NATURAL VENTILATION STATEMENT

280-292 LAKEMBA STREET & 62-70 KING GEORGES ROAD, WILEY PARK

WD673-06F02(REV2)- NVS REPORT

MAY 27, 2021

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DOCUMENT CONTROL

Date	Revision History	Issued Revision	Prepared By (initials)	Instructed By (initials)	Reviewed & Authorised by (initials)
April 29, 2021	Initial.	0	TH	SWR	TH
May 21, 2021	Review latest drawings.	1	TH	SWR	TH
May 27, 2021	Review latest drawings.	2	TH	SWR	TH

EXECUTIVE SUMMARY

This report is in relation to the proposed development located at 280-292 Lakemba Street & 62-70 King Georges Road, Wiley Park 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 Marchese Partners International, received May 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 assessment indicate that a total of 60.6% (86 of 142) of the residential apartments will meet the "deemed to satisfy" requirements of SEPP65 for natural cross ventilation. This has been achieved through openings on orthogonal or opposite aspects (for example corner or through apartments) with direct exposure to the prevailing winds such as operable windows or proposed cross-over plenum ducts as indicated in the architectural drawings, and/or windows located in significantly different pressure regions with an overall depth of cross-over or cross-through apartments not exceeding 18m from glass line to glass line.

Note that it has been assumed the minimum effective openable area of the proposed habitable room openings (external windows, doors etc.) to be 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) this is the minimum effective openable area required to generate pressure driven airflow between openings. The operability of the glazed systems is in accordance with those indicated in the architectural drawings. 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 or have a minimum free area of 0.4m^2 in order to provide effective natural ventilation. Design detail guidelines for the cross-over plenum ducts to ensure effective natural cross-ventilation is achieved are also provided within this report.

CONTENTS

1 REGIONAL WIND CLIMATE

The Sydney region is governed by three principal wind directions, and these can potentially affect the subject development. These winds prevail from the north-east, the south, and the westerly cooler winds. This is based on an analysis of wind data obtained by the Bureau of Meteorology from Kingsford Smith Airport between 1995 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 1 below (when occupants tend to open windows for ventilation). These plots have been produced based on an analysis of the recorded wind speed data obtained from Sydney Airport from 1995 to 2016, corrected to open terrain at 10m.

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.

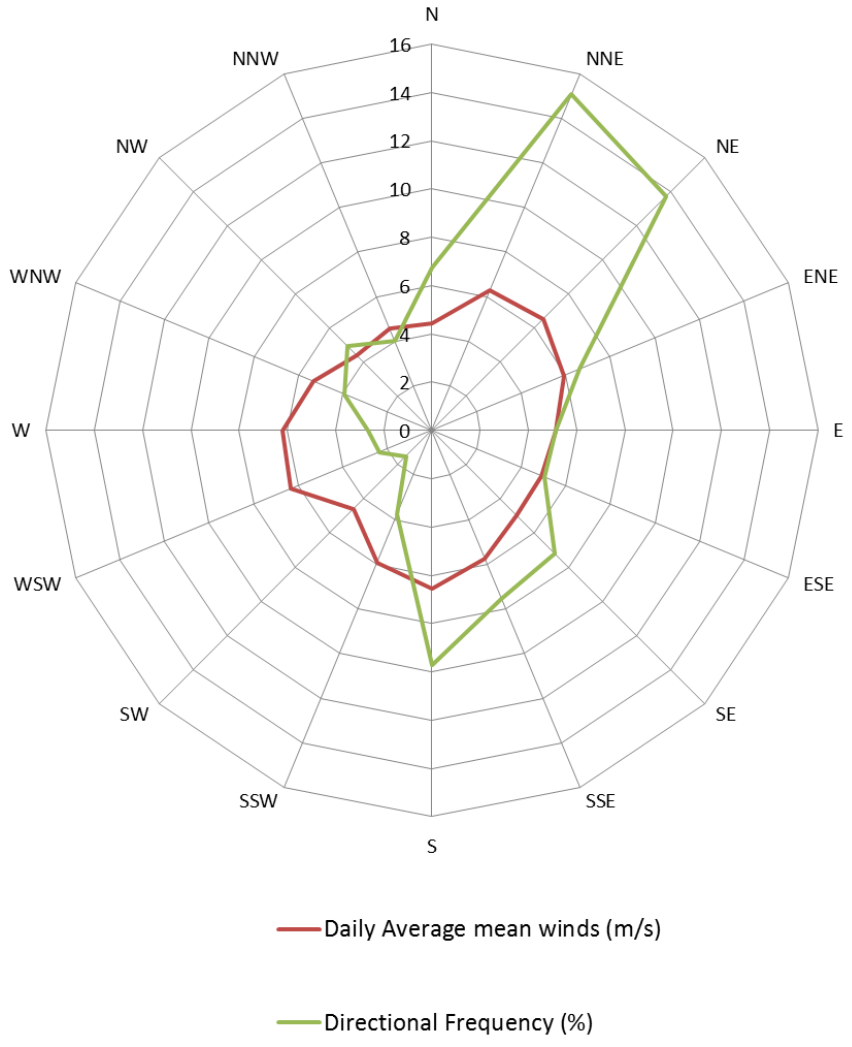

Figure 1: Daily Average Hourly Mean Wind Speeds, and Frequencies of Occurrence, for the Sydney Region for Outdoor Temperatures between 20-29.5°C

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. To be considered to be naturally cross ventilated, the overall depth of a cross-over or cross-through apartment must 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 1 below, which also show the flow paths for natural cross ventilation through the apartments.

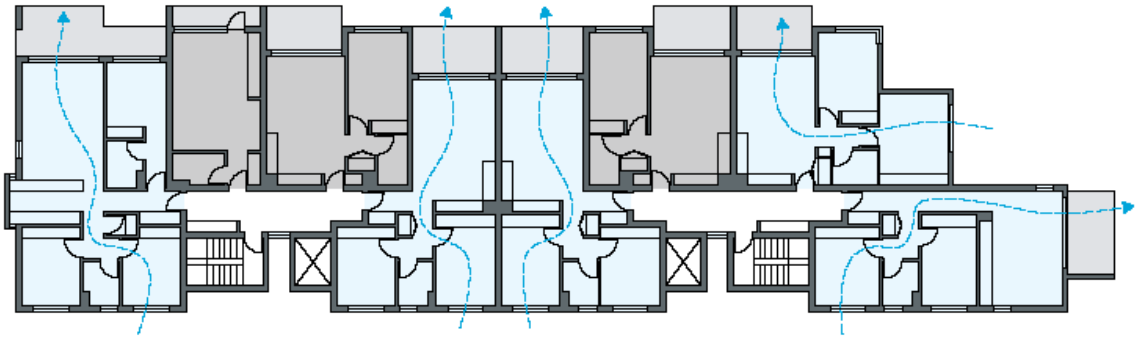

Figure 1a: Examples of Apartments Achieving Effective Natural Cross Ventilation
(from Apartment Design Guide, floor plan of a typical residential building)

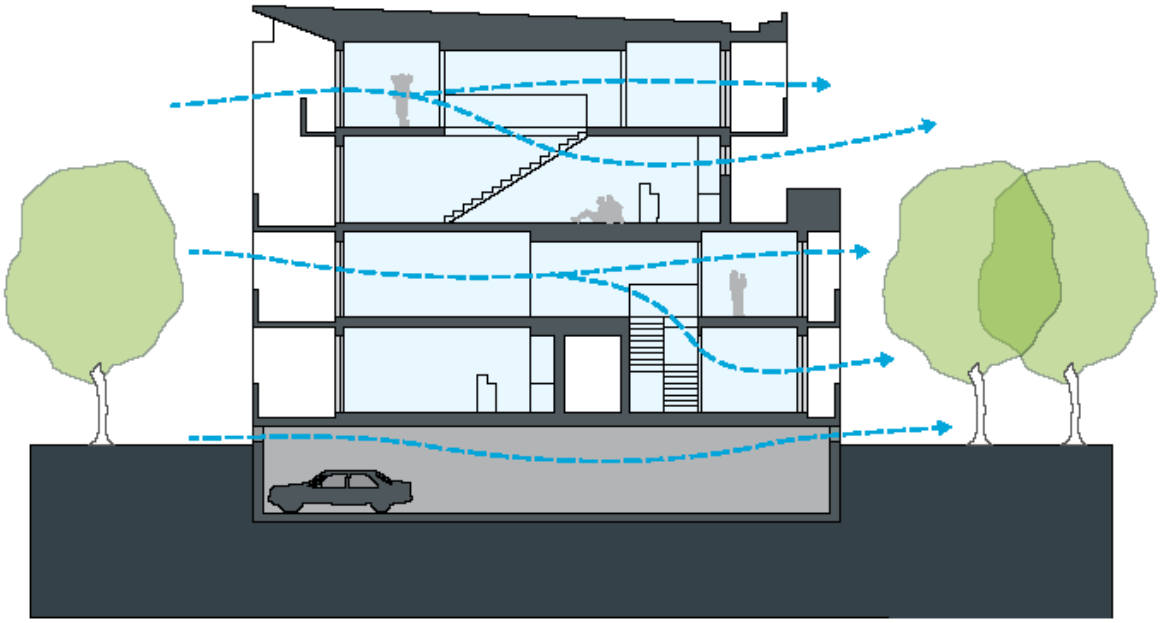

Figure 1b: Examples of Apartments Achieving Effective Natural Cross Ventilation
(from Apartment Design Guide, section elevation of a typical residential building)

Apartments have been considered to have dual aspects if the two openings are able to be 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 at the opening, and their performance cannot be considered to satisfy based on the SEPP65 guidelines.

The Apartment Design Guide 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 is important that the naturally cross ventilated flow path does not flow through a bathroom in order to avoid issues with odours.

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 1 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 AND DISCUSSION

The results of the assessment indicate that a total of 60.6% (86 of 142) of the residential apartments will meet the "deemed to satisfy" requirements of SEPP65 for natural cross ventilation. This has been achieved through openings on orthogonal or opposite aspects (for example corner or through apartments) with direct exposure to the prevailing winds such as operable windows or proposed cross-over plenum ducts as indicated in the architectural drawings, and/or windows located in significantly different pressure regions with an overall depth of cross-over or cross-through apartments not exceeding 18m from glass line to glass line.

The results of the study are listed in Table 1 below. 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 proposed habitable room openings (external windows, doors etc.) to be 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) this is the minimum effective openable area required to generate pressure driven airflow between openings. It has also been assumed that all windows indicated in the architectural drawings are operable. 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. To ensure effective natural ventilation is displayed within the abovementioned apartments design detail for the cross-over plenum ducts is provided in Section 4 of this report that are recommended to be incorporated into the final design of the development.

Table 1: Natural Ventilation Performance

Unit Number	Meets SEPP65 Requirements
1A101	YES
1A102	YES
1A103	NO
1A104	NO
1A105	NO
1A106	YES
1A107	YES
1A201	YES
1A202	YES
1A203	NO
1A204	NO
1A205	NO
1A206	YES

Unit Number	Meets SEPP65 Requirements
1A207	YES
1A301	YES
1A302	NO
1A303	NO
1A304	NO
1A305	YES
1A401	YES
1A402	NO
1A403	NO
1A404	NO
1A405	YES
1A501	YES
1A502	NO
1A503	NO
1A504	NO
1A505	YES
1A601	YES
1A602	NO
1A603	NO
1A604	NO
1A605	YES
1A701	YES
1A702	NO
1A703	NO
1A704	NO
1A705	YES
1B101	YES
1B102	YES
1B103	NO
1B104	NO
1B105	NO
1B106	YES
1B107	YES
1B201	YES
1B202	YES

Unit Number	Meets SEPP65 Requirements
1B203	NO
1B204	NO
1B205	NO
1B206	YES
1B207	YES
1B301	YES
1B302	NO
1B303	NO
1B304	NO
1B305	YES
1B401	YES
1B402	NO
1B403	NO
1B404	NO
1B405	YES
1B501	YES
1B502	NO
1B503	NO
1B504	NO
1B505	YES
1B601	YES
1B602	NO
1B603	NO
1B604	NO
1B605	YES
1B701	YES
1B702	NO
1B703	NO
1B704	NO
1B705	YES
2A101	YES
2A102	YES
2A103	NO
2A104	NO
2A105	YES

Unit Number	Meets SEPP65 Requirements
2A106	YES
2A201	YES
2A202	YES
2A203	NO
2A204	NO
2A205	YES
2A206	YES
2A301	YES
2A302	YES
2A303	NO
2A304	YES - Plenum Duct
2A305	YES
2A306	YES
2A401	YES
2A402	YES
2A403	NO
2A404	YES - Plenum Duct
2A405	YES
2A406	YES
2A501	YES
2A502	YES
2A503	NO
2A504	YES - Plenum Duct
2A505	YES
2A506	YES
2A601	YES
2A602	YES
2B101	YES
2B102	YES
2B103	NO
2B104	NO
2B105	YES
2B106	YES
2B201	YES
2B202	YES

Unit Number	Meets SEPP65 Requirements
2B203	NO
2B204	NO
2B205	YES
2B206	YES
2B301	YES
2B302	YES
2B303	YES - Plenum Duct
2B304	NO
2B305	YES
2B306	YES
2B401	YES
2B402	YES
2B403	YES - Plenum Duct
2B404	NO
2B405	YES
2B406	YES
2B501	YES
2B502	YES
2B503	YES - Plenum Duct
2B504	NO
2B505	YES
2B506	YES
2B601	YES
2B602	YES

4 DESIGN DETAILS

A number of apartments are expected to satisfy the ADG requirements for natural cross-ventilation via locating openings in significantly different pressure regions with the inclusion of treatment options detailed in Section 3 of this report. To ensure effective natural cross-ventilation is achieved, the following design details are recommended to be incorporated into the final design of the development for the recommended treatment options and summarised as follows:

4.1 Openings on Orthogonal Aspects

Natural ventilation is a product of pressure driven flow between two openings on orthogonal aspects; with the windward opening to be positively pressurised and the leeward/sideward opening to be more negatively or neutrally pressurised.

The openings should have a minimum effective openable area of 0.4m^2 in order to provide effective natural ventilation.

These openings can be in the form of operable windows, louvers or vents.

4.2 Plenum Ducts

Natural ventilation through a plenum duct is a product of pressure driven flow between two external façade openings; an opening along the external apartment facade, which is positively pressurised due to its exposure to the prevailing wind direction, and one on the orthogonal external façade (typically of the lobby/corridor), which is negatively or neutrally pressurised. The plenum duct provides a connection between the two openings with an inlet in the rear of the apartment and an outlet on the directly opposite external facade.

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. Note that this would be need to be increased accordingly to account for obstructions such as piping within the plenum duct.

If multiple apartments are connected to a singular plenum duct, it should have an outlet opening and internal plenum duct effective free area of at least 1m^2.

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.

5 REFERENCES

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

ANSI/ASHRAE 62.1-2010, Ventilation for Acceptable Indoor Air Quality, Atlanta: American Society of Heating, Refrigeration and Air-conditioning Engineers.

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.

Aynsley R.M., Melbourne W. and Vickery B.J., (1977) Architectural Aerodynamics, Architectural Science Series, pp192-203.

State Environmental Planning Policy No. 65 (SEPP65), 2015, "Apartment Design Guide", NSW Department of Planning and Environment.

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