

164-172 and 174-194 William St Woolloomooloo Alternative Natural Ventilation Report

2 September 2025

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Executive Summary

This Alternative Natural Ventilation report has been prepared by Flux Consultants Pty Ltd to accompany the proposed State Significant Development Application (SSD) for a mixed-use infill affordable housing development at 164-172 and 174-194 William Street Woolloomooloo.

This report has been prepared to address the Secretary's Environmental Assessment Requirements (SEARs) issued for the project (SSD-80211463), with specific reference to alternative natural ventilation for noise-impacted apartments.

An alternative natural ventilation system is proposed to provide ventilation and acoustic amenity for apartments exposed to road and traffic noise. The adequacy of the proposed alternative natural ventilation has been demonstrated in accordance with the City of Sydney guideline - Alternative Natural Ventilation of Apartments in Noisy Environment Performance Pathway (Guidelines). These Guidelines provide a methodology for demonstrating adequate natural ventilation of habitable rooms per the objectives of the NSW Apartment Design Guide (ADG) where external noise conditions do not allow internal noise amenity to be achieved with windows open to the extent guided by the ADG.

Airflow to each habitable room was tested for each hour of a typical weather year using dynamic thermal and bulk airflow modelling software. The results of the testing confirm that the sizing of the plenums in the proposal meet the minimum requirements of the Guidelines and natural ventilation will be achieved in noise affected apartment as required by ADG 4B-1 and 4J.

Subject to the implementation of the natural ventilation plenums described in this report, the proposal adequately addresses noise-affected natural ventilation as required by the ADG.

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Introduction

1. Introduction

Flux has been commissioned by William Street Residential Pty Ltd to prepare this report in accordance with the technical requirements of the Secretary's Environmental Assessment Requirements (SEARs), and in support of the State Significant Development Application (SSD-80211463) for the proposed mixed-use infill affordable housing development at 164 - 172 and 174-194 William Street Woolloomooloo.

The site is made up of two (2) lots. The legal description of the site is outlined in Table 1.

Property Address	Title description.
164-172 William Street, Woolloomooloo	Lot 52 in DP1049805
174-194 William Street, Woolloomooloo	Lot 1 in DP816050

Table 1 - Legal description

1.1. Project Description

Following the Design Excellence Competition, the scheme has been revised to include In-fill Affordable Housing (IAH) in line with the NSW Government's policy under the State Environmental Planning Policy (Housing) 2021 (Housing SEPP). This policy allows for a 30% increase in Floor Space Ratio (FSR) and building height when 15% of the total FSR is provided as affordable housing for 15 years. The proposed development meets these criteria and is eligible for the bonus uplift.

Given the residential component's Capital Investment Value (CIV) exceeds \$75 million, an SSDA pathway can be taken. The proposal retains key design principles recommended by the Design Excellence Panel and aims to provide additional residential dwellings with a 30% increase in GFA and building height, in accordance with the Housing SEPP.

The purpose of the project is to facilitate the delivery of a high-quality mixed-use development containing residential and retail uses as well as centrally located park, public domain improvements and improved through-site connectivity at a strategically located site. The proposal seeks

to deliver a built form outcome that responds appropriately to its location on William Street in Woolloomooloo and in close proximity to Kings Cross Station and the Sydney CBD. Furthermore, the proposed scheme seeks to deliver an outcome that is consistent with the desired and evolving character of the Woolloomooloo and Potts Point area.

Specifically, this SSDA seeks consent for:

- 227 apartments (167 market housing, 60 affordable housing units).
- Ground floor retail and commercial uses with 7-18 storeys of residential tower across four buildings being:
 - ▶ FJC - William Street (West)
 - ▶ FJC - William Street (East)
 - ▶ Studio Bright - Forbes Street
 - ▶ Tribe Studio - Dowling Street
- A public accessible central park.
- Public domain works and improved through-site links.
- Four basement levels for parking, services and storage.
- Vehicular and loading access from Forbes Street.

1.2. The Site

The site is located at 164-172 and 174-194 William Street Woolloomooloo within the City of Sydney LGA. The site comprised of multiple allotments and is legally described as:

- 164 - 172 William Street, Woolloomooloo.
 - ▶ Lot 52 in DP1049805
- 174 - 194 William Street, Woolloomooloo.
 - ▶ Lot 1 in DP816050.

The land size totals 6,398 m² and consists of a southern frontage to William Street, an eastern frontage to Dowling Street, a western frontage to Forbes Street and northern frontage to Judge Lane.



Figure 1. The site

1.3. Surrounding Context

The immediate urban context surrounding the site is characterised by a mix of medium density residential, commercial, and retail uses. The site is in close proximity to Hyde Park, The Domain, and Rushcutters Bay Reserve. There are a number of educational and health services in proximity to the site, providing ample infrastructure support for the community.

William Street, to which the site fronts, is a classified road providing connection between the Eastern Suburbs of Sydney and the CBD. Vehicle access is currently provided from six points on the site from Judge Lane, Forbes Street, and Dowling Street. Pedestrian access to the site is currently available from all frontages.

The site is highly accessible to both bus and rail services, being approximately 300 m away from Kings Cross Railway Station and having direct access to bus services on William Street that provide connections through the Metropolitan Transport Network.

At the time of lodgement, the site is improved by a warehouse style structure and glass office building to the site's frontage and an at-grade private carpark to the northwestern portion of the site.



Figure 2. Local Context

1.4. Acoustic requirements

This report details natural ventilation to support acoustic amenity. Flux has worked collaboratively with Renzo Tonin and FJC to develop solutions that maximise the potential for natural ventilation in the proposed development.

Renzo Tonin provided advice on the acoustic acceptability of solutions and the habitable rooms require an alternative natural ventilation solution. A full

list of rooms requiring acoustically attenuated natural ventilation is provided in Section 3.2.

1.5. Sources of Information

The performance assessment for alternative natural ventilation was undertaken based on FJC's architectural drawing set dated 15 August 2025.

The floor areas for each habitable room are as detailed in the architectural drawing set.

Acoustic advice has been provided progressively by Renzo Tonin.

Colt and Louvreclad manufacturer-supplied performance data was used for rain defence louvres.

1.6. Limitations

This report considers only the approach and design to resolve the ventilation requirements of natural ventilation system. Flux has not considered aspects related to the system's acoustic performance.

The nomination of performance requirements for weatherproof louvres has considered rain defence characteristics under normal operating conditions. This report does not consider construction details or other aspects of weatherproofing, waterproofing, or other requirements for the envelope under the NCC.

This report addresses natural ventilation performance only of noise impacted apartments and excludes considerations of natural cross ventilation.

Planning and Guidelines Requirements

2. Planning and Guidelines Requirements

This report references the relevant SEARs and guideline requirements applicable to the assessment of alternative natural ventilation performance.

2.1. SEARs Requirements

This report has been prepared in response to the requirements contained within SEARs dated 21 February 2025 and issued for SSD-80211463. Specifically, this report has been prepared to respond to the SEARs requirement issued below:

Item	Description of Requirement	Section Reference (this Report)
6. Built Form and Urban Design	- If relevant, provide an assessment of the development against: • The design principles for residential apartment development set out in Schedule 9 of the Housing SEPP and the Apartment Design Guide (ADG). This should include a table which demonstrates how each dwelling (including affordable dwellings) performs against the ADG design criteria.	Housing SEPP Schedule 9 This report addresses Schedule 9 Part 6 - Amenity, which identifies natural ventilation as one of the key contributors to residential amenity. This report is limited to the natural ventilation performance of the noise-impacted apartments. The amenity of the apartments impacted by noise were assessed against City of Sydney Alternative Natural Ventilation of Apartments in Noisy Environments Performance Pathways. Apartment Design Guide (ADG) Part 4b-1 The objective of Part 4b-1 is “<i>all habitable rooms are naturally ventilated</i>”. Part 4J The objective of Part 4J-1 is that “<i>in noisy or hostile environments the impacts of external noise and pollution are minimised through the careful siting and layout of buildings</i>”. The objective of Part 4J-2 is to provide “<i>appropriate noise shielding or attenuation techniques for the building design, construction and choice of materials are used to mitigate noise transmission</i>” These objectives necessarily limit the size of openings in apartments affected by external noise. Importantly, these do not remove or override the requirement to achieve natural ventilation. This report addresses natural ventilation requirements for noise-impacted apartments, where conventional windows cannot be relied upon to provide natural ventilation due to acoustic constraints. — — — — The consistency of testing approach with CoS guidelines is addressed in Section 2.2 of this report. The minimum requirements for satisfactory can be found in Section 4 of this report. The satisfactory can be found in Section 5 of this report.

Table 2 - SEARs requirements

2.2. City of Sydney Guidelines

This report has been prepared in response to the City of Sydney guideline - Alternative Natural Ventilation of Apartments in Noisy Environments Performance Pathway. The assessment has been undertaken based on the approach outline in the guidelines below.

Item	Section Reference (this report)
Each unique apartment design must be discretely tested and each habitable room must be demonstrated to meet the minimum performance requirements	Each unique apartment design has been discretely tested and each habitable room have demonstrated compliance with the minimum performance requirements. Refer to Section 3.1 and Section 3.2 for the approach of selecting the unique apartments. Refer to Section 3.2 - Table 5 for the minimum performance required for each habitable rooms. Refer to Section 5 Table 7 for simulation results for each unique apartments tested.
Apartments with a similar plan but difference in height of more than six storeys must be considered unique. Where multiple floors are represented by a similar plan, the lowest floor apartment must be modelled.	Unique apartments repeated testing: L01: 105E - repeated for L07. L01: 104E, 103E - repeated for L07 and L13 Refer to Section 3.1 and Section 3.2 for the full list of habitable rooms tested. Refer to Appendix A for the markups of habitable rooms tested.
Arrangement and features of apartments modelled must be consistent with the architectural drawings.	Arrangement and features of apartments modelled are consistent with the architectural drawings. Refer to Section 3.4 for further details. Refer to Appendix C for the screenshot of the habitable rooms modelled in the simulation software.
Natural ventilation openings that comprise the alternative proposal must be assumed open at all times and all other openings must be assumed closed.	Plenums were modelled open at all times. Any other external openings in the tested habitable rooms are considered close. Refer to Section 3.4 for further details.
The calculations must adequately factor in loss in effective openable areas caused by the characteristics of ventilation devices, plenums, control dampers, insect screens and similar as defined in the ADG.	Loss from rain defence louvres and fly screen have been adequately factor in in the Effective Open Area (EOA) calculation of the proposed alternative natural ventilation device. Refer to Section 4.4 for the loss factor of rain defence louvres. Refer to Section 4.5 for the loss factor of fly screen. Refer to Section 4.6 for the full calculation of the EOA.
Performance must be calculated by predicting average hourly airflow rates each hour of the year, i.e. 24 hours x 365 days.	Performance were calculated per hourly basis for 365 days and compliance was considered based on the hourly airflow for 90% of the time. Refer to Section 3.4 for simulation methodology. Refer to Section 5.1 Table 7 for compliance data. Refer to Appendix B for 24 hr x 365 days data.
Multi-zone air flow modelling using dynamic thermal simulation software must be used to verify the performance of the alternative proposal.	Simulation was undertaken using multi-zone airflow modelling in EDSL TAS. Refer to Section 3.4 for further details.

Item	Section Reference (this report)
Hourly weather data for a full calendar year in Sydney must be used as described in the Test Reference Year for Mascot 1987 (94767 Mascot (Syd AMO) 1978-87 1987 available from www.ozemail.com.au/~acadsbsg	The simulation used WYPPA weather file developed by Flux according to the wind speed data that is terrain corrected to account for the typology at Mascot Airport. Flux created it to be typical for coincident wind velocity and direction at the lower quartile of wind speeds, which are the most relevant to testing alternative natural ventilation systems. Refer to Section 3.8 for the detail description of the WYPPA methodology.
Wind must have city terrain type for velocity profile modification.	City terrain has been considered for the simulation. Refer to Section 3.6.
For the purpose of facade pressure coefficient correction, all neighbouring buildings must be assumed to be the greater of: - the same height and equivalent massing as the subject building, or - the full height and massing allowed by the planning controls.	The height of the neighbouring buildings are considered to be the greater of the same height and equivalent massing as the subject building. Refer to Section 3.6.
Specific facade pressure coefficients may be determined using wind tunnel or computational fluid dynamic (CFD) testing which more accurately accounts for the surrounding features (buildings, streets, topography). If wind tunnel or CFD testing is applied, all assumptions must be published and full allowance must be considered for all reasonably anticipated development that will impact the wind pressures on the proposed building. This is taken to be the full extent of future development permitted under the current or exhibited planning controls (whichever is larger)	Not applicable.
Where natural ventilation systems proposed incorporate a device to enhance performance that is not able to be supported with manufacturer performance data relevant to a natural ventilation context, or is highly contextualised by neighbouring environments, such as the reliance upon Venturi capped exhaust stacks, additional point of time testing is required using either CFD or wind tunnel testing.	Not applicable.
Reports must include a full list of assumptions that affect the prediction of performance, including but not limited to:	<i>See below.</i>
- Simulation tool(s) used.	Simulation was undertaken using multi-zone airflow modelling in EDSL TAS. Refer to Section 3.4 for further details.
- Weather file used.	The simulation used WYPPA weather file. Refer to Section 3.8 for further details.

Item	Section Reference (this report)
- All inputs and assumptions used in the simulation(s) that are relevant to predicted results.	All inputs and assumptions have been described in the report. Refer to Section 3.5 for detail descriptions.
- Manufacturers' published performance criteria relied upon for any equipment selection.	All equipment selection has been described in the report. Refer to Section 4.4 for rain defence louvres specification.
- Consistent naming of openings, plenums, chimney/stacks and other system constituents between drawings and reports.	Consistent naming for the plenums as alternative natural ventilation has been applied in this report. Refer to Section 4.6 for the description of the plenum types. Refer to Section 5.1 - Table 7 for the application of each plenum types in the tested habitable rooms. Refer to Appendix A for the markups of the plenums in the architectural plans.

Table 3 - City of Sydney Guidelines performance pathway assessment requirements

Approach

3. Approach

Noise-impacted dwellings were assessed in accordance with the City of Sydney (CoS) Alternative Natural Ventilation pathway. This section outlines the methodology used to inform the design and testing of the alternative ventilation system and identifies the dwellings where this approach is required.

3.1. Unique apartments

Unique apartments were tested from the lowest floor level and subsequently at six-storeys intervals (see *Table 5 in Section 3.2. below and Appendix A*).

Compliance was checked for every noise-impacted habitable rooms.

3.2. Minimum performance requirements

The City of Sydney’s guideline sets minimum performance requirements based on the number of bedrooms in an apartment, or, for oversized apartments, as a function of the apartment’s floor area.

The guideline requires a minimum airflow rate of 10 L/s/person (where the number of persons is equal to the number of bedrooms in the apartment + 1), or 0.3 L/s/m2 for oversized apartments. The minimum airflow performance should be achieved for 85% of all hours in the year for cross-through and cross-over apartments, or 90% of all hours in the year for all other apartments.

Each habitable room must be provided with effective natural ventilation with distribution between rooms proportional to reasonable expectations of use and occupancy. The airflow rate criteria serve as a guide for determining the requirement for each habitable room.

For oversized apartments requiring a higher ventilation rate, the requirement was scaled proportionally to the floor area of the tested habitable room. Where the calculation resulted in a rate below 10 L/s per room, Flux applied a minimum requirement of 10 L/s. Refer to Table 4 for the calculation of oversized apartments.

Oversized unique apartments	Similar apartments	Total apartment floor area (m2)	Habitable rooms requiring alternative natural ventilation	Area of each habitable room (m2)	CoS airflow requirements per habitable area (0.3 L/s/m2)	Flux’s application (L/s)
M03E	-	104	Bedroom - north	12.5	3.75	10
			Bedroom - mid	12.8	3.84	10
103E	203E, 303E, 403E, 503E,	138	Bedroom - north	12.5	3.75	10
			Bedroom - mid	12.8	3.84	10
			Bedroom - south	23.5	7.05	10

Table 4 - Calculation of minimum performance requirement for oversized unique apartments

Furthermore, Flux applied 90% as the minimum percentage of hours required to meet the minimum ventilation rate for all apartments, applying the more stringent criterion as a conservative worst-case approach irrespective of terrain conditions.

Table 5 below identifies the habitable rooms that require alternative natural ventilation and the minimum performance required, including the oversized apartments.

Unique apartments tested	Similar apartments	Noise impacted room tested	Ventilation ratio desirable for each room (L/s)	Minimum rate of ventilation required per apartment (L/s)	Percentage of hours required to meet or exceed minimum ventilation rate.
M09W	111W, 211W, 311W, 410W,	KLD	10.0	20.0	90%
		Bedroom	10.0		
M08W	M07W, 110W, 109W, 107W, 210W, 209W, 207W, 310W, 309W, 307W, 409W, 408W, 406W	KLD	10.0	20.0	90%
		Bedroom	10.0		
M03E	-	Bedroom - north	10.0	20.0 (excluding non-noise impacted habitable rooms that are not tested).	90%
		Bedroom - mid	10.0		
106W	206W, 306W, 405W, 505W, 605W	KLD	10.0	30.0	90%
		Bedroom - north	10.0		
		Bedroom - south	10.0		
105E	205E, 305E, 405E, 505E,	KLD	10.0	30.0	90%
		Bedroom - west	10.0		

Unique apartments tested	Similar apartments	Noise impacted room tested	Ventilation ratio desirable for each room (L/s)	Minimum rate of ventilation required per apartment (L/s)	Percentage of hours required to meet or exceed minimum ventilation rate.
	605E, 705E	Bedroom - east	10.0		
104E	204E, 304E, 404E, 504E, 604E	KLD	10.0	30.0	90%
		Bedroom - west	10.0		
		Bedroom - east	10.0		
103E	203E, 303E, 403E, 503E,	Bedroom - north	10.0	30.0 (excluding non-noise impacted habitable rooms that are not tested).	90%
		Bedroom - mid	10.0		
		Bedroom - south	10.0		
108W	208W, 308W, 407W	KLD	10.0	20.0	90%
		Bedroom	10.0		
509W	609W	Bedroom - south	10.0	10.0 (excluding non-noise impacted habitable rooms that are not tested).	90%
508W	506W, 608W, 606W	KLD	10.0	30.0	90%
		Bedroom - west	10.0		
		Bedroom - east	10.0		
		KLD	10.0		

Unique apartments tested	Similar apartments	Noise impacted room tested	Ventilation ratio desirable for each room (L/s)	Minimum rate of ventilation required per apartment (L/s)	Percentage of hours required to meet or exceed minimum ventilation rate.
507W	607W	Bedroom - west	10.0	30.0	90%
		Bedroom - east	10.0		
705E	-	KLD	10.0	30.0	90%
		Bedroom - west	10.0		
		Bedroom - east	10.0		
704E	804E, 904E, 1004E, 1104E, 1204E	KLD	10.0	30.0	90%
		Bedroom - west	10.0		
		Bedroom - east	10.0		
703E	803E, 903E, 1003E, 1103E, 1203E	Bedroom - south	10.0	10.0	90%
805E	905E, 1005E, 1105E, 1205E, 1305E	Bedroom - west	10.0	20.0 (excluding non-noise impacted habitable rooms that are not tested).	90%
		Bedroom - east	10.0		
1304E	-	KLD	10.0	30.0	90%
		Bedroom - west	10.0		

Unique apartments tested	Similar apartments	Noise impacted room tested	Ventilation ratio desirable for each room (L/s)	Minimum rate of ventilation required per apartment (L/s)	Percentage of hours required to meet or exceed minimum ventilation rate.
		Bedroom - east	10.0		
1303E	-	Bedroom - south	10.0	10.0	90%

Table 5 - Unique apartments tested and minimum requirements for alternative natural ventilation

3.3. Alternative natural ventilation devices

Acoustically attenuated plenums are proposed to provide natural ventilation when additional acoustic treatments are required.

All plenums will be vertical. Vertical plenums are suited to single-aspect apartments, where buoyancy forces drive natural air movement and allow easier access for maintenance and cleaning.

The plenums are utilised as required by the acoustic advice. Flux has proposed a design that accommodates the length and thickness of necessary acoustic treatments and all the components needed to support natural ventilation, including a rain defence louvre and fly screen.

The plenums' effective open area was assessed using standard empirical calculations, in which the resistance of each component part was considered in series. This calculation method is deemed conservative and appropriate for the design stage.

Further details regarding plenum arrangements and sizes can be found in Section 4.2 of this report.

3.4. Simulation

Dynamic thermal analysis was undertaken using EDSL TAS, with each unique apartment modelled explicitly with arrangement and features consistent with the architectural drawings.

Airflow through each alternative natural ventilation device was calculated for each hour of the year using multi-zone airflow modelling, accounting for combined wind-driven and buoyancy-driven pressures.

3.5. Assumptions

Alternative natural ventilation devices were modelled as open at all time, while all other ventilation devices serving the tested habitable rooms were modelled as closed at all times. Where noise-affected habitable rooms were connected to non-noise-affected habitable rooms, the latter were provided with an opening having an EOA equivalent to 5% of the room served. For the affected apartment, a 10% free opening area was assumed for inter-room doors.

Bedrooms were assumed to be air-conditioned during the first nine hours of the day and the last eight hours of the day, with nighttime occupancy and daytime vacancy.

Living rooms were assumed to be air-conditioned from 7 am to 12 am, with no occupancy during the first seven hours of the day.

3.6. Facade pressure coefficients

Facade pressure coefficients were used where the software defaults, which is considered a conservative approach.

The model applied a city terrain type to modify the velocity profile of the wind.

To modify the facade pressure coefficients, surrounding buildings were taken to be the same height as the proposed building for sheltering. Additionally, openings were assumed to be locally sheltered, which

provides a conservative approach to the impacts of near neighbours and the obstruction of the balcony facade. This approach is consistent with the alternative natural ventilation guidelines.

3.7. Thermal loads

Typical BASIX compliance values were used for the thermal performance glass and opaque facade elements. While thermal loads through the fabric and generated internally impact buoyancy-driven ventilation, this impact is tempered through the use of heating and cooling.

The model established internal heat loads and air conditioning set points in the same ranges prescribed in NatHERS.

3.8. Weather data

The simulation used the Weather Year for Passive Performance Assessment (WYPPA) developed by Flux. WYPPA is the best source for hourly weather data for passive performance assessment. Flux created it to be typical for coincident wind velocity and direction at the lower quartile of wind speeds, which are the most relevant to testing alternative natural ventilation systems.

The wind speed data within the WYPPA file for Sydney has been terrain corrected to account for the topology at Mascot airport. This reduces the recorded wind speeds in the SW - SSE sectors and ensures wind speeds from that direction are not overestimated.

A detailed description of the WYPPA methodology is available in Flux's weather repository¹.

The wind rose for all conditions, and the lowest quartile of wind speeds recorded in the WYPPA file are shown below. It is noted that the lower wind speeds, which are most critical to minimum ventilation performance, generally arise from directions other than dominant at higher wind speeds.

¹<https://bitbucket.org/fluxco/weather-repository-for-passive-performance-assessment/src/master/WYPPA%20Methodology%20Statement.pdf>

The length of the bars indicates the frequency of wind from any direction, and the colour of the bar segment indicates the wind speed. The size of the segment indicates the frequency of the speed range.

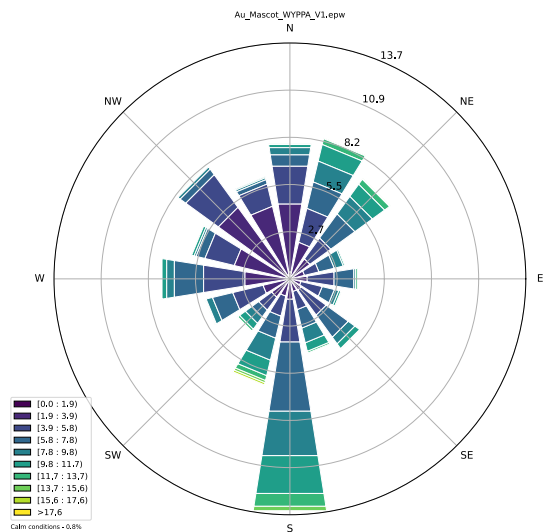


Figure 4. Wind rose for all wind speeds.

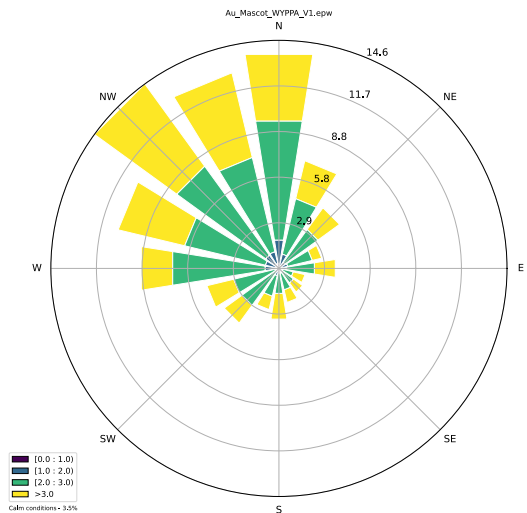


Figure 5. Wind rose for lowest quartile of annual wind speeds

Design Requirements

4. Design Requirements

This section describes the design requirements of the proposed natural ventilation system for noise-impacted apartments.

4.1. Plenum arrangement

The plenum arrangement allows for 10 acoustic chambers with a 50 mm thick acoustic lining to each side of the air path.

The diagrams below detail the arrangement of components and critical dimensions.

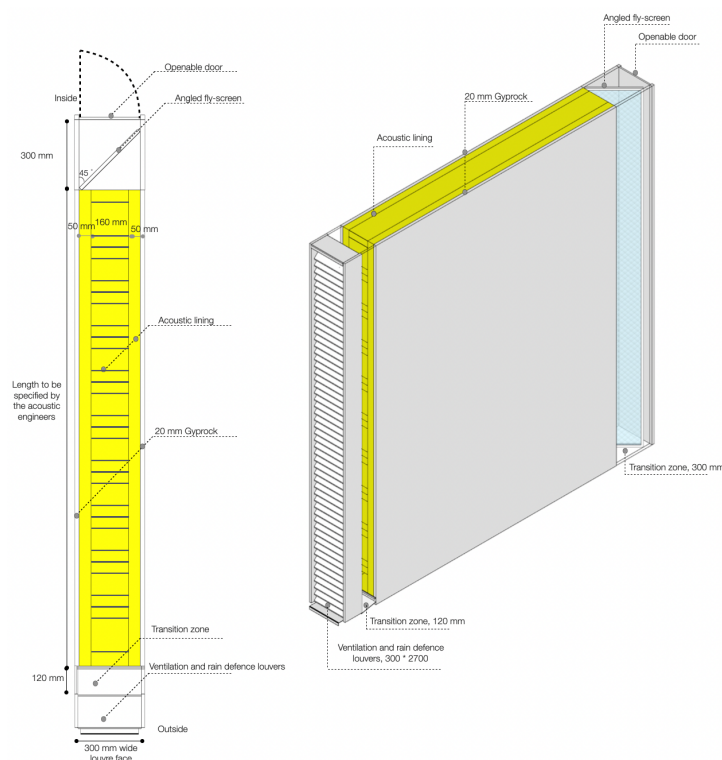


Figure 7. General arrangement of plenum components

4.2. Plenum transition zones

The design provides for zones at either end of the plenum that do not have acoustic installation. This feature maximises the face area available for the weatherproof louvres and fly screen. Providing greater face area for these components reduces airflow resistance and allows for a weatherproof louvre with improved rain defence.

4.3. Plenum operation and access

Opening, closing, and modulating the plenum are achieved through a full-height door on the device's end face, as shown in the plan view in the diagram above. This solution is preferred over a mechanical damper and internal grille arrangement for ease of use and access.

A minimum unobstructed internal dimension of 160 mm within the chamber and external width of 300 mm allow for cleaning.

4.4. Rain defence

For plenums with direct external exposure, the louvres are designed to achieve 100% rain resistance, getting the upper limit of Class A (AS/NZS 4740:2000) at a core velocity of 3.5 m/s.

The core velocity refers to the effective air speed through the louvres and is not the same as wind velocity. We estimate that, with the pressure loss through the plenum, the terrain, and the presence of surrounding buildings, a reference wind speed greater than 30 m/s is required to drive air through an open plenum at 3.5 m/s.

The aerodynamic discharge coefficient (C_d) for a louvre system with this performance is between 0.28 and 0.22. A conservative C_d of 0.22 has been adopted to estimate the plenum's EOA. This corresponds to Class 3 aerodynamic performance.

For plenums connected to balconies, Class C rain defence louvres with Class 2 aerodynamic discharge coefficient are specified to improve aerodynamic performance where rain protection is less critical. A conservative C_d of 0.31 has been adopted.

The plenum arrangement allows for a drip tray inboard of the external louvres to provide additional defence and prevent water from pooling.

4.5. Flyscreen

A removable flyscreen shall be mounted at an angle that maximises the face area. This lessens the fly screen's impact on the plenum's overall performance.

An EOA ratio of 50% has been allowed for the flyscreen. This is not to be confused with the geometric open area of the weave and allows for some performance loss from dust accumulation.

A fly screen with a geometric open area of 60% shall be specified to meet the aerodynamic performance requirements.

4.6. Plenum Equivalent Open Area (EOA)

The EOA is a measure of aerodynamic performance used to describe the device's efficiency. As the design of the plenums is developed, the EOA must be maintained or increased.

The pressure loss from ten acoustic chambers and the associated assemblies have been calculated to determine the spatial requirements and the EOA necessary to achieve the minimum natural ventilation rates. Three types of plenum (P1, P2 and P3) have been proposed, with P1 and P2 are consistent with the plenum design proposed during the Concept DA stage, and P3 with an increased dimension.

Plenum P1 and P3 are applied for habitable rooms ventilated via protected balconies, where Plenum P2 is applied to habitable rooms with direct external exposures. Further details regarding the application of these plenums can be found in Appendix.

Detail plenum arrangement and sizes can be found in the tables below.

Plenum Type P1 arrangement	Height(m)	Width (m)	Geometric Area (m ²)	Cd	EOA (m ²)
Weather proof Louvre (Class 2C rain defence Louvre)	2.70	0.30	0.81	0.31	0.41
Acoustic Chamber (50 mm acoustic lining)	1.60	0.16	0.26	0.66	0.28
Flyscreen (Removable to enable cleaning and access to)	2.50	0.32	0.80	0.31	0.40
Open Chamber	2.80	0.24	0.67	0.73	0.81
Internal opening (hinged door, 90° opening angle)	2.80	0.28	0.78	0.43	0.55
EOA (m ²)					0.18

Plenum Type P2 arrangement	Height(m)	Width (m)	Geometric Area (m ²)	Cd	EOA (m ²)
Weather proof Louvre (Class 3A rain defence Louvre)	2.70	0.30	0.81	0.22	0.29
Acoustic Chamber (50 mm acoustic lining)	1.60	0.16	0.26	0.66	0.28
Flyscreen (Removable to enable cleaning and access to chamber.)	2.50	0.32	0.80	0.31	0.40
Open Chamber	2.80	0.24	0.67	0.73	0.81
Internal opening (hinged door, 90° opening angle)	2.80	0.28	0.78	0.43	0.55
EOA (m ²)					0.17

Plenum Type P3 arrangement	Height(m)	Width (m)	Geometric Area (m ²)	Cd	EOA (m ²)
Weather proof Louvre (Class 2C rain defence Louvre)	2.70	0.32	0.86	0.31	0.44
Acoustic Chamber (50 mm acoustic lining)	1.60	0.18	0.29	0.66	0.31
Flyscreen (Removable to enable cleaning and access to chamber.)	2.50	0.34	0.85	0.31	0.43
Open Chamber	2.80	0.26	0.73	0.73	0.87
Internal opening (hinged door, 90° opening angle)	2.80	0.30	0.84	0.43	0.59
EOA (m ²)					0.20

Table 6 - Proposed plenum design

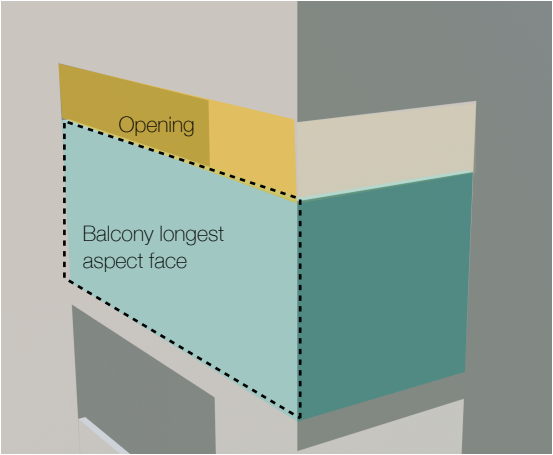


Figure 7. Protected balcony

4.7. Protected balconies

Protected balconies were proposed to support attenuated natural ventilation plenums. In all cases, the protected balcony serves as the primary source of ventilation to adjacent habitable rooms.

A minimum of 25% of the balcony facade area, measured along the longest aspect, is provided as a permanent opening. This opening extends the full length of the balcony and is positioned at high level immediately below the soffit. The protected balcony strategy is applied to apartments adopting the alternative natural ventilation approach in the William Street Building from Mezzanine level to Floor level 02.

Assessment

5. Assessment

This section presents the findings and conclusions based on the simulation results in assessing adequacy of proposed alternative natural ventilation for noise-impacted apartments in accordance with CoS guidelines.

5.1. Findings

The following table details the predicted volume flow rates of natural ventilation for each habitable room at the relevant percentile of all hours threshold where a plenum is required as an alternative natural ventilation. The data reflects that typical units are considered unique every 6 storeys.

Further annual airflow rate results for each noise impacted habitable rooms can be found in Appendix B.

Unique apartments tested	Similar apartments	Noise impacted room tested	Plenum type	Airflow achieve at 10th percentile per room (L/s)	Total minimum airflow rate required by CoS at 10th percentile (L/s)	Total airflow achieved at 10th percentile (L/s)	Meets CoS requirement?
M09W	111W, 211W, 311W, 410W,	KLD	P1	20.4	20.0	38.1	Yes
		Bedroom	P2	17.7			
M08W	M07W, 110W, 109W, 107W, 210W, 209W, 207W, 310W, 309W, 307W, 409W, 408W, 406W	KLD	P1	12.7	20.0	23.2	Yes
		Bedroom	P1	10.5			
M03E	-	Bedroom - north	P2	12.3	20.0 (excluding non-noise impacted habitable rooms that are not tested).	24.6	Yes
		Bedroom - mid	P2	12.2			
106W	206W, 306W, 405W, 505W, 605W	KLD	P1	18.8	30.0	46.1	Yes
		Bedroom - north	P2	17.3			
		Bedroom - south	P3	10.0			
105E	205E, 305E, 405E, 505E, 605E, 705E	KLD	P1	14.3	30.0	30.0	Yes
		Bedroom - west	P3	10.0			
		Bedroom - east	P3	10.4			
104E	204E, 304E, 404E, 504E, 604E	KLD	P1	16.8	30.0	42.7	Yes
		Bedroom - west	P1	10.4			
		Bedroom - east	P2	15.6			
103E	203E, 303E, 403E, 503E,	Bedroom - north	P2	12.0	30.0 (excluding non-noise impacted habitable rooms that are not tested).	36.0	Yes
		Bedroom - mid	P2	11.8			
		Bedroom - south	P2	12.1			
108W	208W, 308W, 407W	KLD	P2	13.6	20.0	26.0	Yes
		Bedroom	P2	12.4			

Unique apartments tested	Similar apartments	Noise impacted room tested	Plenum type	Airflow achieve at 10th percentile per room (L/s)	Total minimum airflow rate required by CoS at 10th percentile (L/s)	Total airflow achieved at 10th percentile (L/s)	Meets CoS requirement?
509W	609W	Bedroom - south	P2	26.6	10.0 (excluding non-noise impacted habitable rooms that are not tested).	26.6	Yes
508W	506W, 608W, 606W	KLD	P1	14.1	30.0	34.9	Yes
		Bedroom - west	P3	10.4			
		Bedroom - east	P3	10.4			
507W	607W	KLD	P1	23.7	30.0	62.6	Yes
		Bedroom - west	P1	15.3			
		Bedroom - east	P2	23.6			
705E	-	KLD	P1	14.5	30.0	35.2	Yes
		Bedroom - west	P3	10.7			
		Bedroom - east	P2	10.0			
704E	804E, 904E, 1004E, 1104E, 1204E	KLD	P1	23.8	30.0	62.4	Yes
		Bedroom - west	P1	15.9			
		Bedroom - east	P2	22.8			
703E	803E, 903E, 1003E, 1103E, 1203E	Bedroom - south	P2	23.7	10.0	23.7	Yes
805E	905E, 1005E, 1105E, 1205E, 1305E	Bedroom - west	P1	35.9	20.0 (excluding non-noise impacted habitable rooms that are not tested).	71.5	Yes
		Bedroom - east	P1	35.7			
1304E	-	KLD	P1	24.1	30.0	63.4	Yes
		Bedroom - west	P1	16.0			
		Bedroom - east	P2	23.4			
1303E	-	Bedroom - south	P2	23.5	10.0	23.5	Yes

Table 7 - Results finding for tested apartments.

5.2. Conclusion

The results demonstrate that all typical apartments comply with the City of Sydney requirement of $10 \text{ L/s} \times (\text{number of bedrooms} + 1)$ for 90% of the time.

The results also show that all habitable rooms meet the minimum 10 L/s of airflow rate for 90% of the time.

Appendix

Appendix

Appendix A - Application of Plenum P1, P2, and P3.

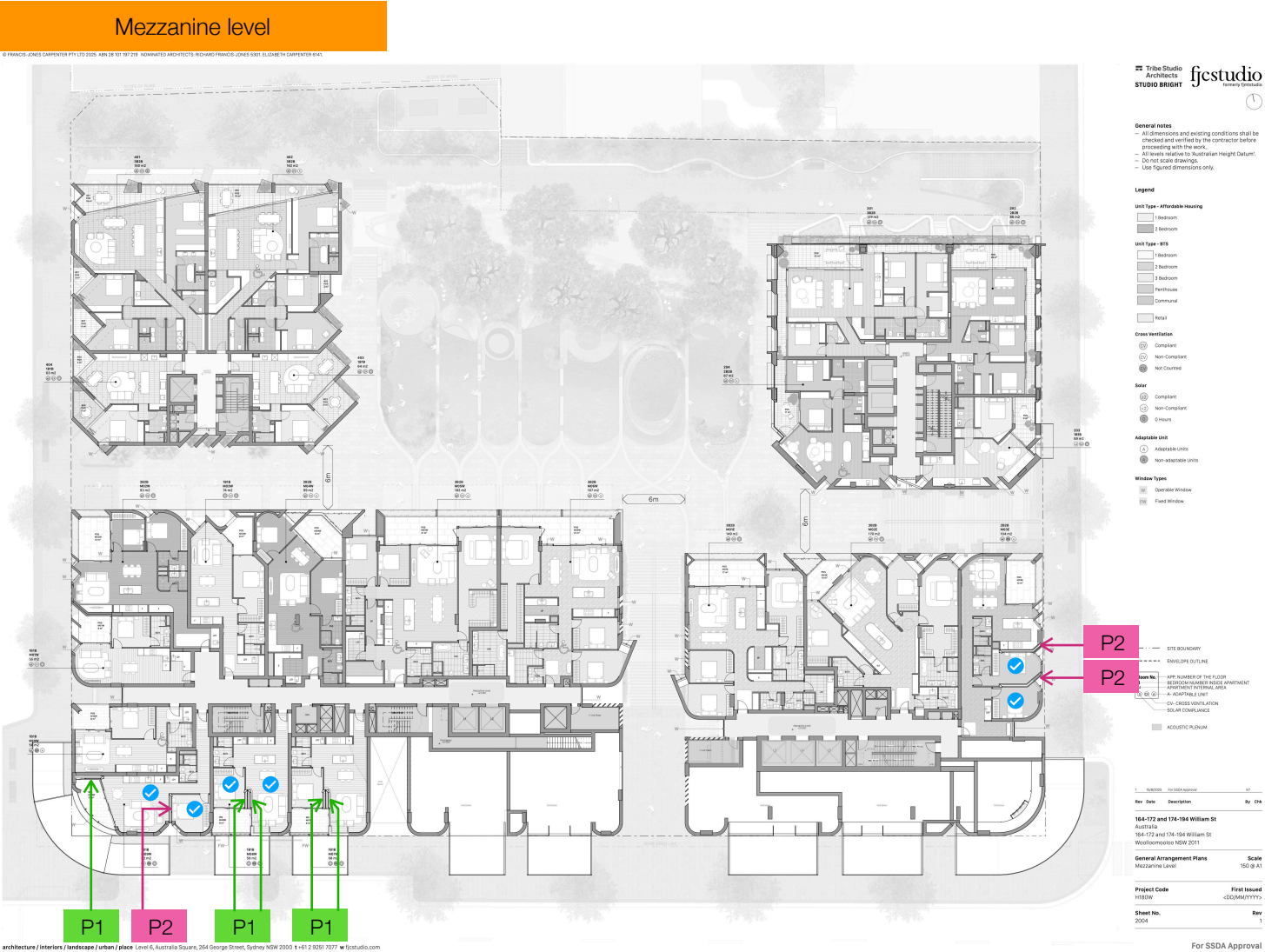
- 

Habitable room tested (typical apartment)
- 

Plenum 1
- 

Plenum 2
- 

Plenum 3



Level 01



Habitable room tested (typical apartment)

P1

Plenum 1

P2

Plenum 2

P3

Plenum 3

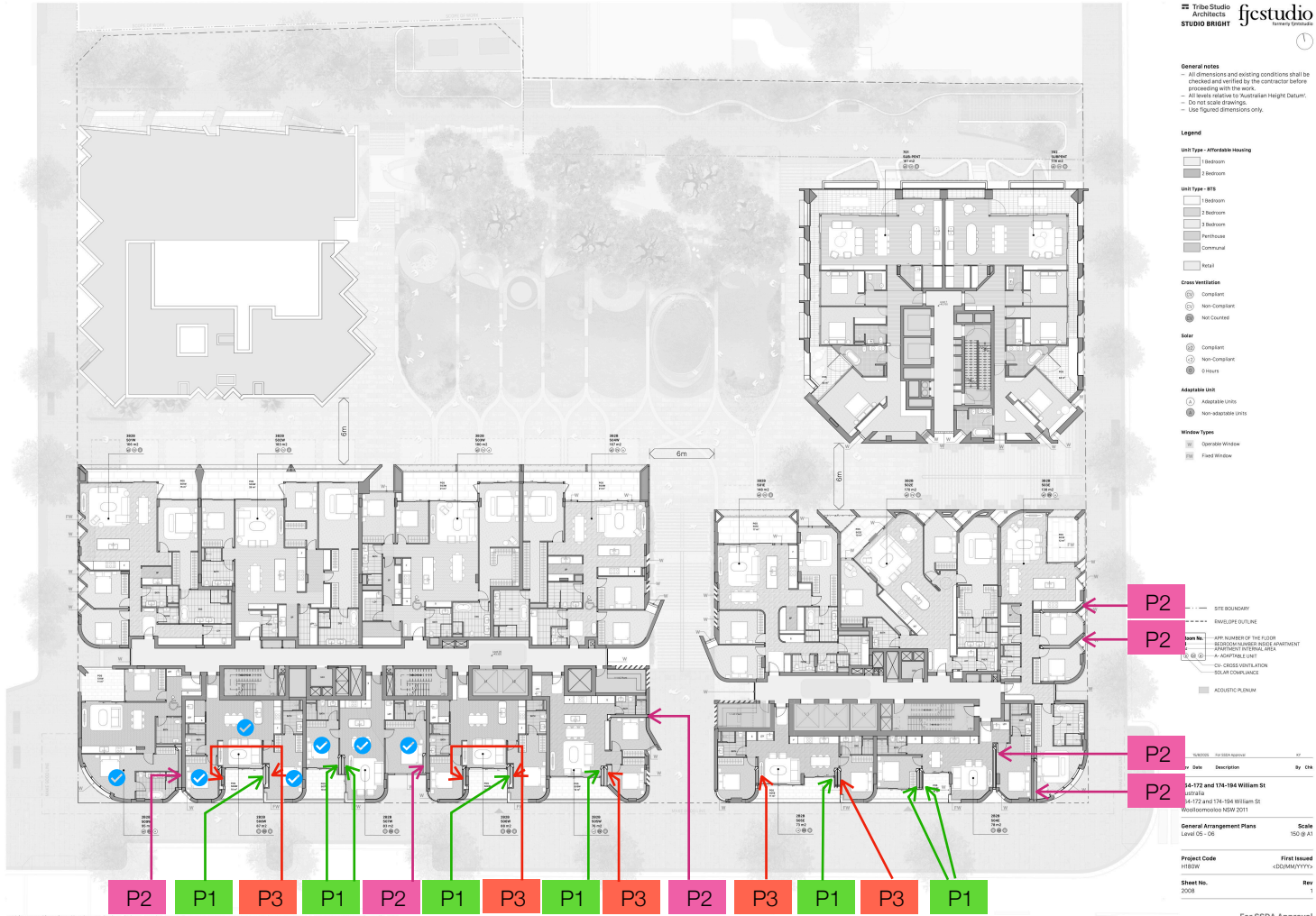


Level 02, 03, 04



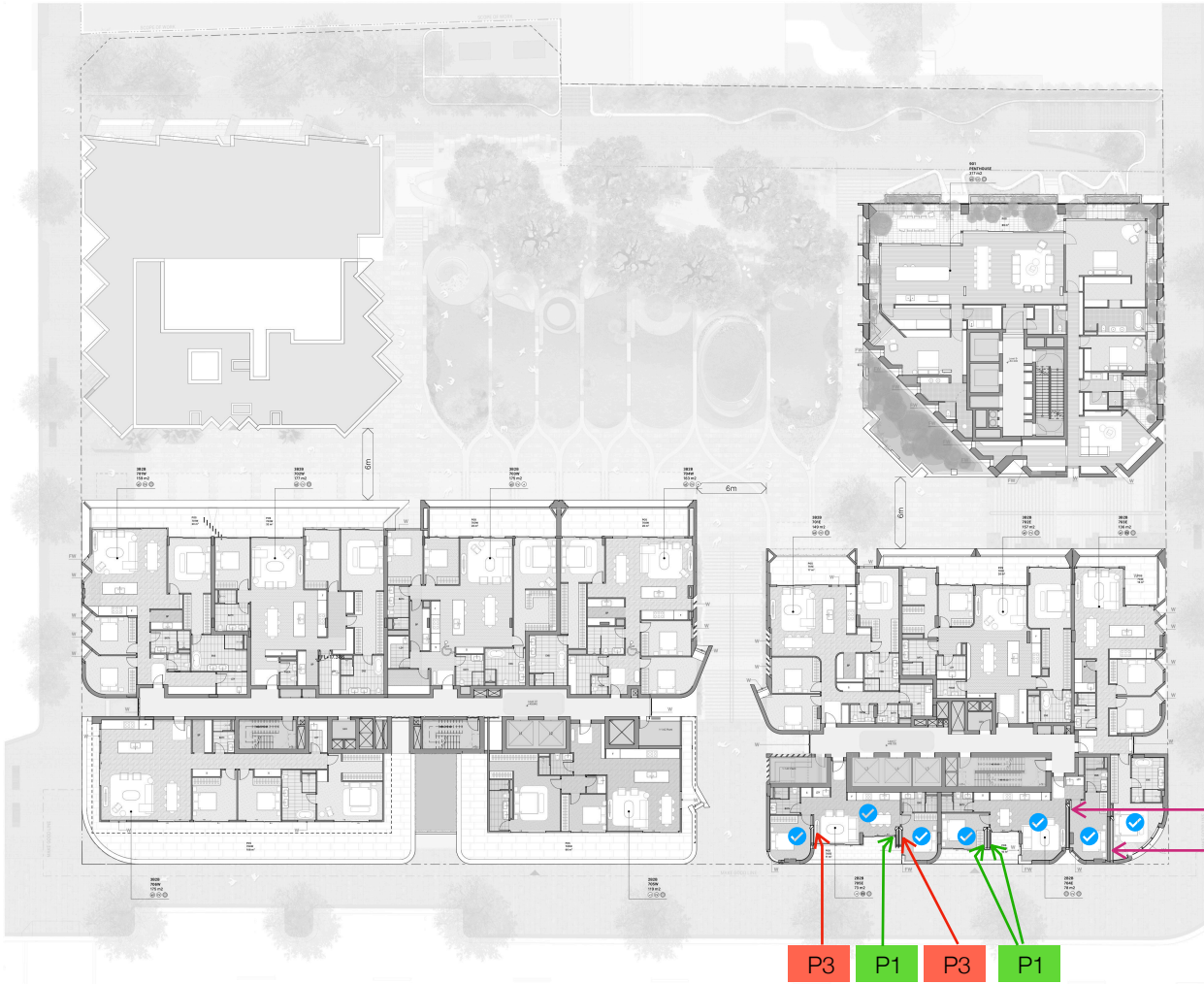
Level 05 - Level 06

-  Habitable room tested (typical apartment)
-  Plenum 1
-  Plenum 2
-  Plenum 3



Level 07

-  Habitable room tested (typical apartment)
-  Plenum 1
-  Plenum 2
-  Plenum 3





General notes

- All dimensions and existing conditions shall be checked and verified by the contractor before proceeding with the work.
- All levels relative to Australian Height Datum.
- Do not scale drawings.
- Use 'typical' dimensions only.

Legend

Unit Type - Affordable Housing

- 1 Bedroom
- 2 Bedroom

Unit Type - MTR

- 1 Bedroom
- 2 Bedroom
- 3 Bedroom
- Penthouse
- Commercial
- Retail

Cross Ventilation

- Compliant
- Non-Compliant
- Not Counted

Solar

- Compliant
- Non-Compliant
- Shaded

Adaptable Unit

- Adaptable Units
- Non-adaptable Units

Window Types

- Operable Window
- Fixed Window

Notes

- SITE BOUNDARY
- ENVELOPE OUTLINE
- APP. PLACEMENT OF THE FLOOR
- BEDROOM/POSSIBLE BEDROOM APARTMENT
- APARTMENT INTERNAL AREA
- ADAPTABLE UNIT
- CROSS VENTILATION
- SOLAR COMPLIANCE
- ACQUISITION PLANNING

Rev	Date	Description	By	Chk
1	14-172 and 174-194 William St			
1	Woolloomooloo NSW 2011			

General Arrangement Plans

Level 07

Scale: 1:50 @ A1

Project Code H180W **First Issued** <COMMUNITY>

Sheet No. 2009 **Rev** 1

For SSDA Approval

Level 08

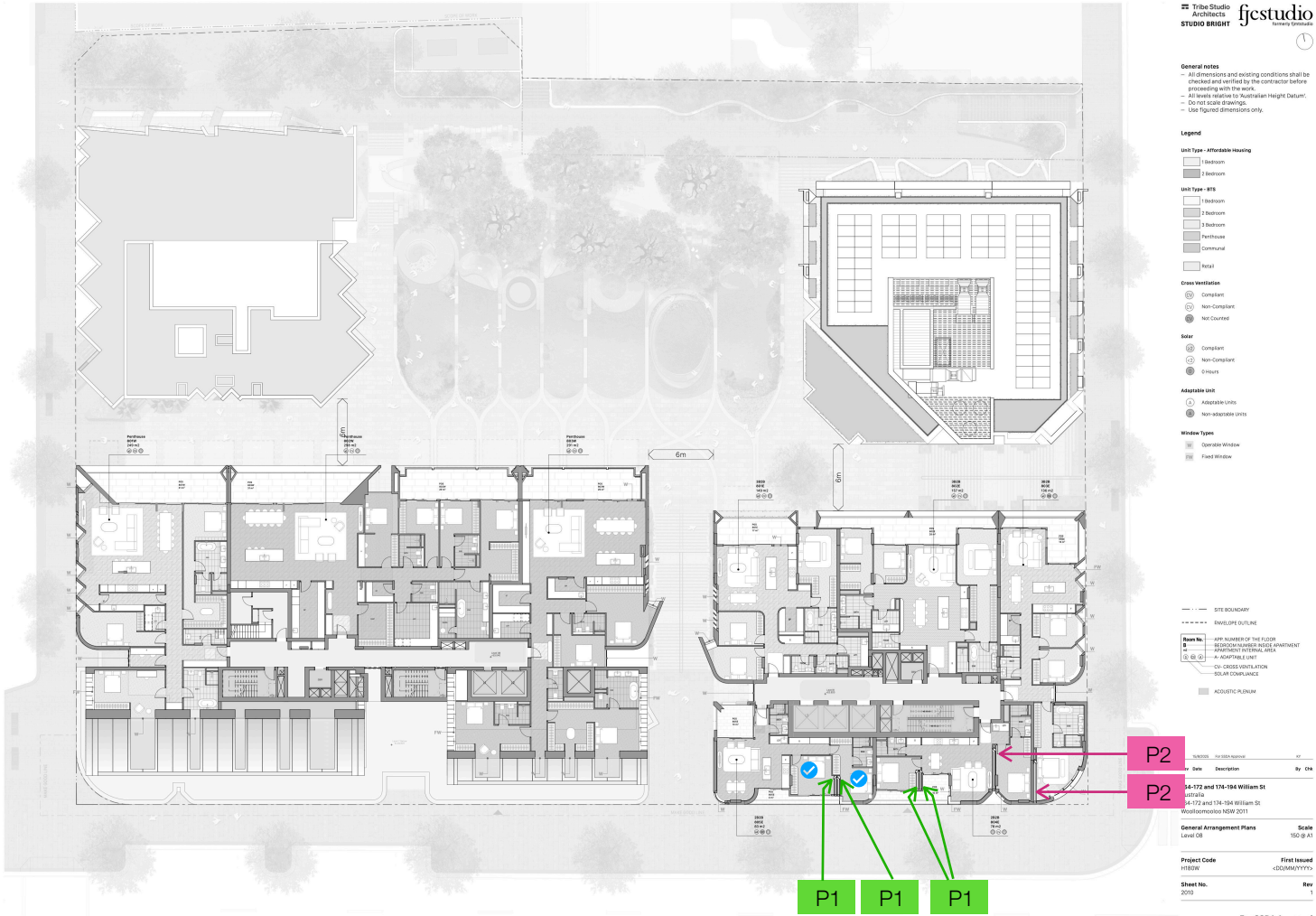
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Habitable room tested (typical apartment)
- 

Plenum 1
- 

Plenum 2
- 

Plenum 3



Level 09 - Level 12



Habitable room tested (typical apartment)

P1

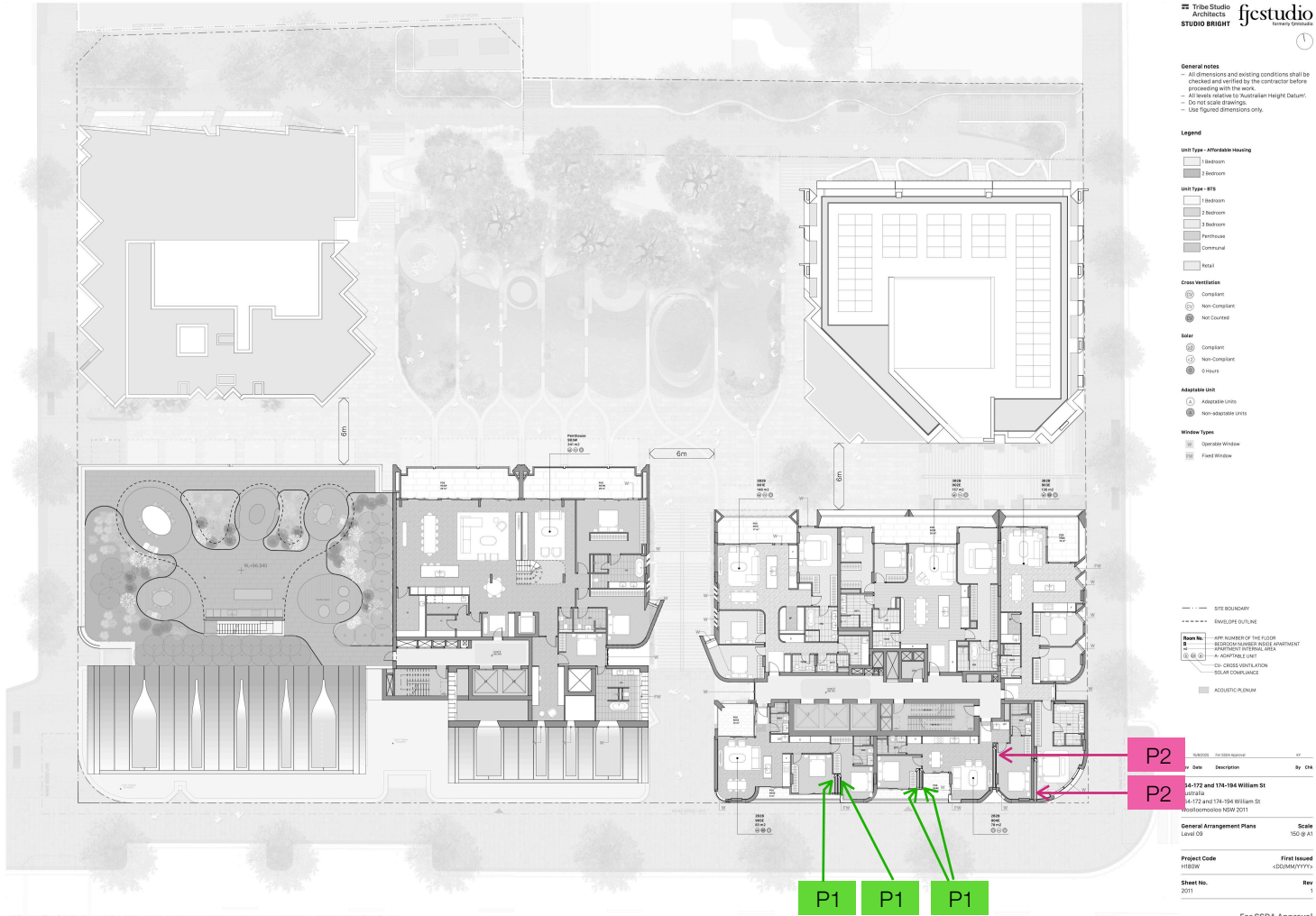
Plenum 1

P2

Plenum 2

P3

Plenum 3



Tribe Studio
Architects
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fjstudio
Interior Design

General notes

- All dimensions and existing conditions shall be checked and verified by the contractor before proceeding with the work.
- All levels relative to Australian Height Datum.
- Do not scale drawings.
- Use 'typical' dimensions only.

Legend

Unit Type - Affordable Housing

- 1 Bedroom
- 2 Bedroom

Unit Type - MFI

- 1 Bedroom
- 2 Bedroom
- 3 Bedroom
- Penthouse
- Commercial
- Hotel

Cross Ventilation

- Compliant
- Non-Compliant
- Not Counted

Solar

- Compliant
- Non-Compliant
- Shaded

Adaptable Unit

- Adaptable Units
- Non-adaptable Units

Window Types

- Operable Window
- Fixed Window

Notes

1. SITE BOUNDARY

2. ENVELOPE OUTLINE

3. APP PLACEMENT OF THE FLOOR

4. DESIGNATED HOUSEHOLD APARTMENT

5. APARTMENT INTERNAL AREA

6. ADAPTABLE UNIT

7. CROSS VENTILATION

8. SOLAR COMPLIANCE

9. ACQUISITION PLANNING

Revised

14-172 and 174-194 William St
Woolloomooloo NSW 2011

By

Chk

General Arrangement Plans

Level 09

Scale

1:50 @ A1

Project Code

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First Issued

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Sheet No.

2011

Rev

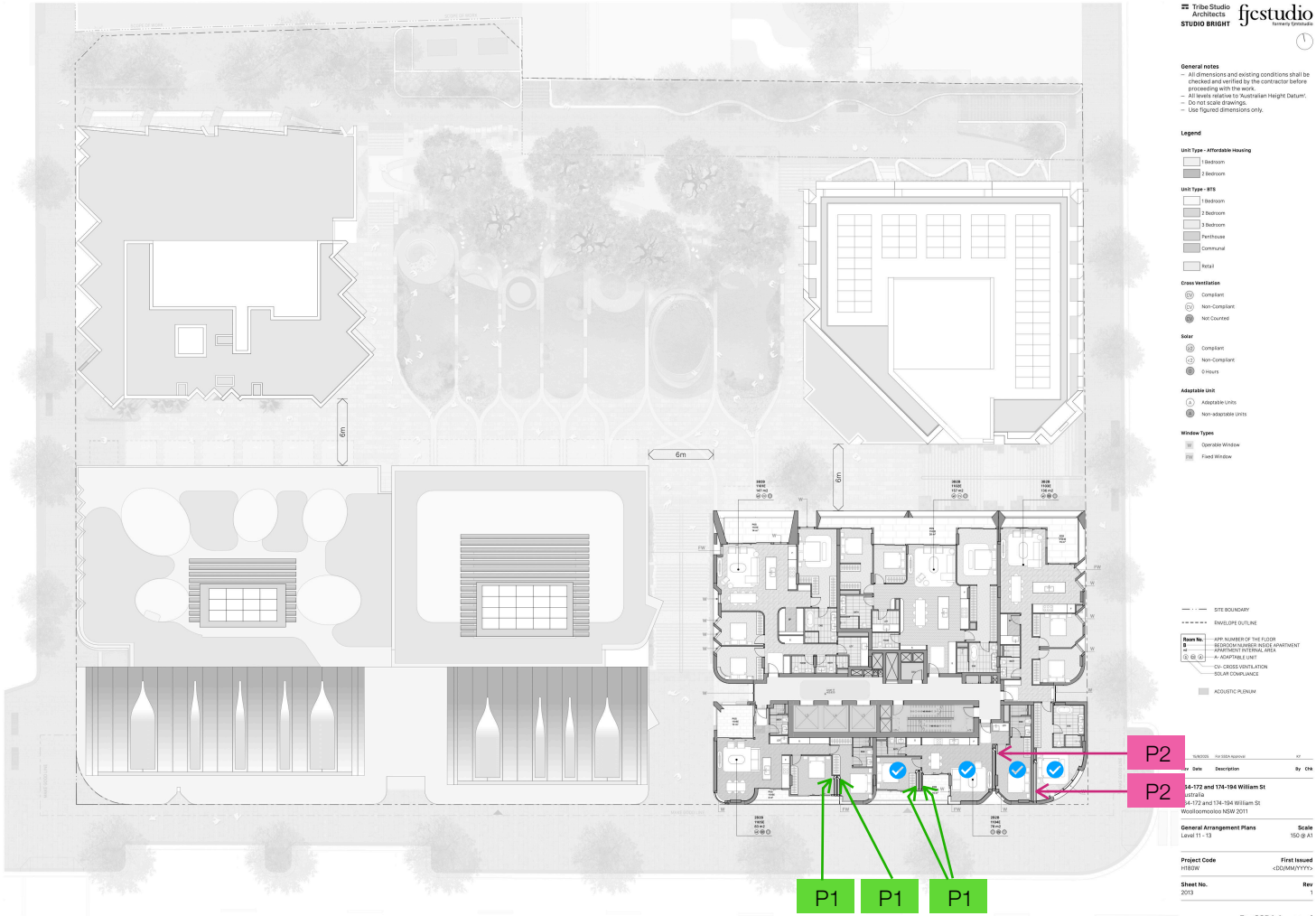
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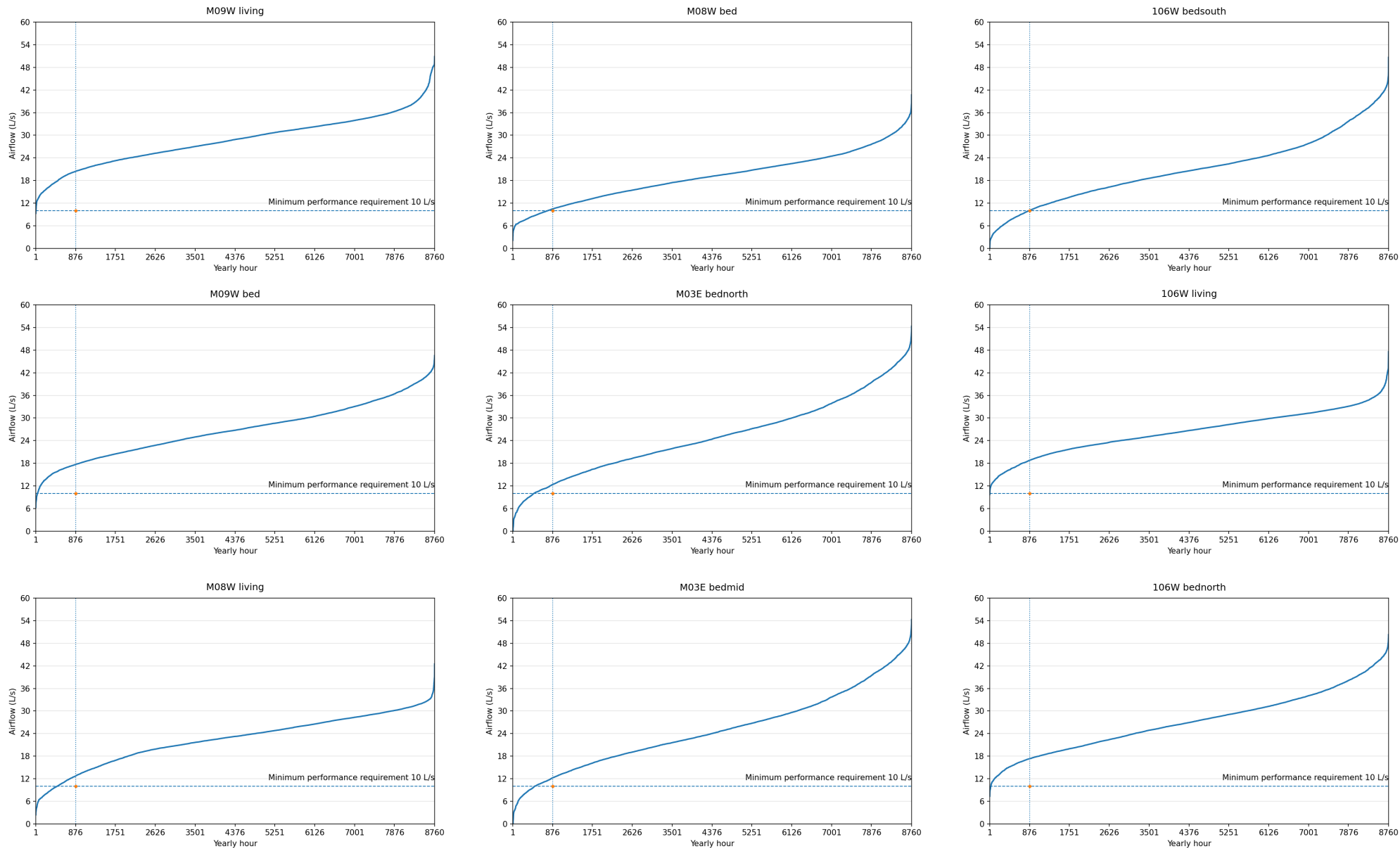
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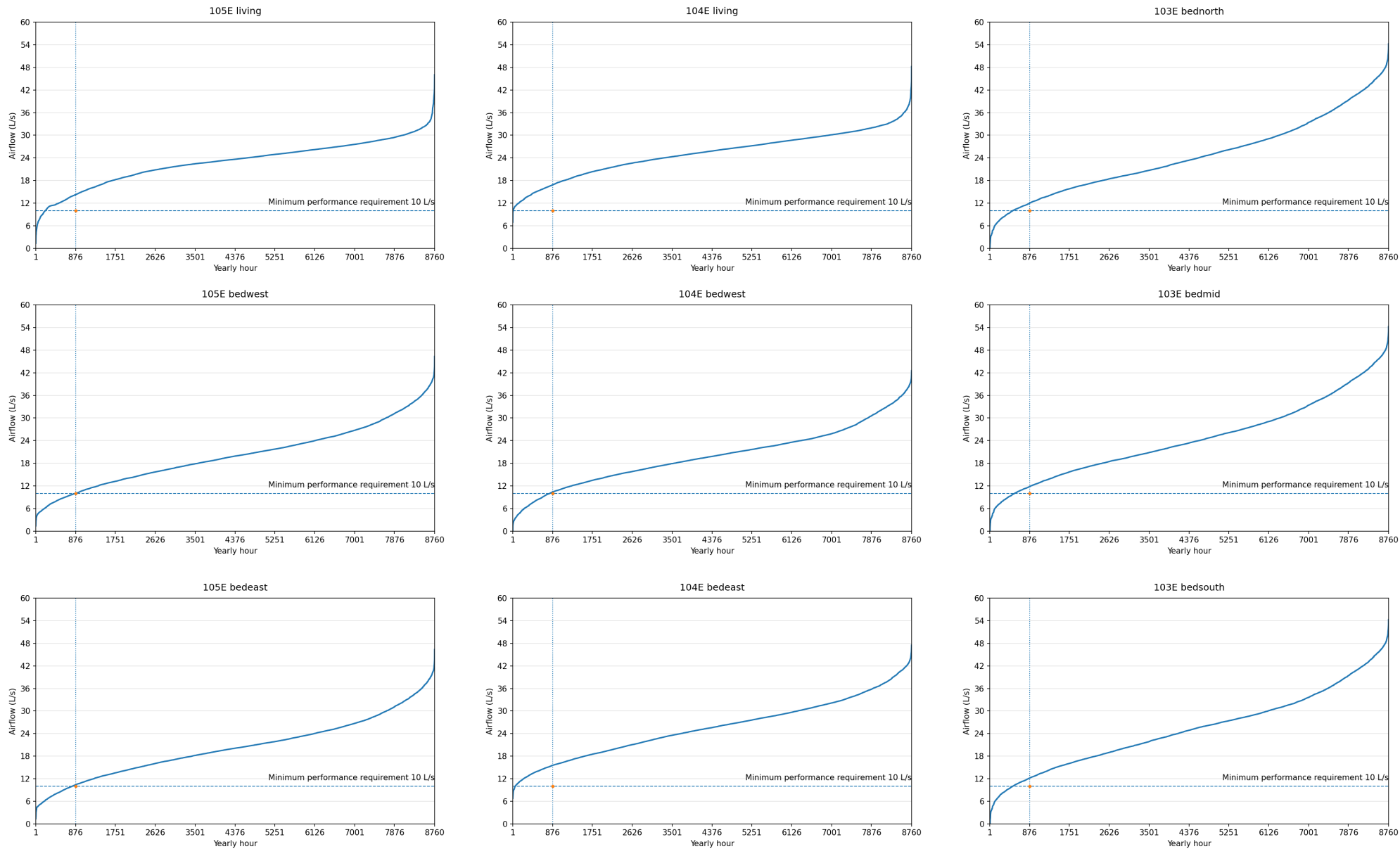
Level 13

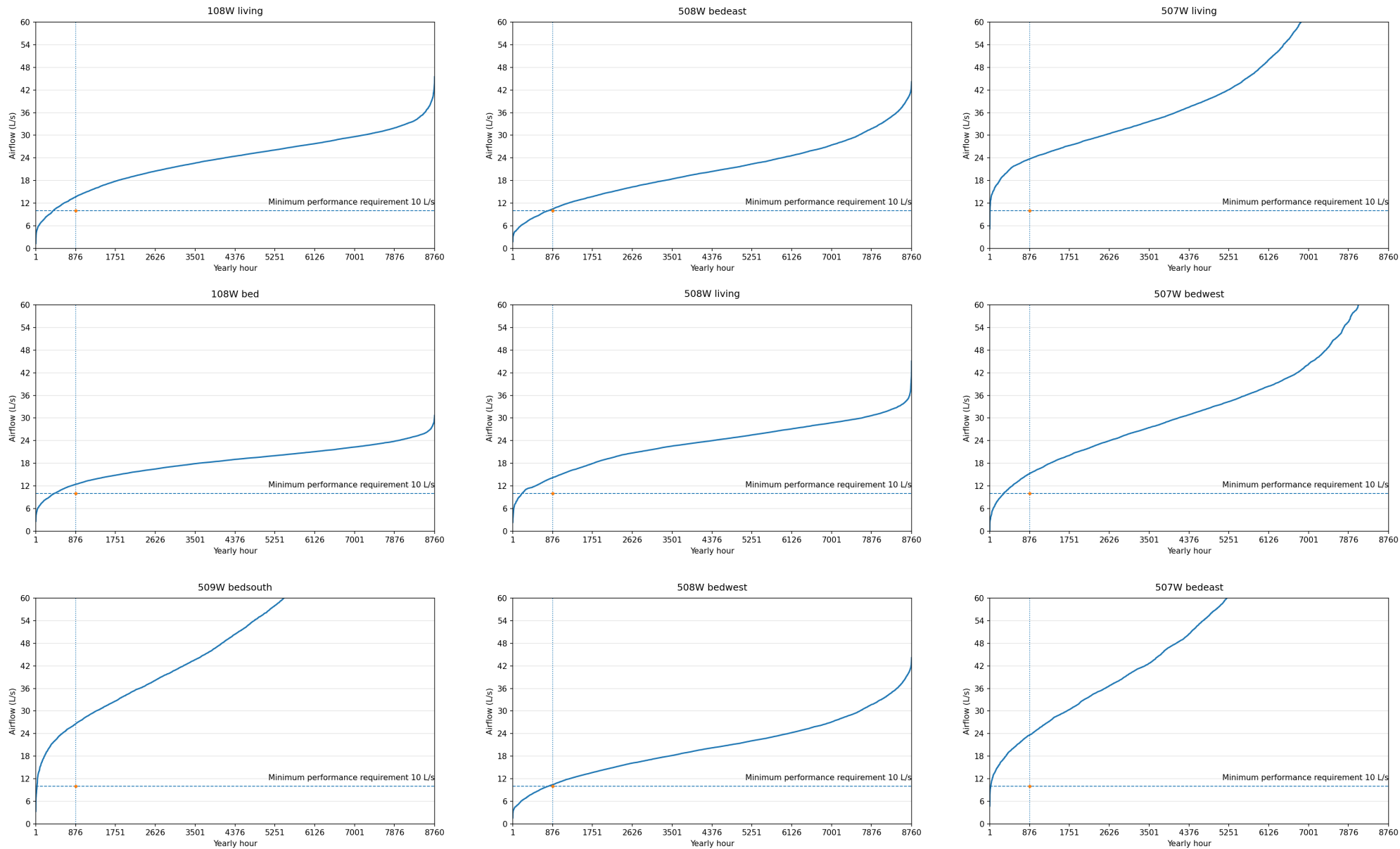
-  Habitable room tested (typical apartment)
-  Plenum 1
-  Plenum 2
-  Plenum 3

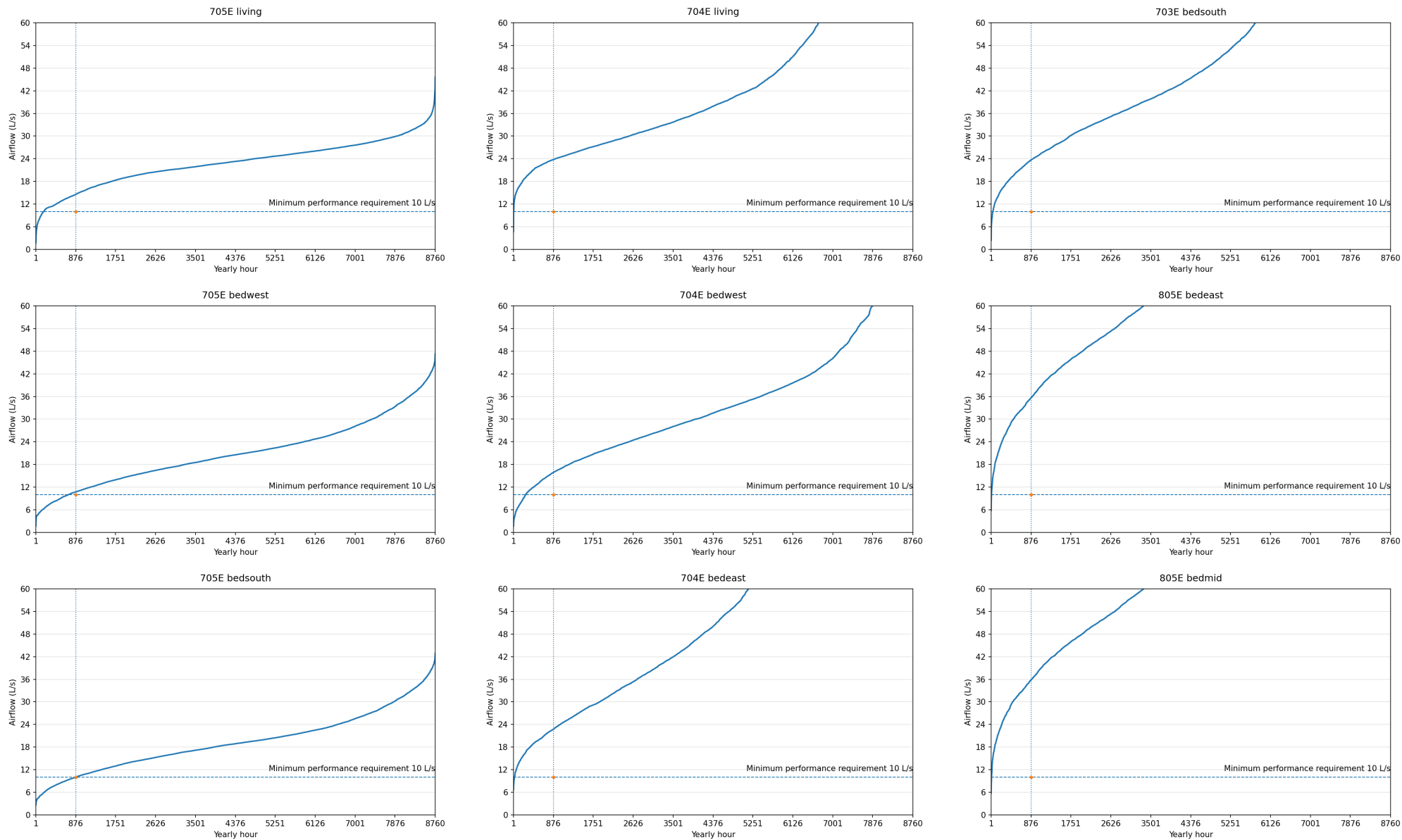


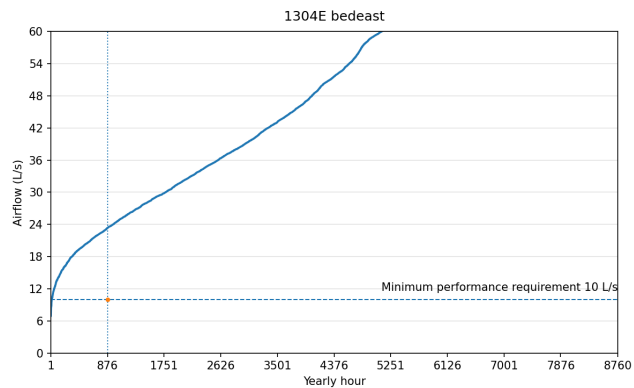
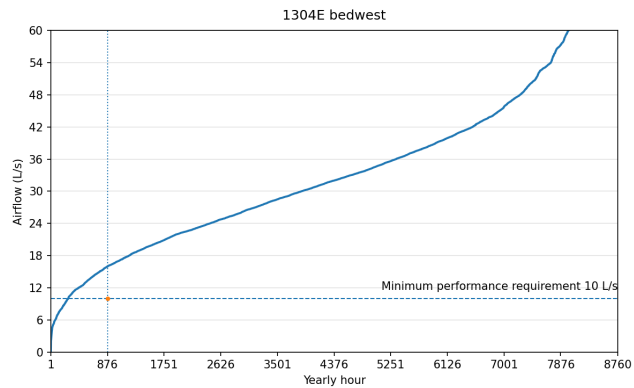
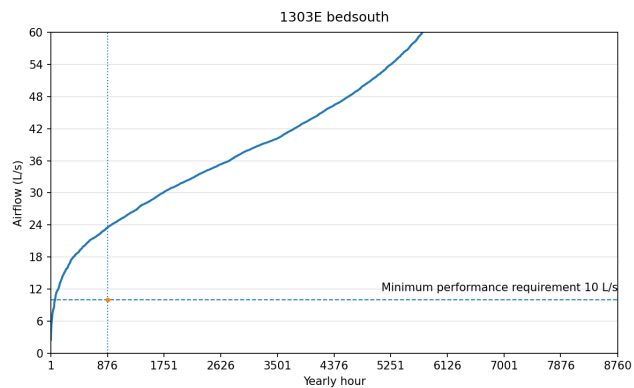
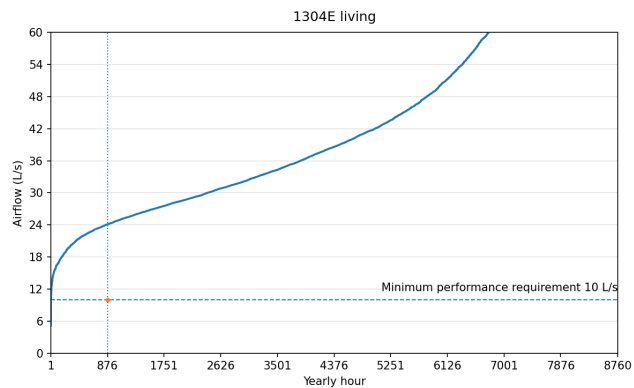
Appendix B - Hourly airflow data for each tested habitable rooms.





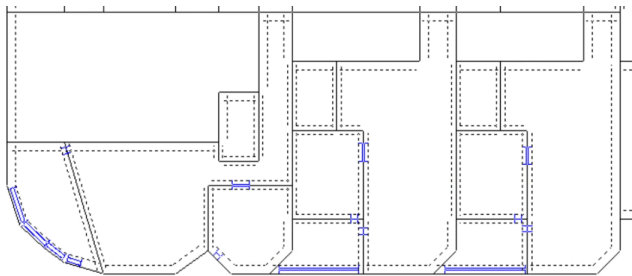




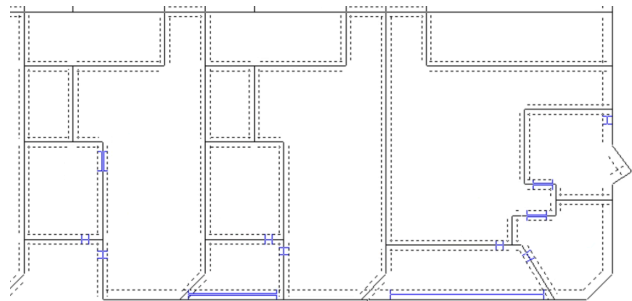


Appendix C - EDSL TAS model

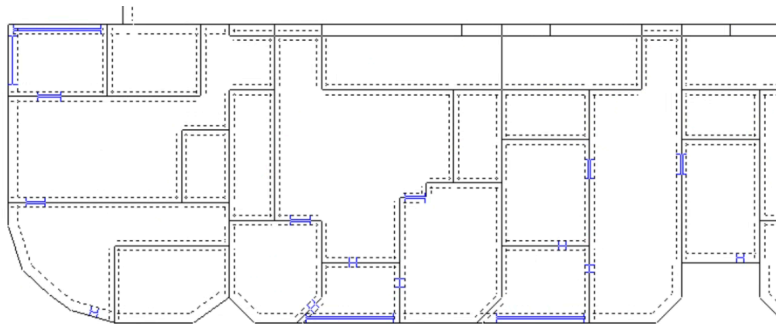
Typical M09W, M08W



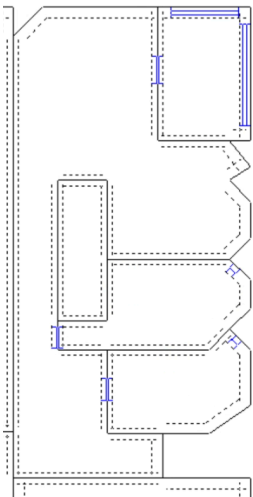
Typical 109W, 106W



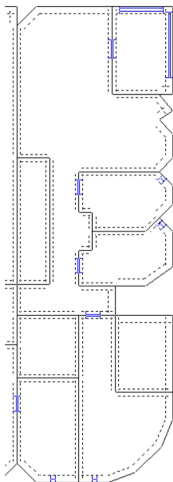
Typical Unit 509Q, 508W, 507W



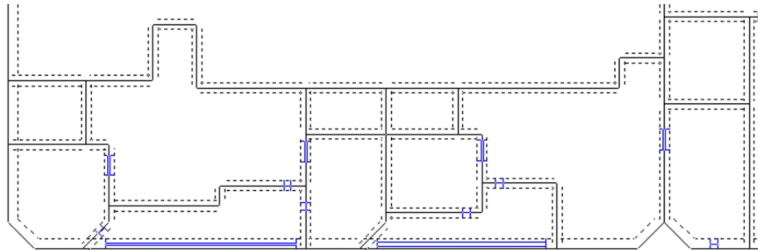
Typical M03W



Typical 103W



Typical Unit 105E, 104E



Typical unit 805E

