

Proposed Residential Development, Calthorpe St., Banbury OX16

Noise Assessment

for Tri7 Limited, Fusion Studio, The Green, Hertfordshire WD25 8ER

Our Reference	Your Reference:	Issue Date	Author	Approver	Revision History
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Executive Summary

Environoise Consulting Limited has been instructed by Tri7 Limited to undertake a noise assessment for a proposed mixed-use development on Calthorpe Street, Banbury OX16. The proposed development consists of townhouses and 4 multi-storey apartment blocks.

Minimum glazing and ventilation sound insulation performances are given to meet BS 8222:2014 internal noise level targets as follows:

Glazing & Background Ventilation

Block A-B:

Bedrooms facing Calthorpe Street:

$\geq 34\text{dB } R_w + C_{tr}$ glazing / $\geq 35\text{dB } D_{ne,w}$ trickle ventilation (if proposed)

All other spaces:

$\geq 28\text{dB } R_w + C_{tr}$ glazing / $\geq 31\text{dB } D_{ne,w}$ trickle ventilation (if proposed)

Block C-D:

All spaces:

$\geq 28\text{dB } R_w + C_{tr}$ glazing / $\geq 31\text{dB } D_{ne,w}$ trickle ventilation (if proposed)

Block E:

All spaces:

$\geq 28\text{dB } R_w + C_{tr}$ glazing / $\geq 31\text{dB } D_{ne,w}$ trickle ventilation (if proposed)

Block F-G:

Spaces facing Calthorpe Street and Marlborough Road:

$\geq 40\text{dB } R_w + C_{tr}$ glazing / $\geq 41\text{dB } D_{ne,w}$ trickle ventilation (if proposed)

South-facing spaces close to Calthorpe Street and Marlborough Road:

$\geq 34\text{dB } R_w + C_{tr}$ glazing / $\geq 35\text{dB } D_{ne,w}$ trickle ventilation (if proposed)

All other spaces:

$\geq 28\text{dB } R_w + C_{tr}$ glazing / $\geq 31\text{dB } D_{ne,w}$ trickle ventilation (if proposed)

Townhouses:

All spaces:

$\geq 28\text{dB } R_w + C_{tr}$ glazing / $\geq 31\text{dB } D_{ne,w}$ trickle ventilation (if proposed)

Gatehouse:

Spaces facing Calthorpe Street:

$\geq 40\text{dB } R_w + C_{tr}$ glazing / $\geq 41\text{dB } D_{ne,w}$ trickle ventilation (if proposed)

All other spaces:

$\geq 34\text{dB } R_w + C_{tr}$ glazing / $\geq 35\text{dB } D_{ne,w}$ trickle ventilation (if proposed)

Purge Ventilation

Openable windows to all habitable spaces for the purpose of purge ventilation is permitted as internal noise level targets are not applicable during these conditions. The openable window specification should comply with the requirements given in Appendix B of The Building Regulations 'Approved Document F: Ventilation'.

Overheating (Approved Document O)

Where an ADO 'simplified method' assessment by the M&E consultant determines a 'medium' and 'high' risk of overheating, the ADO noise parameters will unlikely be met based on an open window strategy alone for all bedrooms across the site. In this case, an ADO dynamic thermal modelling assessment would likely be required for all bedrooms and an alternative strategy (e.g., louvered wall vents, mechanical ventilation / cooling system) should be considered at an early design stage so compliance with ADO can be demonstrated.

External Amenity Area

Predicted noise levels in proposed external garden/terrace amenity areas meet the $\leq 50\text{dB } L_{Aeq,16\text{hour}}$ target to prevent the onset of moderate annoyance, in accordance with BS8233.

Recommendations to reduce noise levels in proposed balcony areas are provided in section 4.2.3.

Limiting Plant Noise Levels

Noise limits have been provided in section 5.1 to achieve a 'low impact' in accordance with BS4142 at the nearby residential receptors for any proposed external plant.

1 Criteria

1.1 Internal Ambient Noise Levels

- 1.1.1 Guidance given in Table 4 of BS 8233 'Guidance on sound insulation and noise reduction for buildings'ⁱⁱ and World Health Organisation (WHO) Guidelines; 'Community and Noise, 1999'ⁱⁱⁱ gives recommend internal ambient and maximum noise levels respectively to be achieved in habitable spaces, see Table 1.1. The maximum noise level criterion should not be exceeded more than 10 times during the night-time period (23.00 – 07.00hrs).

Table 1.1: Recommended internal noise level targets.

Activity	Location	07:00 to 23:00	23:00 to 07:00
Dining	Dining Room	≤40dB L _{Aeq,16hour}	N/A
Resting	Living Room	≤35dB L _{Aeq,16hour}	
Sleeping (daytime resting)	Bedroom	≤35dB L _{Aeq,16hour}	30dB L _{Aeq,8hour} 45dB L _{Amax,fast}

1.2 Outdoor Amenity Areas

- 1.2.1 BS 8233:2014 states that it is desirable for the steady noise level in external amenity spaces (such as gardens or outdoor living areas) to be less than 50dB L_{Aeq,16hour} to prevent moderate annoyance with 55dB L_{Aeq,16hour} regarded as an upper limit in order to prevent serious annoyance for occupants. BS 8233:2014 recognises that guideline values are not achievable in all circumstances where development might be desirable, it states that:

'In higher noise areas, such as city centres or urban areas adjoining strategic transport network, a compromise between elevated noise levels and other factors, such as the convenience of living in these locations or making efficient use of land resources to ensure development need can be met, might be warranted. In such a situation, development should be designed to achieve the lowest practicable levels in these external amenity spaces, but should not be prohibited.'

2 Noise Survey

2.1 Site Description

2.1.1 The existing site accommodates 'TK Maxx' and 'Farmfoods' retail units on the south portion of the site, which are to be demolished. The north portion of the existing site contains an 'NCP' car park. To the north, east, south and west of the site are residential properties situated on High Street, Calthorpe Street, Dashwood Road and Marlborough Road respectively.

2.2 Noise Survey Details

2.2.1 Unattended noise surveys were done between 14.45hrs, Thursday 10th and 11.00hrs, Monday 14th November 2022 measuring contiguous A-weighted background, ambient and maximum noise levels ($L_{A90(15min)}$, $L_{Aeq,15min}$, $L_{Amax,fast(15min)}$) and corresponding octave bands for 15-minute periods. Measurements were taken by fixing microphones to extension poles at a height of 1.5 metres at the following positions:

- **Position 1:** 8m from the centre of the road on Marlborough Road. The dominant noise source was road traffic on Marlborough Road and High Street. Representative of existing residential noise sensitive receptors on Marlborough Road and High Street.
- **Position 2:** 7m from the centre of the road on Calthorpe Street. The dominant noise source was road traffic passes on Calthorpe Street when occurring. Other noise included delivery noise from the 'Iceland' supermarket opposite. Audio recordings taken indicate that this position was affected by plant noise that we consider to be associated with the 'Iceland' supermarket. The position is also representative of existing residential noise sensitive receptors on Calthorpe Street.

2.2.2 Further attended noise level measurements were taken between 13.15hrs and 13.30hrs on Thursday 10th November 2022, measuring contiguous A-weighted ambient and maximum noise levels ($L_{Aeq,1min}$, $L_{A90(15min)}$). Measurements were taken 10m from the centre of the A361 to measure road traffic noise levels on this road.

Figure 2.1: Proposed site and noise measurement positions.



Calibration

- 2.2.3 The sound level meters were calibrated at the start and end of the noise surveys. The meters were calibrated to 94.0dB at 1kHz with no recorded drift greater than 0.5dB at 1 kHz; therefore, the measurements are acceptable. Details of instrumentation and calibration are available on request.

Weather Conditions

- 2.2.4 Weather data has been sourced from a local meteorological station and a summary is given in Table 2.1. Noise data has been cross-referenced with survey periods where wind speeds exceeded 5m/s and no elevation of noise levels occurred; therefore, all noise survey data has been used.

Table 2.1: Summary of weather during noise surveys.

Date	Rainfall	Wind speed (m/s)	Temperature range (°C)	Observed cloud cover (Octas)
10/11/2022 (14.45 – 00.00)		9	11 – 14	6
11/11/2022 (00.00 – 23.59)		8	13 – 15	
12/11/2022 (00.00 – 23.59)	None	4	11 – 15	-
13/11/2022 (00.00 – 23.59)		3	10 – 13	
14/11/2022 (00.00 – 11.00)		2	8 – 13	8

2.3 Ambient & Maximum Noise Levels

2.3.1 Tables 2.2 and 2.3 present the highest logarithmically averaged daytime and night-time ambient (L_{eq}) noise levels together with the night-time maximum ($L_{max,fast}$) noise levels during the night-time period. Table 2.2 also contains the logarithmically averaged 15-minute ambient noise levels taken at Position 3. Time histories of noise survey results are presented in Figure A1, Appendix A.

Table 2.2: Logarithmically averaged ‘free-field’ ambient noise levels.

Position	Period	$L_{eq,T}$ at octave band centre frequency (Hz) dB							$L_{Aeq,T}$ (dB)
		63	125	250	500	1k	2k	4k	
1	Daytime (07.00 – 23.00hrs, 12/11/2022)	69	64	62	59	60	56	49	64
	Night-time (23.00 – 07.00hrs, 12/11/2022 – 13/11/2022)	62	57	55	53	56	51	41	59
2	Daytime (07.00 – 23.00hrs, 12/11/2022)	66	60	57	55	54	50	46	58
	Night-time (23.00 – 07.00hrs, 12/11/2022 – 13/11/2022)	59	53	52	52	51	45	38	55
3	Daytime (13.15 – 13.30hrs, 10/11/2022)	77	68	68	66	67	62	55	70

2.3.2 The fifth-highest maximum noise level during any one night-time period has been used to determine that the maximum noise level criterion is not to be exceeded more than 10 – 15 times during a night-time period, as the measurement period of 15-minutes potentially includes multiple transient noise events.

Table 2.3: Night-time maximum noise levels.

Position	Measurement	L _{max,fast} at octave band centre frequency (Hz) dB							L _{Amax,fast} (dB)
		63	125	250	500	1k	2k	4k	
1	Night-time (00.45hrs, 13/11/2022)	75	75	75	73	80	74	61	81
2	Night-time (23.00hrs, 12/11/2022)	66	59	60	70	72	73	64	76

2.4 Background Noise Levels

2.4.1 To assess the impact of noise from any proposed fixed external plant on nearby noise sensitive receptors, BS 4142 requires the use of a 'representative' background noise level. We have determined this to be the lowest modal value obtained during any one daytime and night-time period for Position 1, and the lowest modal value obtained during any one daytime at Position 2. We consider the representative background noise level to be the lowest value obtained during any one night-time at Position 2 to account for the contribution from services plant noise associated with the 'Iceland' supermarket, see Table 2.4.

Table 2.4: Measured background noise levels.

Position	Period	Measured background noise level [L _{A90} (15min) (dB)]	
		Range	Representative value
1	Daytime (07.00 – 23.00hrs, 13/11/2022)	42 – 55	53
	Night-time (23.00 – 07.00hrs, 13/11/2022 – 14/11/2022)	40 – 46	41
2	Daytime (07.00 – 23.00hrs, 13/11/2022)	50 – 55	53
	Night-time (23.00 – 07.00hrs, 13/11/2022 – 14/11/2022)	49 – 51	49

3 Noise Ingress Assessment

3.1 Assessment

3.1.1 A SoundPLAN® computer noise model has been created of the proposed development (see Figure B1, Appendix B). Noise levels at proposed façade positions have been calculated as per the methodology in ISO 9613-2:1996 'Attenuation of sound during propagation outdoors. Part 2, General method of calculation'^{iv}.

3.1.2 Noise ingress levels have been calculated in accordance with BS EN 12354-3:2000^v with a reverberation time of 0.8 seconds for living spaces and 0.5 seconds for bedrooms. Typical room and glazing dimensions have been determined from architectural drawings¹. An example noise ingress calculation is shown in Appendix C.

Building Envelope Constructions

3.1.3 Detailed building envelope constructions are not available at this stage; therefore, we have considered typical building envelope constructions and corresponding predicted using Insul 9.0.20 modelling software with octave band sound reduction indices (R) in Tables 3.1 and 3.2.

Table 3.1: Sound insulation performances for considered apartment block building envelope constructions.

Building element	Construction	Sound reduction indices (R) (dB)						
		63	125	250	500	1k	2k	4k
External wall	<ul style="list-style-type: none"> 102.5mm brickwork 150mm cavity with full-fill insulation 12mm sheathing board 							
	<ul style="list-style-type: none"> 100mm SFS filled with 50mm mineral wool insulation ($\geq 10\text{kg/m}^3$) 12.5mm standard plasterboard ($\geq 7.7\text{kg/m}^2$, e.g., Gyproc Wallboard) 	36	48	52	61	66	69	71
Roof	<ul style="list-style-type: none"> Single-ply membrane 100mm rigid insulation ($\geq 40\text{kg/m}^3$) 150mm pre-cast concrete slab ($\geq 1800\text{kg/m}^3$) 	42	43	43	48	59	77	77

¹ Provided in email from Holly Sissons, Corstorphine and Wright to Jake Brickley, Environoise Consulting on 17.11.2022.

Table 3.2: Sound insulation performances for considered townhouses/gatehouse building envelope constructions.

Building element	Construction	Sound reduction indices (R) (dB)						
		63	125	250	500	1k	2k	4k
External wall	<ul style="list-style-type: none"> • 102.5mm brickwork • 75mm insulated cavity • 100mm aerated blockwork • 12.5mm standard plasterboard (7.7kg/m²) on dabs 	38	41	45	45	54	58	61
Roof	<ul style="list-style-type: none"> • Roofing tiles • Timber pitched roof system • 100mm mineral wool insulation ($\geq 10\text{kg/m}^3$) between joists • 12.5mm standard plasterboard (7.7kg/m²) 	15	33	44	52	57	58	58

3.1.4 A further detailed review would be required should alternative building envelope constructions be proposed to those considered in Tables 3.1 and 3.2 to determine the suitability of the glazing and ventilation recommendations in section 3.2.

3.2 Recommendations

3.2.1 Suitable window glazing and background ventilation specification performances and locations are recommended in Table 3.3 to meet noise ingress targets. Corresponding locations are given in Figures 3.1 to 3.14. Background ventilation should be provided in accordance with The Building Regulations 'Approved Document F: Ventilation'^{vi}.

Table 3.3: Recommended minimum glazing and trickle vent sound insulation performances.

Key	Glazing Performance [$\geq R_w + C_{tr}$ (dB)]	Example Glazing spec	Vent Performance [$\geq D_{ne,w}$ (dB)]	Example Vent Type
	40	6mm pane / 16mm argon cavity / 8.8mm laminated pane	44	Titon C75 / V75
	34	6mm pane / 16mm cavity / 6.8mm pane	35	Titon C25 / V25
	28	6mm pane / 6 - 20mm cavity / 4mm pane	31	Titon TV90 Hi Lift

Figure 3.1: Recommended façade strategy – Block A-B, GF

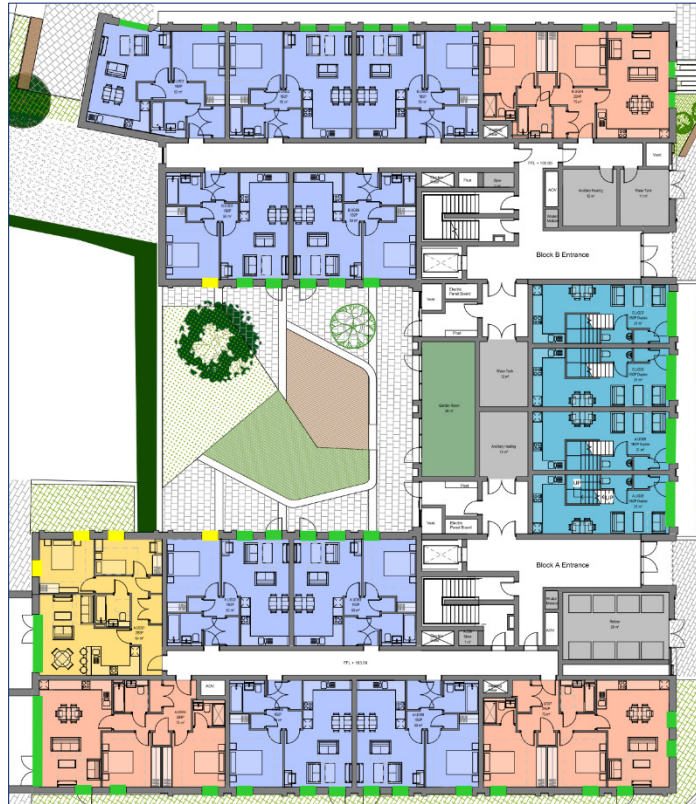


Figure 3.2: Recommended façade strategy – Block A-B, 1F

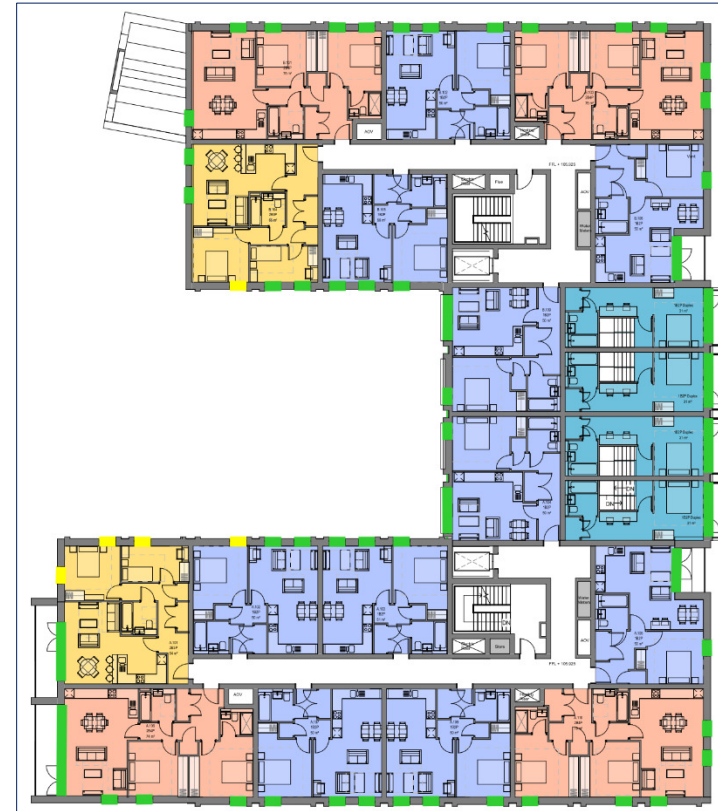


Figure 3.3: Recommended façade strategy – Block A-B, 2F

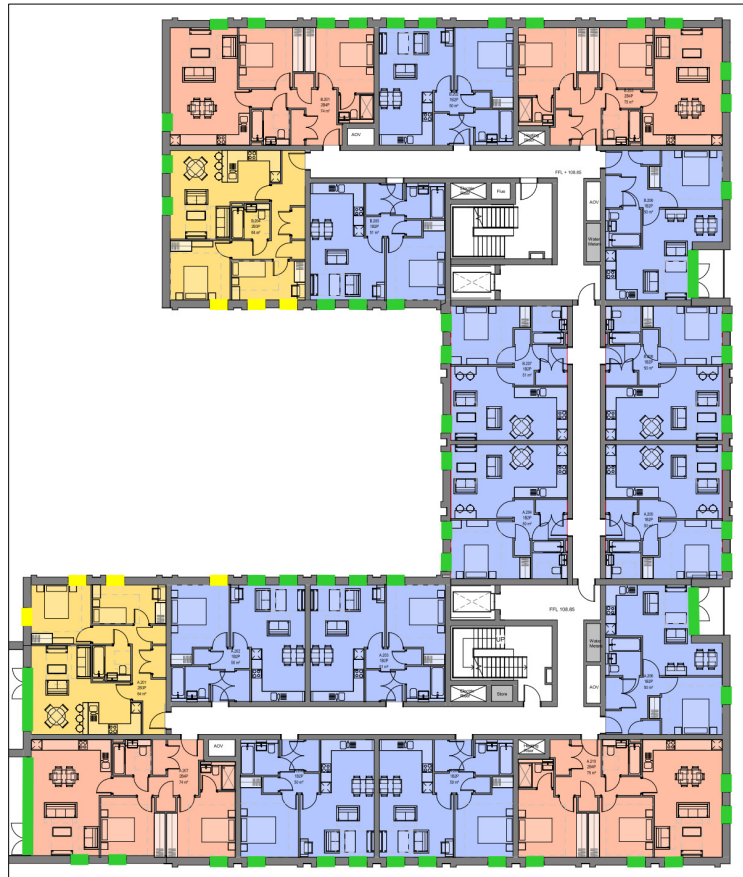


Figure 3.4: Recommended façade strategy – Block A-B, 3F

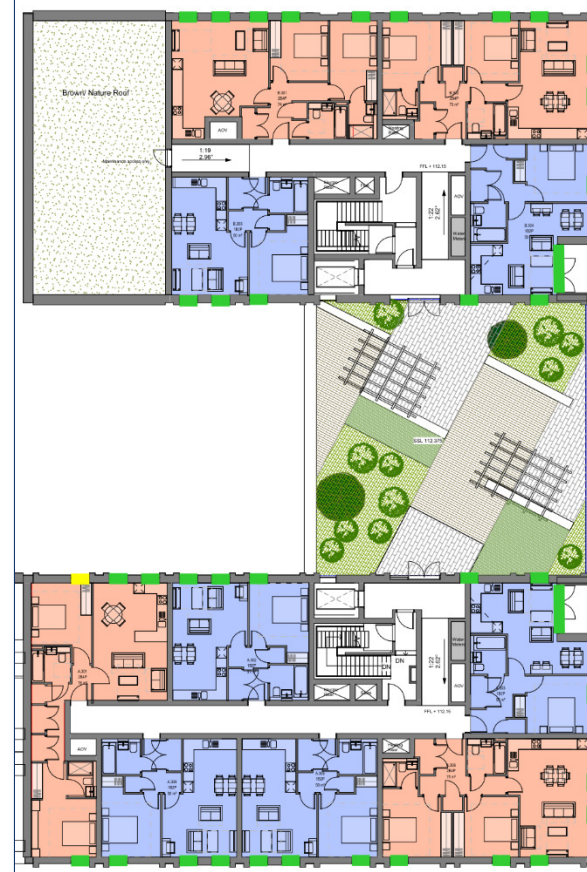


Figure 3.5: Recommended façade strategy – Block C-D, LGF

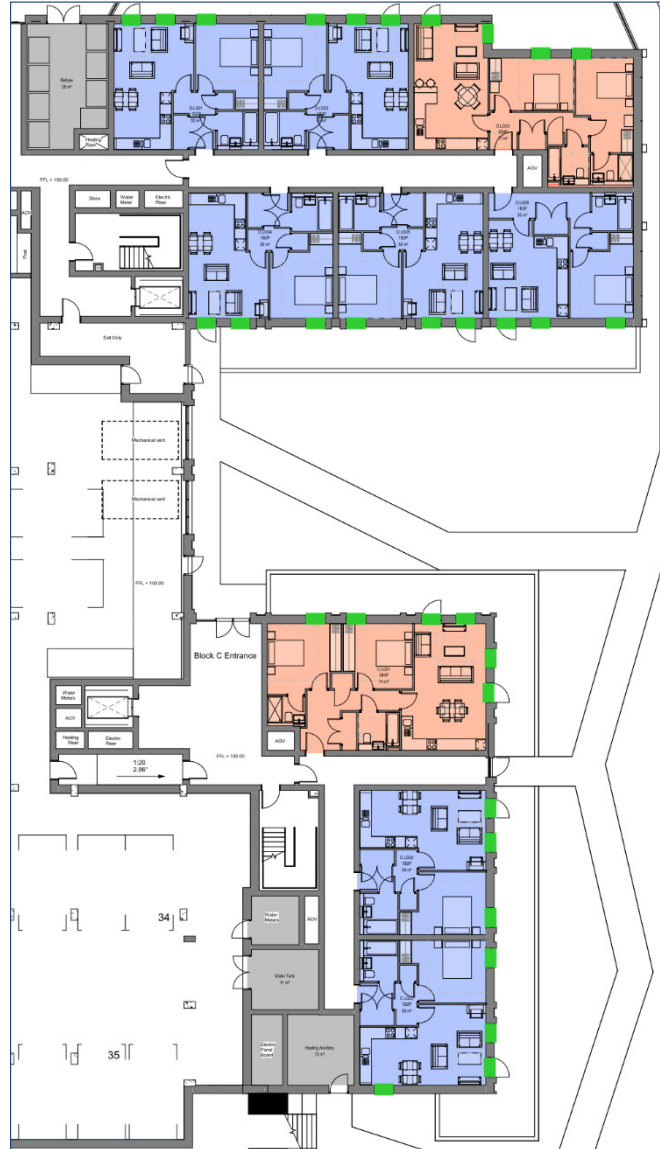


Figure 3.6: Recommended façade strategy – Block C-D, GF

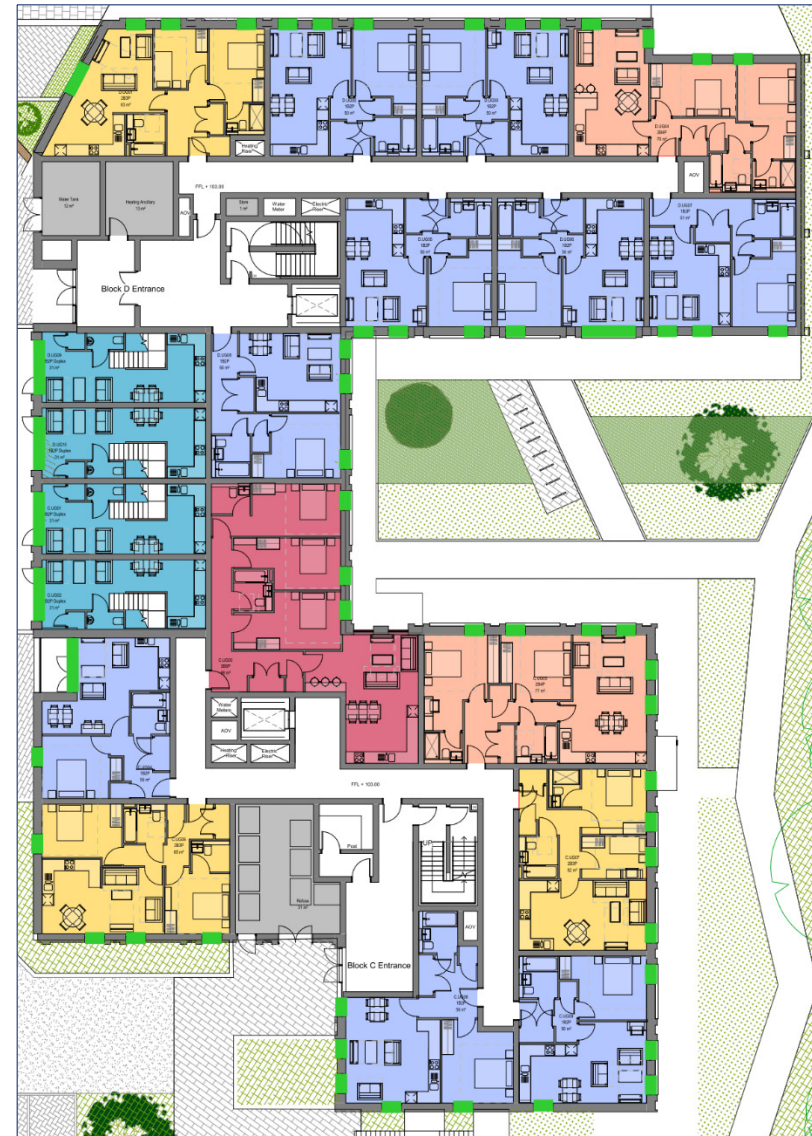


Figure 3.7: Recommended façade strategy – Block C-D, 1F

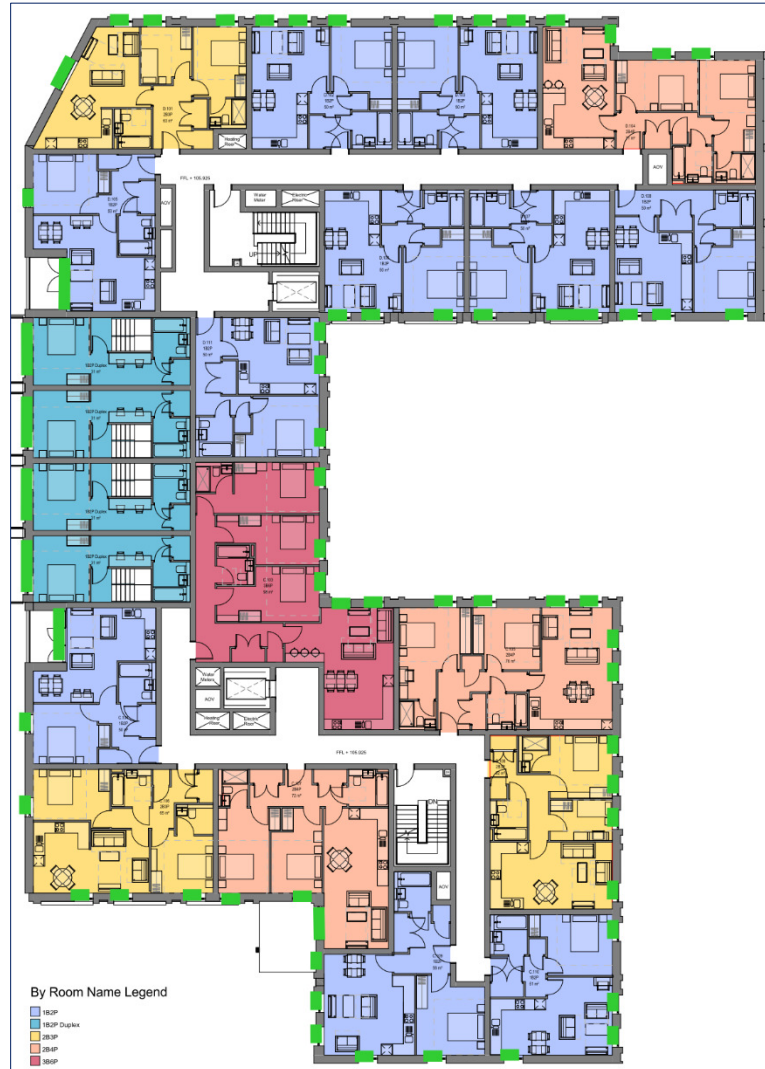


Figure 3.8: Recommended façade strategy – Block C-D, 2F

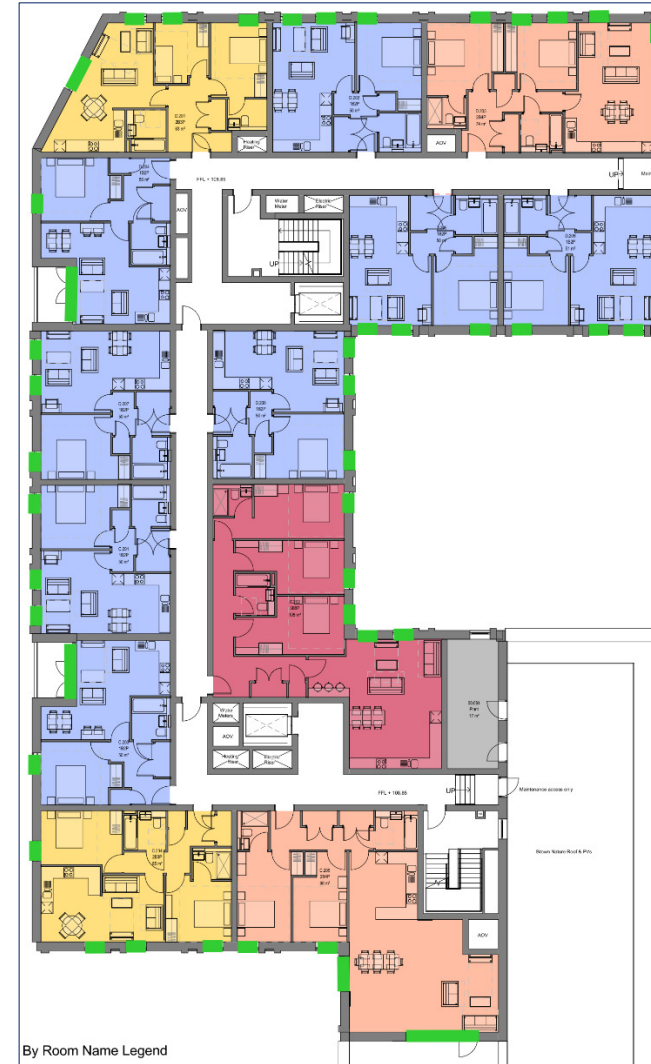


Figure 3.9: Recommended façade strategy – Block C-D, 3F



Figure 3.10: Recommended façade strategy – Block E, LGF



Figure 3.11: Recommended façade strategy – Block E, GF

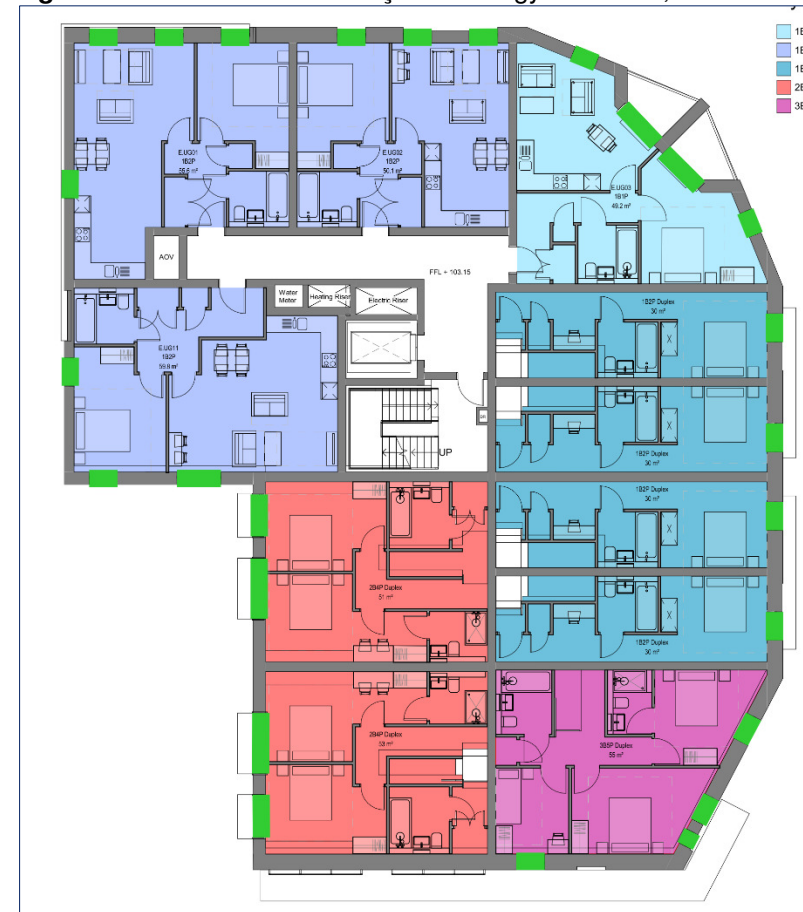
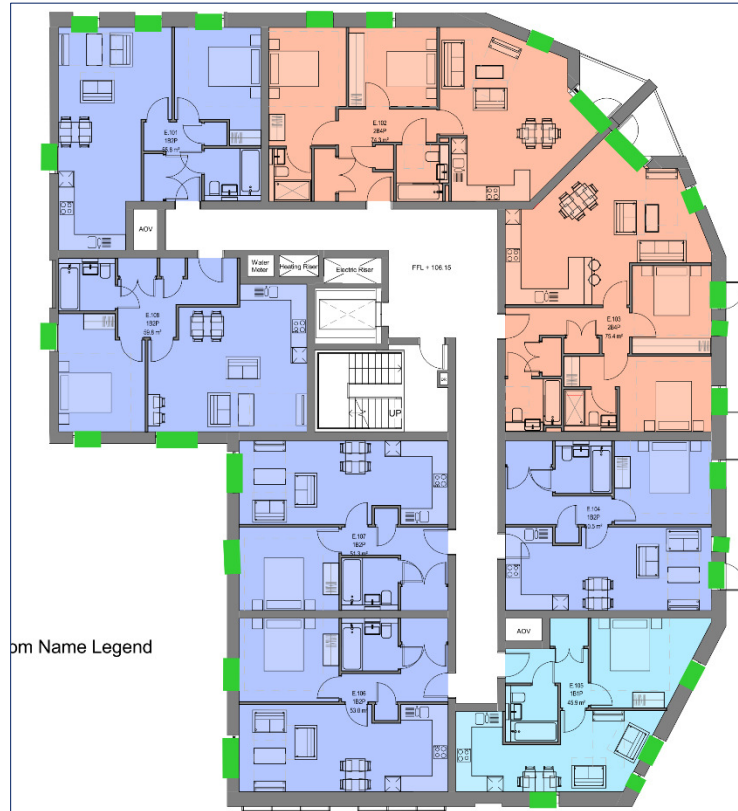


Figure 3.12: Recommended façade strategy – Block E, 1F



Room Name Legend

Figure 3.13: Recommended façade strategy – Block E, 2F



Figure 3.16: Recommended façade strategy – Block F - G, 1F



Figure 3.17: Recommended façade strategy – Block F - G, 2F

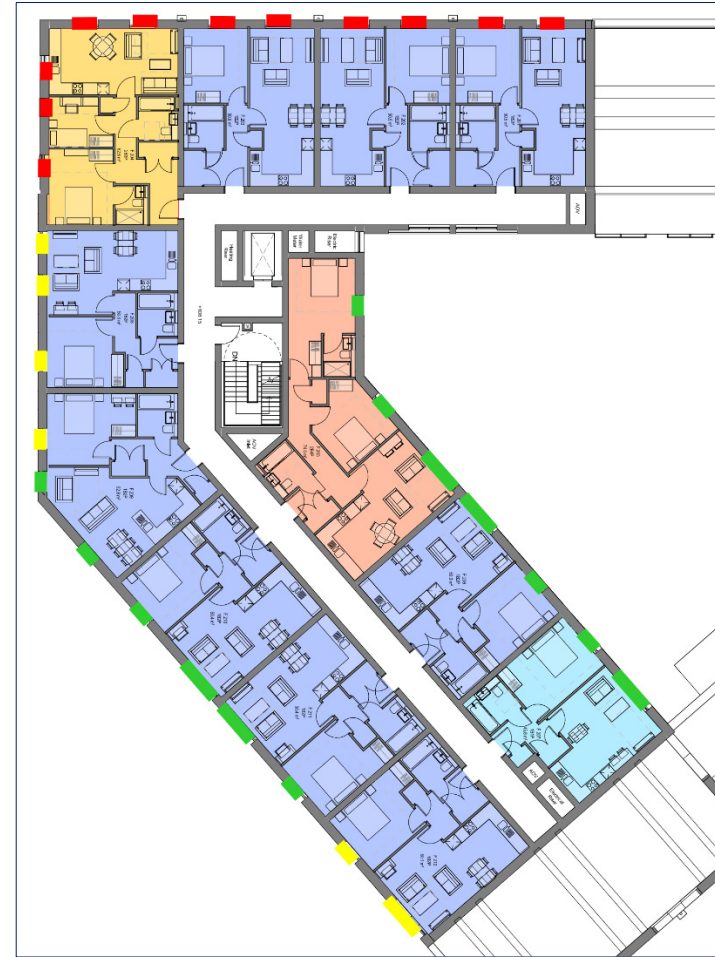


Figure 3.18: Recommended façade strategy – Townhouses, GF

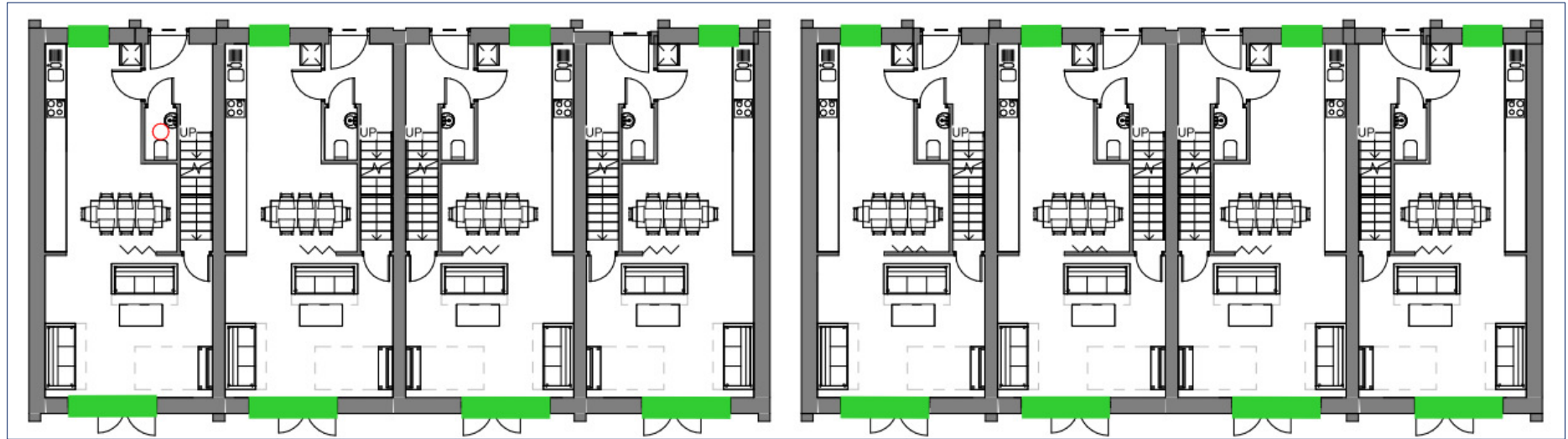


Figure 3.19: Recommended façade strategy – Townhouses, 1F

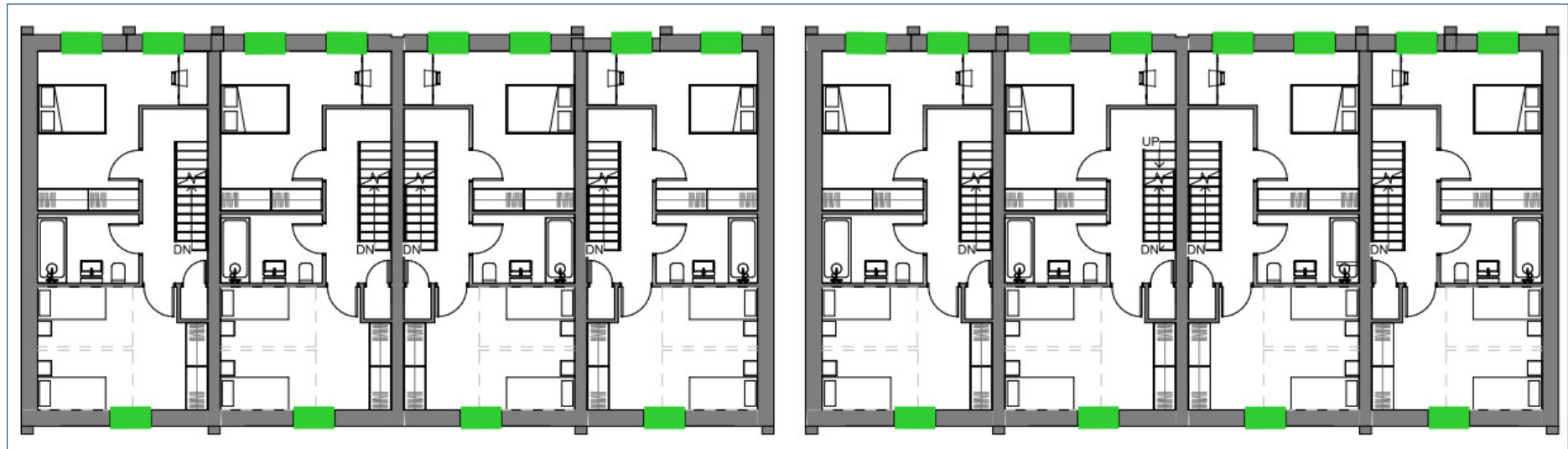


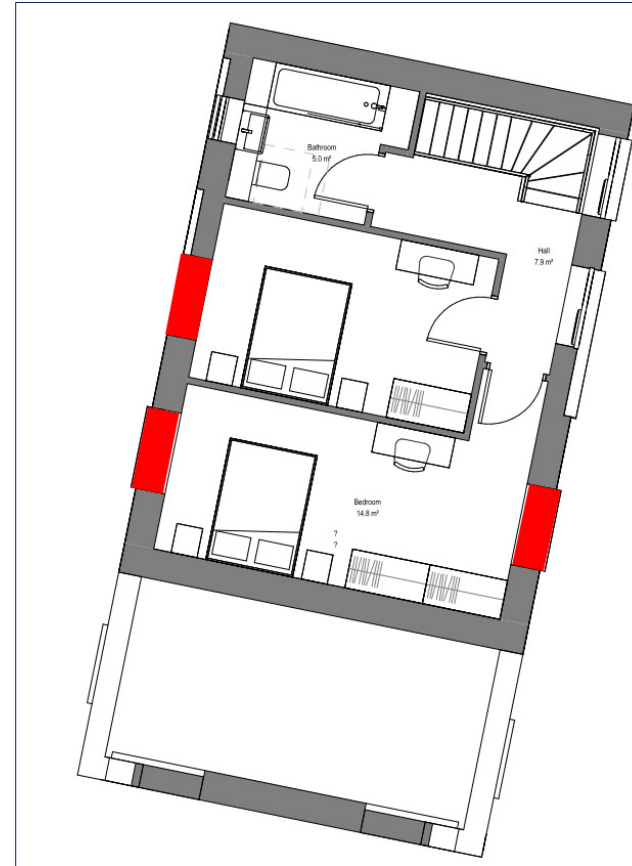
Figure 3.20: Recommended façade strategy – Townhouses, 2F



Figure 3.21: Recommended façade strategy – Gate House, 1F



Figure 3.22: Recommended façade strategy – Gate House, 2F



3.2.2 The glazing performance should be constant across the assembly, so the framing should be of similar or greater performance than the glazing recommended in Table 3.3. The performance of the glazing units also depends on the quality of framing and good contact with window seals. A side or top hung window with good seals would typically compromise the sound insulation performance of the glass by 2dB, a greater compromise typically occurs for a sliding or sash window.

3.3 Ventilation

Purge (Approved Document F)

3.3.1 Openable windows to all habitable spaces for the purpose of purge ventilation is permitted as internal noise level targets are not applicable during these conditions. The openable window specification should comply with the requirements given in Appendix B of Approved Document F: Ventilation'.

Overheating (Approved Document O)

3.3.2 Should overheating be a potential concern for the development, Requirement 01(2)(a) section 3 of The Building Regulations 'Approved Document O: Overheating'^{vii} states that windows are likely to be closed where internal noise levels in bedrooms exceed the following noise levels:

- 40dB $L_{Aeq,T}$, averaged over 8 hours (between 23.00 and 07.00hrs)
- 55dB $L_{Amax,fast}$, no more than 10 times a night (between 23.00 and 07.00hrs)

3.3.3 Where an ADO 'simplified method' assessment by the M&E consultant determines a 'medium' and 'high' risk of overheating, the ADO noise parameters will unlikely be met based on an open window strategy alone for all bedrooms across the site.

3.3.4 It is likely that a further ADO dynamic thermal modelling assessment would be required for all bedrooms, with an alternative strategy (e.g., louvered wall vents, mechanical ventilation / cooling system) to remove excess heat considered by the M&E and noise consultant at an early design stage so compliance with ADO can be demonstrated.

3.3.5 Any proposed mechanical ventilation system should be designed to meet the internal ambient noise level targets in Table 1.1.

4 Outdoor Amenity Noise

4.1 Guidance

- 4.1.1 Guidance given in BS 8233 states that it is desirable for the steady noise level in external amenity spaces (such as gardens, balconies or outdoor living areas) to be less than 50dB $L_{Aeq,16hour}$ to prevent moderate annoyance with 55dB $L_{Aeq,16hour}$ regarded as an upper limit in order to prevent serious annoyance for occupants.

4.2 External Amenity Areas

Terrace/Garden Areas

- 4.2.1 Noise levels in the Block A-B roof terrace, Block C-D roof terrace, and Block F-G garden area are predicted to be 50dB, 45dB and 44dB $L_{Aeq,16hour}$ respectively; therefore, the BS8233 target to prevent moderate annoyance is predicted to be met with no further mitigation measures required.
- 4.2.2 Predicted noise levels in the garden spaces of the proposed townhouses are 41 – 44dB $L_{Aeq,16hour}$, therefore the BS8233 target to prevent moderate annoyance is predicted to be met with no further mitigation measures required.

Balconies

- 4.2.3 Predicted ambient noise levels range from 54 – 57dB $L_{Aeq,16hour}$ at Block A-B balconies; from 46 – 50dB $L_{Aeq,16hour}$ in Block C-D balconies; and from 51 – 55dB $L_{Aeq,16hour}$ in Block E balconies. We recommend that solid balustrades are installed to Block A-B balconies (overlooking Calthorpe Street) so that noise levels are reduced to ≤ 55 dB $L_{Aeq,16hour}$. The solid section of the balustrade should cover a minimum of 60% of the width of each balcony; with occupants situated behind this.

5 Limiting Plant Noise Levels

5.1 Noise Targets at Existing NSRs

- 5.1.1 The rating noise level of any proposed fixed external plant associate with the development should meet the targets given in Table 5.1 when measured at 1 metre from existing residential properties to achieve a 'low impact' in accordance with BS 4142:2014. It should be noted that the local authority requirement may be more onerous.
- 5.1.2 A noise character correction should be applied if the plant contains any tonal, intermittent, or impulsive acoustic characteristics in accordance with BS4142:2014. It should be noted that the plant noise limiting levels shown in Table 5.1 are the highest allowable noise levels at 1 metre from the nearest receptor with all plant associated with the development in simultaneous operation.

Table 5.1: Limiting plant noise levels.

Period	Lowest 'representative' background noise level [LA90 (15mins) (dB)]	Plant rating noise limit at 1m from residential receptor [L _{Ar,Tr} (dB)]
Daytime (07.00 - 23.00hrs)	53	53
Night-time (23.00 – 07.00hrs)	41	41

Appendix A: Noise Data

Figure A1: Time history of unattended measured noise levels – Position 1.

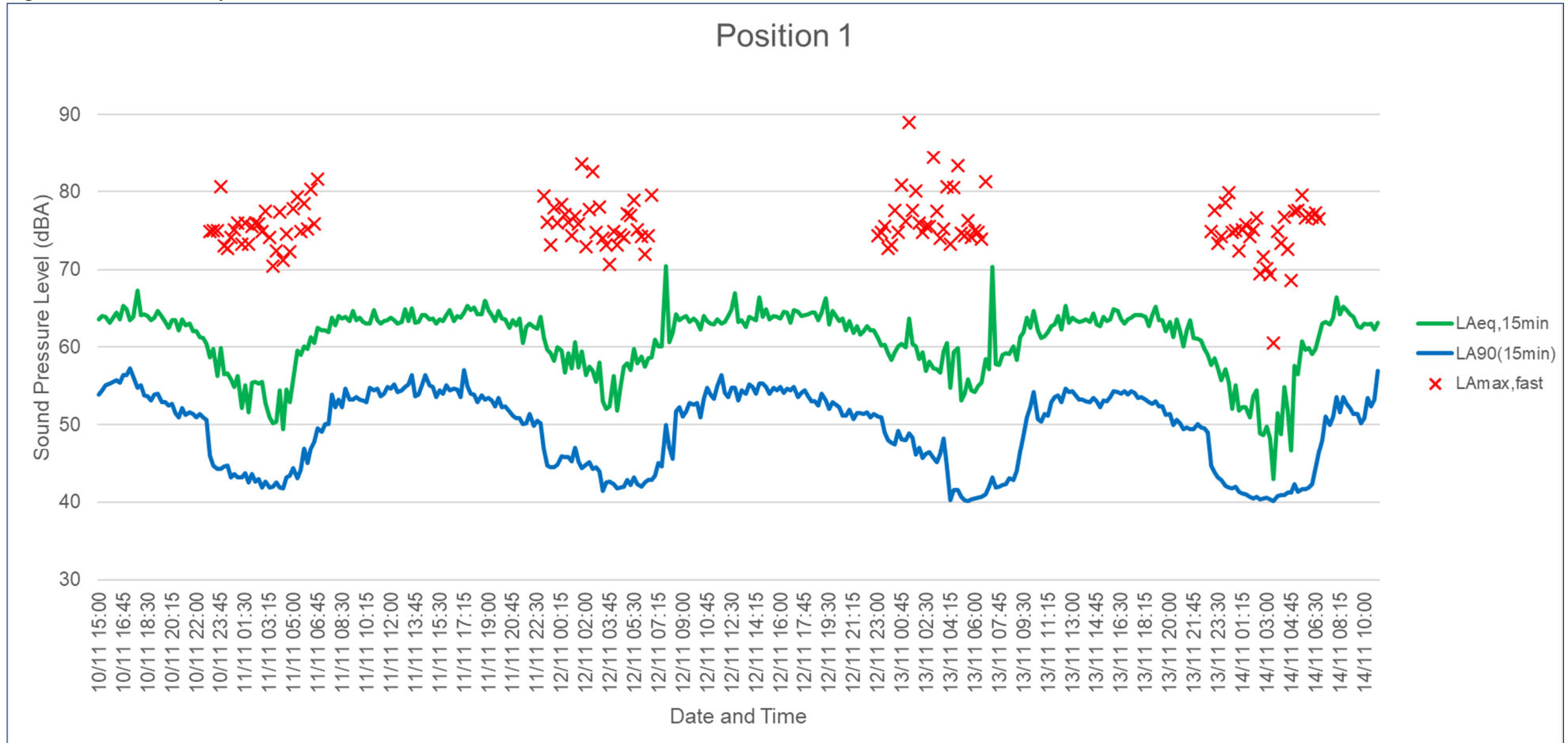
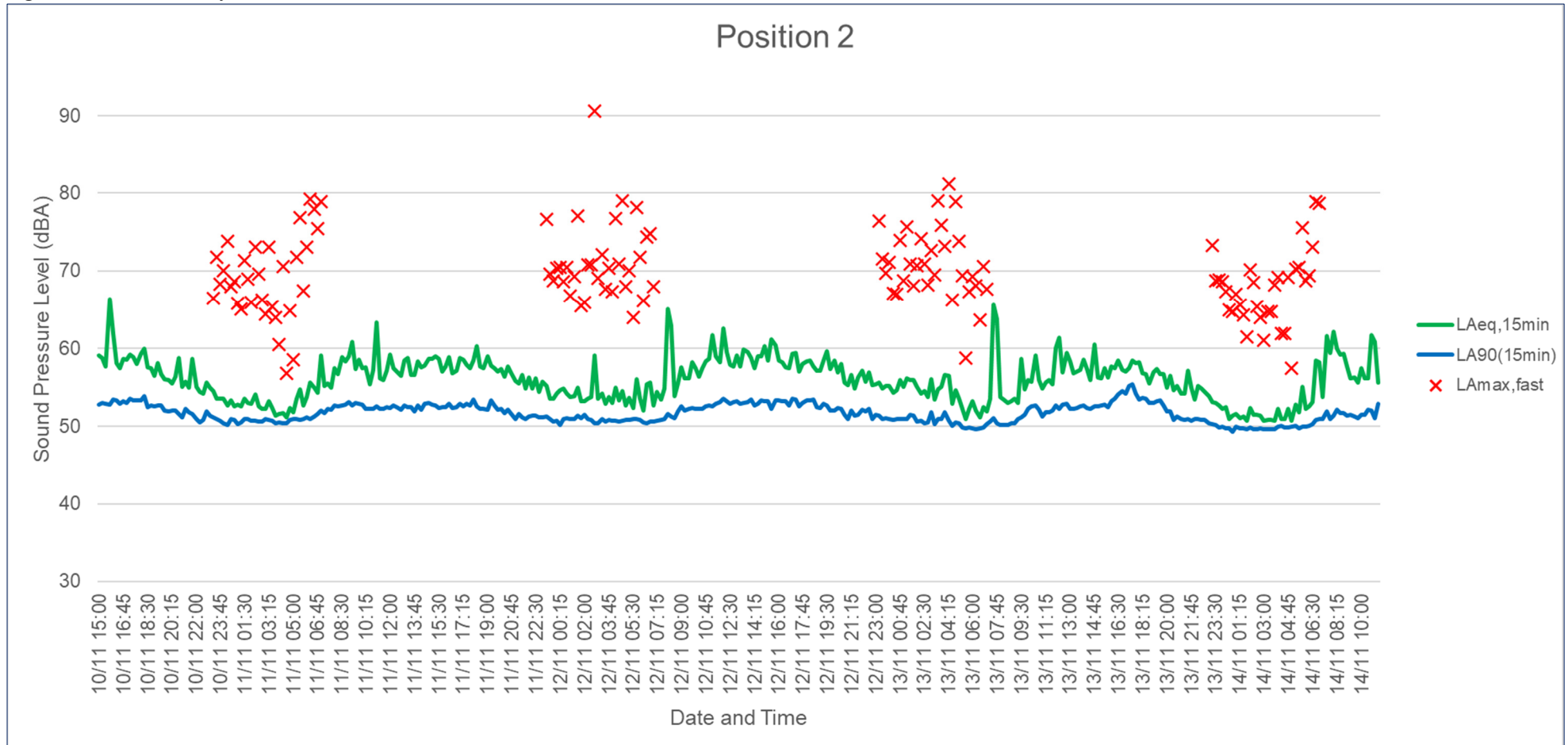


Figure A2: Time history of unattended measured noise levels – Position 2.



Appendix B: Calculations

Figure B1: SoundPLAN model – 3D view.

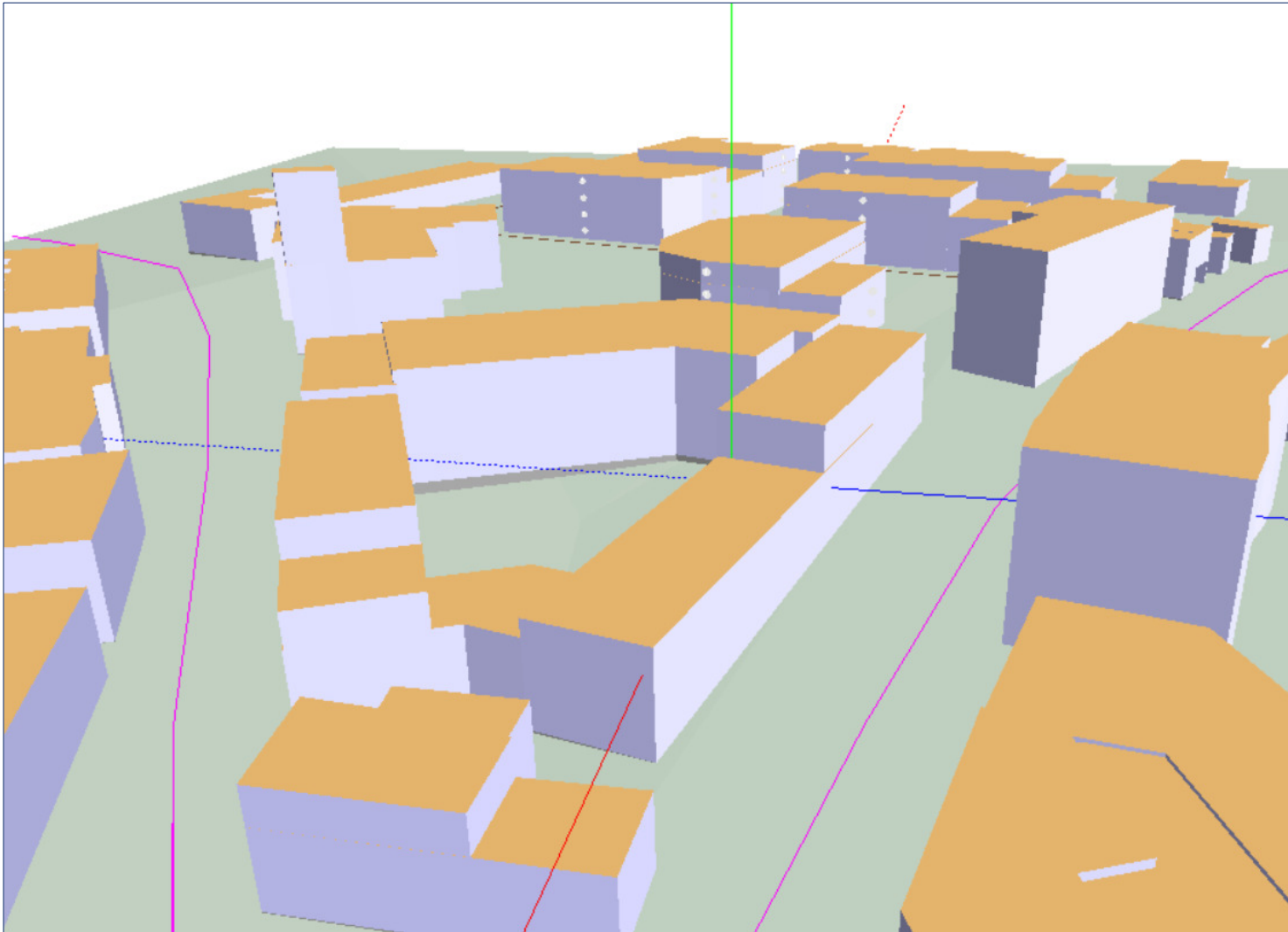
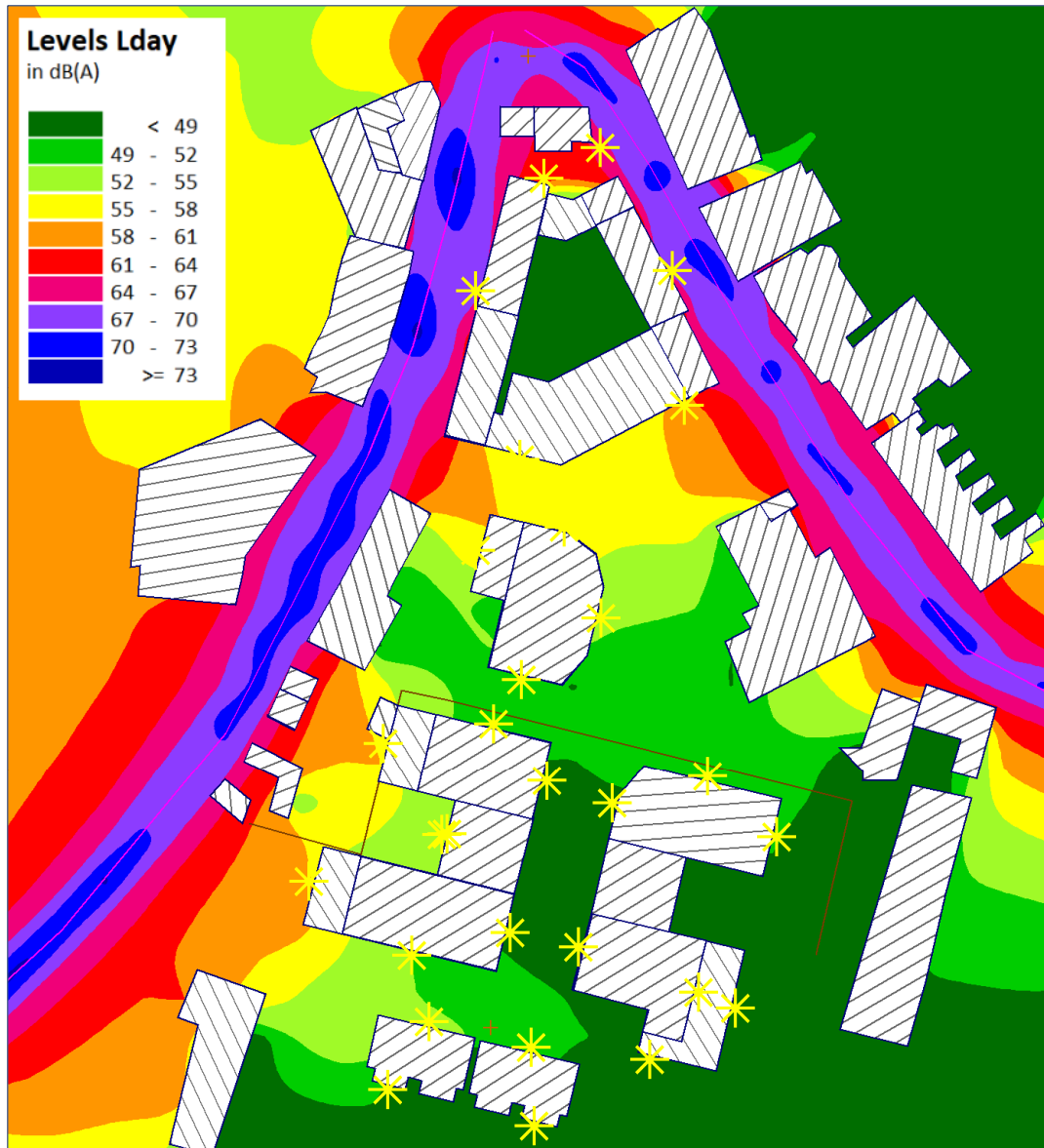


Figure B2: SoundPLAN model – daytime noise map.



Appendix C: Example Calculation

Figure C1: Example noise ingress calculation – Bedroom 2B3P - Block F-G, Ground Floor.

ENVIRONOISE		Leq - Bedroom, GF								
Project	Calthorpe Street									
Client	Rhomco									
Room	Bedroom, GF									
Enter Facade Correction	0 dB									
Receiving Room										
Height of room	2.4 m									
Width of room	3.3 m									
Length of room	3.0 m									
Volume of room	23.8 m ³									
		<input checked="" type="radio"/> Bedroom <input type="radio"/> Living Area								
Element										
Area 1 - Glazing	0.0 m ²									
Area 2 - Glazing & TV	3.0 m ²									
Area 3 - Non Glazed	7.9 m ²									
Area 4 - Non Glazed	0.0 m ²									
Angle of incidence	0 deg									
Frequency Hz		63	125	250	500	1000	2000	4000	8000	
Reverberation time [sec]	0.50 0.50 0.50 0.50 0.50 0.50 0.50 0.50									
Absorption (sabines)	7.7 7.7 7.7 7.7 7.7 7.7 7.7 7.7									
Frequency Hz		63	125	250	500	1000	2000	4000	8000	dB(A)
External dB	61 50 47 46 48 43 34 34									
External Freefield										
External Freefield Leq dB	61	50	47	46	48	43	34	34	34	51
Additional Correction		0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0								
10log(cos[angle])		0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0								
SRI Ref		Area								
0.0 m ²		0	0	0	0	0	0	0	0	No data
3.0 m ²		17	20	20	25	29	28	29	29	
21 7.9 m ²		36	48	52	61	66	69	71	71	
0 0.0 m ²		0	0	0	0	0	0	0	0	No data
Combined SRI		22	26	25	30	35	34	34	34	
Criterion (NR at 1kHz)		58	47	39	33	29	26	24	22	
Additional SRI Required		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	To Meet NR29
Internal Leq dB		47	32	29	23	21	17	7	7	28 dB(A)
Internal Lfmax dB		45	34	35	40	38	40	30	30	44 dB(A)

References

- ⁱ The Building Regulations 'Approved Document F: Ventilation' (2010 edition incorporating 2010 and 2013 amendments).
- ⁱⁱ BS 8233 'Guidance on sound insulation and noise reduction for buildings', 2014.
- ⁱⁱⁱ World Health Organisation (WHO) Guidelines; 'Community and Noise, 1999'
- ^{iv} ISO 9613-2:1996 'Attenuation of sound during propagation outdoors. Part 2, General method of calculation.' 1996.
- ^v BS EN 12354-3:2000 'Building acoustics. Estimation of acoustic performance in buildings from the performance of elements. Airborne sound insulation against outdoor sound', 2000.
- ^{vi} The Building Regulations 'Approved Document F: Ventilation' (2010 edition incorporating 2010 and 2013 amendments).
- ^{vii} The Building Regulations (2010) 'Approved Document O: Overheating' (2021 edition)