GASCOIGNE EAST PHASE 2 BLOCKS E&F

INTEGRATED FAÇADE ASSESSMENT
GEP2-MAL-ZZ-ZZ-RP-X-9005

Willmott Dixon

GASCOIGNE EAST PHASE 2 BLOCKS E&F

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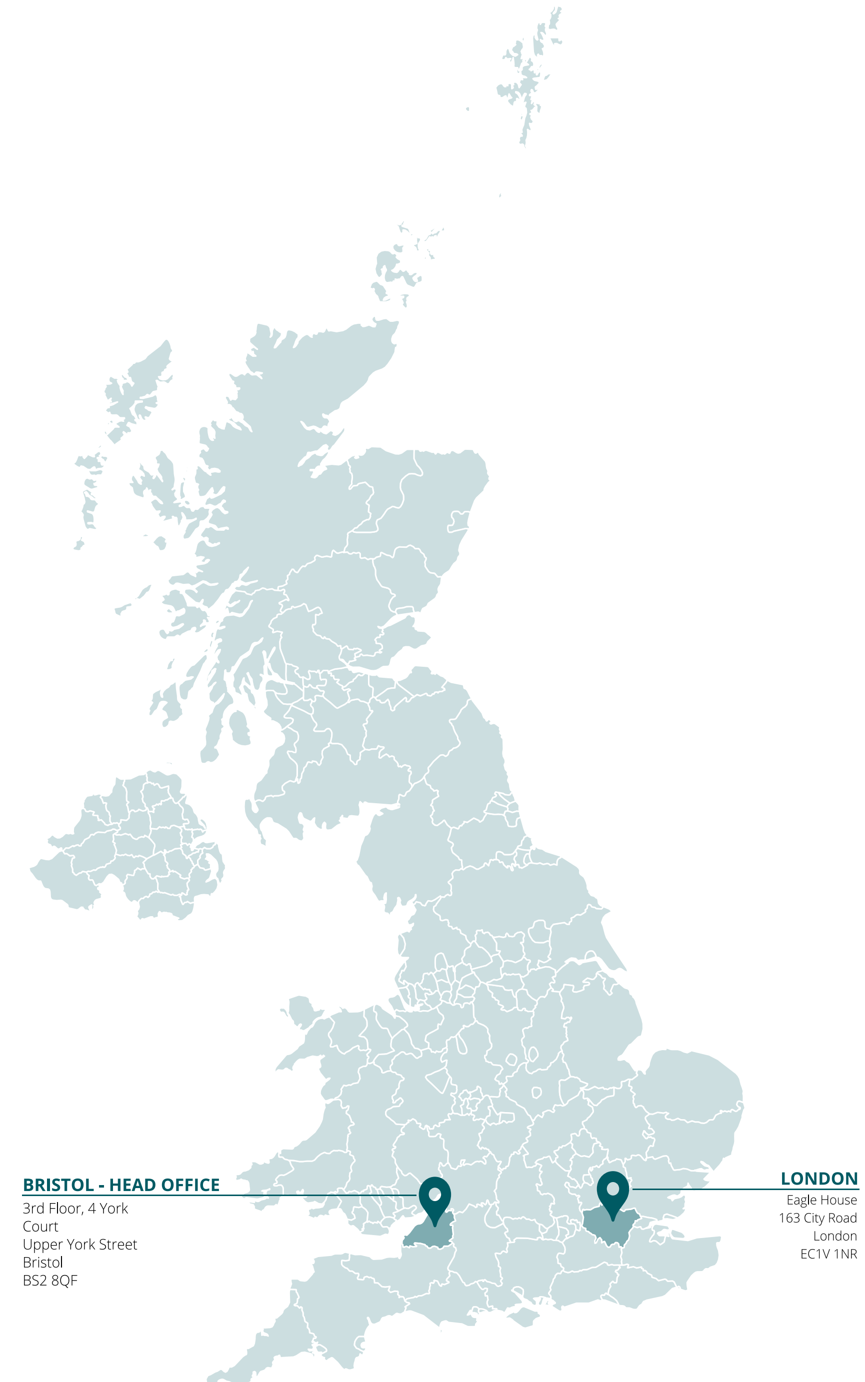


CONTENTS

1.0 EXECUTIVE SUMMARY

A combined acoustic, thermal and energy assessment has been carried for the proposed Gascoigne East Phase 2 development. This report focuses predominantly on the E2 building, however principles applied to E2 can be applied to other blocks within the scheme.

As part of the assessment, MACH have reviewed alternative ventilation and acoustic strategies to identify opportunities for producing low carbon and cost effective solutions.

Noise mapping has identified that in order to achieve good quality acoustic conditions throughout the year, some north facing facades will require summertime cooling through extract ventilation without using openable windows or attenuators.

On other facades, noise ingress can be controlled through the use of attenuators or openable windows. The requirement for a sealed façade, attenuator or openable window will rely on the agreed noise ingress targets, as well as the open area required for summertime cooling.

MACH have proposed alternative performance targets based upon new guidance with the 'Acoustics, Ventilation and Overheating' documentation. This needs to be approved by LBBD if to be used to sign off acoustic planning conditions.

MACH have carried out thermal modelling to demonstrate that dwellings with a continuous MEV or MVHR system, with openable windows, will achieve TM52 overheating criteria. North facing dual or single aspect rooms without openable windows will also achieve TM52 criteria through the use of MVHRs in 'boost' mode.

While TM59 criteria will not be achieved throughout the development, there are methods of improving thermal comfort through exposed thermal mass, cross ventilation between internal rooms and adopting AVO Guide noise ingress criteria to allow for larger window openings.

Early stage Part L calculations have been carried out to determine the quantity of PV panels required to achieve GLA's and LBBD's criteria for 40% improvement above Part L. Options have been assessed for MEV, MVHR or a combination of both. The difference between MEV and MVHR is approximately an additional 1m^2 of PV panel per dwelling.

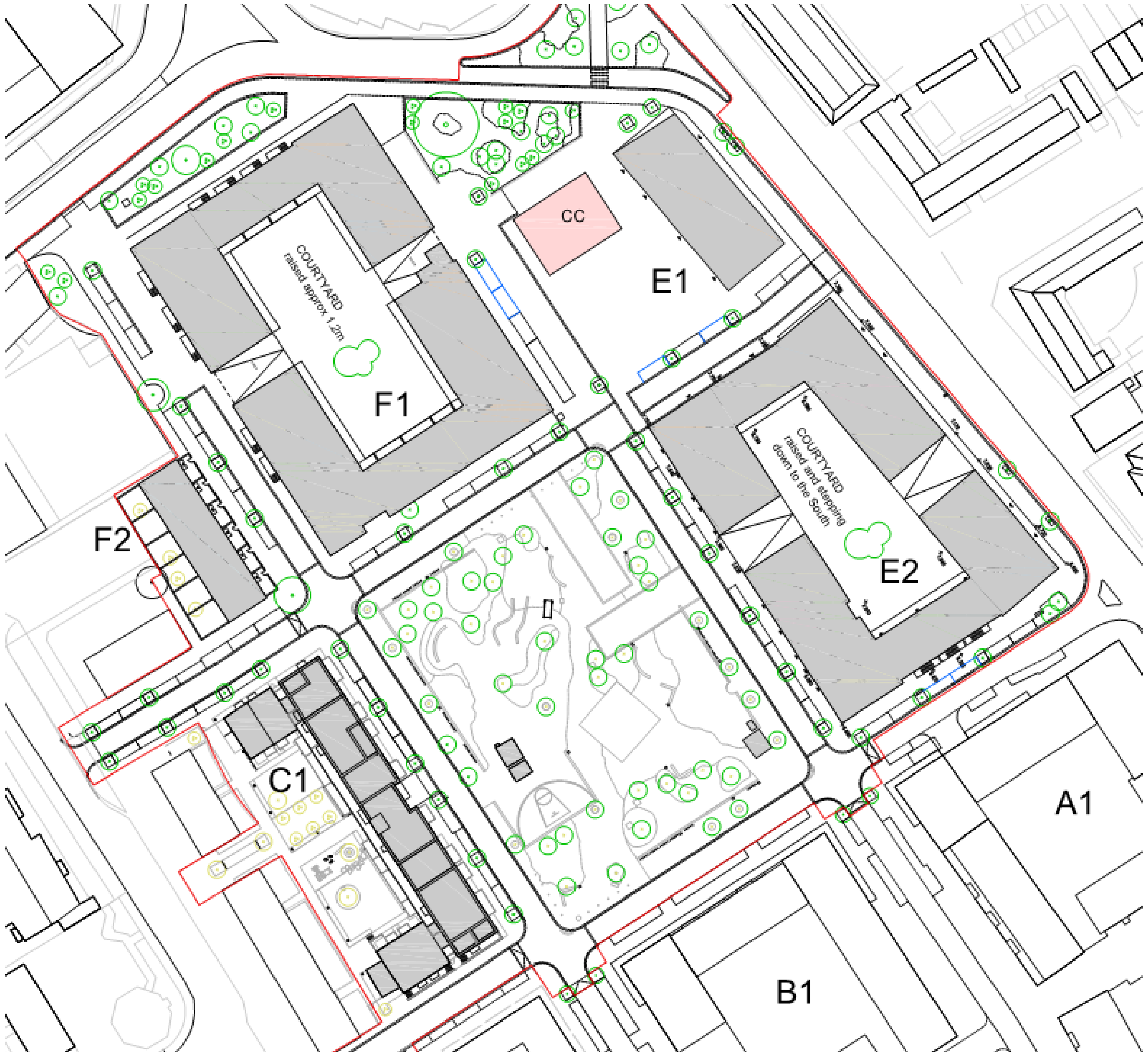
2.0 INTRODUCTION

This report provides details of the acoustic façade assessments for the proposed redesign of Blocks E & F of the Gascoigne East Phase 2 development.

This is the RIBA 2 issue of the report and provides guidance on façade noise levels, overheating risk, façade types and ventilation strategy. Where consideration is made to WHO, BS8233 planning requirements and the AVO guide.

This report should be read in conjunction with:

- Part L Assessment Report GEP2-MAL-ZZ-ZZ-RP-X-9100
- Initial Overheating Report GEP2-MAL-ZZ-ZZ-RP-X-9101



3.0 LONDON PLAN & PLANNING POLICY

3.1 NOISE POLICY STATEMENT

The overarching policy on noise management is provided within the Noise Policy Statement for England (NPSE), which aims to promote good health and a good quality of life through the effective management of noise.

The NPSE also contains three aims: "Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- avoid significant adverse impacts on health and quality of life;
- mitigate and minimise adverse impacts on health and quality of life; and
- where possible, contribute to the improvement of health and quality of life."

3.1 LONDON PLAN & ENERGY HIERARCHY

As required under planning and GLA's London Plan, the development will be assessed under in accordance with the Energy Hierarchy, which is as follows;

- Be Lean - Use good passive design to minimise energy demand
- Be Clean - Use energy efficient heating
- Be Green - Use renewable sources of energy

As required by planning, the development should demonstrate how the energy hierarchy has been adopted to achieve a 40% betterment above CO_2 Building Regulations Part L baseline.

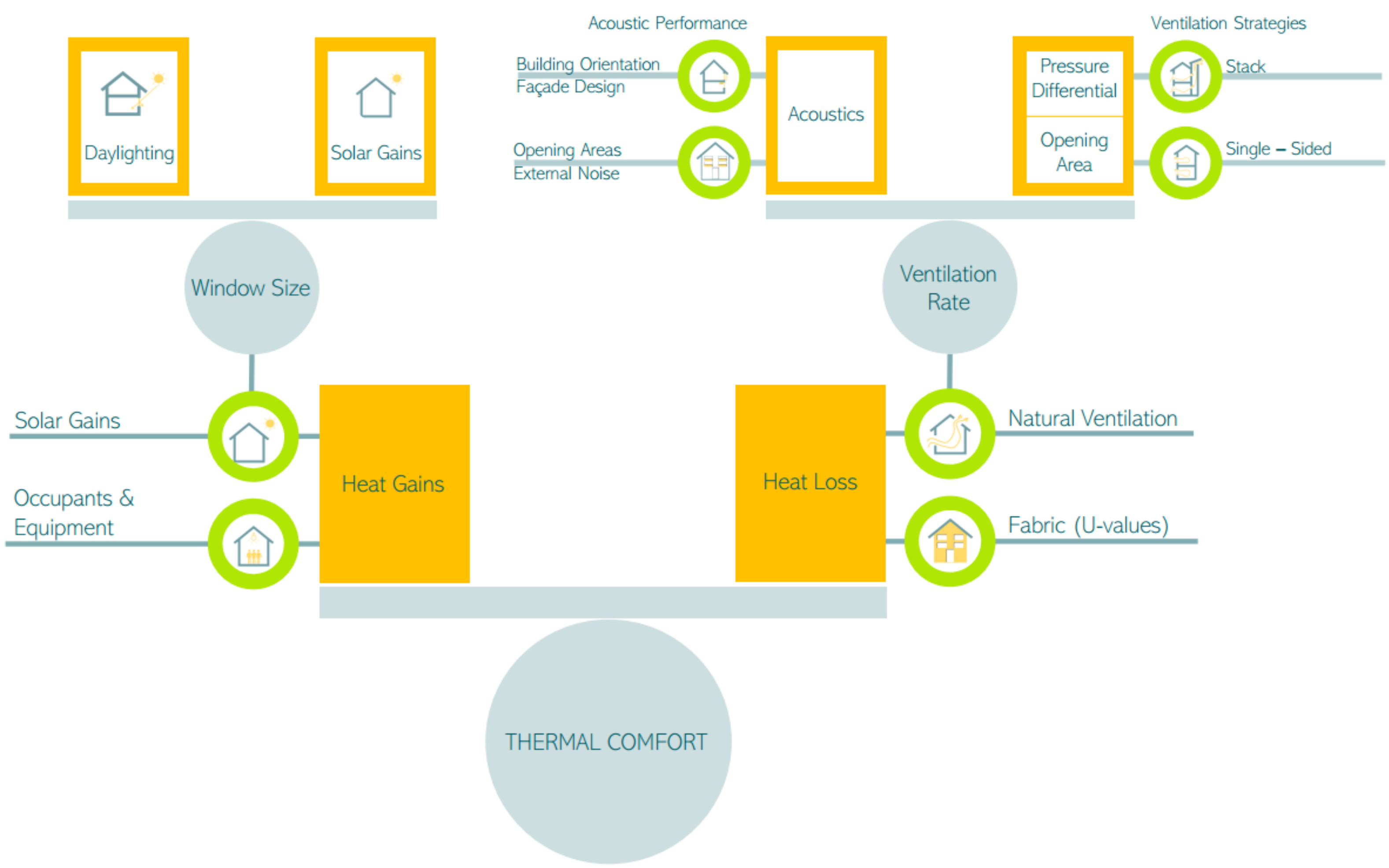
In addition to this, GLA guidance states that overheating analysis should be carried out using the Good Homes Alliance Overheating Risk Tool, as well as through the use of thermal modelling, assessing against TM52 and TM59.

4.0 MACH'S DESIGN PHILOSPHY

At MACH we believe in enhancing wellbeing and user experience within the built environment, through efficient low energy design solutions and exceptional engineering.

With acoustics and building physics engineers our design philosophy is to provide a balanced approach to façade design which benefits overall indoor environmental quality rather than benefitting an individual discipline.

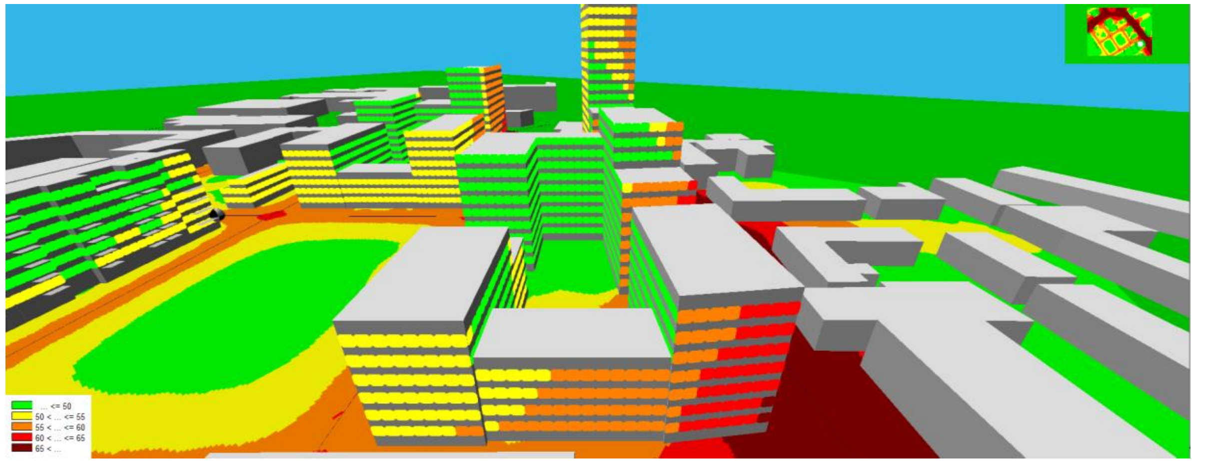
The figure below illustrates the interrelation of acoustics and buildings physics and shows the need to carefully consider all aspects during design.

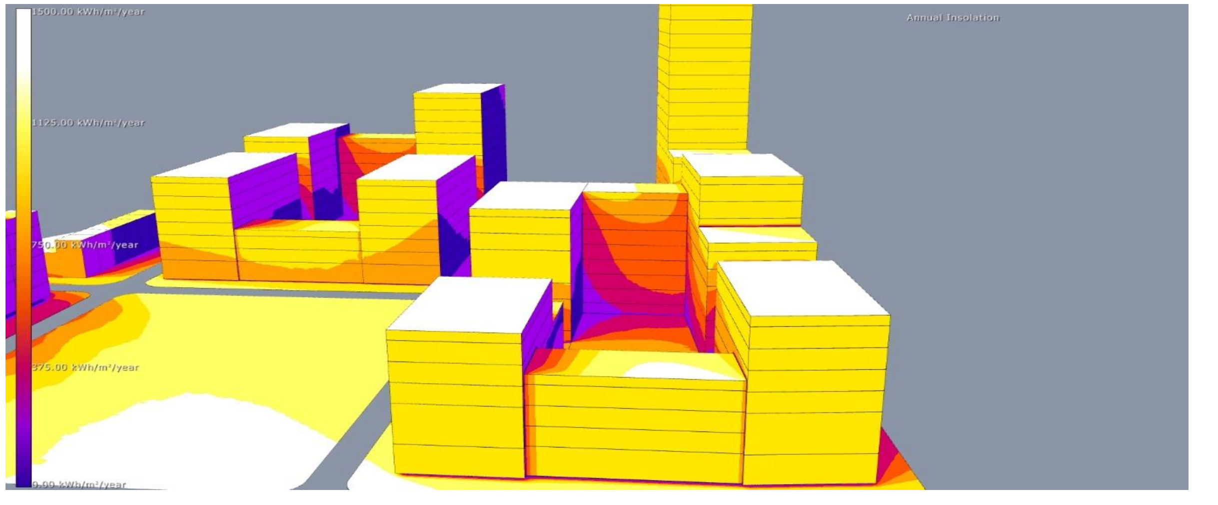


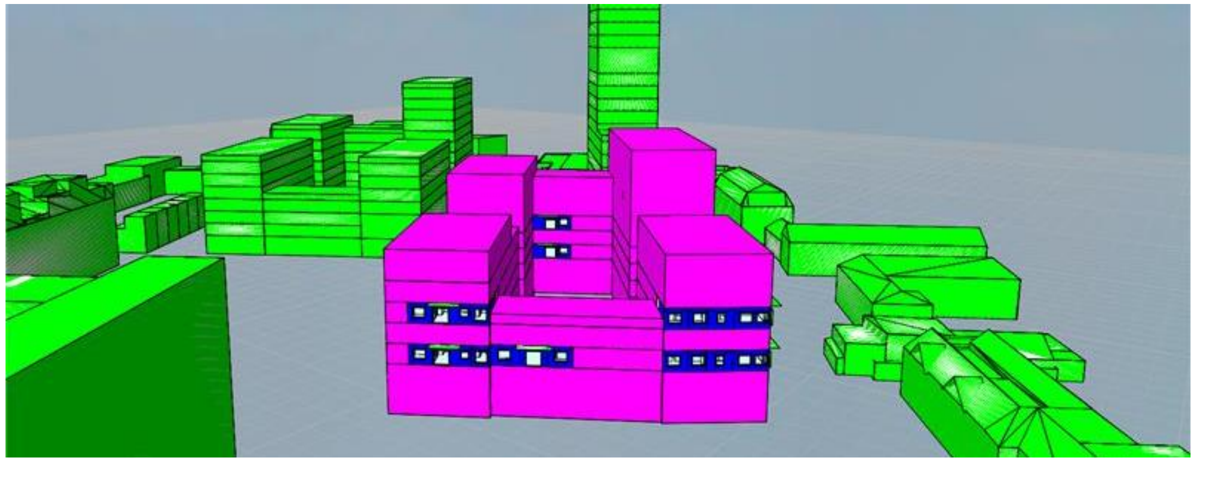
5.0 ONE MODEL APPROACH

Our Interoperability studies through research with Bath University, allow MACH to run IES and 3D noise mapping in tandem, allowing daylighting, ventilation (for open area) solar shading, façade shaping, thermal mass, window selection and of course acoustics to all originate from a single model at the start of the project.

The figures to the right illustrate the acoustics, solar and thermal modelling undertaken for GEP2.







6.0 NOISE SURVEY

An environmental noise survey has been conducted by Sandy Brown at early stage of stage of this project. The survey used two unattended positions and three attended measurements. These are summarised as follows:

	Measurement Position	Sound Pressure Levels (dB)	
		Daytime (07:00-23:00) $L_{Aeq,16hr}$	Night (23:00-07:00) $L_{Aeq,8hr}$
Unattended	A	68	63
	B	55	50

Table 1.1: Summary of Unattended Noise Measurements

	Measurement Position	Sound Pressure Levels (dB)			
		$L_{Aeq,15min}$	$L_{Amax,15min}$	$L_{A90,15min}$	$L_{A10,15min}$
Attended	1	54	73	48	56
	2	67	82	58	70
	3	66	80	57	69

1.2: Summary of Attended Noise Measurements

Please note, these measurements were taken while the proposed site was shown as per the figure to the right.

Figure 1.1: Measurement locations (Sandy Brown)

Please refer to '*18410-R01-A Environmental noise survey report*' from Sandy Brown for full details of the noise survey.

The results of this noise survey have been used to calibrate the noise model used in this façade assessment.

7.0 INTERNAL NOISE REQUIREMENTS

7.1 Planning Conditions

Criteria for internal noise levels within dwellings are provided within Condition 13a/b of the 'Masterplan' planning conditions.

This requires that internal noise levels achieve the following performance criteria:

- 35dB $L_{Aeq,16hr}$ during the daytime (0700-2300) with the windows closed.
- 40dB $L_{Aeq,16hr}$ during the daytime (0700-2300) with the windows open
- 35dB $L_{Aeq,8hr}$ during the night time (2300-0700) with the windows open.

Although not listed in the planning condition it is assumed that the internal noise levels within bedrooms during the night time must also achieve:

- 30dB $L_{Aeq,8hr}$ during the night time (2300-0700) with the windows closed.

MACH is currently seeking confirmation from the local planning authority within regards to the internal noise requirements and the application of the Acoustics Ventilation and Overheating guide and summarised in the followed section. Please see *'Acoustics and Overheating Report GEP2-MAL-XX-XX-RP-X-9102'* for further details.

7.2 BS8233

The table below illustrates the internal noise requirements of BS8223 which is typically called upon planning. These values are seen represent Good conditions for resting and sleeping .

Activity	Location	0700 - 2300	2300 - 0700
Resting	Living Room	35 dB $L_{Aeq,\ 16\ Hour}$	-
Dining	Dining Room	40 dB $L_{Aeq,\ 16\ Hour}$	-
Sleeping	Bedroom	35 dB $L_{Aeq,\ 16\ Hour}$	30 dB $L_{Aeq,\ 8\ Hour}$

Note 7 within BS8233 advises that these internal noise criteria may be relaxed by 5dB and reasonable internal conditions still achieved, where development is necessary or desirable, despite external noise levels above WHO guidelines.

- BS 8233: 2014 provides no definitive methodology for assessment of L_{Amax} levels.
- The WHO Community Noise Guidelines 1998 states that in order to avoid sleep disturbance within bedrooms during the night, the internal sound pressure level should not exceed 45 dB $L_{Amax.}$ It is widely accepted that noise events should not exceed 45 dB L_{Amax} more than 10-15 times during the night time period (2300 - 0700).

7.3 AVO Guide

Version 1.1 of Acoustics Ventilation and Overheating Guide (AVO) by the Association of Noise Consultants (ANC) January 2020, provides a methodology for an integrated approach to acoustic design, within the context of the ventilation and thermal comfort requirements.

It therefore provides a methodology to assess internal noise during both background ventilation to comply with Part F of the buildings and also during summertime overheating, where the internal noise requirement is dependent upon the risk of overheating and the amount of time this occurs.

MACH are proposing that this design guide is adopted on this scheme due to the interdependencies of acoustics, ventilation and overheating on indoor environmental quality (IEQ) and the need to meet the aspirations for sustainable development outlined within the Noise Policy Statement for England and the London Plan Policy.

At this stage in the design, the methodology outlined within the AVO guide is yet to agreed by the local planning authority.

The internal noise requirements during overheating are dependent upon the risk of overheating, which at an early stage is determined using the Good Homes Alliance Overheating Tool.

At this stage four option of dwellings have been assessed depending on their orientation. The table below provides description of the four options considered, their risk of overheating and the proposed internal noise targets.

Façade Option	Description	Overheating Risk	Internal Noise Limit (Overheating), $L_{Aeq,T}$	
			Daytime (07:00 – 23:00)	Night-Time (07:00 – 23:00)
Option 1a	South-facing Single aspect flats	High	<40 dB	<35 dB
Option 1b	South-facing Dual aspect flats	Medium-High	<44 dB	<37 dB
Option 2a	North-facing Single aspect flats	Medium- Low	<47 dB	<40 dB
Option 2b	North-facing Dual aspect flats	Low	<50 dB	<42 dB

7.4 Summary of Internal Noise Requirements

Please note that at this stage, the criteria or approach proposed for this development is yet to be agreed with the local authority.

A summary of the internal noise requirements of the two different methods of assessment for this development are provided within the table below.

- Option 1 - Planning Condition 13a/b, where internal noise levels are to comply with BS8233 with the windows closed & BS8233 + 5dB relaxation with the windows open; or
- Option 2 - Internal noise requirements of BS8233 with the windows closed and background ventilation and the internal noise requirements outlined within AVO guide which is dependent upon the risk of overheating.

Performance Criteria	Ventilation Mode	Unit Type	Period	Overheating Risk	Bedroom		Living Room
					$L_{Aeq,t}$ dB	L_{Amax} dB	$L_{Aeq,t}$ dB
Option 1 - Planning 13a/b	Windows Closed	All	Daytime	N/a	35	-	35
	Windows Open				40	-	40
	Windows Closed		Night time		30	45	-
	Windows Open				35	-	-
Option 2 - AVO Guide	Background Ventilation Part L (windows closed)	All	Daytime	N/a	35	-	35
			Night time		30	45	-
	Summertime Overheating	South Facing Single Aspect	Daytime	High	40	-	40
			Night time		35	50	-
		Dual Facing Single Aspect	Daytime	Medium / High	44	-	44
			Night time		37	52	-
		South Facing Single Aspect	Daytime	Medium / Low	47	-	47
			Night time		40	60	-
		Dual Facing Single Aspect	Daytime	Low	50	-	50
			Night time		42	65	-

8.0 NOISE MODELLING

A noise model of the site has been used to predict noise levels at all facades and has been calibrated upon the results of the environmental noise survey by others discussed in Section 2 of this report.

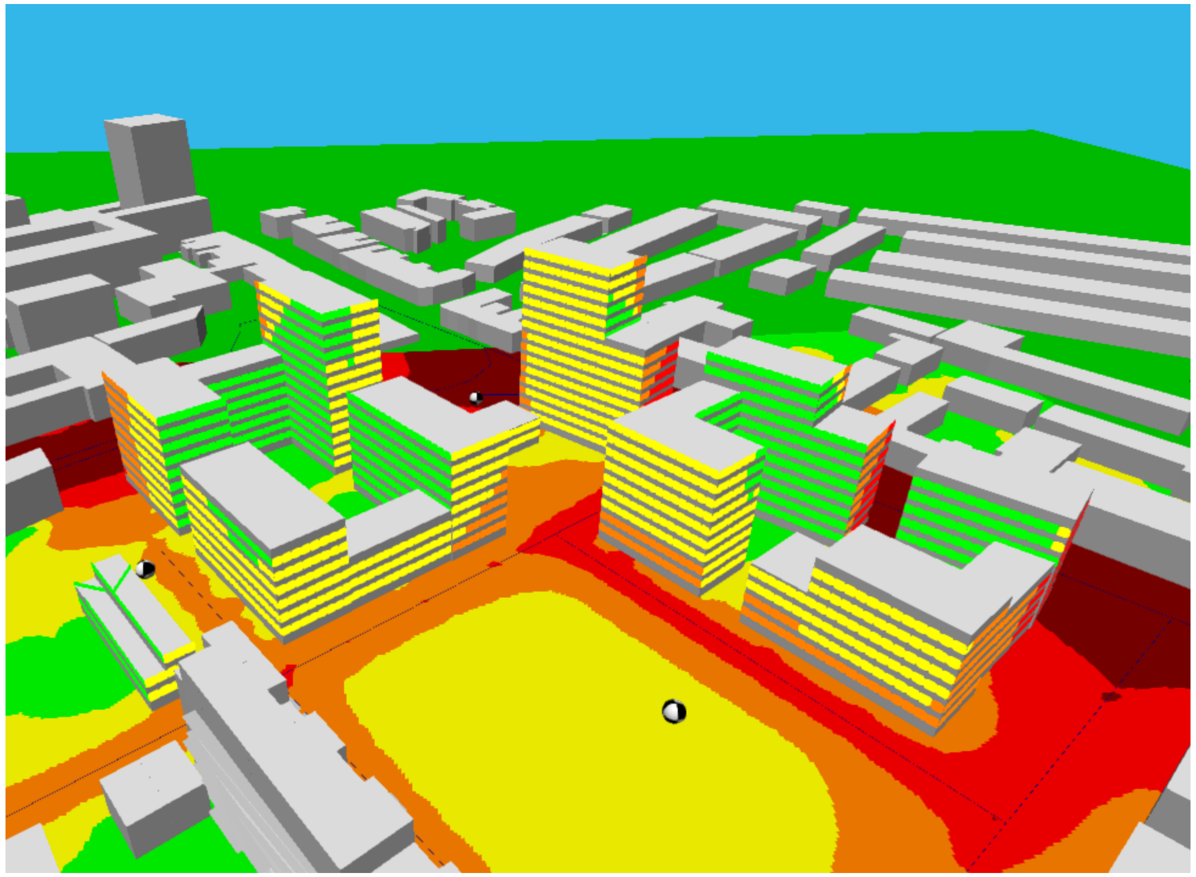
The noise model has been calibrated for existing noise sources and the layout illustrated within Figure 1.1. This layout has then been replaced by the massing within the following documents:

GEP2-WAB-ZZ-XX-SK-A-6113-OPTION 1B-1_200515_binder

Whilst all roads have been calibrated using the noise spectrums and measured levels as per Sandy Browns noise survey, there will be roads running through the site that do not currently exist and therefore the layout and volume of traffic has been assumed.

The noise model will therefore be updated following confirmation of traffic flows from the Highways Consultant.

Façade noise levels have simplified into noise exposure categories or bands of noise which have then been used to calculated the % of façade area for each noise exposure category. Indicative glazing and trickle vent specifications have then been provided.



The predicted noise level on the roads running through the site has been predicted using a CRTN calculation based on 50 or100 cars per hour driving at 20mph speed limit. This results in a sound *pressure* level of 54/57dBA at 10 m from the road.

Figures illustrating the noise exposure levels for each elevation are provided within Appendix A.

9.0 FAÇADE TYPES – GLAZING /TRICKLE VENTS

The table shown to the right give the R_w rating for the glazing and the D_{new} rating for trickle vents required for each noise Exposure Category. These ratings are based upon:

- The external wall achieving 55dB Rw
- Internal noise requirements of BS8233 and the planning conditions for closed windows and background ventilation and therefore to achieve:
    - Daytime 35dB $L_{Aeq,16hr}$
    - Night time 30dB $L_{Aeq,8hr}$
    - Night time 45dB L_{Afmax}

Please note that Dnew value for trickle vents is the overall performance, where the performance for each vent can be calculated using the following equation which is dependent upon the number of trickle vents required.

$D_{new,vent} = D_{new} + 10Log(n)$ where n is the number of vents per room.

The table to the right also illustrates indicative ventilation types.

	Façade Noise Level (dB)			
Option 1B-1	<55	55-60	60-65	>65
% of Façade Area	47%	27%	20%	7%
Glazing (R_w)	29	36	40	45
Trickle Vents (D_{new})	23	30	35	41
Ventilation Type				
Open Windows	*	*	*	
MEV + Open Windows	*	*	*	
MVHR - Small	*	*	*	
MVHR - Large Unit			*	*

10.0 ROOM DATABASE

10.1 Room Database

A database for every room within every dwelling has been produced for Block E2 only. This has been based upon an initial floor plan and will be updated as the design develops. The purpose of this database is to accurately identify the appropriate façade type for each room and includes the following information:

- Façade noise level
- Risk of overheating
- Internal noise level requirement
- Balconies

As the internal noise performance criteria is yet to be defined, a summary of option 1 and 2 (as described within Section 2.3) has been provided in the tables to the right.

10.2 BIM

As the design develops this this database may be integrated into the BIM model to ensure the appropriate façade types for each dwelling.

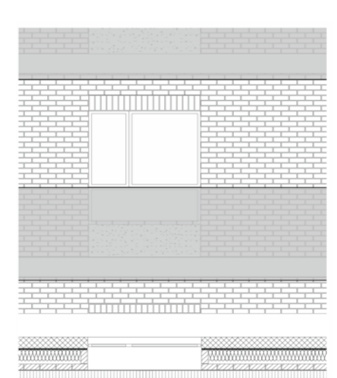
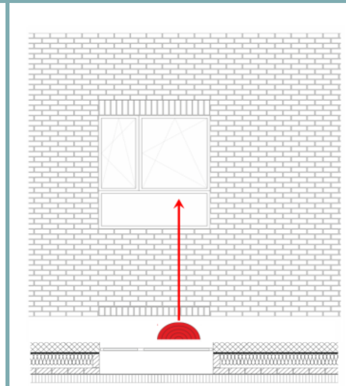
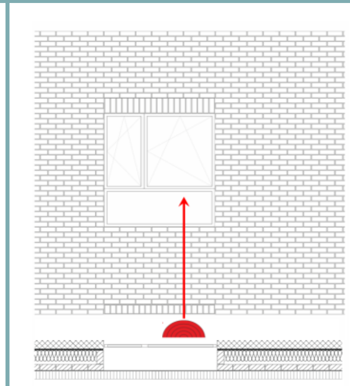
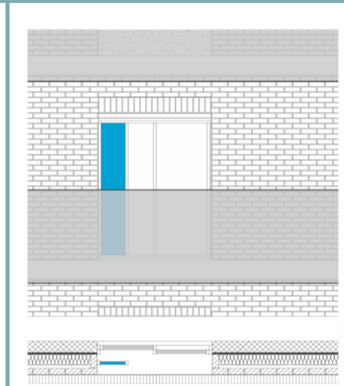
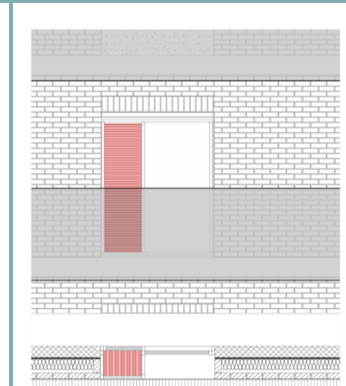
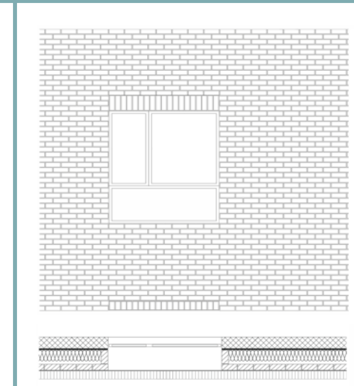
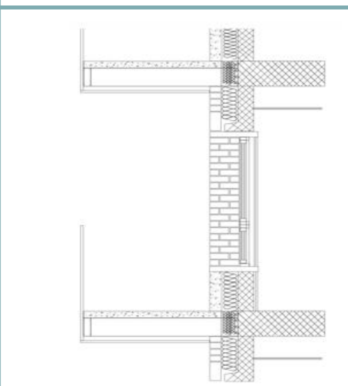
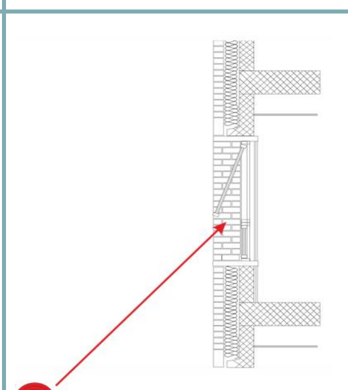
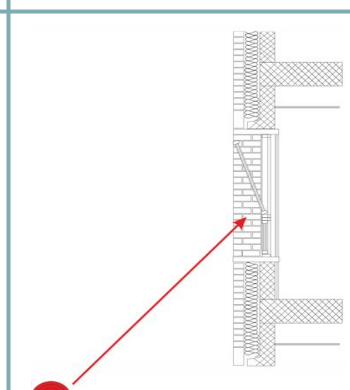
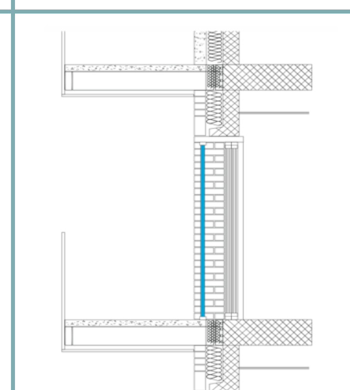
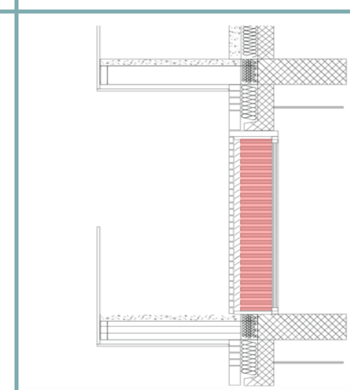
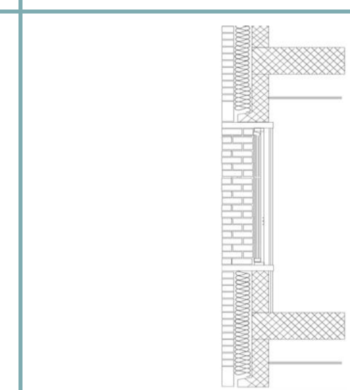
	Façade Type - Option 1 (Planning)				
Floor	Type 1	Type 2	Type 3	Type 4	Type 5
Sound Reduction	12	16	20	28	32
Floor (0)	18	6	27	20	19
Floor (1)	20	17	21	16	19
Floor (2)	20	18	22	15	18
Floor (3)	20	18	23	16	16
Floor (4)	21	22	19	16	15
Floor (5)	14	16	18	13	15
Floor (6)	13	17	19	27	0
Floor (7)	15	9	12	27	0
Floor (8)	6	8	14	11	0
Floor (9)	0	3	4	9	0
Floor (10)	0	3	2	7	0
Total	147	137	181	177	102

	Façade Type - Option 2 (AV0)				
	Type 1	Type 2	Type 3	Type 4	Type 5
Sound Reduction	12	16	20	28	32
Floor (0)	18	6	27	20	19
Floor (1)	23	14	21	16	19
Floor (2)	23	15	22	15	18
Floor (3)	23	15	23	16	16
Floor (4)	24	19	19	16	15
Floor (5)	17	13	18	13	15
Floor (6)	16	14	19	27	0
Floor (7)	16	8	12	27	0
Floor (8)	6	8	14	11	0
Floor (9)	1	1	4	9	0
Floor (10)	1	2	1	7	0
Total	168	115	180	177	102

11.0 FACADE TYPES

The table below illustrates the different façade types being considered for this project and the level of sound reduction these façade types will provide.

Further details are provided Appendix A.

Description	**Balcony**	**Façade Type 1**	**Façade Type 2**	**Façade Type 3**	**Façade Type 4**	**Façade Type 5**
	Balcony	Openable Window	Angled Window	Baffled Window	Attenuated Opening	Sealed Facade
Elevation Plan						
Section						
Reduction	3 dB	<12 dB	<16 dB	<20 dB	<28 dB	>28 dB

12.0 PART L & LONDON PLAN COMPLIANCE

Initial calculations have been carried out to determine the predicted energy use of the proposed dwellings, and the renewable energy requirements required to achieve a 40% betterment above Part L, as required by planning. These calcs are based upon blocks E2 and F1 only.

As part of the assessment, MACH have compared the use of MEV or MVHR systems, and the impact this may have on the total number of PV panels required.

It is shown that the difference between MEV and MVHR may have a significant impact upon PV Panel area required, in which an additional 1m^2 of PV panel per dwelling may be required if MEV is used.

It may be that a combination of MEV and MVHR is used for the development design, and as such this assessment has been carried out as well, as summarised in the table opposite.

Further information can be found within a separate Part L report, titled '*GEP2-MAL-ZZ-ZZ-RP-X-9100-S3-P02*'.

	Option 1 MEV		Option 2 MVHR		Option 3 30% MVHR / 70% MEV	
	Tonnes CO_2/Yr	% Reduction	Tonnes CO_2/Yr	% Reduction	Tonnes CO_2/Yr	% Reduction
Part L 2013 Baseline (TER)	434	-	434	-	434	-
Be Lean (Reducing Energy Demand)	399	8%	399	8%	399	8%
Be Green (Low Energy District Heating)	327	25%	298	32%	318	27%
Be Clean (PV Panels)	260	40%	260	40%	260	40%

Initial Part L Calculations – Blocks E2 and F1 only

	Residential (MEV Option)	Residential (MVHR Option)	Residential (30% MVHR / 70% MEV Option)
Amount of CO_2 to offset	66 Tonnes CO_2/Yr	37 Tonnes CO_2/Yr	57 Tonnes CO_2/Yr
Grid Carbon Factor	0.519 kgCO_2/kWh	0.519 kgCO_2/kWh	0.519 kgCO_2/kWh
Equivalent Grid Electricity	87 MWh	29 MWh	67 MWh
Peak Generated per 6m^2	150 kWh	150 kWh	150 kWh
Area of PV required	848 m^2	475 m^2	732 m^2

Initial Part L Calculations – Blocks E2 and F1 only

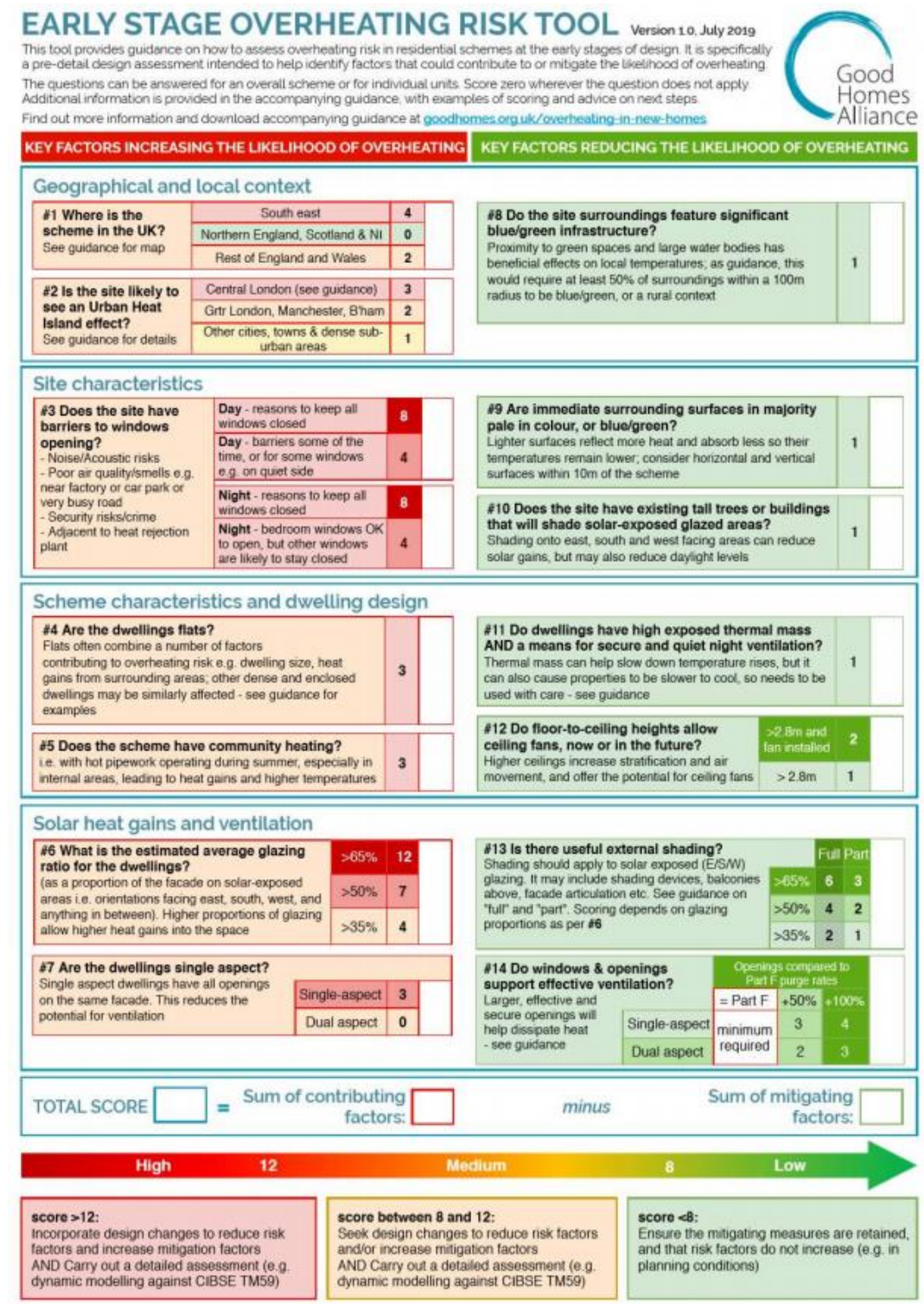
13.0 OVERHEATING RISK ANALYSIS

As recommended within the GLA's 'Energy Assessment Guidance' (Draft – April 2020), an overheating assessment has been carried out in accordance to the *Good Homes Alliance Early Stage Overheating Risk Tool*. Initial results show that risk of overheating varies from Low to High depending on orientation and the single/dual aspect of flat layouts.

This assessment also feeds into determining suitable internal noise targets during overheating, as per AVO Guide methodology.

Further information can be found in the separate report titled '*Acoustics and Overheating Performance Targets*' (*GEP2-MAL-ZZ-ZZ-RP-X-9102-S3-P01).*

Façade Option	Description	Overheating Risk	Internal Noise Limit (Overheating), $L_{Aeq,T}$	
			Daytime (07:00 – 23:00)	Night-Time (07:00 – 23:00)
Option 1a	South-facing Single aspect flats	High	<40 dB	<35 dB
Option 1b	South-facing Dual aspect flats	Medium-High	<44 dB	<37 dB
Option 2a	North-facing Single aspect flats	Medium- Low	<47 dB	<40 dB
Option 2b	North-facing Dual aspect flats	Low	<50 dB	<42 dB



14.0 INITIAL THERMAL MODELLING

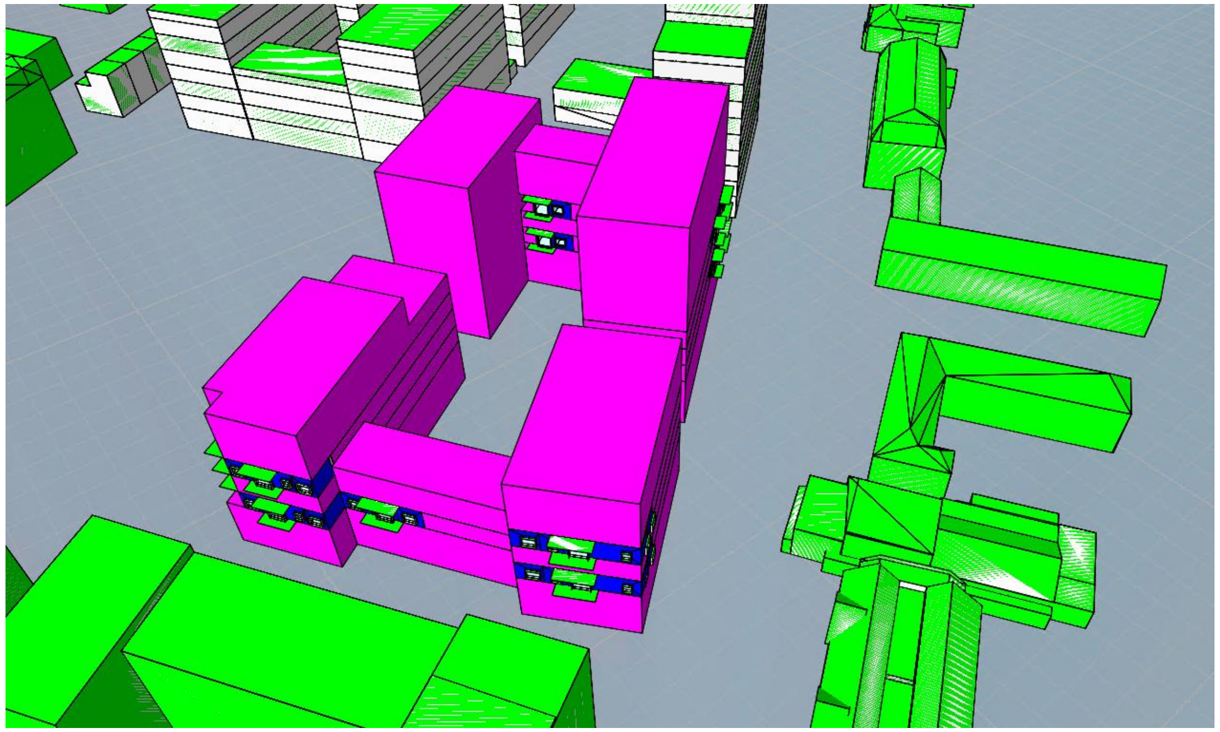
Thermal modelling carried out by MACH has been based upon a selection of 7 sample dwellings, highlighted in the figure below. This selection has been chosen to compare the performance of single and dual aspect flats, as well as different orientation.

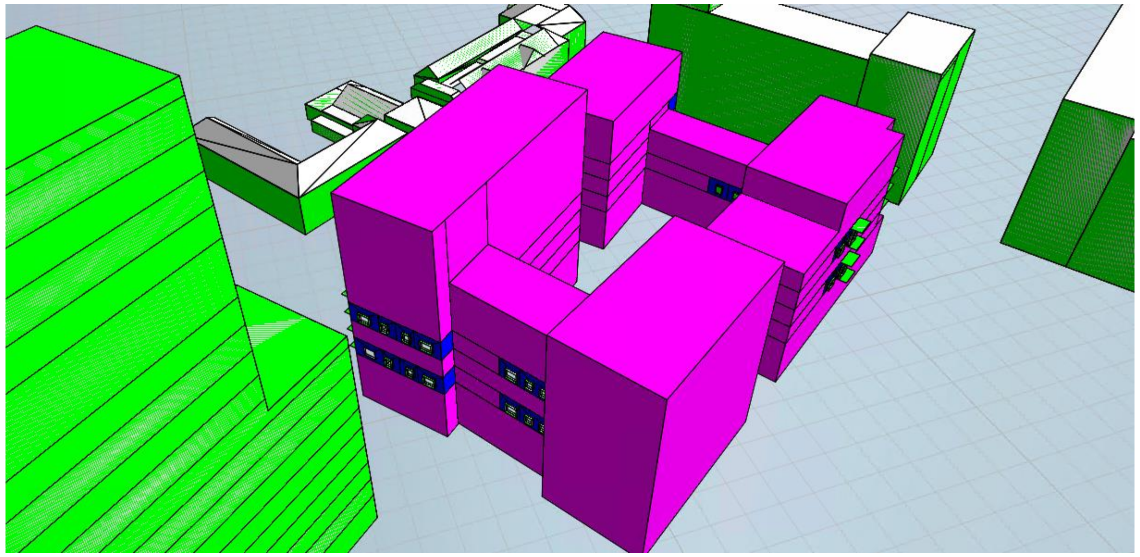
6 different model scenarios have been assessed, which assess different combinations of MEV flow rates, exposed soffits, and cross ventilation between internal rooms. A sealed façade scenario has also been assessed, so to demonstrate if TM52 criteria can still be achieved if a sealed façade is required for acoustics.

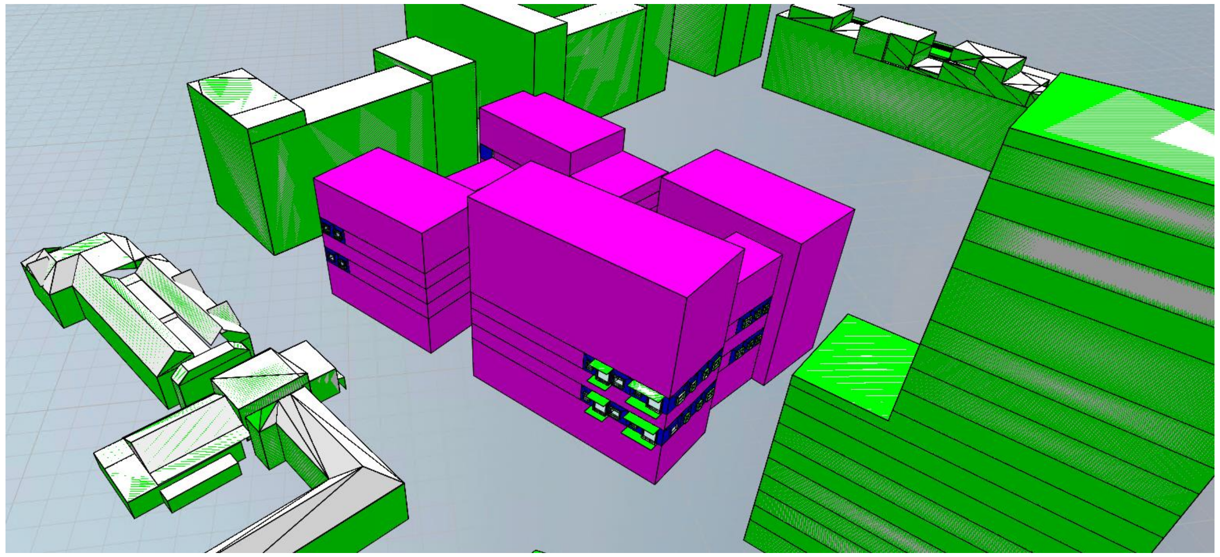
Model Option	Description
1	- Shading as shown on drawing - Plasterboard ceiling - Continuous MEV, Part F flow rates (5 l/s bedrooms, 9 l/s living rooms/kitchens)
2	- Shading as shown on drawing - Exposed concrete soffit - Continuous MEV, Part F flow rates (5 l/s bedrooms, 9 l/s living rooms/kitchens)
3	- Shading as shown on drawing - Plasterboard ceiling - Continuous MEV on 'boost mode' (20l/s bedrooms, 35 l/s living rooms/kitchens)
4	- Shading as shown on drawing - Exposed concrete soffit - Continuous MEV on 'boost mode' (20l/s bedrooms, 35 l/s living rooms/kitchens)
5	- Shading as shown on drawing - Exposed concrete soffit - Continuous MEV on 'boost mode' (20l/s bedrooms, 35 l/s living rooms/kitchens) - 0.5m2 cross ventilation between rooms
6	- Shading as shown on drawing - No exposed thermal mass - Sealed facade - MVHR vent (30l/s bedrooms, 45 l/s living rooms/kitchens)

14.0 INITIAL THERMAL MODELLING

Screenshots of the initial thermal modelling carried out by MACH are shown opposite and below.







14.0 INITIAL THERMAL MODELLING

Thermal modelling has been carried out using two sets of open areas, which are based upon achieving either the current planning criteria for noise ingress, or the updated criteria proposed by MACH, based upon AVO Guide methodology.

Further information can be found within '*GEP2-MAL-ZZ-ZZ-RP-X-9101-S3-P02*'.

Model Option	Open Area (m^2)			
	Living Room	Bedroom 1	Bedroom 2	Bedroom 3
Flat A	0.8	0.4	0.4	N/A
Flat B	1.2	0.6	N/A	N/A
Flat C	1.2	0.4	0.6	N/A
Flat D	0.5*	0.4*	0.4*	0.4*
Flat E	0.5*	0.4*	N/A	N/A
Flat F	0.5*	0.4*	0.5*	0.5*
Flat G	1.2	0.6	0.4	0.4
*Internal noise levels unlikely to be achieved with openable windows – attenuator required				

Open Area Requirements – BS833 + 5dB

Flat Type	Reference Flats	Overheating Risk	Internal Noise Limit, $L_{Aeq,T}$ BS8233 + 5dB		Internal Noise Limit, $L_{Aeq,T}$ AVO Guide	
			Daytime	Night-Time	Daytime	Night-Time
South-facing Single aspect flats	A & B	High	<40 dB	<35 dB	<40 dB	<35 dB
South-facing Dual aspect flats	F & G	Medium-High	<40 dB	<35 dB	<44 dB	<37 dB
North-facing Single aspect flats	E	Medium- Low	<40 dB	<35 dB	<47 dB	<40 dB
North-facing Dual aspect flats	C & D	Low	<40 dB	<35 dB	<50 dB	<42 dB

Open Area Requirements – AVO Guide

Model Option	Open Area (m^2)			
	Living Room	Bedroom 1	Bedroom 2	Bedroom 3
Flat A	0.8	0.4	0.4	N/A
Flat B	1.2	0.6	N/A	N/A
Flat C	1.6	0.8	1.0	N/A
Flat D	0.6	0.4*	0.4*	0.4*
Flat E	0.4	0.4*	N/A	N/A
Flat F	0.4	0.4*	0.5*	0.5*
Flat G	1.6	0.8	0.6	0.6
*Internal noise levels unlikely to be achieved with openable windows – attenuator required				

Open Area Requirements – AVO Guide

14.1 THERMAL MODELLING - RESULTS

Open Areas to Achieve BS8233 + 5dB

The table below provides the results of the overheating assessment, using the open area requirements to achieve current planning criteria for noise ingress.

Results show that TM52 criteria will not be achieved for south-facing flats which have a sealed façade (with MVHR), or a combination of MEV (low-flow rate) and plasterboard ceiling.

However it is shown that both TM52 and TM59 can be achieved in some dwellings through the use of MEV (boost mode), exposed soffit and cross ventilation between internal rooms.

Model Option	Description	FLAT A		FLAT B		FLAT C		FLAT D		FLAT E		FLAT F		FLAT G	
		TM52	TM59	TM52	TM59	TM52	TM59	TM52	TM59	TM52	TM59	TM52	TM59	TM52	TM59
1	- Shading as shown on drawing - Plasterboard ceiling - Continuous MEV (low flow rate)	No	>100 hrs above	No	>100 hrs above	Yes	74-78 hrs above	Yes	>100 hrs above	Yes	>100 hrs above	Yes	>100 hrs above	Yes	>100 hrs above
2	- Shading as shown on drawing - Exposed concrete soffit - Continuous MEV (low flow rate)	Yes	>100 hrs above	Yes	>100 hrs above	Yes	61-68 hrs above	Yes	59-84 hrs above	Yes	>100 hrs above	Yes	>100 hrs above	Yes	>100 hrs above
3	- Shading as shown on drawing - Plasterboard ceiling - Continuous MEV (Boost mode)	Yes	85-88 hrs above	Yes	60 hrs above	Yes	38 hrs above	Yes	26-45 hrs above	Yes	59 hrs above	Yes	39-57 hrs above	Yes	22-69 hrs above
4	- Shading as shown on drawing - Exposed concrete soffit - Continuous MEV (Boost mode)	Yes	65 hrs above	Yes	42 hrs above	Yes	23-27 hrs above	Yes	17-30 hrs above	Yes	52 hrs above	Yes	29-51 hrs above	Yes	13-55 hrs above
5	- Shading as shown on drawing - Exposed concrete soffit - Continuous MEV (Boost mode) - 0.5m^2 cross vent between rooms	Yes	35-37 hrs above	Yes	17 hrs above	Yes	0 - 4 hrs above	Yes	5 - 10 hrs above	Yes	23 hrs above	Yes	3 - 18 hrs above	Yes	0 - 26 hrs above
6	- Shading as shown on drawing - No exposed thermal mass - Sealed facade - MVHR vent (90 l/s)	No	>100 hrs above	No	>100 hrs above	Yes	41-86 hrs above	Yes	100 hrs above	Yes	73 hrs above	Yes	>100 hrs above	Yes	>100 hrs above

14.1 THERMAL MODELLING - RESULTS

Open Areas to Achieve AVO Guide Criteria

The table below provides the results of the overheating assessment, using the open area requirements to achieve MACH's proposed noise ingress criteria based upon AVO Guide methodology.

Results show a slight improvement above the previous results for current planning criteria. As shown, it is possible for up to half the dwellings to achieve TM59 in at least 1 bedroom per flat, with both Flats B and C achieving full TM52 and TM59 compliance.

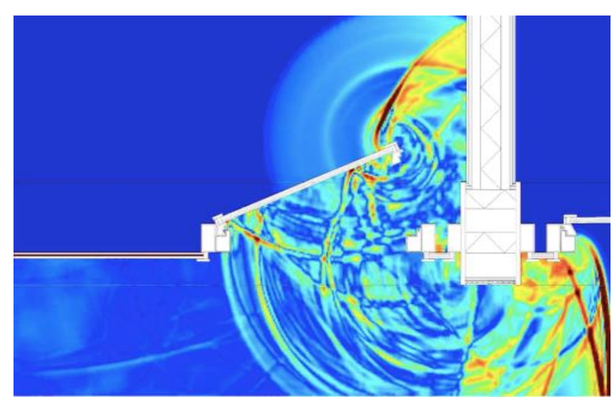
Model Option	Description	FLAT A		FLAT B		FLAT C		FLAT D		FLAT E		FLAT F		FLAT G	
		TM52	TM59	TM52	TM59	TM52	TM59	TM52	TM59	TM52	TM59	TM52	TM59	TM52	TM59
1	- Shading as shown on drawing - Plasterboard ceiling - Continuous MEV (low flow rate)	No	>100 hrs above	No	>100 hrs above	Yes	34-53 hrs above	Yes	60-99 hrs above	Yes	>100 hrs above	Yes	>100 hrs above	Yes	>100 hrs above
2	- Shading as shown on drawing - Exposed concrete soffit - Continuous MEV (low flow rate)	Yes	>100 hrs above	Yes	>100 hrs above	Yes	19-43 hrs above	Yes	50-78 hrs above	Yes	90 hrs above	Yes	>100 hrs above	Yes	>100 hrs above
3	- Shading as shown on drawing - Plasterboard ceiling - Continuous MEV (Boost mode)	Yes	45-88 hrs above	Yes	36 hrs above	Yes	15-28 hrs above	Yes	23-52 hrs above	Yes	35 hrs above	Yes	39-58 hrs above	Yes	16-50 hrs above
4	- Shading as shown on drawing - Exposed concrete soffit - Continuous MEV (Boost mode)	Yes	38-65 hrs above	Yes	23 hrs above	Yes	11-15 hrs above	Yes	16-30 hrs above	Yes	30 hrs above	Yes	29-51 hrs above	Yes	13-41 hrs above
5	- Shading as shown on drawing - Exposed concrete soffit - Continuous MEV (Boost mode) - 0.5m^2 cross vent between rooms	Yes	13-35 hrs above	Yes	Yes	Yes	Yes	Yes	0 - 10 hrs above	Yes	10 hrs above	Yes	10-18 hrs above	Yes	0 - 14 hrs above
6	- Shading as shown on drawing - No exposed thermal mass - Sealed facade - MVHR vent (90 l/s)	No	>100 hrs above	No	>100 hrs above	Yes	41-86 hrs above	Yes	100 hrs above	Yes	73 hrs above	Yes	>100 hrs above	Yes	>100 hrs above

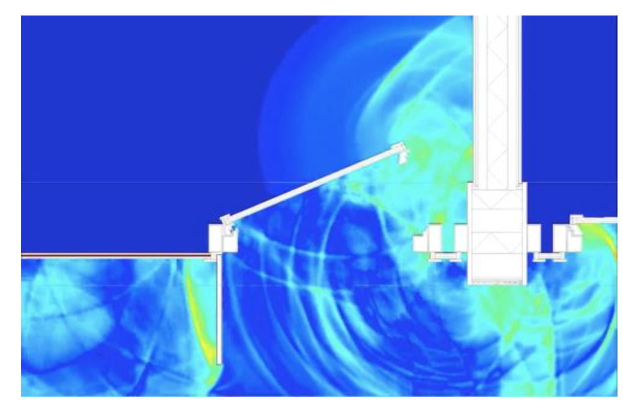
15.0 FUTURE WORK

In the subsequent stages MACH propose to develop on the acoustic/thermal modelling and assessments already undertaken to identify and maximise efficient, low energy façade solutions which minimise cost and the environmental impact.

We will seek to achieve this through a holistic design approach considering:

- Heat gains and solar shading through the use of balconies to reduce open area requirements
- Thermal mass and façade specifications
- Window form, shape / size
- Window opening mechanism in relation to direction of noise source.
- Detailed noise modelling of facades and the use of balconies for acoustic screening.
- Detailed noise modelling using FDTD modelling tools as illustrated below right.

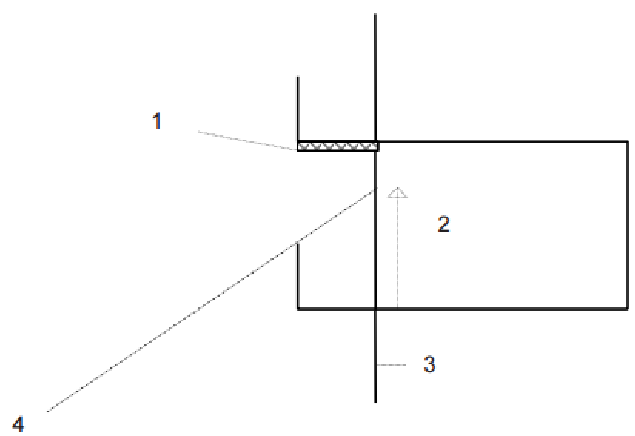




APPENDIX A – FAÇADE TYPES

BALCONIES

BS12354-3:2000 provides guidance on the performance of balconies where the performance of the balcony is dependent upon primarily dependent upon the line of site to noise and whether any absorption to underside of the balcony above.



Key

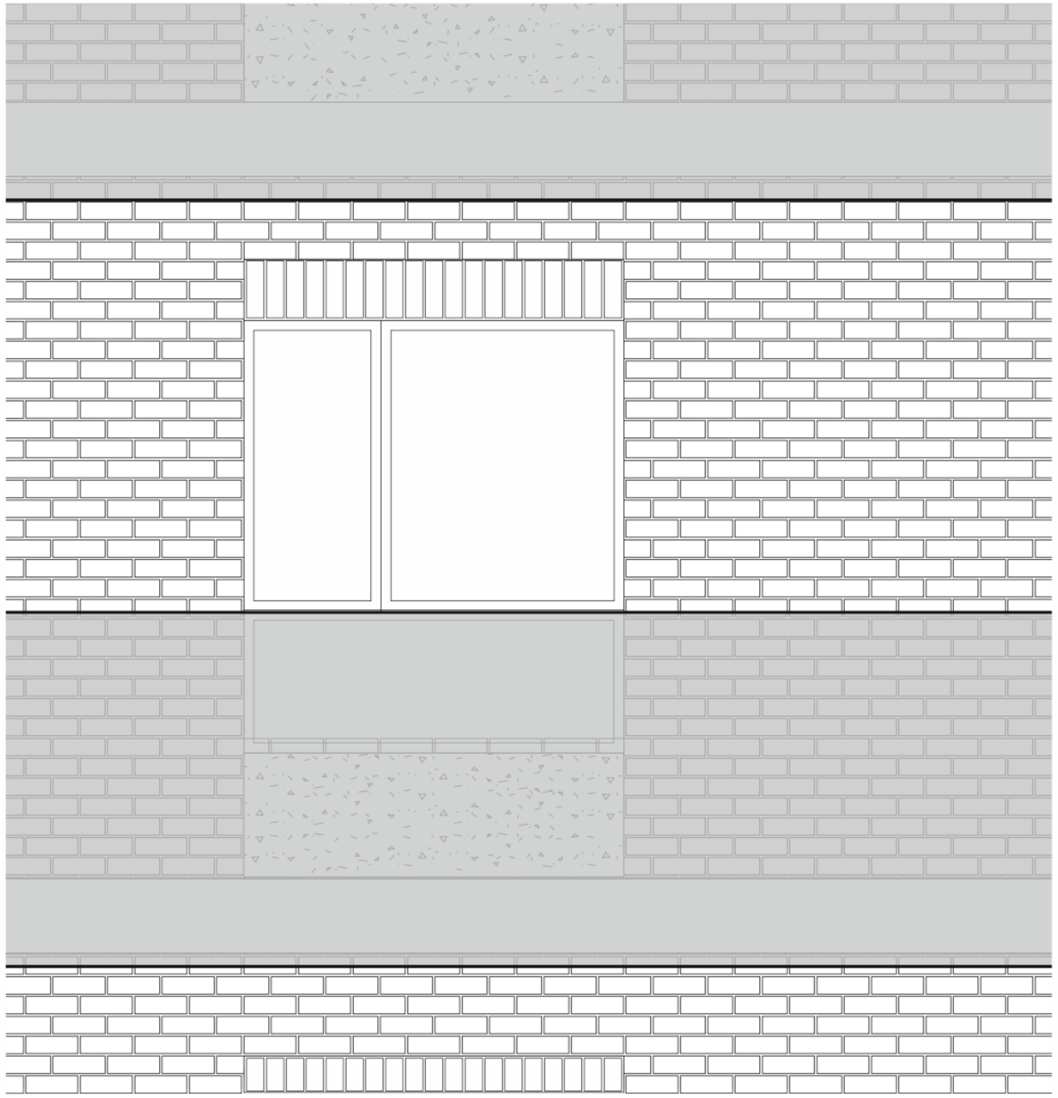
1 Absorption
2 Height of line of sight
3 Façade plane
4 Sound source

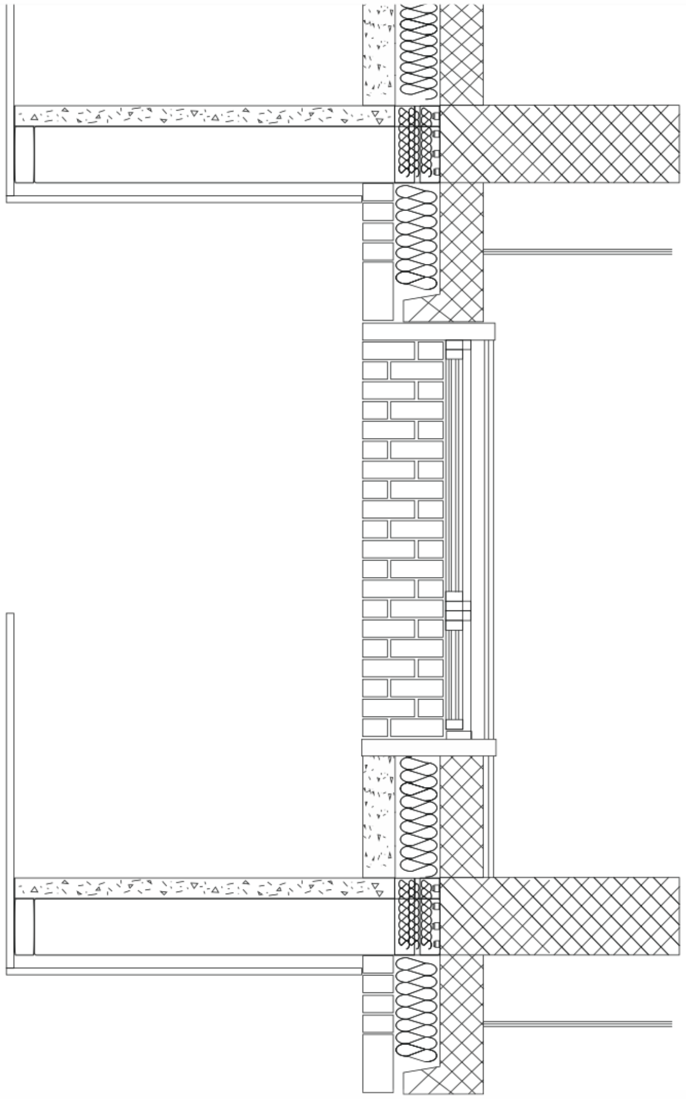
<ins>Where balconies are vertically stacked, an allowance for an absorptive soffit should be made such to not degrade the benefit of balcony.</ins>

ΔL_{fs} dB	1 plane façade	2 gallery			3 gallery			4 gallery			5 gallery		
absorption roof (α_W) ⇒	does not apply	≤ 0,3	0,6	≥ 0,9	≤ 0,3	0,6	≥ 0,9	≤ 0,3	0,6	≥ 0,9	≤ 0,3	0,6	≥ 0,9
line-of-sight on façade: < 1,5 m	0	–1	–1	0	–1	–1	0	0	0	1	does not apply		
(1,5 to 2,5) m	0	does not apply			–1	0	2	0	1	3			
> 2,5m	0				1	1	2	2	2	3	3	4	6

	6 balcony			7 balcony			8 balcony			9 terrace open fence			closed fence		
absorption roof (α_W) ⇒	≤ 0,3	0,6	≥ 0,9	≤ 0,3	0,6	≥ 0,9	≤ 0,3	0,6	≥0,9	≤ 0,3	0,6	≥ 0,9	≤ 0,3	0,6	≥ 0,9
line-of-sight on façade: < 1,5 m	–1	–1	0	0	0	1	1	1	2	1	1	1	3	3	3
(1,5 to 2,5) m	–1	1	3	0	2	4	1	1	2	3	4	5	5	6	7
> 2,5m	1	2	3	2	3	4	1	1	2	4	4	5	6	6	7

BS12354 guidance on sound reduction of balconies.





Balcony - 3 dB

Do not scale from this dra ing

Indicative Drawing

MACH GROUP

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t: 0117 944 1388
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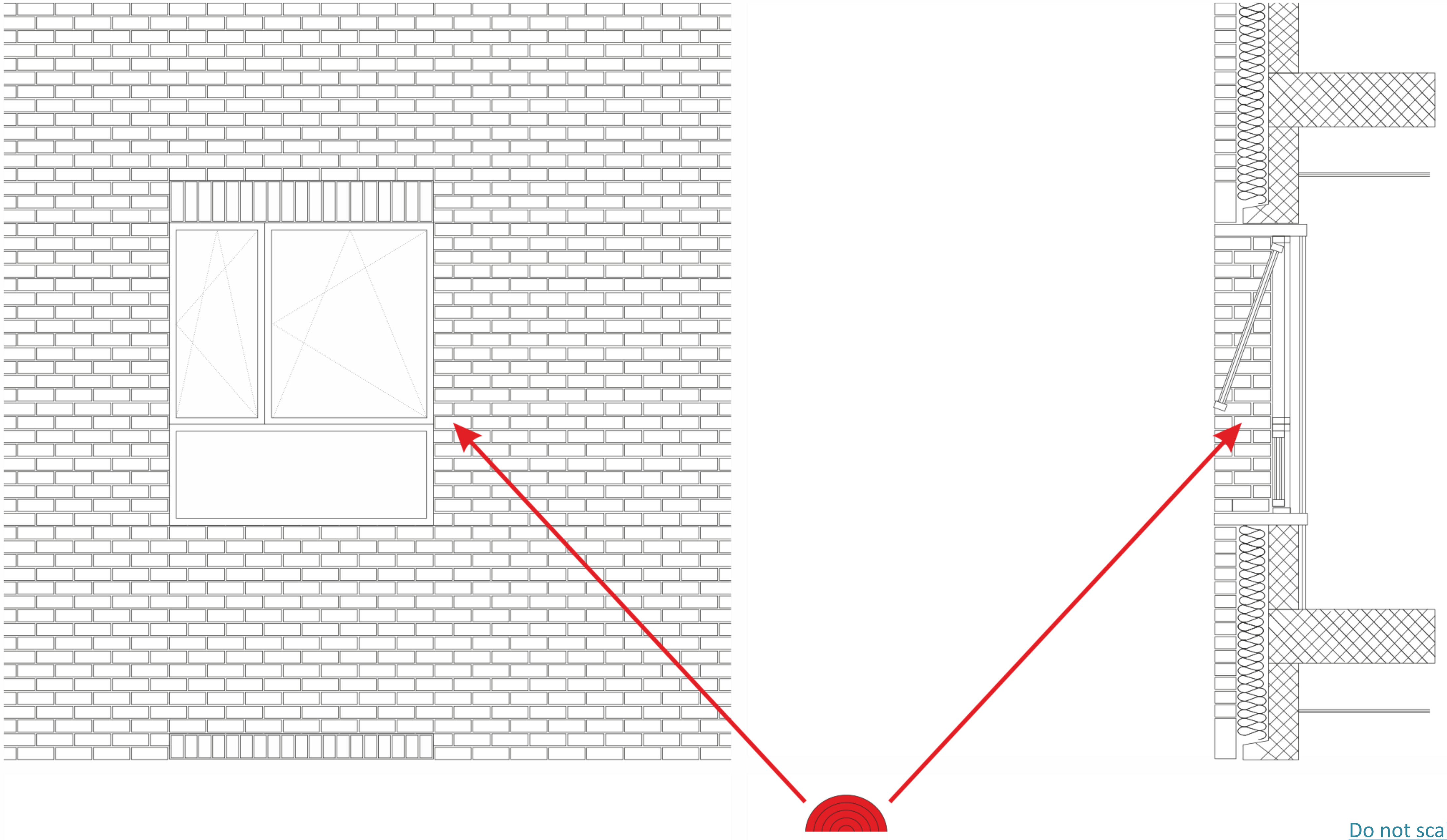
e: info@machacoustics.com

Title: Balconies	Drawing No:
Report	Date: -
Project: -	Rev: 00

Facade Type 1 <12 dB



Do not scale from this drawing

Indicative Drawing

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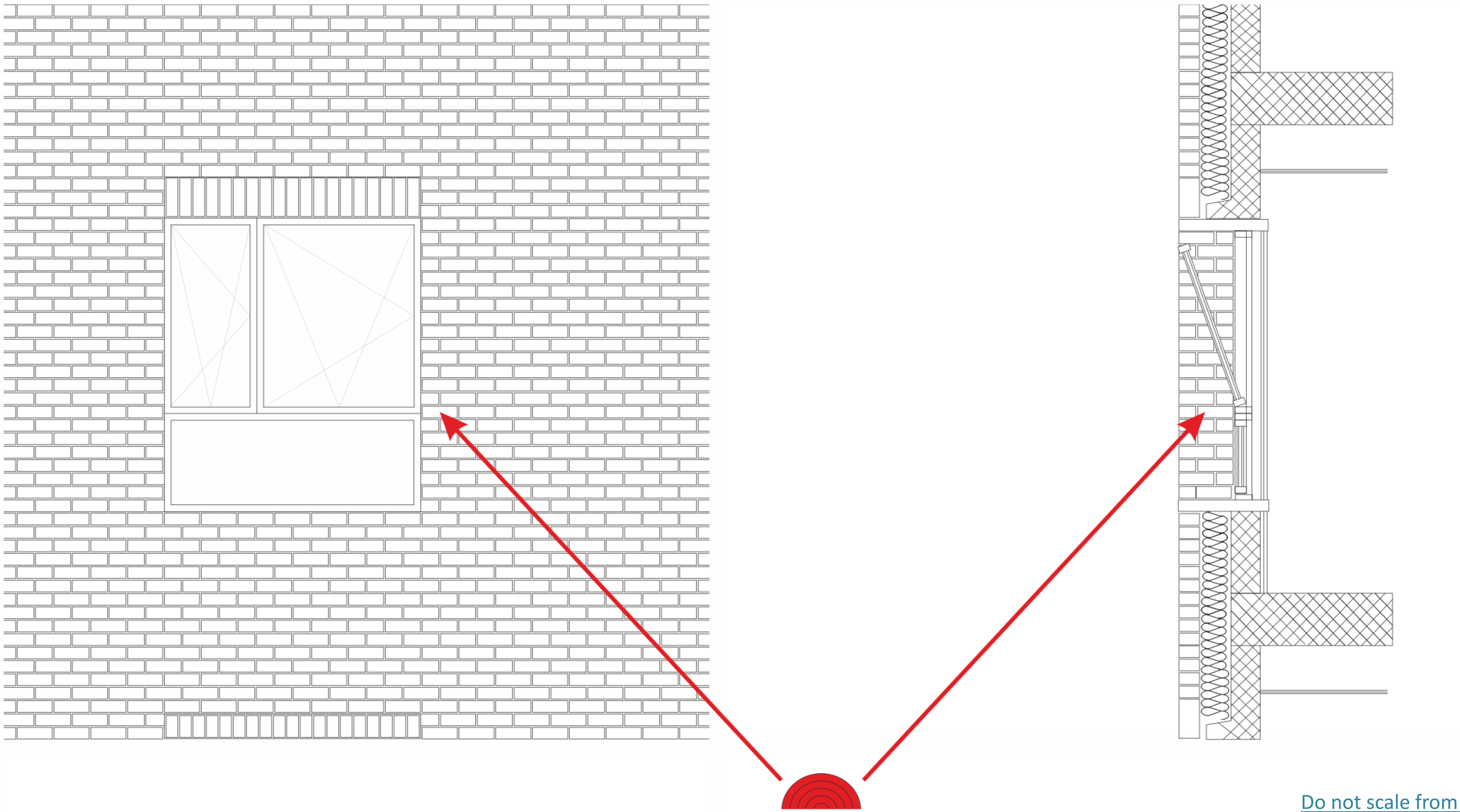
Title:	Openable Windows	Drawing No:	
Report		Date:	-
Project:	-	Rev:	00

Facade Type 2 <16 dB



Do not scale from this drawing

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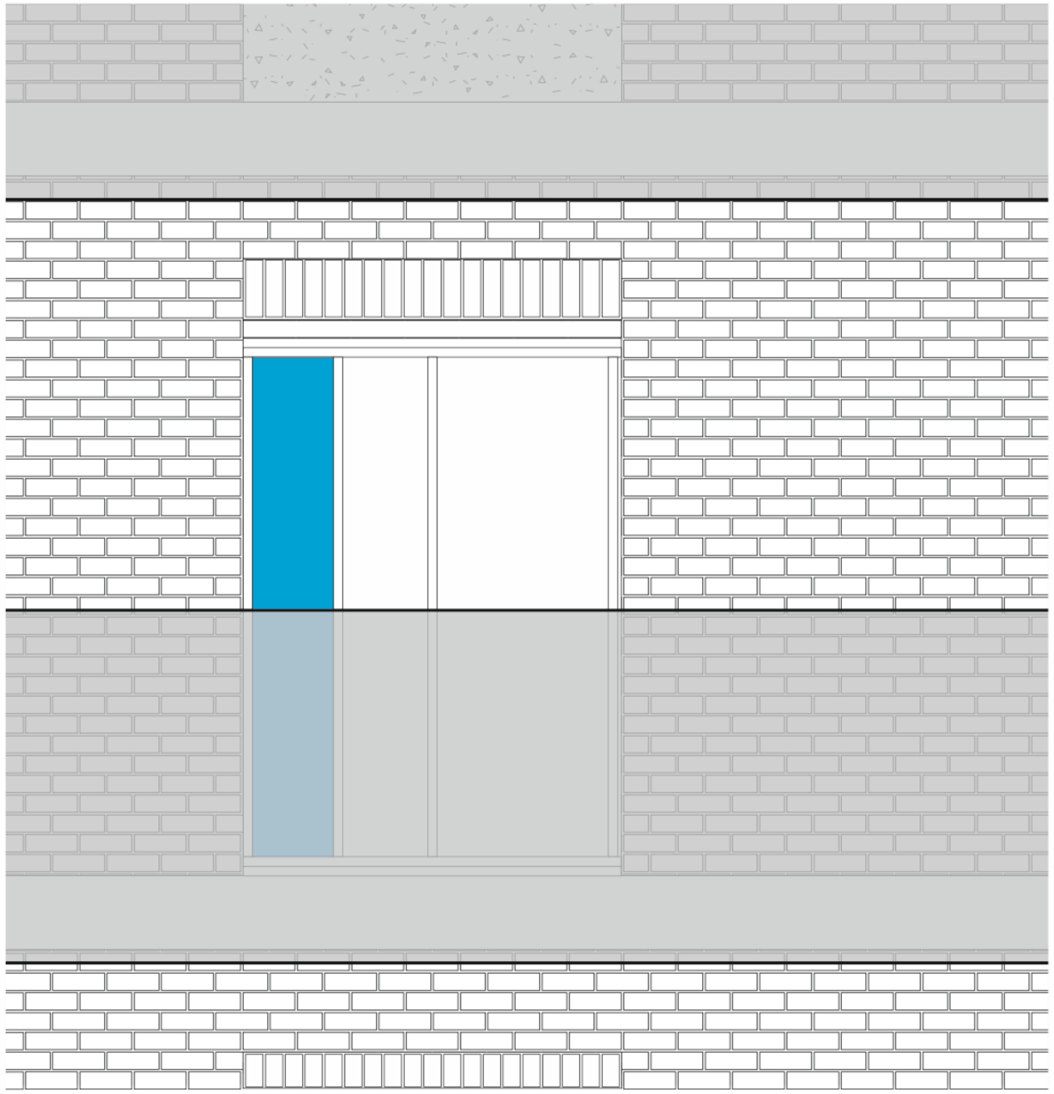
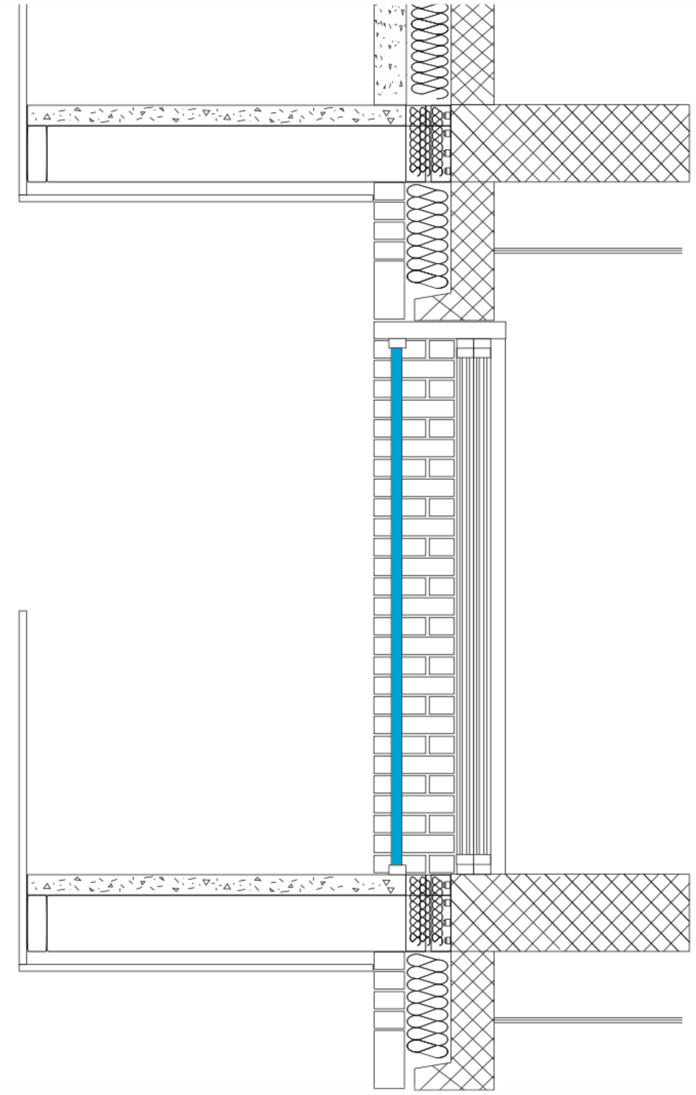
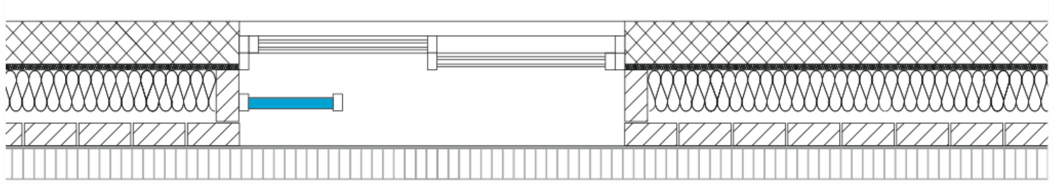
Title:	Angled Window	Drawing No:	
Report		Date:	-
Project:	-	Rev:	00







Facade Type 3 <20 dB

Do not scale from this drawing

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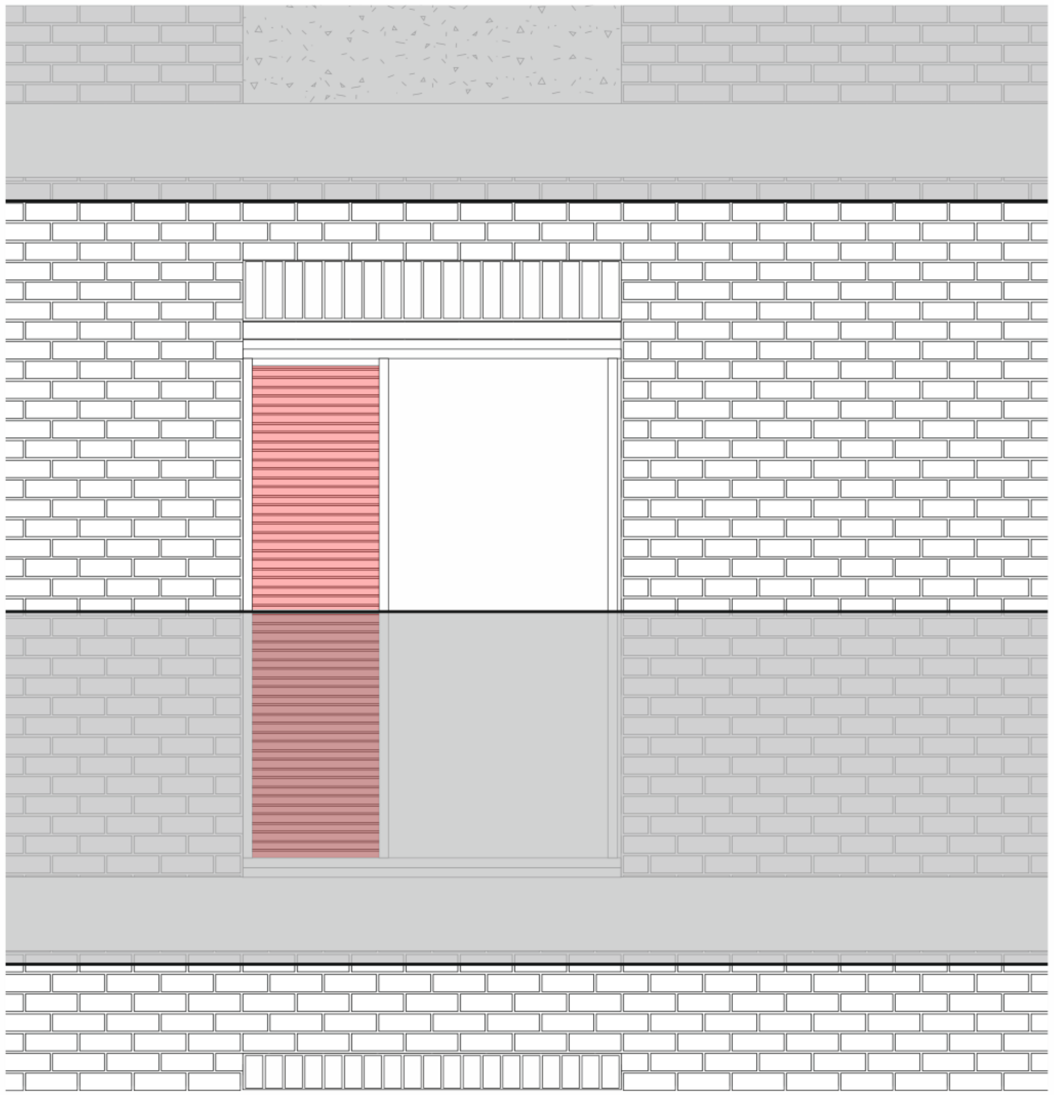
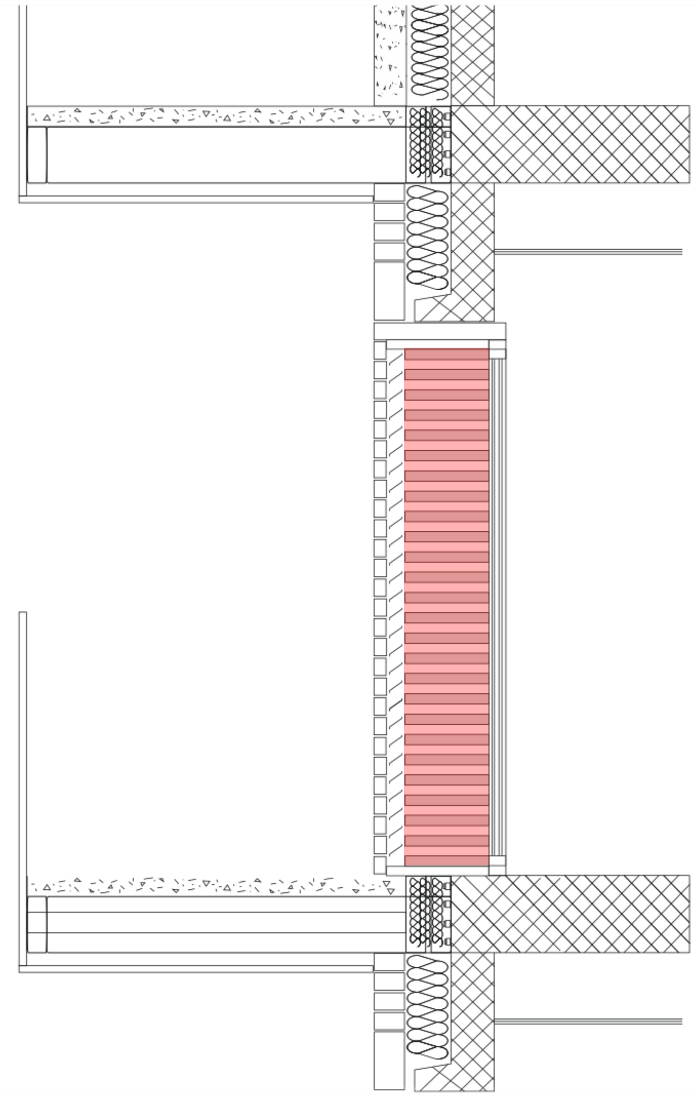
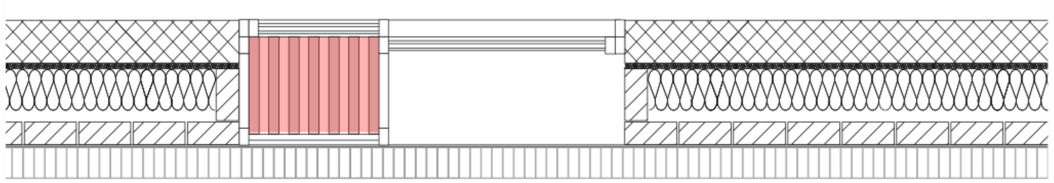
Title: Baffled windows	Drawing No:
Report	Date: -
Project: -	Rev: 00







Facade Type 4 <28 dB

Do not scale from this drawing

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Report	Date: -
Project: -	Rev: 00

FINS

The addition of fins on a façade have the ability to create acoustic shading for certain elevations. This is particularly effective for instances where there is a notable net direction of sound.

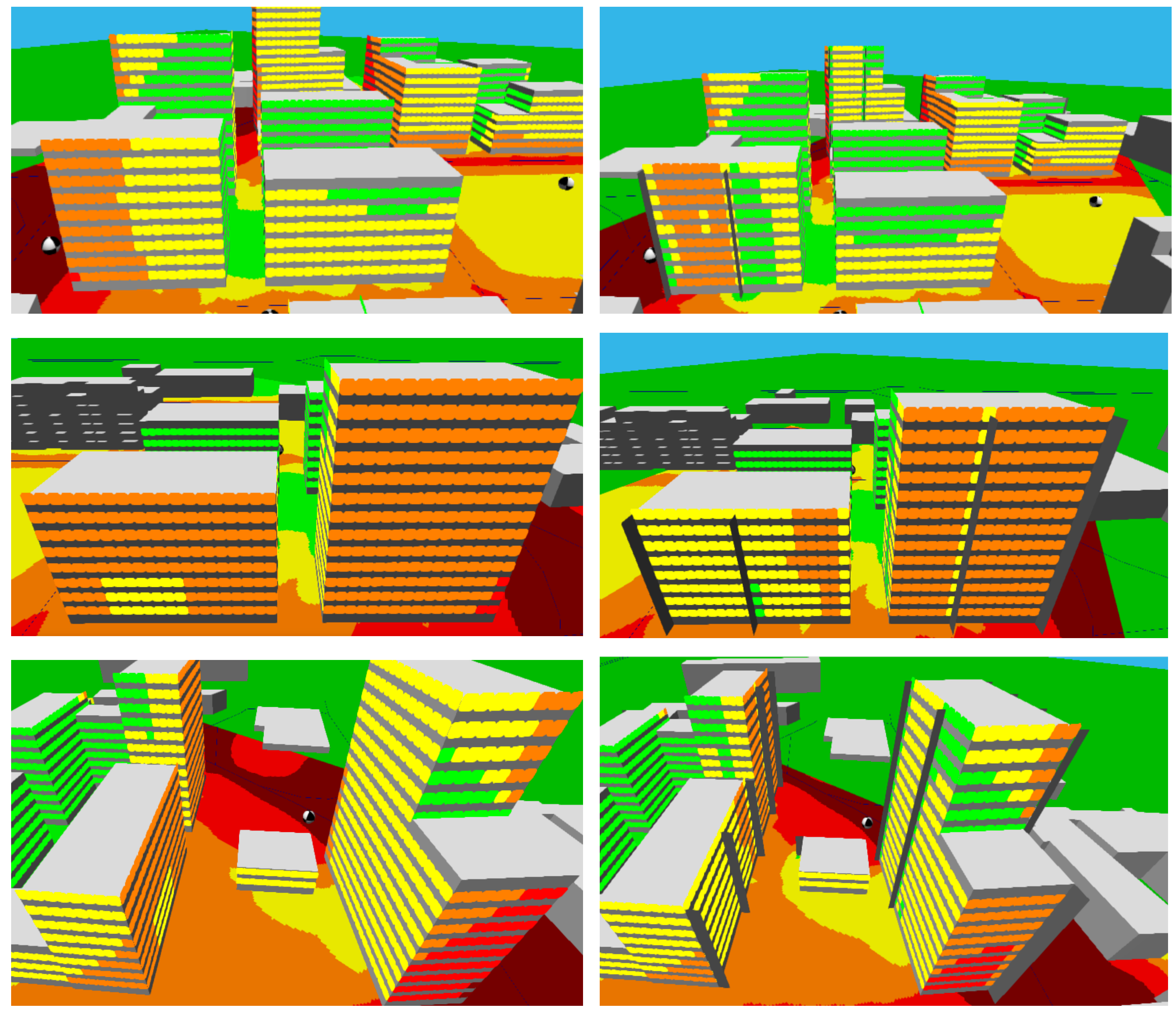
All fins added are of a maximum protrusion of 2.5m.

From the images to the right, it can be seen that the addition of fins to the western elevation of F1 reduces the façade noise level of a significant number flats to ≤50dBA.

This can also be seen on the eastern elevation of F1 where fins provide acoustic shading to a number of flats reducing the façade exposure level to ≤55dBA.

However, although the addition of fins to the western elevation of E1provides some sound reduction for flats further up the building, it is not significant compared to the number of overall flats.

No Fins | Fins Added



F1 – West Elevation

F1 – East Elevation

F1 – East Elevation, E1 – West Elevation

FINS (CONTINUED)

The addition of fins to the eastern elevations of E1 & E2 reduces the façade noise level to ≤65dbA for flats on the 6th & 7th floors, however performance improvement up the building is not appreciable.

However, a fin added to the southern elevation of E2, highlighted by the blue rectangle, ensures that all flats within the central building are subject to a facade noise level of ≤60dbA.

Adding a fin to the northern elevation of E2 does provide some shading across the façade but a number of flats are still subject to high noise levels.

Please note, as per the balconies MACH are currently undertaking more detailed assessment of fins for the proposed development, however the results of this assessment will be provided in subsequent version of this report.