the internal ambient noise levels detailed in Table 10.14 (Chapter 10, ES October 2017) and BS8233:2014 shall be submitted to and approved in writing by the Local Planning Authority. The measured or calculated noise levels shall be determined in accordance to the latest British Standard 8233:2014 Guidance on sound insulation and noise reduction for buildings.
- The approved works are to be completed prior to occupation of the development and retained for the lifetime of the development.
- Prior to first occupation of the development, a Post Completion Report demonstrating compliance with the mitigation measures in A above shall be submitted to and approved by the Local Planning Authority.

Reason: In order to safeguard the amenities, health and safety of neighbouring properties and occupiers and of the area generally, and to ensure compliance with Policy 7.15 of the London Plan (2016).

1.3 This report contains technical terminology; a glossary of terms can be found at www.cassallen.co.uk/glossary.

2. DEVELOPMENT DESCRIPTION

2.1 The development site is located at the disused Clarendon Gas Works, between Hornsey Park Road, Mayes Road, Clarendon Road and the Kings Cross East Coast Main Line, in London. To the west of the site is the Kings Cross East Coast Main Line, a train maintenance building and sidings. Industrial units are located to the north and south of the site, and the east of the site is bounded by existing residential properties.

2.2 An annotated aerial photo of the site is shown in Figure 1 below.

Figure 1 Annotated Aerial Photo



2.3 Phase 3a of the development comprises four blocks (D1-4) of residential properties. A current drawing of the proposed development layout is shown in Appendix 1.

3. NOISE IN HABITABLE AREAS OF THE DEVELOPMENT

3.1 The noise levels that will exist within the habitable areas of the finished development have been predicted based on the existing noise environment at the site and details for the design of the development. The predicted noise levels have then been compared with appropriate design criteria. Suitable mitigation measures have been identified where necessary to achieve acceptable noise levels.

Design criteria – Internal noise levels

3.1 Planning Condition 30 requires the development to achieve the internal noise level criteria given in BS8233:2014 'Guidance on sound insulation and noise reduction for buildings', which are summarised in Table 1 below.

Table 1 BS8233:2014 Internal Noise Criteria

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living room	35 dB LAeq,16hour	-
Dining	Dining room/area	40 dB LAeq,16hour	-
Sleeping (daytime resting)	Bedroom	35 dB LAeq,16hour	30 dB LAeq,8hour

3.2 Planning Condition 30 also requires the development to achieve the internal ambient noise levels detailed in Table 10.14 (shown below) taken from Chapter 10 of the Environmental Statement (ES) prepared by Watermans dated October 2017.

Table 10.14: Indicative Façade Sound Insulation Performance for Glazing Elements

Building / Development Zone	Use	Noise Levels [dB]			Minimum Required Sound Reduction Index [R _w + C _{tr}]
		Day (L _{Aeq,T})	Night (L _{Aeq,T})	Night (L _{AFTmax})	
J2, J4	Residential	64	64	66	≥34
G2	Residential	62	62	63	≥32
H1	Residential	60	57	61	≥27
H2	Residential	64	65	70	≥35
D2	Residential & D1	53	57	58	≥27
E2	Residential & A2	62	62	60	≥32
E3	Residential & A1	56	57	58	≥27
D4	Residential & D1	51	55	56	≥27
E1	Residential & A1	52	61	64	≥31
C1	Residential & B1	67	68	76	≥38
D1	Residential	61	56	58	≥27
D3	Residential & D2	52	56	56	≥27
A4	Residential & B3	67	68	76	≥38
B4	Residential	55	58	63	≥28
A3	Residential	67	68	76	≥37
B3	Residential	56	57	63	≥27
A2	Residential	66	67	74	≥37
B2	Residential	58	59	65	≥29
A1	Residential	66	67	72	≥37
B1	Residential	58	62	62	≥32

3.3 The data shown in Table 10.14 from Chapter 10 of the ES is indicative only and therefore should be superseded by the detailed acoustic façade specification given in this report.

3.4 St William Homes also has an internal design guide that requires internal ambient noise levels within habitable rooms to meet the criteria stipulated in Table 2 below, which is derived from the guidance within BS8233.

Table 2 St William Design Guide Requirements – Internal Noise

Location	Min. Accepted dB
Habitable rooms	35 dB
Bedrooms	30 dB
Risers / Plan / Lifts	<30dB (external of)
Fans	<25dB
Smoke Extract	4dB below background

3.5 Given that the internal noise criteria for habitable rooms (including bedrooms) in Table 2 above do not explicitly state a time period for which the levels should be targeted, it is deemed appropriate to use the guidance within BS8233 from which these criteria are derived.

3.6 Although not part of Planning Condition 30, BS8233 provides guidance with regards to noise limits for external amenity areas, which for the current development are balconies. BS8233 states that it is desirable that noise levels in external amenity areas of residential developments do not exceed 50 dB LAeq and that 55 dB LAeq,T should be regarded as a upper guideline value. BS8233 recognises however that these guideline values will not always be achievable in city centres or urban areas adjoining main roads or other transport sources, as is the case with the current development. In these cases, BS8233 states that the development should be designed to achieve the lowest practical noise levels in the amenity spaces.

3.7 The following acoustic design criteria have therefore been adopted for the development:

- Average noise levels in living rooms and dining rooms during the day should not exceed 35 dB LAeq,0700-2300hrs;
- Average noise levels in bedrooms should not exceed 35 dB LAeq,0700-2300hrs during the day and 30 dB LAeq,2300-0700hrs during the night;
- Where possible, average noise levels in external amenity areas during the day should be lower than 50-55 dB LAeq,0700-2300hrs.

Existing site noise levels

3.8 Numerous noise surveys of the site have been carried out:

- Waterman Infrastructure & Environment Ltd: 28/7/2016 to 2/8/2016
- Hodgkinson Consultancy: 18/8/2017 to 23/8/2017
- Cass Allen Associates Ltd: 25/7/2018
- Cass Allen Associates Ltd: 22/11/2019

3.9 The purpose of the noise surveys carried out at the site by Cass Allen were to validate the existing noise data from the previous surveys and to determine if the noise environment had significantly changed. The full methodology and results of this noise survey are provided in Appendix 2. The results from the Cass Allen surveys confirm that the overall noise levels at the site had not changed significantly, therefore noise data from all surveys have been used to inform the current assessment.

3.10 Average and maximum noise levels are dictated by train movements on the adjacent railway (Kings Cross East Coast Main Line), both commuter and freight trains contribute to overall levels. It has been confirmed by St James that the rail maintenance building directly to the west of the site is not operational during the night time. Towards the east of the site road traffic from Clarendon Road/Mary Neuner Road and Hornsey Park Road contribute to noise levels during the day.

3.11 Background noise levels across the site are dictated by constant road traffic on roads in the area.

3.12 Areas of the development facing Clarendon Road/Mary Neuner Road will be subject to the highest daytime noise levels. The noise survey results show that noise level at this position is as follows:

- Average noise levels during the daytime - 61 dB LAeq,0700-2300hrs;

3.13 Areas of the development at western edge of the site facing the railway will be subject to the highest night time noise levels. The noise survey results show that noise levels at this position are as follows:

- Average noise levels during the night-time - 58 dB LAeq,2300-0700hrs;

3.14 Based on the results of the site noise survey, a 3D computer noise model was developed to predict and assess the noise levels that will exist across the entire development.

3.15 The 3D noise model was developed using Cadna/A 2020 environmental noise modelling software. Cadna/A incorporates the calculation methodology outlined in the Department of Transport Welsh Office - *Calculation of Road Traffic Noise* (CRTN) for the assessment of road traffic noise propagation and CRN for rail noise.

3.16 The layout of the development and surrounding area was input into the model. To calculate the spread of noise levels around the site, day-time average noise levels were input for the surrounding roads and railway and calibrated to the results of the on-site noise measurements.

3.17 The methodology and results of the noise modelling are provided in Appendix 3. It can be seen from the modelling results that noise levels will be highest on facades of the development facing the railway, and Mary Neuner Road.

3.18 A subjective assessment of vibration was carried out whilst on site and confirmed that vibration levels were very low and considered to be imperceptible.

Internal noise levels in noise-sensitive rooms

3.19 The facades of the development will predominantly be constructed using a masonry construction comprising a facing brick, which will provide a high level of sound insulation. Therefore, noise ingress through the facades will be dictated by the glazing and ventilators.

3.20 It is noted that that there are a number of facades at the upper levels across the blocks which will be constructed using a lighter weight construction. These constructions will need to be assessed in detail in due course, however it should be relatively straightforward to achieve a sufficient level of sound insulation given these facades are further away and partially screened from the surrounding noise sources.

3.21 The ventilation scheme for the project will be continuous mechanical extraction ventilation (MEV) with trickle ventilators in the external facades (i.e. System 3 as per Building Regulations Part F). Openable windows will be used for the provision of purge ventilation.

3.22 Calculations were carried out using façade modelling software in accordance with the methodology given in BS8233:2014 to calculate the sound insulation performance required of the glazing to achieve the nominated internal noise criteria in the habitable rooms of the development.

3.23 The calculations were carried out based on the dimensions/details for facade elements taken from project drawings. In addition, two ventilators were assumed for living rooms and one ventilator was assumed for bedrooms.

3.24 The results of the calculations are given in Appendix 4. Based on the results of the calculations, a specification has been developed showing the sound insulation performance requirements for all facades of the development. The façade specification is shown in Appendix 5 and is summarised in Table 3 below.

3.25 The specification also shows examples of glazing and ventilator types that would typically be expected to achieve the required levels of sound insulation.

Table 3 Façade Specification

'Worst Case' Rooms	Glazing Performance Requirements (inc. Frames)	Ventilator Performance Requirements
Bedrooms in block D1 (southern façade, floors 1-4; western façade, floors 1-6) (2300-0700hrs)	33 dB Rw+Ctr	40 dB Dne,w + Ctr
Living rooms in block D1 (southern façade, floors 1-4; western façade, floors 1-6) (0700-2300hrs)	33 dB Rw+Ctr	40 dB Dne,w + Ctr
All other bedrooms in the development (2300-0700hrs)	27 dB Rw+Ctr	31 dB Dne,w + Ctr

'Worst Case' Rooms	Glazing Performance Requirements (inc. Frames)	Ventilator Performance Requirements
All other living rooms in the development (0700-2300hrs)	27 dB Rw+Ctr	31 dB Dne,w + Ctr

3.26 As can be seen from the façade specification, standard thermal double glazing and 'hit & miss' in-frame trickle ventilation has been specified for the majority of the façades of the development. The exceptions are two facades on block D1 (southern façade, floors 1-4; western façade, floors 1-6) which require acoustically upgraded thermal double glazing and acoustically upgraded in-frame trickle ventilators.

3.27 The façade specifications provided above are also expected to be sufficient to mitigate against noise from commercial properties at ground level.

Noise levels in external amenity areas

3.28 The layout of the development has also been reviewed in relation to the BS8233 recommendation that noise levels in external amenity areas should ideally not exceed 50 – 55 dB LAeq,T.

3.29 Based on the results of the noise survey and 3D noise model, noise levels on balconies overlooking Mary Neuner Road would be expected to exceed the BS8233 recommended levels by around 6 dB. However, whilst this is not ideal, in our view, exceeding the BS8233 recommended levels does not normally mean that the balconies would be unacceptable to future residents as most developments in urban areas will be subject to noise levels above the BS8233 recommended levels for balconies and it is reasonable to assume that residents would prefer the option to have a noisier balcony as opposed to having no balcony at all.

4. PLANT NOISE DESIGN

Design criteria – Mechanical plant noise

4.1 Planning Condition 9 contains specific limits for mechanical plant noise emissions from the development. The condition states that noise from the new plant shall comply with the levels within the approved Noise and Vibration Report (Chapter 10 ES, Watermans dated October 2017), and be designed to a level 10 dB below the existing background noise level at a position 1m from the façade of the nearest sensitive receptors.

4.2 The requirements of Planning Condition 10 are based on the general assessment methodology given in BS4142. The BS4142 assessment methodology can be summarised as follows:

1. Measure the existing background noise levels (LA90,T dB) at the locations of nearby noise sensitive receptors during the quietest periods when the noise source(s) under investigation will operate;
2. Predict or measure the noise emissions (LAeq,T dB) from the noise source(s) under investigation at the location(s) of the nearby sensitive receptors, and add corrections for any distinguishable acoustic features (e.g. tones, whines, screeches, hisses etc);
3. Subtract the measured background noise levels (item 1 above) with the measured or predicted rating noise levels (item 2 above) at each sensitive receptor. BS4142 states that:

a) Typically, the greater this difference, the greater the magnitude of the impact.

b) A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.

c) A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.

d) The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

NOTE Adverse impacts include, but are not limited to, annoyance and sleep disturbance. Not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact.

4.3 It should be noted that the requirements of Planning Condition 9 state that the plant noise should not exceed 10 dB lower than the background noise levels. This is a fairly stringent criterion when considered against the guidance within BS4142, however, it is a commonly adopted design target.

4.4 Background noise levels (LA90) at the site were measured as part of the site noise surveys previously carried out. The measured background noise levels have been used to develop limits for plant noise emissions from the new development at the positions of the surrounding residential properties in accordance with the BS4142 assessment methodology. The limits for the existing nearest sensitive receptors, as defined in the approved Noise and Vibration Report (Chapter 10 ES, Watermans dated October 2017), are shown in Table 4 below.

Table 4 Plant Noise Limits at Existing Nearest Sensitive Receptors

Location	Period	Representative LA90,5min	Plant Noise Emission Limit (LAeq,T) ¹⁺²
SR – A & B	Daytime (07:00 and 23:00)	52	42
	Night-time (23:00 and 07:00)	38	35
SR – C	Daytime (07:00 and 23:00)	46	36
	Night-time (23:00 and 07:00)	38	35
SR – D & E	Daytime (07:00 and 23:00)	52	42
	Night-time (23:00 and 07:00)	38	35

Notes: ¹ If there is determined to be tonal or intermittent content emitting from plant then an acoustic feature correction should be applied in accordance with BS4142:2014 advice. ² Noise limits apply at a position 1m from the façade of the nearest noise sensitive properties and include the total contribution of noise from all noise generating plant that may run during any particular period.

4.5 Location B is the most representative of the nearest residential properties to Phase 3a of the development and therefore have been adopted for the design, i.e:

- 42 dB LAeq,T during the daytime

- 35 dB LAeq,T during the night-time

4.6 Paragraph 10.7.40 within the approved Noise and Vibration Report (Chapter 10 ES, Watermans dated October 2017), caveats the plant noise levels by limiting them to 35 dB LAeq,T where 10 dB less than the prevailing background noise level becomes less than this limit. This avoids unrealistic design targets for plant noise mitigation where background noise levels are particularly low.

4.7 St William Homes also require the plant noise criteria displayed in Table 5 below, to be met. It is assumed that the noise criteria relating to risers, lifts and fans pertain to internal noise limits within the buildings of the development (i.e. in corridors), and that the fan noise criteria is for fans within dwellings as measured in the centre of the habitable rooms.

Table 5 Project Requirements – Mechanical Plant Noise Limits

Location	Min. Accepted dB
Habitable rooms	35 dB
Bedrooms	30 dB
Risers / Plan / Lifts	<30dB (external of)
Fans	<25dB
Smoke Extract	4dB below background

4.8 The St William Homes criteria does not include noise limits for other items of mechanical plant such as boilers and CHP units etc. In our view a criteria of 20 dB, LAeq,T as measured in the centre of habitable rooms is considered reasonable for these items.

4.9 In terms of noise levels from lifts within living accommodation, it is common practice to adopt the guidance provided in BS8233, which is as follows:

- Bedroom: ≤ 25 dB LAmax,F
- Living room: ≤ 30 dB LAmax,F
- Other areas: ≤ 35 dB LAmax,F

Proposed mechanical plant design

4.10 Detailed design information is not yet available for external mechanical plant for the development, and therefore noise emissions from external mechanical plant cannot be accurately predicted at the positions of nearby residential properties at this stage.

4.11 The selection and design of external mechanical plant will be reviewed as project information becomes available to ensure that the project noise limits are achieved.

4.12 Given that plant rooms and rooftop plant areas are proposed adjacent to residential properties within the development itself, noise mitigation is likely to be required in order to meet the plant noise limits shown in Table 5 and paragraph 4.8. This could be in the form of acoustically attenuated louvres on the façades of the plant rooms, or selecting sufficiently quiet equipment. In terms of rooftop plant, suitably specified attenuators and/or acoustic barriers will be selected. This will be assessed as the design progresses.

4.13 It is understood at this stage that floor type F4 and wall type E2 will be separating commercial/plant room spaces from residential units within the development. The build-up of F4 is shown in Table 6 below:

Table 6 Build-up of floor separating commercial/plant spaces from residential

Floor Type F4	
	• 15mm Finish zone • 45mm Liquid applied anhydrite screed • Separating layer (TBC) • 160mm Kingspan K103 Phenolic foam rigid insulation • 10mm acoustic layer • 225 concrete slab
Note	Floor build-up taken from typical wall types drawing ref. W257-PTE-DE-ZZ-DR-A-33-0001 P2

4.14 In order to achieve the fan noise criteria in Table 5, appropriate specifications for noise levels from MEV fans (operating at typical maximum duty) would be < 25 dB LAeq,T in the centre of habitable rooms. It is assumed that this applies during background ventilation duties. A relaxation of 5 dB in the limits would be appropriate for boost ventilation rates.

5. SOUND INSULATION BETWEEN UNITS

5.1 The ADE requirements for sound insulation for “Purpose built dwelling-houses and flats” are summarised in Table 7.

Table 7 Current ADE Requirements – Sound Insulation

Partition	Airborne Sound Insulation (Minimum Limits)	Impact Sound Insulation (Maximum Limits)
Separating walls between dwellings (or between dwellings and commercial areas)	45 dB DnTw+Ctr (see Note 1)	-
Separating floors between dwellings (or between dwellings and commercial areas)	45 dB DnTw+Ctr (see Note 1)	62 dB L'nTw (see Note 1)
Internal Partitions within dwellings (e.g. between bedrooms etc)	40 dB Rw	-

Note 1 Building Control requires evidence that developments achieve these criteria either through pre-completion sound insulation testing or the use of Robust Details.

5.2 In addition to the standard Building Regulation requirements, all separating walls and floors should be designed to achieve 5 dB better than Building Regulation standards, as required by St William Homes. The resultant requirements for the development are shown in Table 8.

Table 8 Project Requirements – Sound Insulation Between Units

Partition	Airborne Sound Insulation (Minimum Limits)	Impact Sound Insulation (Maximum Limits)
Separating walls between dwellings (or between dwellings and commercial areas)	50 dB DnTw+Ctr	-
Separating floors between dwellings (or between dwellings and commercial areas)	50 dB DnTw+Ctr	57 dB L'nTw

5.3 It is essential that flanking transmission paths are assessed to ensure that the sound insulation performances of the separating partitions are not compromised. This will be reviewed as the project progresses through RIBA Stages 3 and 4 to ensure that the design criteria in Table 6 is achieved.

6. REVERBERATION CONTROL IN COMMON AREAS

6.1 In addition to sound insulation limits for separating walls and floors, ADE also requires that reverberation control is provided for common areas onto which apartment doors open.

6.2 It is understood that there will be a standard plasterboard ceiling fitted in communal spaces and that a Class C absorber will not be used on the ceiling. As such, Method B, as per ADE, will be adopted to control reverberation in communal spaces. The Method B approach is shown described below

“Determine the minimum amount of absorptive material using a calculation procedure in octave bands. Method B is intended only for corridors, hallways and entrance halls as it is not well suited to stairwells”

6.3 Section 7.11 of ADE discusses required areas of absorption in stairwells to control reverberation. However, these requirements only apply when apartments are accessed directly from the stairwells (i.e. the doors to flats are in the stairwells).

7. ADDITIONAL RECOMMENDATIONS

7.1 Penetrations through separating walls between dwellings should be treated generally as set out in the guidance contained in sections 4.45 to 4.50 of current ADE.

7.2 In particular, electrical sockets should not be fitted back-to-back and removed areas of plasterboard should be kept to an absolute minimum. Wherever practical, sockets should not be located in separating walls. Where unavoidable these should be treated generally in accordance with diagram 2-37 of current ADE.

7.3 Any soil vent pipes running through separating floors should be wrapped with insulation and boxed-in with plasterboard. The boxing-in should run full height inside flats and penetrations through the slab should be sealed airtight around the pipe. Fire stopping as per the building regulations will normally be sufficient in this regard.

7.4 The doors between flats and the corridors should be chosen in light of Section 6.6 of the current ADE, which states:

“Ensure any door has good perimeter sealing (including the threshold where practical) and a minimum mass per unit area of 25 kg/m². Alternatively, use a doorset with a minimum sound reduction index of 29dB Rw (measured in the laboratory according to BS EN ISO 140-3:1995 and rated according to BS EN ISO 717-1:1997). The door should also satisfy the Requirements of Building Regulation Part B -Fire safety.”

7.5 The quality of construction is a major determinant of the sound insulation achieved on site. The assessments of the proposed partitions (to be completed in due course) assume a reasonably high general level of workmanship. Poor workmanship will reduce the achieved insulation and may result in the building regulation criteria not being achieved. It is therefore important to ensure effective site supervision.

8. CONCLUSIONS

- 8.1 Cass Allen Associates was instructed by St William Homes LLP assess the acoustic design of the proposed development as required by the 'Part 2 brief' and Planning Conditions 9 & 30.
- 8.2 Noise levels at the site are dictated by train movements on the adjacent railway and to a lesser extent by road traffic noise emissions from Clarendon Road/Mary Neuner Road and Hornsey Park Road.
- 8.3 Acceptable internal noise levels will be achieved in habitable rooms of the development subject to the adoption of the acoustic glazing specification and ventilation system detailed in Appendix 5 of this report.
- 8.4 Appropriate limits for noise from mechanical plant have been established based on the requirements of Planning Condition 9. The design of the plant will be assessed further in due course as details become available.
- 8.5 Design targets to achieve the internal sound insulation requirements of Approved Document E (ADE), and the project specific criteria, have been provided.
- 8.6 Guidance on reverberation control for common areas onto which apartment doors open, as required by ADE, has been provided.
- 8.7 Additional recommendations in relation to other requirements and guidance within ADE have been provided.

Appendix 1 Development Layout



Appendix 2 Survey Results

Survey Summary:	The survey comprised short-term operator attended noise measurements at the site. Noise levels at the site were generally dictated by train passes on the adjacent railway.
Survey Period:	25/07/2018 and 22/11/2019
Survey Objectives:	- To identify noise sources that contribute to ambient noise levels at the site; - To measure noise levels around the site

Equipment Used (Appendix 2, Table 1):

Type	Manufacturer	Model	Serial Number
Sound level meter¹	Bruel & Kjaer	2250 (G1)	2630237
Calibrator	Bruel & Kjaer	4231	2115551
Sound level meter¹ (noise logger)	Rion	NL-32	01182950

Note 1: All sound level meters were calibrated before and after measurement periods and no significant drift in calibration was found to have occurred. The results of the measurements are therefore considered to be representative.

Weather Conditions:	The observed weather conditions were acceptable for acoustic measurement throughout the attended survey periods (low-medium wind speeds and no rain).
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Measurement Positions (Appendix 2, Table 2):

Position (refer plan below)	Description
N1	Attended noise monitoring position. 5m above railway track on footbridge. Free-field. Direct line of sight to railway
N2	Attended noise monitoring position. 4m above ground. Free-field. Direct line of sight to railway, 20 m from track.

Site Plan showing Measurement Positions (Appendix 2, Figure 2):



Attended Noise Monitoring Results (Appendix 2, Table 3):

Date	Position	Time	Meas. Length	LAeq, dB	LAmix, dB	LA90, dB	Observations
25/07/2018	N1	9:17	5 secs	74	81	72	Noise dictated by fast train pass on adjacent railway
		9:19	8 secs	75	80	64	
		9:19	13 secs	61	68	56	Noise dictated by slow train pass on adjacent railway
		9:24	11 secs	81	87	74	Noise dictated by fast train pass on adjacent railway
		9:25	13 secs	72	77	69	Noise dictated by medium train pass on adjacent railway
		9:26	10 secs	73	76	71	
		9:30	9 secs	79	84	74	Noise dictated by fast train pass on adjacent railway
		9:31	11 secs	72	83	64	
		9:32	8 secs	74	77	72	Noise dictated by medium train pass on adjacent railway
		9:34	11 secs	76	81	65	Noise dictated by fast train pass on adjacent railway
		9:35	7 secs	76	79	73	
		9:36	8 secs	76	81	75	
		9:41	9 secs	75	81	69	
		9:43	11 secs	77	82	62	
		9:43	13 secs	61	68	59	Noise dictated by slow train pass on adjacent railway
		9:43	18 secs	68	73	64	
		9:44	11 secs	76	82	62	Noise dictated by fast train pass on adjacent railway
		9:46	7 secs	83	88	78	
		9:47	15 secs	65	72	59	Noise dictated by slow train pass on adjacent railway
		9:47	11 secs	73	77	66	Noise dictated by medium train pass on adjacent railway
	N2	10:36	1 min	49	58	42	Noise dictated by medium train pass on adjacent railway
		10:37		62	74	42	
		10:39		55	64	44	Noise dictated by slow train pass on adjacent railway
		10:40		68	81	48	Noise dictated by fast train pass on adjacent railway
		10:43		63	75	42	
		10:45		59	72	45	
		10:46		66	75	51	
		10:48		62	72	43	
		10:51		64	75	48	
		10:52		55	65	44	Noise dictated by slow train pass on adjacent railway
		10:59		67	81	46	Noise dictated by fast train pass on adjacent railway
		11:09		71	85	57	
		11:13		69	84	46	
		11:36		65	78	42	Noise dictated by train horn
		11:40		70	89	44	
22/11/2019	N3	15:42	5:00	58	78	52	Noise dictated by sporadic car passes. Background noise levels caused by distant road traffic from nearby roads (predominantly from Mayes Road).
	N4	15:48		54	70	50	
	N5	15:53		56	70	51	

Appendix 3 Modelling Results

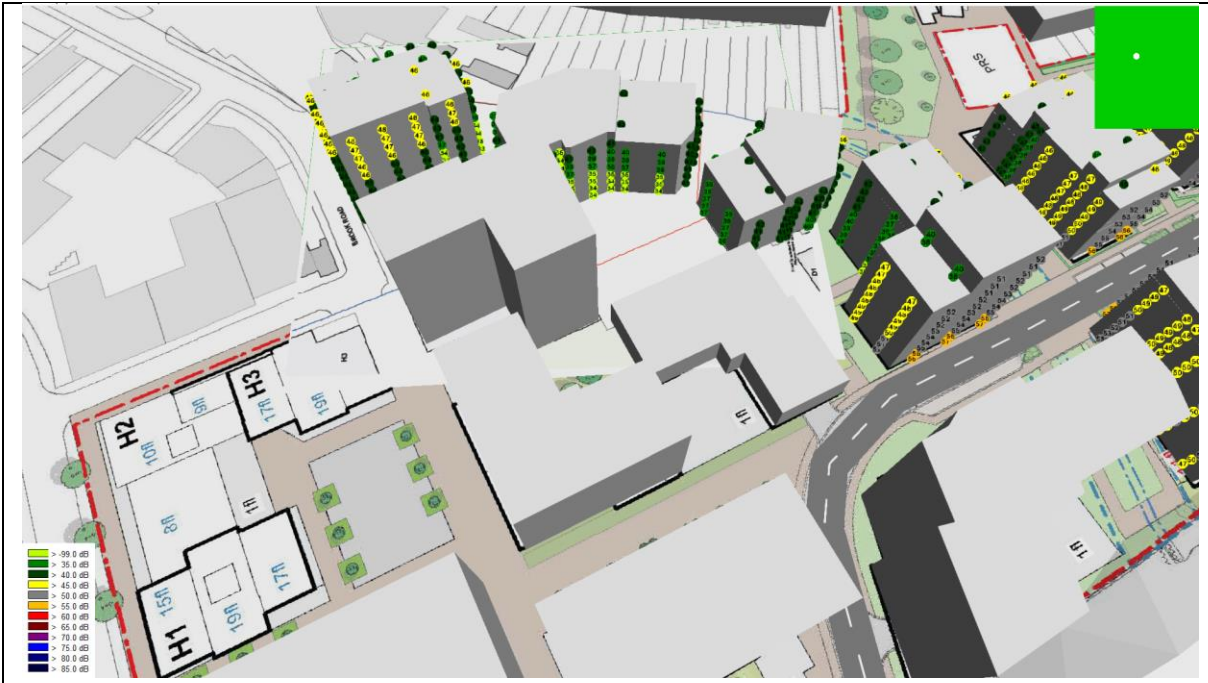
Modelling Software:	CADNA/A Version 2020
Modelled Scenarios:	Day and night-time average noise levels across the site
Data inputs:	Noise survey results

Calculation Algorithms Used:

- Topographical data for the site
 - Development layout
- Calculation of Road Traffic Noise 1988 – Department of Transport
 - ISO 9613-1:1993 Acoustics-Attenuation of sound during propagation outdoors
 - Part 1: Calculation of the absorption of sound by the atmosphere
 - ISO 9613-2:1996 Acoustics-Attenuation of sound during propagation outdoors
 - Part 2: General method of calculation

Modelling Printout (Appendix 3, Figure 1):

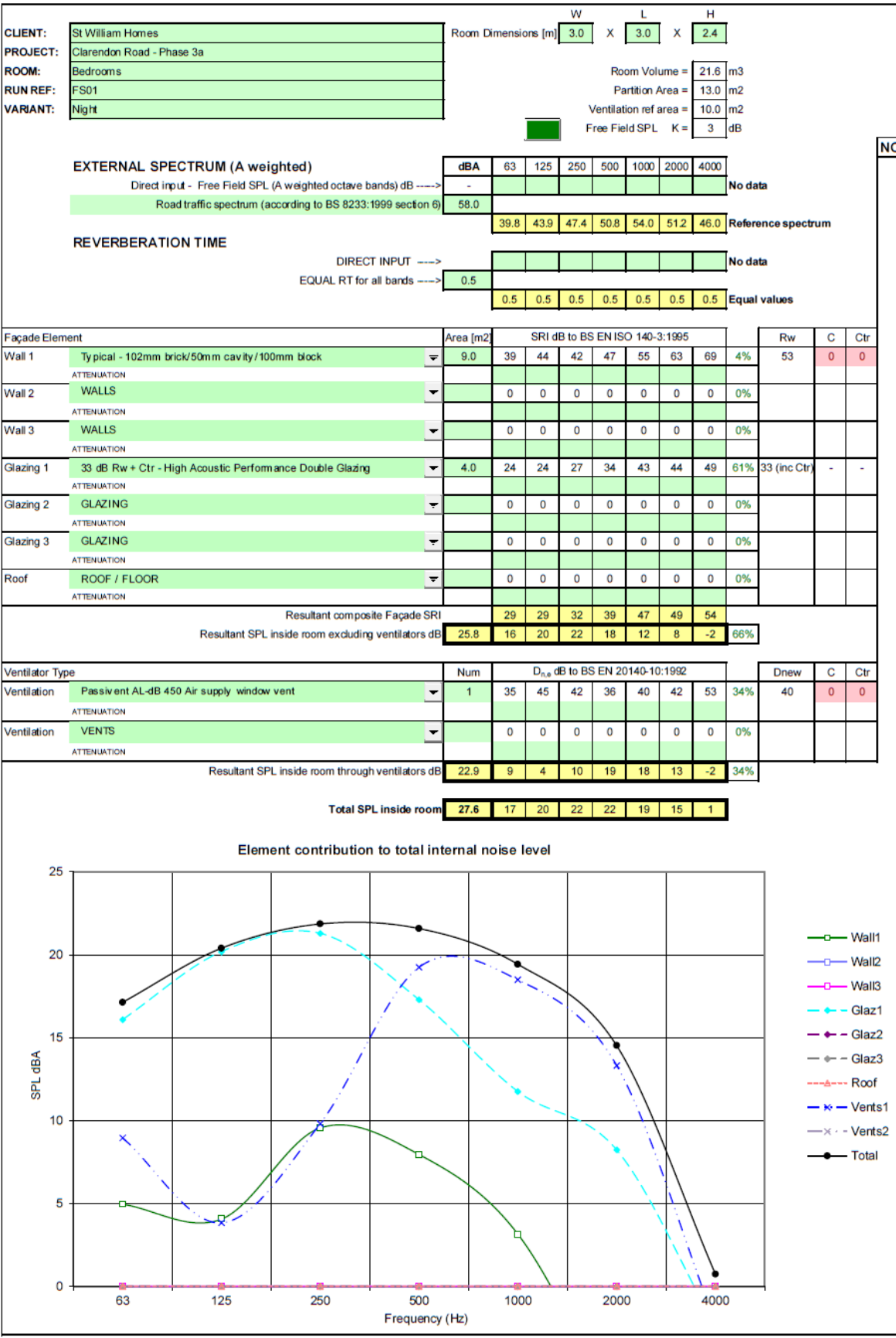
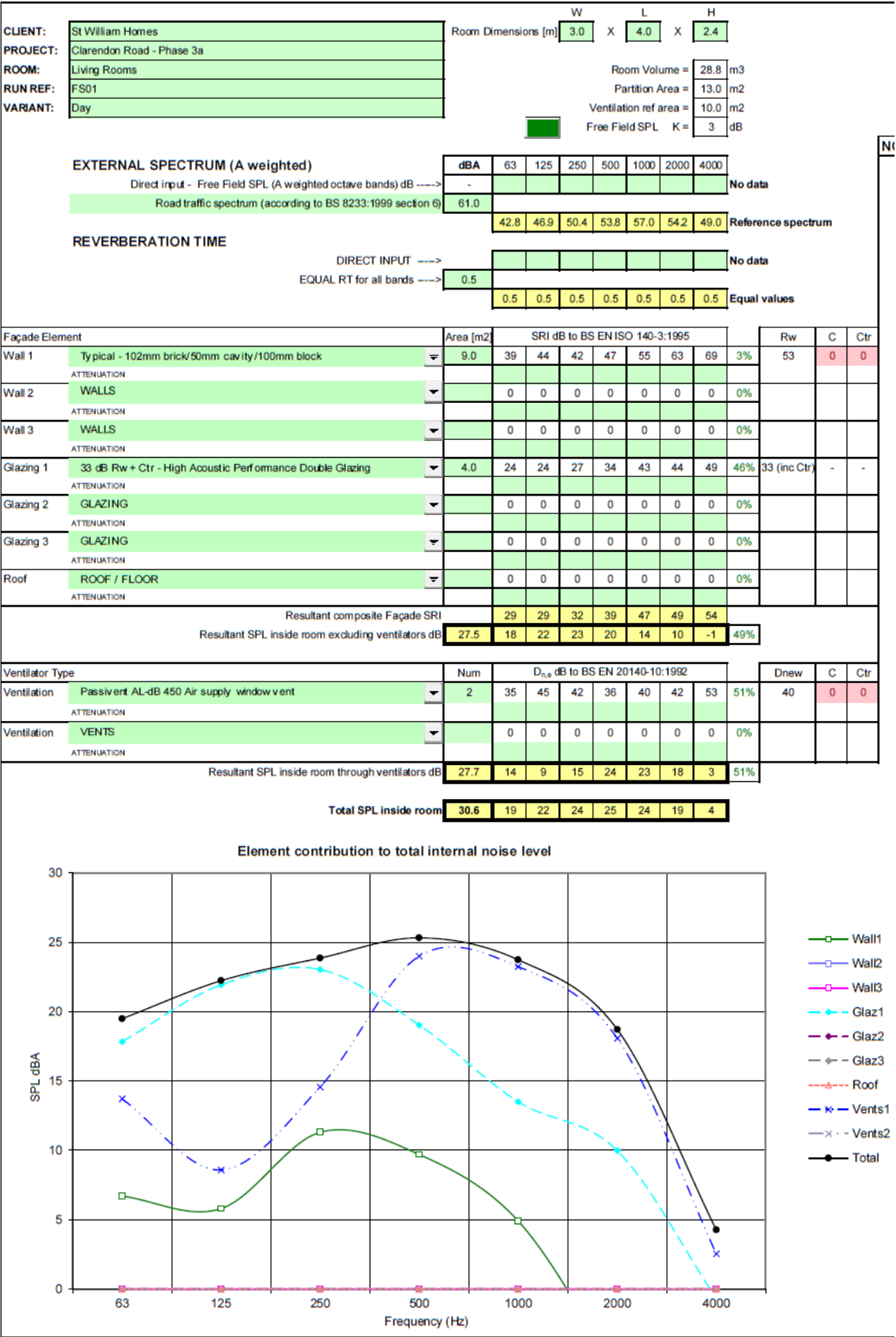


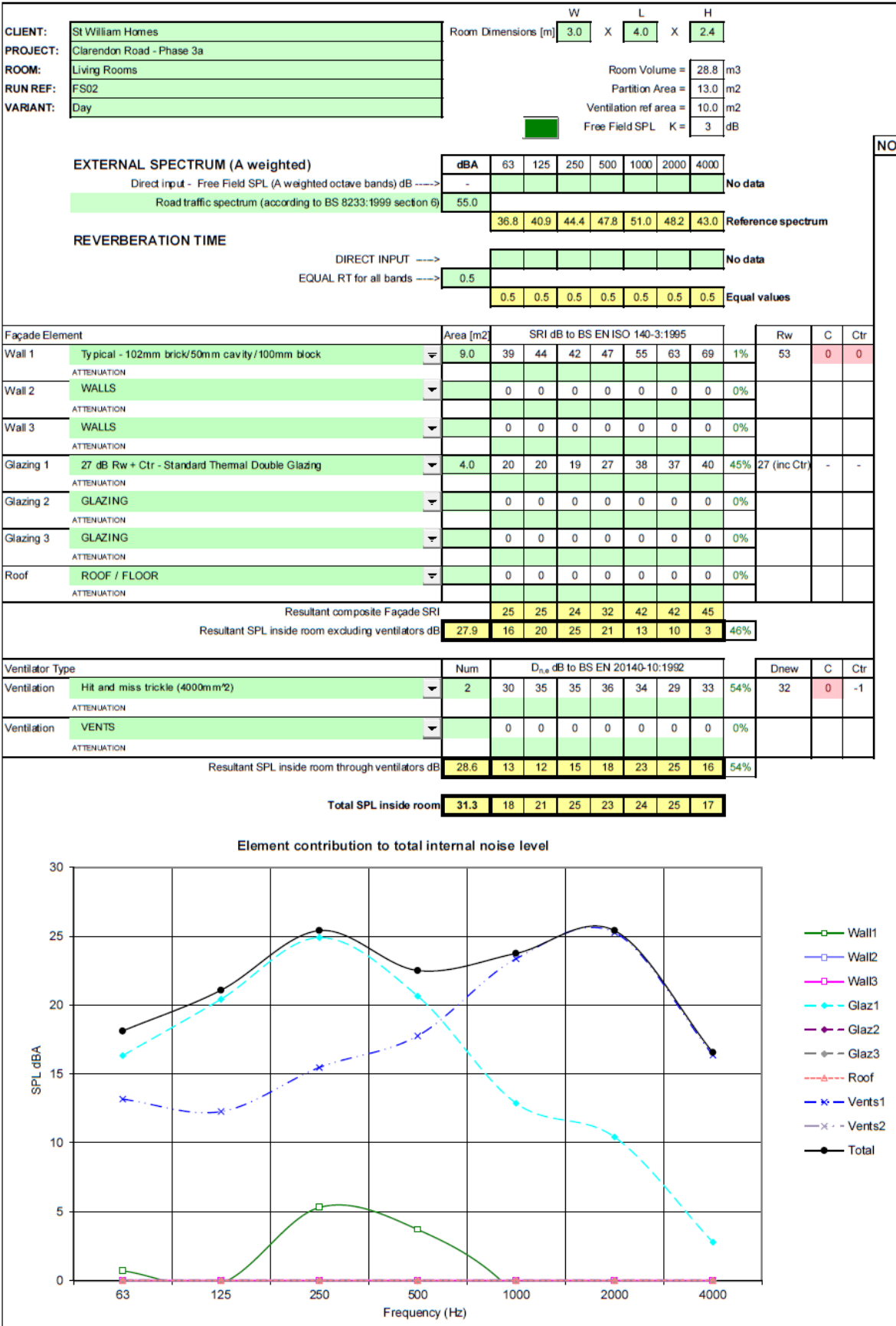
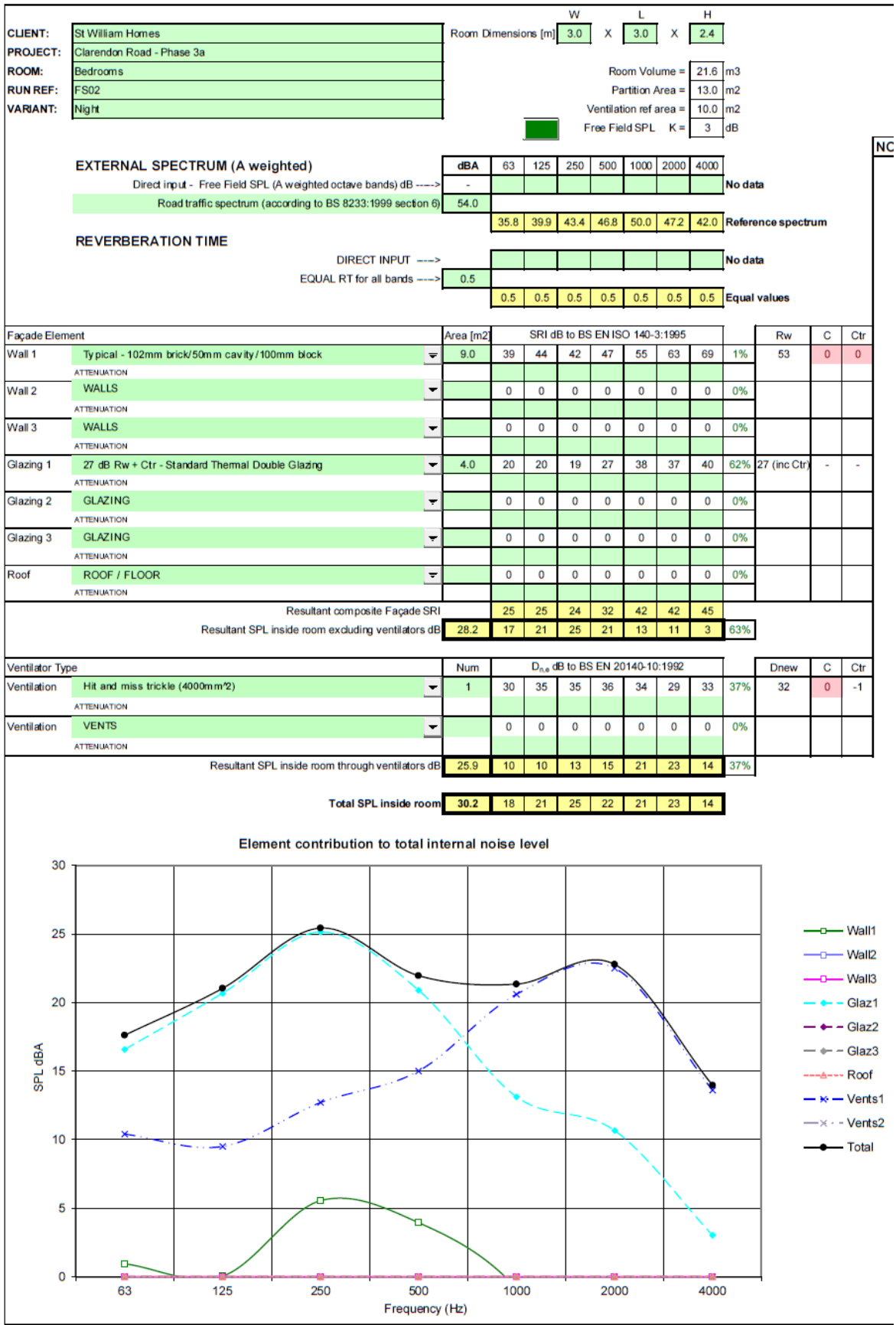


Modelling Printout (Appendix 3, Figure 2):



Appendix 4 FacSim Calculations





Appendix 5 Acoustic Facade Specification

Summary of Facade Glazing, Spandrel Panel, & Ventilator Acoustic Performance Requirements

Referen ce	Colo ur	Bedrooms		Living Rooms	
		Glazing Specificati on	Ventilator Specificati on	Glazing Specificati on	Ventilator Specificati on
FS01		33 dB Rw+Ctr	40 dB Dnew+Ctr	33 dB Rw+Ctr	40 dB Dnew+Ctr
FS02		27 dB Rw+Ctr	31 dB Dnew+Ctr	27 dB Rw+Ctr	31 dB Dnew+Ctr

NOTES: Values must include the Ctr correction. Manufacturers or suppliers should provide laboratory test data demonstrating that the proposed systems are capable of achieving the values given. Windows should be tested as complete systems (rather than just the glazing in isolation).

Where spandrel panels are used, they should have a minimum acoustic specification of the corresponding glazing.

The glazing and ventilator acoustic performances are only required for habitable spaces. Standard thermal double glazing can be applied to non-habitable spaces.

Example Glazing / Ventilator Acoustic Performances

Glazing (in Good Quality Sealed Frames)	Typical Weighted Sound Reduction (Rw + Ctr)
4/16/4mm standard thermal double glazing	27
8.8mm/16/4mm acoustically upgraded thermal double glazing	33
Ventilators	Typical Acoustic Performance (Dnew + Ctr)
Standard 'hit & miss' in-frame trickle ventilator	31
Glidevale TVAL-dB 450 in-frame trickle ventilator	40

Floors 1-4



Floors 5-6



Floors 6+



