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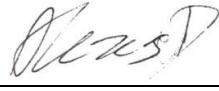


RSL ANZAC Village Renewal Project, 90 Veterans Parade, Narrabeen – Stage 1 Building 2

Qualitative Natural Ventilation Study



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Executive Summary

Vipac Engineers & Scientists Pty Ltd has been engaged by **RSL Lifecare Limited** to conduct a qualitative assessment of natural ventilation potential of the proposed development at **RSL ANZAC Village Renewal Project, 90 Veterans Parade, Narrabeen – Stage 1 Building 2**. This appraisal is based on Vipac's experience as a wind-engineering consultancy.

Drawings of the proposed development were provided by **AJC Architect** in **December 2025**.

Based on our engineering observations and the qualitative study, it is concluded that for the proposed development:

- **64.1%** (25/39) apartments are expected to be naturally cross ventilated, thereby meeting the ADG requirements of 60% for the first nine storey of the proposed development.
- Middle façade apartments are expected to satisfy the recommended Air Change Per Hour (ACH) of 3.

This analysis has been made on the basis of our engineering assumptions and on experience gained from model scale wind tunnel or Computational Fluid Dynamics (CFD) analysis of a range of developments of similar magnitude to the proposed development.

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1 Introduction

Vipac Engineers & Scientists Pty Ltd has been commissioned by **RSL Lifecare Limited** to undertake a qualitative cross ventilation assessment at **RSL ANZAC Village Renewal Project, 90 Veterans Parade, Narrabeen – Stage 1 Building 2**. This report will be a qualitative review of the natural ventilation under Apartment Design Guide (ADG).

Natural ventilation is taken to mean that quantify of fresh air that enters a building without mechanical assistance. Supply of outside air to the indoors can decrease the level of indoor pollutant or when a building requires cooling. There are two main mechanisms for natural ventilation: 'stack (or chimney)' effect and 'wind pressure' effect.

Stack effect is produced by two columns of air at different temperature, where the interference between the two columns is unstable and tends to allow the colder air to move into the warmer air at low level and the warmer air into cooler air at an upper level. The rate of air circulation due to stack effect in a building depends on separated distance (height) of the cold and hot air, opening area at a bottom and top of the building and temperature difference.

Wind pressure effect is produced by the interaction of wind with the building. The interaction will produce a building surface with local suction and pressures. The pressure area used as intake of outside air and suction as removal of indoor air. The different pressure distribution across the building will be used to achieve the required indoor air circulation.

The proposed development is 5 storey aged-care residential building with an approximate roof height of 18m from the ground level. The site is irregular in shape and is bounded by Veterans Parade to the east and Lantana Avenue to the south. It currently comprises an existing low and mid-rise seniors housing development that contains a mixture of independent living units, veteran accommodation, residential care facility accommodation, and associated ancillary uses. A satellite image of the proposed development site and north-eastern elevation of the proposed development are shown in Figure 1 and Figure 2, respectively. Assumed terrain categories for wind speed estimation is shown in Figure 3.

Source: Nearmap and Ethos Urban



Figure 1 - Aerial view of the proposed development site.



Figure 2 - North-Eastern elevation of the proposed development.



Figure 3 - Assumed terrain categories (TC) for wind speed estimation.

2 Sydney Wind Climate

The mean and gust wind speeds have been recorded in the Sydney Airport wind station (**WS_066037**) for over 30 years. These data have been analysed, and directional probability distribution of wind speeds have been determined. The probability distribution of hourly mean wind speed and directionality at a gradient height (~500 m) is shown in Figure 4. The winds from the west are strongest and more frequent followed by those from the northeast and south directions.

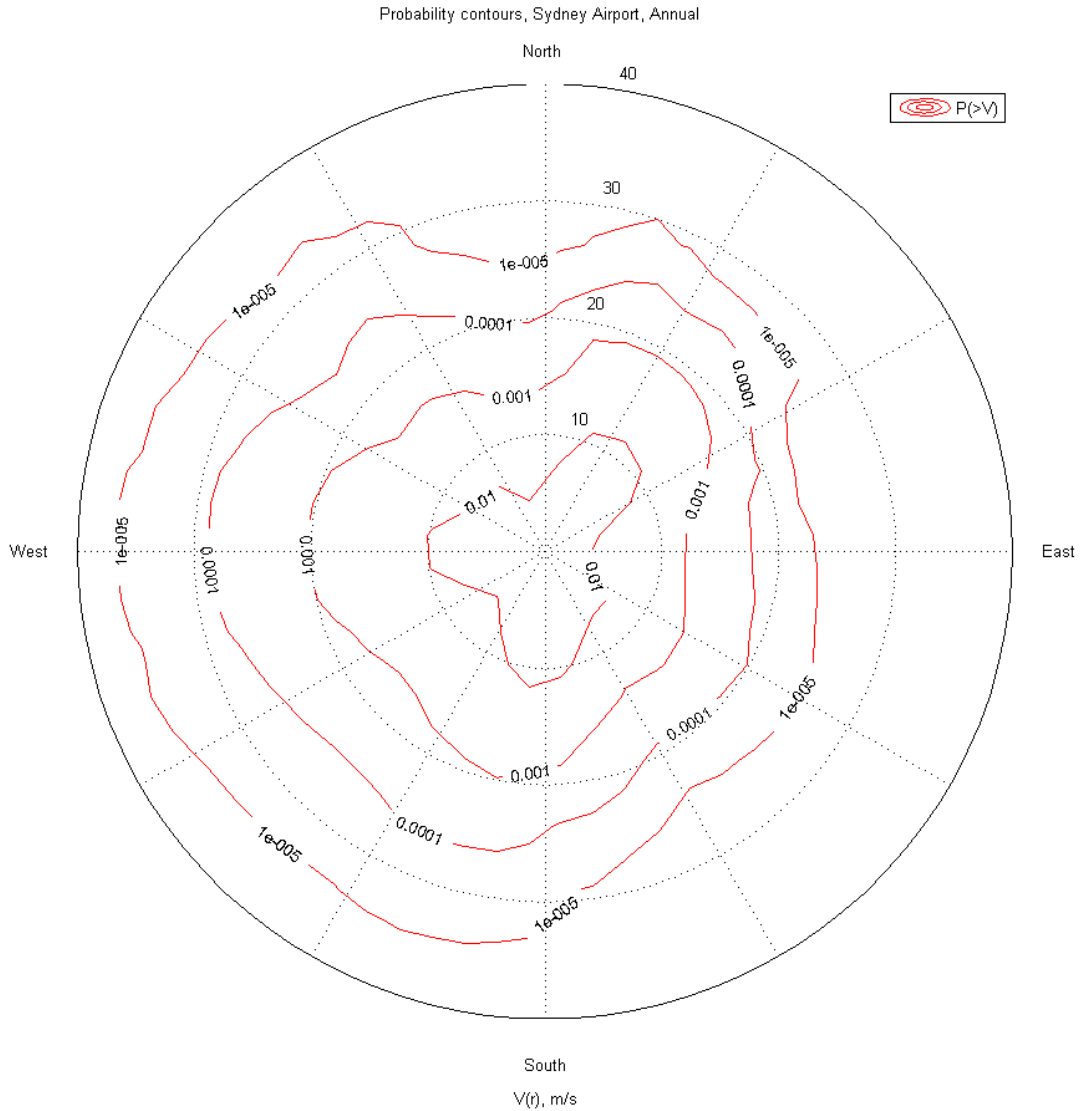


Figure 4: Wind probability of mean wind speed and direction for Sydney wind climate.

3 Natural Ventilation Analysis

Natural ventilation through apartments is driven by differential pressures between dominant openings, which are generated by the outside wind flow around the building structure and additional elements. The pressure distribution will vary according to the incoming wind directions and turbulence characteristics from the upstream, the angle between the local wind and the building façade, elevation of the apartment to ground level, local façade geometry, and size of door opening.

For this assessment, southerly winds were chosen as it is main contribution for the south-western façade of the middle apartments (224, 225, 234, 235, 244 and 245). Wind frequency exceeded at 80% of the time were selected for this assessment. This resulted in a calm to light breeze reference wind speed of 2m/s.

3.1 Australian Design Guide (ADG) Requirements

The NSW State Environmental Planning Policy No. 65 (SEPP65) supported by the Australian Design Guide (ADG) is relevant to the assessment of the natural ventilation through residential components of proposed development. Section 4B-3 of the Australian Design Guide (ADG) states that:

"At least 60% of the apartments are naturally cross ventilated in the first nine storeys of the building. Apartments at ten storeys or greater are deemed to be cross ventilated only if any enclosure of the balconies at these levels allows adequate natural ventilation and cannot fully enclosed".

The proposed development implements a number of the ADG recommendations to maximize the natural cross ventilation throughout the development:

- The proposed development has been provided with opening on multiple sides of the apartments for the majority of the proposed floor plans, allowing it to make use of wind-induced natural ventilation throughout the year and thereby minimising energy costs; and
- The overall depth of cross-over or cross through units does not exceed 18m as per Design Criteria of Objective 4B-3.

There are no specific requirements to calculate Air Change Hour (ACH) in the ADG guideline. However, AS1668.2-2002 "The use of ventilation and air conditioning in buildings Part 2" states:

Ventilation design for indoor air contaminant control (excluding requirements for the health aspects of tobacco smoke exposure) recommends 3 ACH for habitable rooms to satisfy the air quality requirements [9].

3.2 Assumptions and Limitations

The results from the desktop natural ventilation assessment should not be used for structural or cladding wind load analysis. Awning windows with a size of (1.7m (H) x 0.7m (W)) and sliding door size opening of (2.7m (H) x 1.4m (W)) have been used for the ACH calculation. For this assessment, all entrance swing doors are assumed to be closed to represent a worst-case scenario.

For the first five storey, the proposed development has 39 apartments in total. The corner apartments are expected to be the best option for the cross natural ventilation. To simplify the analysis to achieve 3 ACH for, the middle apartments (**224, 225, 234, 235, 244, and 245**) are selected for the analysis.

For wind-driven cross ventilation, the flow rate (Q) and Air Change Per Hour (ACH) equations can be written as follows:

$$Q = C_d A_{\text{opening}} U_{\text{ref}} \sqrt{C_{p_{\text{windward}}} - C_{p_{\text{leeward}}}} \quad (\text{or}) \quad Q = C_d A_{\text{opening}} \sqrt{\frac{2\Delta P}{\text{Air density}}} \quad (\text{eqn. 1})$$

$$\text{ACH} = \frac{Q}{V} \times 3600 \quad (\text{eqn. 2})$$

Where, Q is the volumetric flow rate entering inside the apartment space, C_d is the discharge coefficient, V is the volume of the enclosed space, U_{ref} is the reference wind speed, and A is the equivalent opening area.

Discharge coefficient is a source of uncertainty in the calculation of volumetric airflow rates. It characterizes the local contraction of the flow at opening level, shear stress forces, and dimensions of the opening. For small sharp-edge openings, typical values for discharge coefficient are within the range of **0.40-0.65 [14]**. For this assessment, all openings discharge coefficient of **0.65** is considered. Thus, result presented in the report represent a best-case scenario.

For this assessment:

- All windows and entrance doors in liveable areas are assumed to be open. This should be considered as a best scenario to calculate ACH within the apartment units;
- Extract the building façade pressure (windward and leeward side) using ASNZ1170.2-2021 for different elevations; and
- Calculate the flow rates (Q) at the opening sides for different wind directions and calculate ACH based on equation 1 and 2.

4 Results and Discussion

4.1 SEPP65 Assessment (ADG)

The natural ventilation for the proposed residential apartments has been qualitatively assessed. Cross ventilation is achieved by the differential pressure between the windward and leeward building façades. Description of the natural ventilation principles that apply for the proposed development are shown in Appendix A.

The following comments are made regarding the proposed cross ventilation system for the development:

- Balconies featuring sliding doors are positioned on all façades, offering openings to various directions, thus significantly improving airflow, which is a favourable design selection. The proposed development benefits from all prevailing Sydney winds, creating the potential for cross ventilation (Figure 5 to Figure 7).
- Based on a qualitative study **64% (25 out of 39)** of the apartments within the proposed development comply with the cross-ventilation requirements of the Australian Design Guide (ADG) for the first nine stories (Table 1).
- As there is not a substantial pressure variation between the ground floor and level 1, there is expected to be negligible airflow passing through the building at these levels. Recommended mitigations to the current design on these levels is unlikely to introduce additional flow paths to enable cross ventilation.
- From experience Vipac has found that numerical solutions including Computational Fluid Dynamics (CFD) and wind tunnel studies can prove these apartments to provide appropriate through apartment ventilation and circulation for natural ventilation requirements.

Table 1: Apartments with openings to support cross ventilation.

Levels	Number of Apartments	Number of Apartments with Openings to Support Cross Ventilation (as per ADG)	Percentage (%)
L00	7	3	43%
L1	8	4	50%
L2	8	6	75%
L3	8	6	75%
L4	8	6	75%
Total	39	25	64%

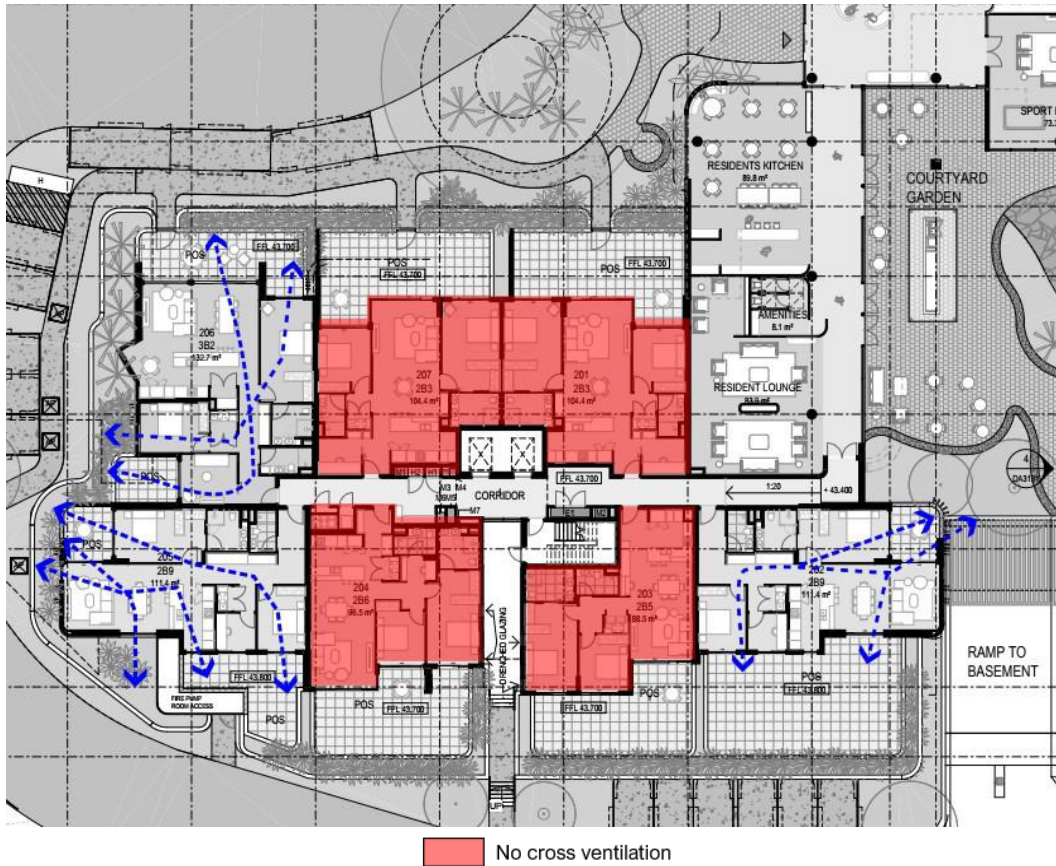


Figure 5: Natural cross ventilation flow paths for Level 00 (Ground Floor).

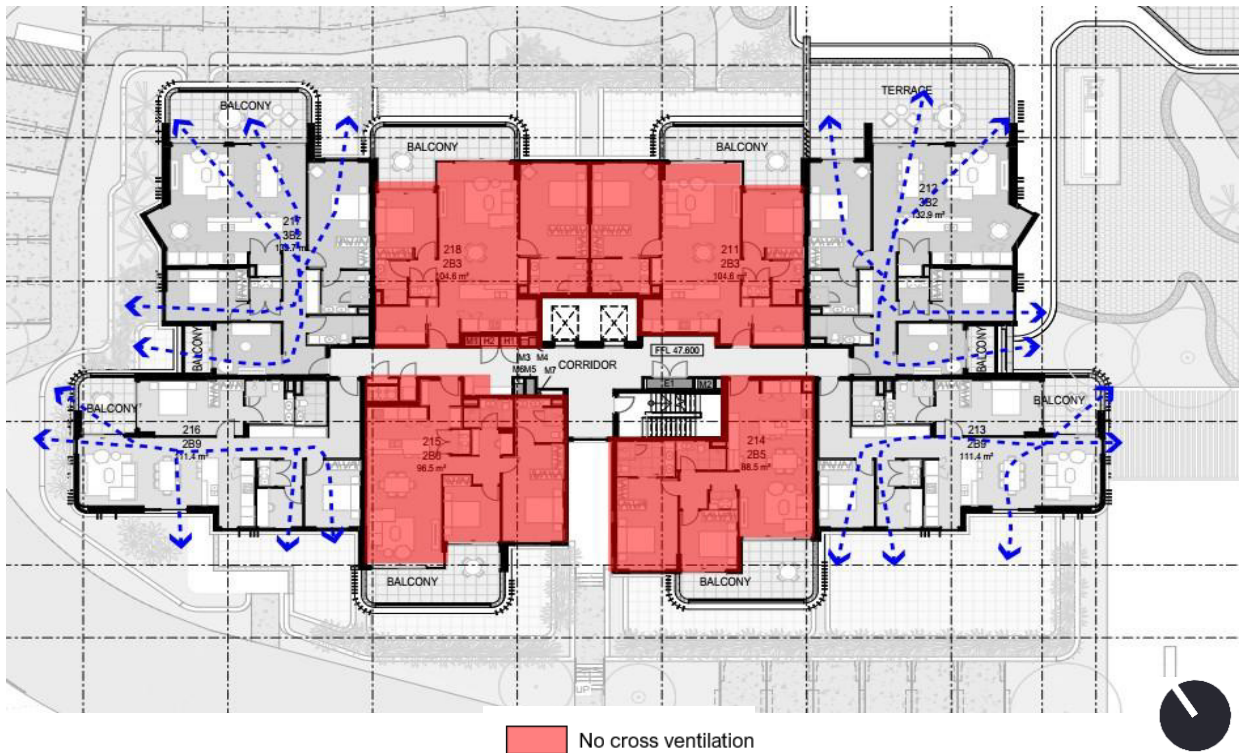


Figure 6: Natural cross ventilation flow paths for Level 1.

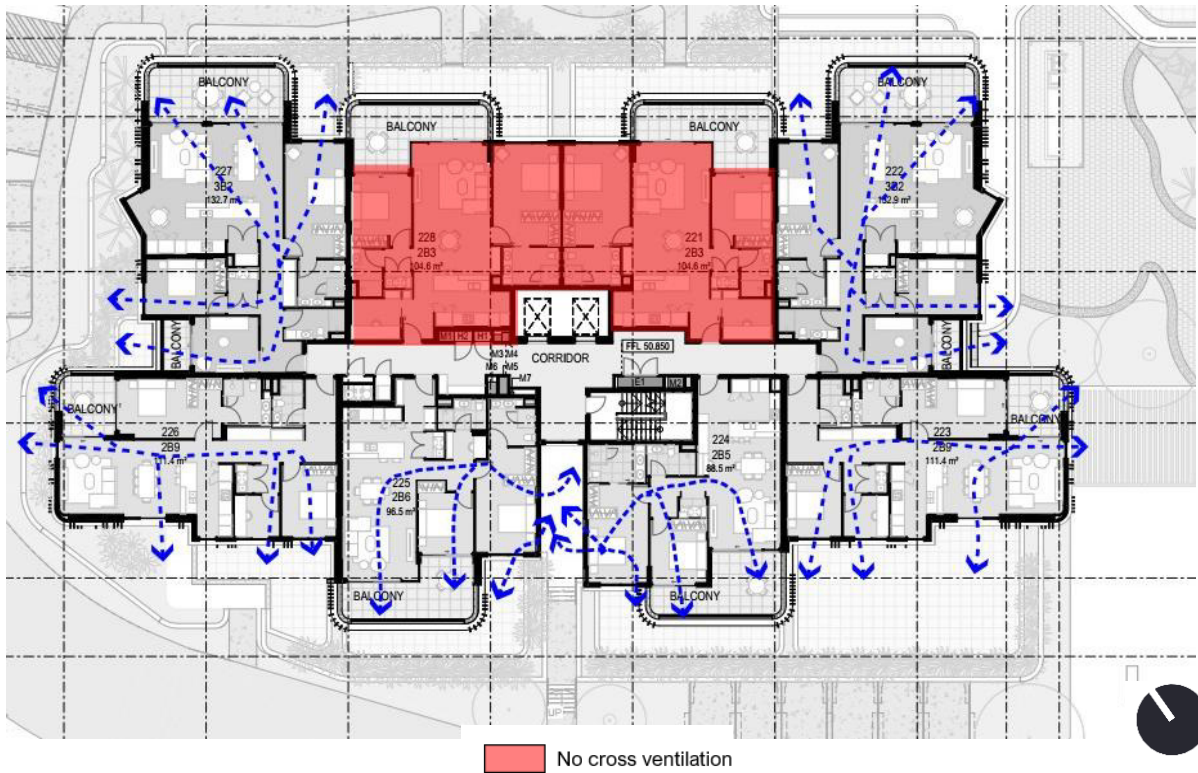


Figure 7: Natural cross ventilation flow paths for Level 2-4.

4.2 Natural Ventilation (AS 1668.2) Detail Assessment

A space is considered sufficiently naturally ventilated by the determination of Air Change Hour (ACH) driven by environmental wind conditions. As the Australian Design Guide (ADG) do not specify criteria therefore an ACH of 3 is used in accordance to AS 1668.2. The environmental wind speeds, pressures and volume of the apartments were analysed to determine compliance against this criterion. To calculate ACH, **224, 225, 234, 235, 244, and 245** apartments were selected for this analysis to represent problematic apartments on the south-western side.

Wind Pressures & ACH

The table below of the wind pressure calculation is based on the Australian Standard which incorporates a number of assumptions and generalization. For more accurate results, wind tunnel testing or Computational Fluid Dynamics (CFD) is recommended.

Table 2: Wind pressure calculation based on ASNZ1170.2-2021 and ACH for the various apartment units (south-west).

Southerly Winds				
Apartment	Windward Pressure (Pa)	Leeward Pressure (Pa)	Differential Pressure (Pa)	Air Change Hour (ACH)
224	0.94	-0.8	0.14	3.00
225	0.94	-0.8	0.14	3.23
234	1.03	-0.8	0.23	3.10
235	1.03	-0.8	0.23	3.23
244	1.10	-0.8	0.30	3.08
245	1.10	-0.8	0.30	3.21

As per section, awning windows with an effective opening of 0.45 m² and sliding door openings of 3.7m² has been assumed for the ACH calculation. With this opening, the units satisfy the ACH requirement of 3.

5 Conclusion

Vipac Engineers & Scientists Pty Ltd has been engaged by **RSL Lifecare Limited** to conduct a qualitative assessment of natural ventilation potential of the proposed development at **ANZAC Village, 4 Colooli Rd, Narrabeen NSW**. This appraisal is based on Vipac's experience as a wind-engineering consultancy.

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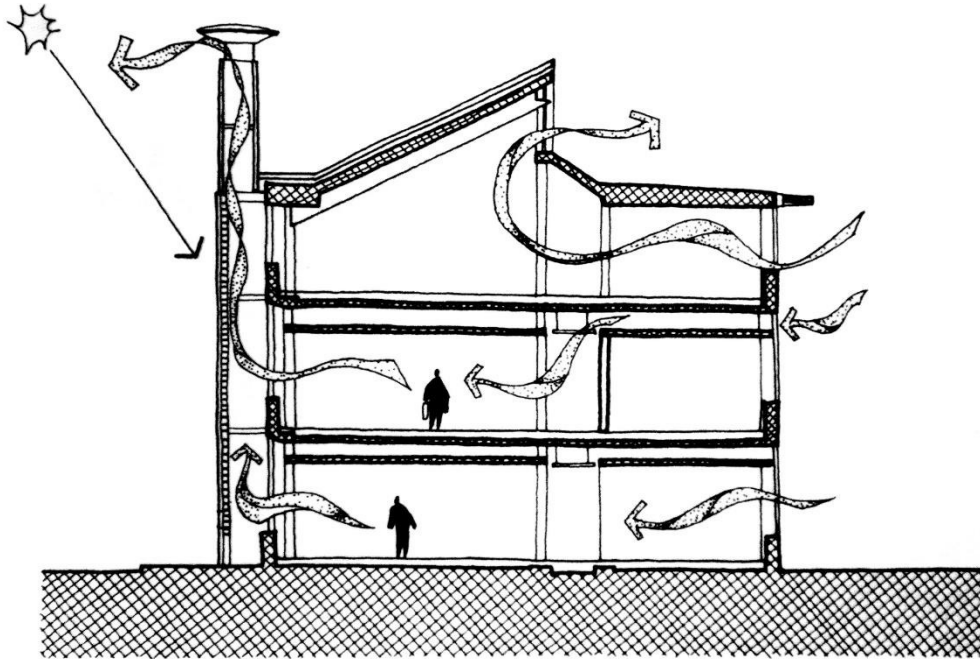
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This analysis has been made based on our engineering assumptions and on experience gained from model scale wind tunnel or Computational Fluid Dynamics (CFD) analysis of a range of developments of similar magnitude to the proposed development.

Appendix A Environmental Wind Effects

Natural Ventilation (Stack effects)

Stack ventilation uses temperature differences to move air. Hot air rises because it generates lower pressure due to the density variation. For this reason, it is sometimes called buoyancy driven flow ventilation. In the stack effect, hot air plume rises due to buoyancy and its low-pressure sucks in fresh air from outside.



Source: G.Z brown and Mark Dekay, published by Wiley.

Natural Ventilation (Wind effects)

Wind induced natural ventilation works on the pressure differential concept. If a building massing has multiple openings and there exists a pressure difference between those openings, e.g. the wind pressure at one opening is greater than the pressure at the other side of the openings; airflow will be pushed through building openings in the direction positive to negative sign.

$$ACH = \frac{\text{Volumetric flow rate inside the enclosed space } \left(\frac{m^3}{s}\right)}{\text{Volume of the enclosed space } (m^3)} \times 3600$$

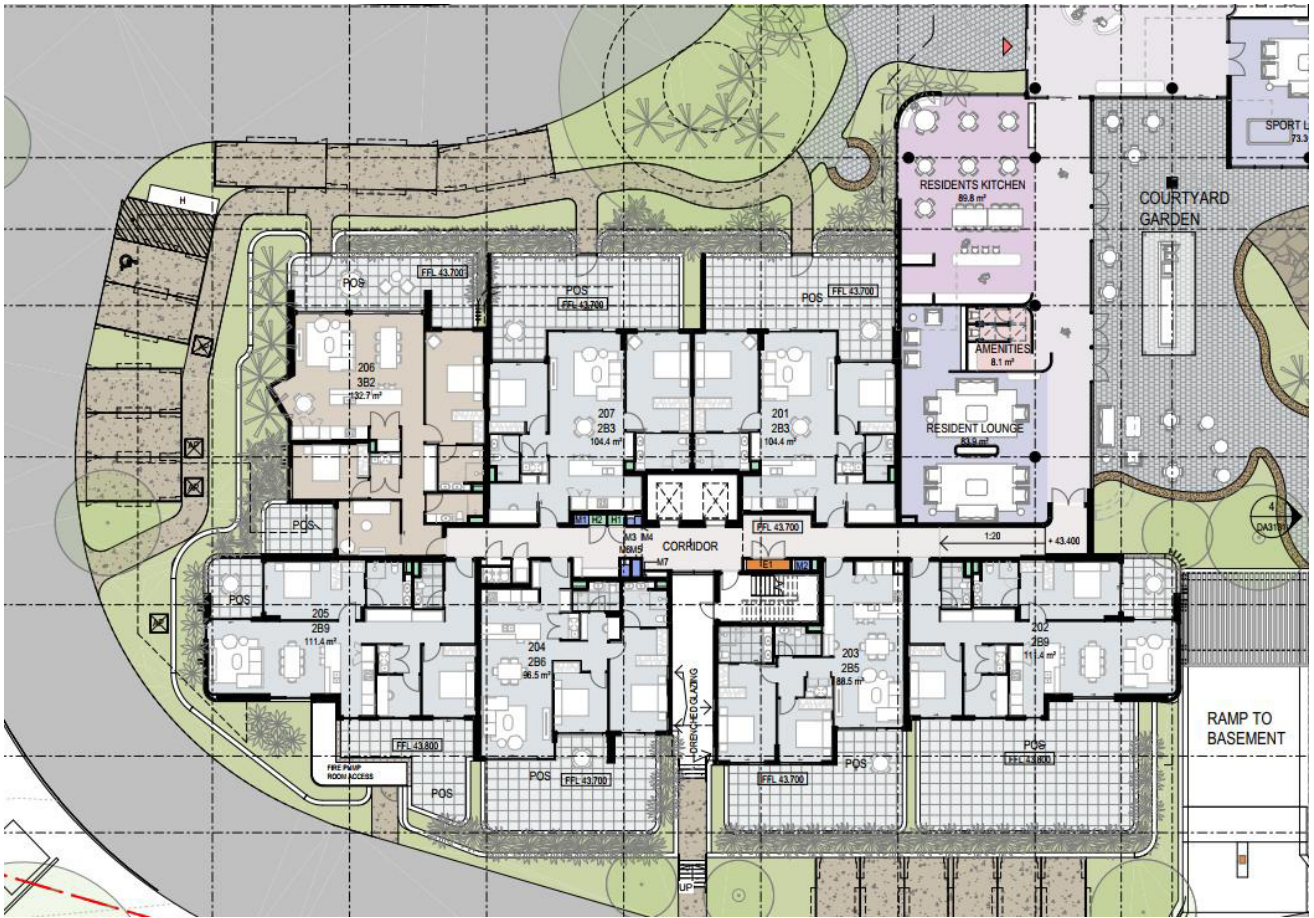


Appendix B Drawings List

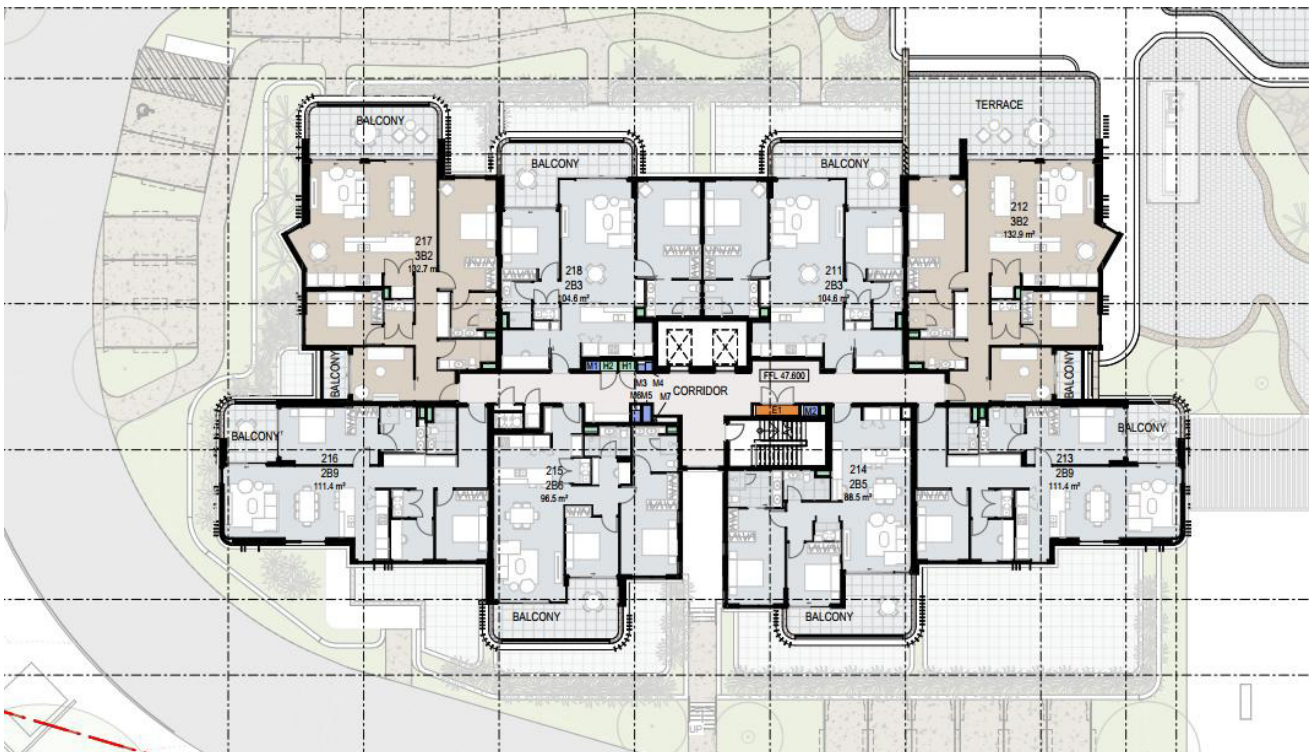
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Appendix C Floor Plans

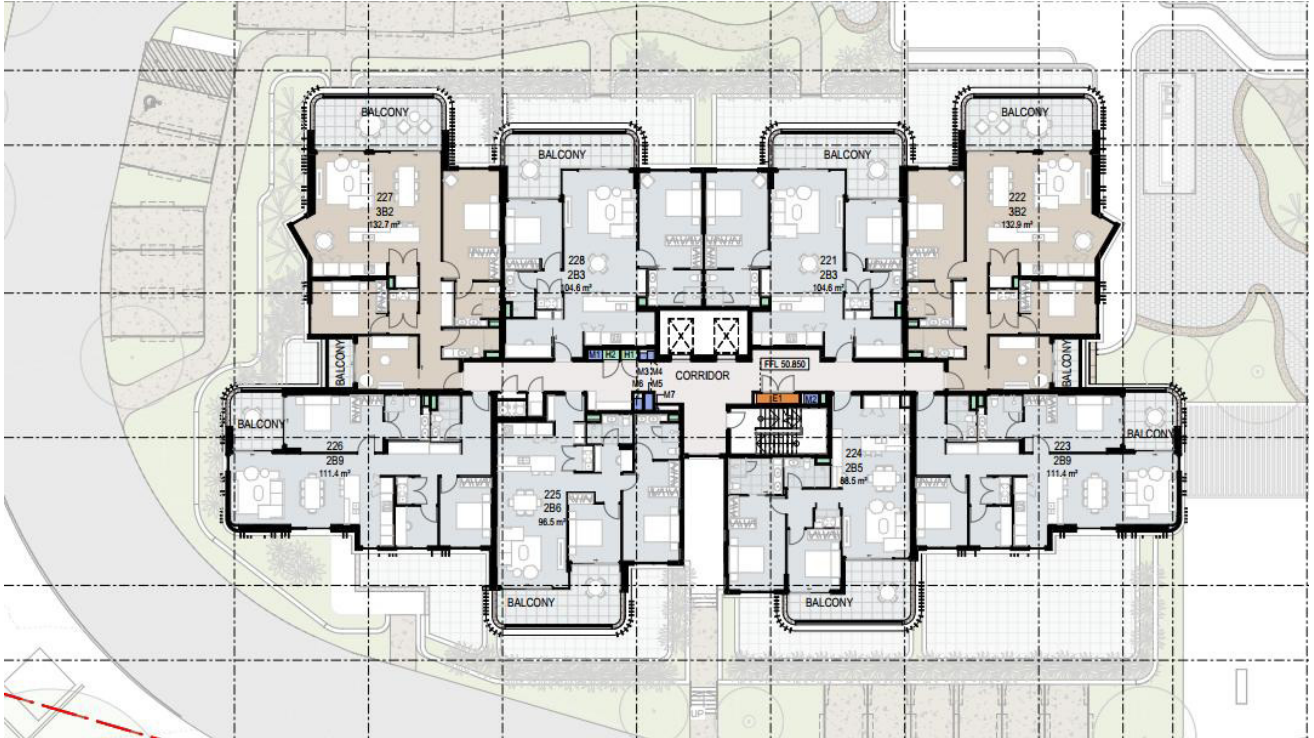
L00 (Ground Floor)



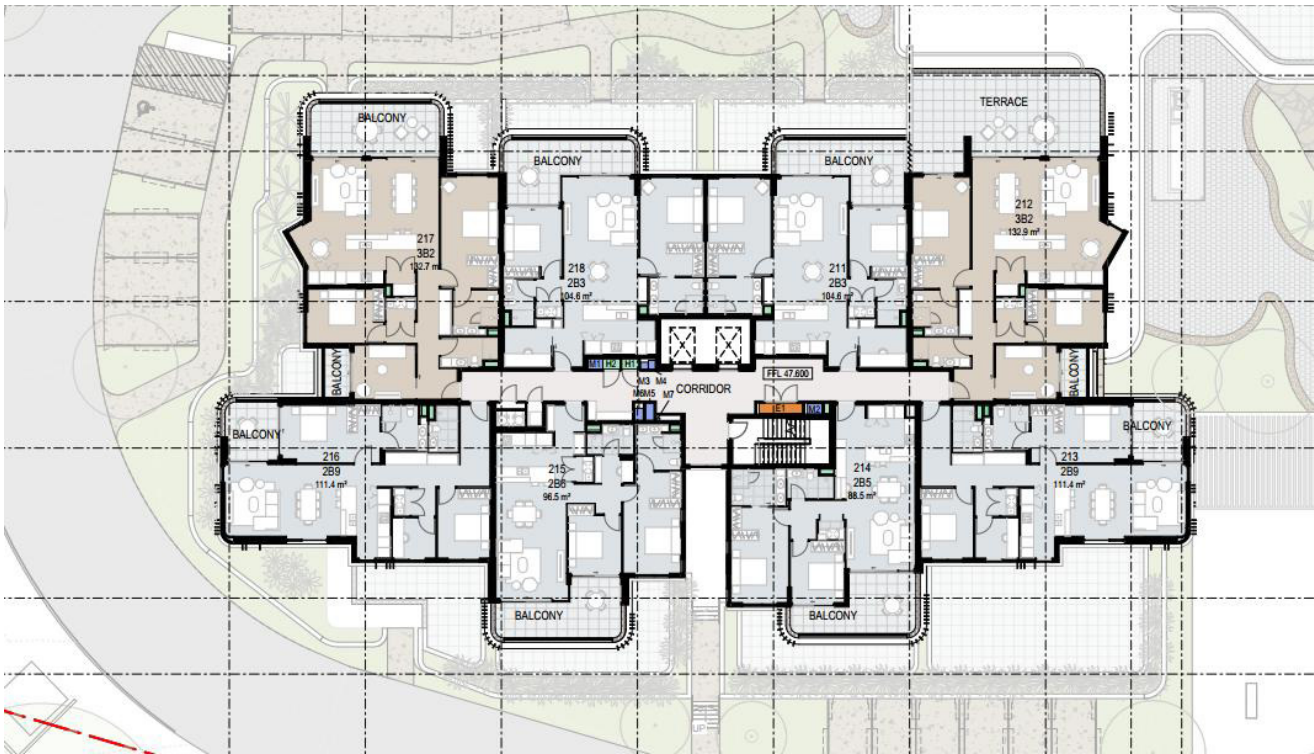
Level 1



Level 2



Level 3



Appendix D References

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