WINDTECH

NATURAL VENTILATION STATEMENT

11-13 ALBERT ROAD, STRATHFIELD

WG097-01F03(REV3)- NVS REPORT

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Prepared for:

Kennedy Associates Architects Pty Ltd

Level 3, 1 Booth Street,
Annandale NSW 2038

DOCUMENT CONTROL

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May 12, 2021	Initial.	0	GC	SWR	HK
May 17, 2021	Updating unit count and treatment	1	GC/HK	SWR	HK/SWR
June 10,2021	Updated drawings	2	GC	SWR	HK
June 18, 2021	Updated with Final set of drawings	3	GC	SWR	HK

EXECUTIVE SUMMARY

This report is in relation to the proposed 11-13 Albert Road development, located in Strathfield and presents an opinion on the natural ventilation performance and characteristics of the various residential apartments of the subject development.

The conclusions of this report are drawn from our extensive experience in this field and are based on the architectural drawings prepared by the project architect Kennedy Associates Architects, received 17 June 2021. It should be noted that no wind tunnel testing has been undertaken for this assessment and, hence, this report addresses only the general wind effects and any localised effects that are identifiable by visual inspection. The results of the assessment have been compared against the wind-driven natural cross ventilation criteria detailed in the Apartment Design Guide (ADG) of the State Environmental Planning Policy No. 65 (SEPP65). Any recommendations in this report are made only in-principle and are based on our extensive experience in the study of wind-driven natural ventilation effects.

The results of the natural cross ventilation characteristics of the various residential apartments of the proposed development indicates that 51 apartments have openings located on opposite or orthogonal aspects within significantly different pressure regions. The design also allows for natural cross ventilation through plenum ducts with openings located in significantly different pressure regions for 21 units.

Therefore, a total of **60% (72 out of 120)** residential apartments in the first nine storeys will meet the deemed to satisfy requirements of SEPP65 for natural cross ventilation.

It should be noted that each habitable room should have an unobstructed opening size of at least of 5% of the floor area served by the opening, in accordance with Objective 4B-1 of the ADG or have a minimum free area of 0.4m^2 in order to provide effective natural ventilation.

In addition to this, for any acoustically impacted apartments (as identified by the project acoustic consultant reporting), supplementary analysis can be undertaken to optimise the size and performance of the acoustically attenuated ventilation openings, such as acoustic louvres and plenums. This further assessment and collaborative design process can be undertaken at a more detailed design stage to design an effective acoustically attenuated ventilation solution for air quality purposes. The design of this supplementary ventilation system will ensure that sufficient ventilation can also be achieved when the openings (that are typically used for natural ventilation or air purges) are closed. Windtech's experience indicates that the use of supplementary acoustically attenuated plenums within the current design envelope is an appropriate method to allow adequate levels of ventilation to any noise impacted apartments while maintaining their acoustic amenity.

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1 WIND CLIMATE FOR THE CENTRAL WESTERN SYDNEY REGION

The Central/Western Sydney region is governed by three principal wind directions, and these can potentially affect the subject development. These winds prevail from the north-east, south-easterly to east-south-easterly, and westerly cooler winds. This summary is based on an analysis of wind rose data obtained by the Bureau of Meteorology from Bankstown Airport between 1993 and 2016. Directional plots of the daily average winds when temperatures are between 20-29.5°C; which is the thermal comfort range for this region is shown in Figure 2 below (when occupants tend to open windows for ventilation). These plots have been produced based on an analysis of recorded wind speed data obtained from Bankstown Airport from 1993 to 2016.

Natural ventilation for a residential apartment is most beneficial during the warmer times of the year, when the occupants of the apartment are most likely to open the windows and/or doors and also when the cooling effect of airflow through the apartment is most effective. An analysis of the Bankstown wind climate data within the thermal comfort zone range indicates that more than half of the wind events occur from the north-north-easterly to south-south-easterly directions, where the north-easterly to east-north-easterly and south-easterly to east-south-easterly winds are the most dominant.

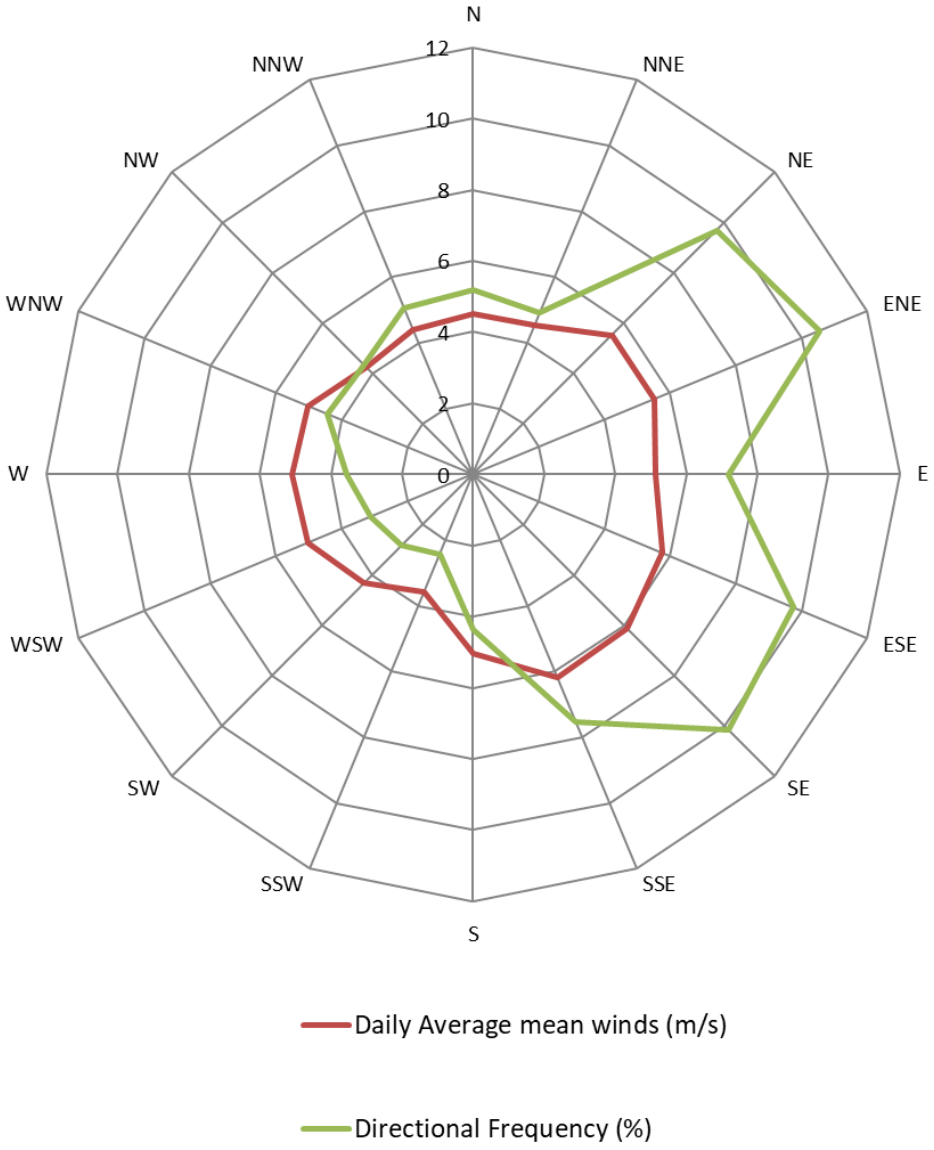

Figure 1: Daily Average Hourly Mean Wind Speeds, and Frequencies Occurrences, for the Bankstown Region for Outdoor Temperatures between 20-29.5°C (based on observations from Bankstown Airport from 1993 to 2016, corrected to open terrain at 10m)

2 NATURAL CROSS VENTILATION OF DEEMED TO SATISFY APARTMENTS

Natural ventilation of indoor areas can be used to improve both the level of occupant comfort and the air quality of an internal space. Natural ventilation is beneficial in improving occupant comfort during the warmer months of the year when the occupants will generally have windows and doors open, while during the winter months it is considered primarily beneficial for air quality purposes only.

The predominant wind directions for the Sydney region, as analysed in Section 1 of this report, illustrates that only the north-easterly and south-easterly winds should be considered as contributors to natural ventilation for occupant comfort purposes. On the other hand, the cooler westerly winds would be beneficial for air quality purposes only.

The NSW State Environmental Planning Policy No. 65 (SEPP65) states that, for a development to be considered naturally ventilated, at least 60% of the individual apartments in the first nine storeys of the building must be considered to be naturally cross ventilated. 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 be fully enclosed. The overall depth of a cross-over or cross-through apartment does not exceed 18m, measured glass line to glass line. Examples of apartments which are classified as being naturally ventilated by SEPP65 are shown in Figures 2a and 2b below, which also show the flow paths for natural cross ventilation through the apartments.

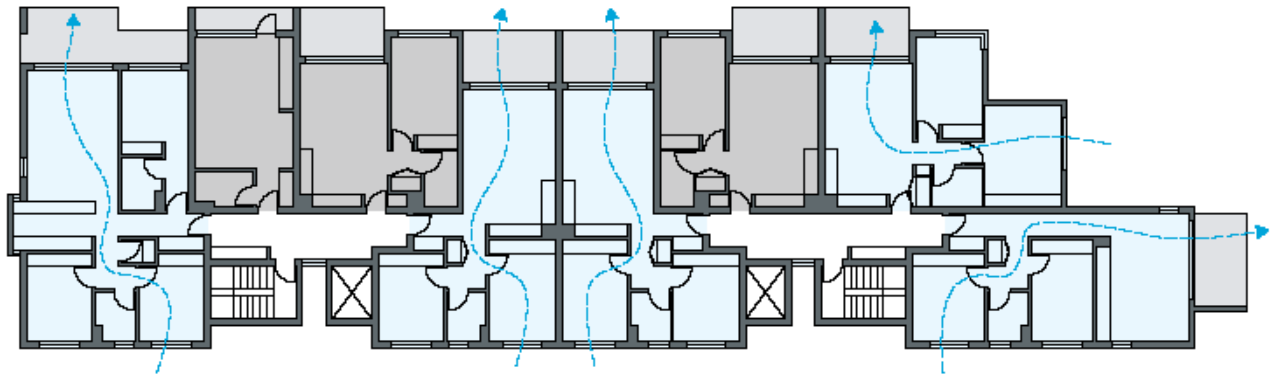

Figure 2a: Examples of Apartments Achieving Effective Natural Cross Ventilation
(from ADG, floor plan of a typical residential building)

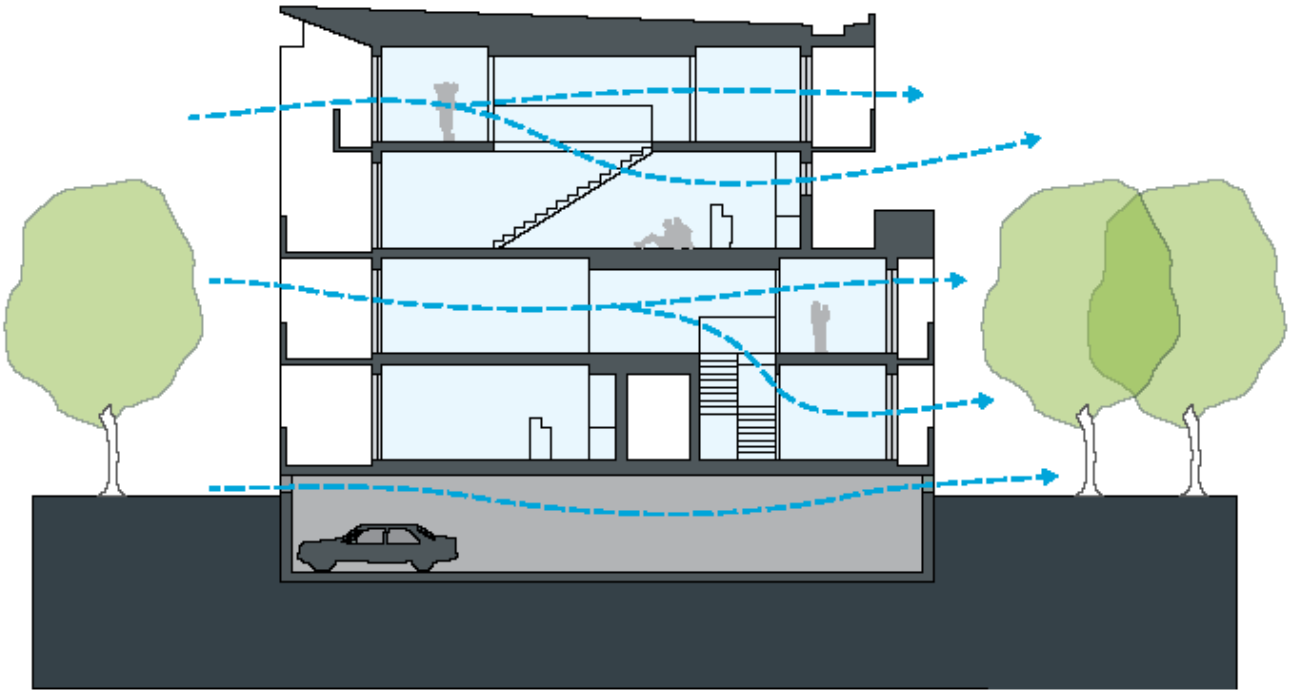

Figure 2b: Examples of Apartments Achieving Effective Natural Cross Ventilation
(from ADG, section elevation of a typical residential building)

Apartments are considered to have dual aspects if the two openings are located on aspects which are less than 135° in plan orientation from each other. Openings which are located on aspect orientations greater than this are more likely to have similar pressures, and their performance cannot be considered to satisfy the criteria based on the SEPP65 guidelines.

The ADG does provide design guidance for the layout and design of single aspect apartments to maximise natural ventilation. While these are not considered naturally cross ventilated, they allow for site restraints for design excellence in single aspect apartments. The design allows for the inclusion of plenums, vertical ventilation shafts and building indentations with a width to depth ratio of 2:1 or 3:1 to ensure effective air circulation and avoid trapped smells.

It should be noted that deviations in the apartment layout shown in SEPP65 can have the potential to provide effective natural ventilation through the apartment. However, due to the complicated nature of flow paths driven by pressure differentials at different openings of an apartment, the effectiveness of natural ventilation for apartments which are outside of those presented in Figures 2a and 2b should be demonstrated by means of a detailed wind tunnel study. A comparison between the predicted natural ventilation characteristics of an apartment obtained from wind tunnel testing with the observed full-scale characteristics of the same apartment have been published in the paper titled 'Designing for Natural Ventilation for Tall Residential Buildings' by Peddie and Rofail (2011), which demonstrates close agreement.

3 RESULTS SUMMARY OF SEPP65 ASSESSMENT

The results of the natural cross ventilation characteristics of the various residential apartments of the proposed development indicated that 51 residential apartments on the first nine storeys will meet the deemed to satisfy requirements of SEPP65 for natural cross ventilation with openings on orthogonal or opposite aspects. This has been achieved through openings on orthogonal or opposite aspects (for example corner or through apartments), with direct exposure to prevailing winds or windows located in significantly different pressure regions and overall depth of cross-over or cross-through apartments not exceeding 18m from glass line to glass line. The proposed design also allows for natural cross ventilation through plenum ducts with openings located in significantly different pressure regions for 21 units. Therefore, a total of **60% (72 out of 120)** residential apartments in the first nine storeys will meet the deemed to satisfy requirements of SEPP65 for natural cross ventilation. This is also summarised in Table 1. It is important that the naturally cross ventilated flow path does not flow through a bathroom in order to avoid issues with odours.

Note that it has been assumed the minimum effective openable area of the various habitable room openings (external windows, doors etc.) to be a minimum of 0.4m^2, based on our extensive experience and research into natural ventilation characteristics of residential apartment buildings utilising wind tunnel testing as well as full-scale verification testing (Peddie and Rofail, 2011). It has also been assumed that all windows presented in the architectural drawings are operable. It is recommended that the plenum ducts have a minimum open area of at least 0.4m^2 for each unit to be effective in natural cross ventilation.

Additionally, each habitable room should have an unobstructed opening size of at least of 5% of the floor area served by the opening, in accordance with Objective 4B-1 of the ADG. For example, a bedroom with a floor area of 12m^2 should have an effective opening size of around 0.6m^2.

In addition to this, for any acoustically impacted apartments (as identified by the project acoustic consultant reporting), supplementary analysis can be undertaken to optimise the size and performance of the acoustically attenuated ventilation openings, such as acoustic louvres and plenums. This further assessment and collaborative design process can be undertaken at a more detailed design stage to design an effective acoustically attenuated ventilation solution for air quality purposes. The design of this supplementary ventilation system will ensure that sufficient ventilation can also be achieved when the openings (that are typically used for natural ventilation or air purges) are closed. Windtech's experience indicates that the use of supplementary acoustically attenuated plenums within the current design envelope is an appropriate method to allow adequate levels of ventilation to any noise impacted apartments while maintaining their acoustic amenity.

Table 1: Natural Ventilation Performance of Each Apartment

Unit Number	Meet ADG Requirements for Natural Cross-Ventilation	Distance from Opening less than 18m
P001	No	No
P002	No	No
P003	No	No
P004	No	No
P011	No	No
P012	Yes – Plenum Duct	Yes
P013	Yes	Yes
P014	Yes – Plenum Duct	Yes
P015	Yes – Plenum Duct	Yes
P016	Yes – Excluded for Acoustics	Yes
P017	Yes	Yes
P018	No	No
P019	Yes – Plenum Duct	Yes
P021	No	No
P022	Yes – Plenum Duct	Yes
P023	Yes	Yes
P024	Yes – Plenum Duct	Yes
P025	Yes – Plenum Duct	Yes
P026	Yes – Excluded for Acoustics	Yes
P027	Yes	Yes
P028	No	No
P029	Yes	Yes
P031	No	No
P032	Yes – Plenum Duct	Yes
P033	Yes	Yes
P034	Yes – Plenum Duct	Yes
P035	Yes – Plenum Duct	Yes
P036	Yes – Excluded for Acoustics	Yes
P037	Yes	Yes
P038	No	No
P039	Yes	Yes
P041	No	No
P042	Yes – Plenum Duct	Yes
P043	Yes	Yes

Unit Number	Meet ADG Requirements for Natural Cross-Ventilation	Distance from Opening less than 18m
P044	Yes – Plenum Duct	Yes
P045	Yes	Yes
P046	Yes	Yes
P047	Yes	Yes
P051	No	No
P052	Yes	Yes
P053	Yes	Yes
P054	Yes – Plenum Duct	Yes
P055	Yes	Yes
P056	Yes	Yes
P061	No	No
P062	Yes	Yes
P063	Yes	Yes
P064	Yes – Plenum Duct	Yes
P065	Yes	Yes
P066	Yes	Yes
P071	No	No
P072	Yes	Yes
P073	Yes	Yes
P074	Yes – Plenum Duct	Yes
P075	Yes	Yes
P076	Yes	Yes
P081	No	No
P082	Yes	Yes
P083	Yes	Yes
P084	Yes – Plenum Duct	Yes
P085	Yes	Yes
P086	Yes	Yes
A011	Yes	Yes
A012	No	No
A013	Yes – Plenum Duct	Yes
A014	No	No
A015	No	No
A016	Yes	Yes
A017	No	No

Unit Number	Meet ADG Requirements for Natural Cross-Ventilation	Distance from Opening less than 18m
A018	Yes – Plenum Duct	Yes
A021	Yes	Yes
A022	No	No
A023	No	No
A024	No	No
A025	No	No
A026	Yes	Yes
A027	No	No
A028	Yes	Yes
A031	Yes	Yes
A032	No	No
A033	No	No
A034	No	No
A035	No	No
A036	Yes	Yes
A037	No	No
A038	Yes	Yes
A041	Yes	Yes
A042	No	No
A043	Yes	Yes
A044	No	No
A045	No	No
A046	Yes	Yes
A047	No	No
A051	Yes	Yes
A052	No	No
A053	Yes	Yes
A054	No	No
A055	No	No
A056	Yes	Yes
A057	No	No
A061	Yes	Yes
A062	Yes – Plenum Duct	Yes
A063	Yes	Yes
A064	No	No

Unit Number	Meet ADG Requirements for Natural Cross-Ventilation	Distance from Opening less than 18m
A065	No	No
A066	Yes	Yes
A067	No	No
A071	Yes	Yes
A072	Yes – Plenum Duct	Yes
A073	Yes	Yes
A074	No	No
A075	No	No
A076	Yes	Yes
A077	No	No
A081	Yes	Yes
A082	Yes – Plenum Duct	Yes
A083	Yes	Yes
A084	No	No
A085	Yes	Yes
A087	No	No

3.1 Design Details of the Natual Cross-Ventilation Methods

To ensure effective natural cross ventilation is achieved for at least 60% of apartments, the following design details are recommended to be incorporated into the final design of the selected apartments. It is recommended that the minimum effective openable area of these openings to be a minimum of 0.4m^2 or at least of 5% of the floor area served by the opening, in accordance with Objective 4B-1 of the ADG. They are summarised as follows:

3.1.1 Plenum Ducts

- Natural ventilation is a product of pressure driven flow between two openings, in this case flow between an opening along the external apartment's façade, which is more positively pressurised and one on the directly opposite or orthogonal external lobby façade, which is more negatively or neutrally pressurised. The plenum ducts are to extend within the ceiling's spaces above the internal building lobbies or corridors, with the inlet at the rear of the apartment and the outlet on the façade on an orthogonal aspect. The entire flow path, from façade to façade, should not exceed 18m.

- The inlet/outlet openings and the plenum duct should have a minimum free area of 0.4m^2 in order to provide effective natural ventilation for a single apartment connected to a single shaft. For example, for a plenum duct with an internal height of 500mm the width should be at least 800mm. Now that this would be need to increased accordingly to account for obstructions such as piping within plenum duct.

- The plenum duct should be a straight duct connecting the inlet/outlet openings with no or minimal bending to prevent pressurisation losses within the duct.

- Obstructions to flow within the duct such as pipes are recommended to be kept to a minimum.

- Provisions should be made for acoustic lining to mitigate the potential noise transfer.

- Provisions should be made for the inclusion of fire dampers in the shaft. The design and location of these should be verified by the fire engineer as requirements for access may be stipulated.

- Provisions should be made for the inclusion of operable or one-way louvres at the inlet opening in the rear of the apartment to mitigate the potential smell transfer.

4 REFERENCES

ANSI/ASHRAE 55-2010, Thermal Environmental Conditions for Human Occupancy, Atlanta: American Society of Heating, Refrigeration and Air-conditioning Engineers.

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AS1668.2-2002, The use of ventilation and air conditioning in buildings, Part 2: Ventilation design for indoor air contaminant control (excluding requirements for the health aspects of tobacco smoke exposure), Standards Australia.

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