



TALLAWONG TOWN CENTRE NATURAL VENTILATION STATEMENT

WF125-02F01(REV0)- NVS REPORT

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EXECUTIVE SUMMARY

This report is in relation to the proposed Stage 3 and Stage 4 developments located at 43-53 Cudgegong Road, Rouse Hill and presents an opinion on the natural ventilation performance and characteristics of the various residential apartments of the subject developments.

The conclusions of this report are drawn from our extensive experience in this field and are based on the architectural drawings prepared by Zhinar Architects Pty Ltd, received March 24, 2020. 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).

The report also addresses council contentions relating to the natural ventilation performance of the development, as cited in the Development Application Appeal document NSWLEC No. 2020/341091.

The results of the natural cross ventilation characteristics of the various residential apartments of the proposed development indicated that a total of 60.0% (135 out of 225) of the residential apartments in the first eight storeys of Stage 3 will meet the deemed to satisfy requirements of SEPP65 for natural cross ventilation with openings on orthogonal or opposite aspects, while a total of 59.7% (138 out of 231) of the residential apartments in the first nine storeys of Stage 4 will meet the deemed to satisfy requirements of SEPP65 for natural cross ventilation with openings on orthogonal or opposite aspects.

The development satisfies the design criteria of Objective 4B-3 of the ADG for natural cross-ventilation, as referenced in the SEPP65.

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RESPONSE TO COUNCIL CONTENTIONS

The following section addresses the various council contentions in relation to the natural ventilation performance of the development, as cited in the Development Appeal Application, NSWLEC No. 2020/341091:

- i. Ventilation patterns in several units should be reconsidered. Particular attention should be given to units indicating ventilation patterns that rely on openings facing a blank wall (that is, units A1.UG.08).*
- ii. ADG Objective 4B-2 recommends that building indentations have a width to depth ratio of 2:1 or 3:1 to ensure effective air circulation and avoid trapped smells.*
- iii. As per ADG Objective 4B-2 primary windows that are augmented with plenums and light wells are generally not suitable for cross ventilation.*
- iv. Details of recommendations provided within the Natural Ventilation Statement prepared by Windtech Consultant Pty Ltd, WF125-01F02(REV3)- NVS Report, dated 27 March 2020 to be demonstrated on the architectural plans.*

Windtech Responses:

- i. The development incorporates slots through the buildings that allow wind flow to pass from the windward aspect to the leeward aspect. The wind is able to flow to the opposite side of the building through slots in the building, while the front of the façade of the unit is exposed to the prevailing wind. Windtech have undertaken wind tunnel studies for other developments having similar slot configurations. These have shown that this type of arrangement facilitates pressure driven flow through the apartment by creating a significant pressure difference between the windward aspect of the apartments and the relatively neutral pressure within the orthogonal (slot) opening. Our experience supports the position of Section 4B of the ADG, which specifically suggests that for an apartment to be naturally cross ventilated it needs to have openings “located in significantly different pressure regions, rather than relying on purely wind driven air”.

Some apartments such as A1.2.09, A1.2.05 B1.2.08 and B1.2.04 of Stage 3 and A2.2.02 and A2.2.08 of Stage 4 are located adjacent to these slots, and have an opening leading to these slots. Based on the above, these apartments are expected to achieve satisfactory natural cross ventilation performance.

- ii. As per the ADG Objective 4B-2, the design guidance for the width to depth ratio of 2:1 or 3:1 is a general design principle to maximise natural ventilation. These design features need context, and can apply for some sites, while not applying for others. Furthermore, this is purely for guidance, and not a design criterion.

This design guidance also has significant limitations. For example, the guidance, with regards to the ratio, has the implication that a building indentation with dimensions 6cm:2cm (3:1 width to depth ratio) width to depth ratio maximises natural ventilation, but then an 8m:2m (4:1 width to depth ratio) building indentation would not. It is clear from the above examples that this guidance has its limitations. From our experience, this guidance is not necessary for achieving adequate natural cross ventilation performance.

- iii. As per the ADG Objective 4B-2, the design guidance for the augmentation of primary windows with plenums and light wells is generally not suitable for cross ventilation of single aspect apartments. We agree with this in the case where a plenum or lightwell links to an external surface of a similar aspect and region of similar pressure and would therefore not be naturally cross ventilated.

However, through the use of plenum ducts linking to an area of opposite or orthogonal aspect of the building form, we are able to have the openings servicing the apartment located significantly different pressure regions, allowing for natural cross ventilation through the unit.

- iv. The project architect (Zhinar Architects) to include additional specifications at a more detailed design stage. Generally, plenum ducts require that the cross-sectional effective open area be a minimum of 0.4m^2 , which is achievable with the current design. For obstructions within and at the ends of the ducts such as meshes or louvres, the effective open area will be affected, and the cross-sectional area of the duct will need to be increased accordingly.

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 west. A summary of the principal time of occurrence of these winds throughout the year is presented in Table 1 below. 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.

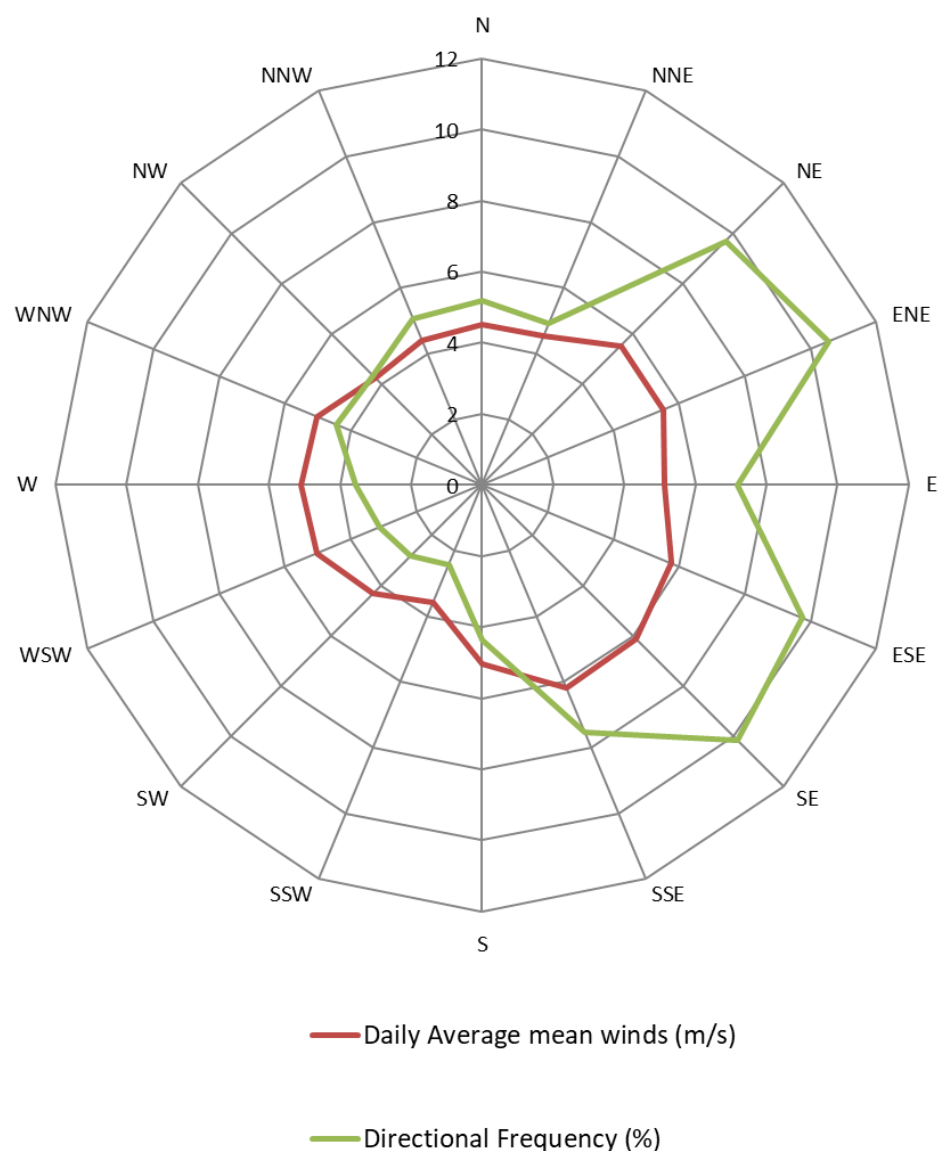


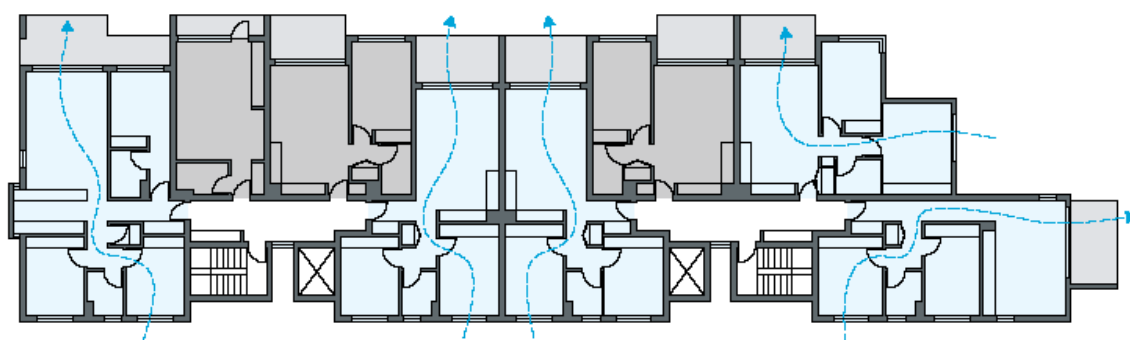
Figure 1: Daily Average Hourly Mean Wind Speeds, and Frequencies of Occurrence, for the Bankstown Region for Outdoor Temperatures between 20-29.5°C (based on observations from Bankstown Airport from 1993 to 2016, corrected to open terrain at 10m)

2 NATURAL CROSS VENTILATION OF DEEMED TO SATISFY APARTMENTS

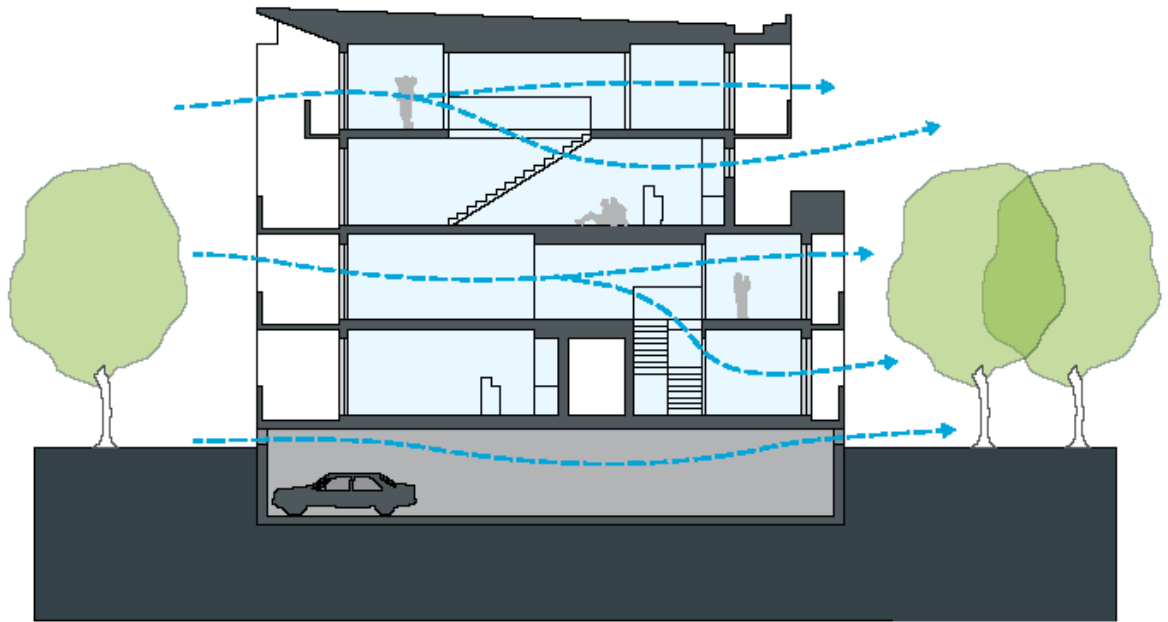
Natural ventilation of indoor areas can be used to improve both the level of occupant comfort and the air quality of an internal space. Natural ventilation is beneficial in improving occupant comfort during the warmer months of the year when the occupants will generally have windows and doors open, while 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 southerly 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. 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 a total of 60.0% (135 out of 225) of the residential apartments on the first eight storeys of Stage 3 will meet the deemed to satisfy requirements of SEPP65 for natural cross ventilation with openings on orthogonal or opposite aspects, while a total of 59.7% (138 out of 231) of the residential apartments on the first nine storeys of Stage 4 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. Additionally, a number of apartments have achieved the standards with the implementation of ventilated skylights or plenum ducts. This is summarised in Tables 1. It is important that the naturally cross ventilated flow path does not flow through a bathroom in order to avoid issues with odours.

It has been assumed the minimum effective openable area of the various habitable room openings (external windows, doors etc.) to be a minimum of 0.4m², 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).

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 12m² should have an effective opening size of around 0.6m².

Note that is important that the breezeways that flow through buildings A1 and B1 of Stage 3 and through building A2 of Stage 4 remain open in the final design.

3.1 Design Details of the Plenum Ducts & Ventilated Skylights

To ensure effective natural cross ventilation is achieved the apartments, the following design details are recommended to be incorporated into the final design of the development. They are summarised as follows:

Cross-over 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 facade, which is more positively pressurised and one on the directly opposite or orthogonal external lobby facade, which is more negatively or neutrally pressurised. A plenum duct is provided with an inlet in the rear of the apartment and an outlet on the directly opposite external lobby facade.
- The inlet/outlet openings and the plenum duct should have a minimum effective open area of 0.4m^2 in order to provide effective natural ventilation for a single apartment connected to a single shaft. E.g., for a plenum duct with an internal height of 500mm, the width should be at least 800mm. Note that this would 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 open 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.

Operable Skylight

- Similar to the plenum duct, natural ventilation is a product of pressure driven flow between two openings between an opening along the external apartment facade, which is more positively pressurised and an opening (operable skylight) on the roof of the development, which is more negatively or neutrally pressurised.
- The operable skylight should be situated near to the rear of the unit to promote natural cross-ventilation through the whole apartment.
- The operable skylight should have a minimum effective openable area of 0.4m^2 in order to provide effective natural ventilation, and may require acoustic treatment.

Table 1a: Natural Ventilation Performance of Each Apartment (Stage 3)

| Unit Number | Meet ADG Requirements for Natural Cross-Ventilation | Distance from Opening less than 18m |
|-------------|---|-------------------------------------|
| A1.UG.01 | NO | YES |
| A1.UG.02 | NO | YES |
| A1.UG.03 | YES | YES |
| A1.UG.04 | YES | YES |
| A1.UG.05 | NO | YES |
| A1.UG.06 | YES | YES |
| A1.UG.07 | YES | YES |
| A1.UG.08 | NO | YES |
| A1.UG.09 | NO | YES |
| A1.UG.10 | NO | YES |
| A1.1.01 | NO | YES |
| A1.1.02 | NO | YES |
| A1.1.03 | YES | YES |
| A1.1.04 | YES | YES |
| A1.1.05 | NO | YES |
| A1.1.06 | YES | YES |
| A1.1.07 | YES | YES |
| A1.1.08 | YES | YES |
| A1.1.09 | YES | YES |
| A1.1.10 | NO | YES |
| A1.2.01 | YES | YES |
| A1.2.02 | NO | YES |
| A1.2.03 | NO | YES |
| A1.2.04 | YES | YES |
| A1.2.05 | YES | YES |
| A1.2.06 | NO | YES |
| A1.2.07 | YES | YES |
| A1.2.08 | YES | YES |
| A1.2.09 | YES | YES |
| A1.2.10 | YES | YES |
| A1.2.11 | NO | YES |
| A1.3.01 | YES | YES |
| A1.3.02 | NO | YES |
| A1.3.03 | NO | YES |
| A1.3.04 | YES | YES |
| A1.3.05 | YES | YES |

| Unit Number | Meet ADG Requirements for Natural Cross-Ventilation | Distance from Opening less than 18m |
|-------------|---|-------------------------------------|
| A1.3.06 | NO | YES |
| A1.3.07 | YES | YES |
| A1.3.08 | YES | YES |
| A1.3.09 | YES | YES |
| A1.3.10 | YES | YES |
| A1.3.11 | NO | YES |
| A1.4.01 | YES | YES |
| A1.4.02 | NO | YES |
| A1.4.03 | NO | YES |
| A1.4.04 | YES | YES |
| A1.4.05 | YES | YES |
| A1.4.06 | NO | YES |
| A1.4.07 | YES | YES |
| A1.4.08 | YES | YES |
| A1.4.09 | YES | YES |
| A1.4.10 | YES | YES |
| A1.4.11 | NO | YES |
| A1.5.01 | YES | YES |
| A1.5.02 | NO | YES |
| A1.5.03 | NO | YES |
| A1.5.04 | YES | YES |
| A1.5.05 | YES | YES |
| A1.5.06 | NO | YES |
| A1.5.07 | YES | YES |
| A1.5.08 | YES | YES |
| A1.5.09 | YES | YES |
| A1.5.10 | YES | YES |
| A1.5.11 | YES - Ventilated Skylight | YES |
| A1.6.01 | YES | YES |
| A1.6.02 | YES - Ventilated Skylight | YES |
| A1.6.03 | YES - Ventilated Skylight | YES |
| A1.6.04 | YES | YES |
| A2.UG.01 | NO | YES |
| A2.UG.02 | NO | YES |
| A2.UG.03 | NO | YES |
| A2.UG.04 | YES | YES |
| A2.UG.05 | YES | YES |
| A2.1.01 | NO | YES |

| Unit Number | Meet ADG Requirements for Natural Cross-Ventilation | Distance from Opening less than 18m |
|-------------|---|-------------------------------------|
| A2.1.02 | NO | YES |
| A2.1.03 | NO | YES |
| A2.1.04 | YES | YES |
| A2.1.05 | YES | YES |
| A2.1.06 | NO | YES |
| A2.1.07 | NO | YES |
| A2.1.08 | NO | YES |
| A2.2.01 | NO | YES |
| A2.2.02 | NO | YES |
| A2.2.03 | YES | YES |
| A2.2.04 | YES | YES |
| A2.2.05 | NO | YES |
| A2.2.06 | NO | YES |
| A2.3.01 | NO | YES |
| A2.3.02 | NO | YES |
| A2.3.03 | YES | YES |
| A2.3.04 | YES | YES |
| A2.3.05 | NO | YES |
| A2.3.06 | NO | YES |
| A2.4.01 | NO | YES |
| A2.4.02 | NO | YES |
| A2.4.03 | YES | YES |
| A2.4.04 | YES | YES |
| A2.4.05 | NO | YES |
| A2.4.06 | NO | YES |
| A2.5.01 | NO | YES |
| A2.5.02 | YES | YES |
| A2.5.03 | YES | YES |
| A2.5.04 | NO | YES |
| A2.6.01 | YES | YES |
| A2.6.02 | YES | YES |
| B1.UG.01 | NO | YES |
| B1.UG.02 | NO | YES |
| B1.UG.03 | YES | YES |
| B1.UG.04 | YES | YES |
| B1.UG.05 | NO | YES |
| B1.UG.06 | YES | YES |
| B1.UG.07 | NO | YES |

| Unit Number | Meet ADG Requirements for Natural Cross-Ventilation | Distance from Opening less than 18m |
|-------------|---|-------------------------------------|
| B1.UG.08 | NO | YES |
| B1.UG.09 | NO | YES |
| B1.1.01 | YES | YES |
| B1.1.02 | NO | YES |
| B1.1.03 | YES | YES |
| B1.1.04 | YES | YES |
| B1.1.05 | NO | YES |
| B1.1.06 | YES | YES |
| B1.1.07 | YES | YES |
| B1.1.08 | YES | YES |
| B1.1.09 | NO | YES |
| B1.1.10 | YES | YES |
| B1.2.01 | YES | YES |
| B1.2.02 | NO | YES |
| B1.2.03 | YES | YES |
| B1.2.04 | YES | YES |
| B1.2.05 | NO | YES |
| B1.2.06 | YES | YES |
| B1.2.07 | YES | YES |
| B1.2.08 | YES | YES |
| B1.2.09 | NO | YES |
| B1.2.10 | YES | YES |
| B1.3.01 | YES | YES |
| B1.3.02 | NO | YES |
| B1.3.03 | YES | YES |
| B1.3.04 | YES | YES |
| B1.3.05 | NO | YES |
| B1.3.06 | YES | YES |
| B1.3.07 | YES | YES |
| B1.3.08 | YES | YES |
| B1.3.09 | NO | YES |
| B1.3.10 | YES | YES |
| B1.4.01 | YES | YES |
| B1.4.02 | NO | YES |
| B1.4.03 | YES | YES |
| B1.4.04 | YES | YES |
| B1.4.05 | NO | YES |
| B1.4.06 | YES | YES |

| Unit Number | Meet ADG Requirements for Natural Cross-Ventilation | Distance from Opening less than 18m |
|-------------|---|-------------------------------------|
| B1.4.07 | YES | YES |
| B1.4.08 | YES | YES |
| B1.4.09 | YES | YES |
| B1.5.01 | YES | YES |
| B1.5.02 | NO | YES |
| B1.5.03 | YES | YES |
| B1.5.04 | YES | YES |
| B1.5.05 | YES | YES |
| B1.5.06 | YES | YES |
| B1.5.07 | YES | YES |
| B1.5.08 | YES | YES |
| B2.UG.01 | YES | YES |
| B2.UG.02 | NO | YES |
| B2.UG.03 | YES | YES |
| B2.UG.04 | YES - Plenum Duct | YES |
| B2.UG.05 | NO | YES |
| B2.UG.06 | YES - Plenum Duct | YES |
| B2.UG.07 | NO | YES |
| B2.UG.08 | YES | YES |
| B2.UG.09 | NO | YES |
| B2.UG.10 | NO | YES |
| B2.UG.11 | NO | YES |
| B2.UG.12 | YES | YES |
| B2.1.01 | YES | YES |
| B2.1.02 | NO | YES |
| B2.1.03 | YES | YES |
| B2.1.04 | YES - Plenum Duct | YES |
| B2.1.05 | NO | YES |
| B2.1.06 | YES - Plenum Duct | YES |
| B2.1.07 | YES | YES |
| B2.1.08 | YES | YES |
| B2.1.09 | NO | YES |
| B2.1.10 | NO | YES |
| B2.1.11 | NO | YES |
| B2.1.12 | YES | YES |
| B2.2.01 | YES | YES |
| B2.2.02 | NO | YES |
| B2.2.03 | YES | YES |

| Unit Number | Meet ADG Requirements for Natural Cross-Ventilation | Distance from Opening less than 18m |
|-------------|---|-------------------------------------|
| B2.2.04 | YES - Plenum Duct | YES |
| B2.2.05 | NO | YES |
| B2.2.06 | YES - Plenum Duct | YES |
| B2.2.07 | YES | YES |
| B2.2.08 | YES | YES |
| B2.2.09 | NO | YES |
| B2.2.10 | NO | YES |
| B2.2.11 | NO | YES |
| B2.2.12 | NO | YES |
| B2.2.13 | YES | YES |
| B2.3.01 | YES | YES |
| B2.3.02 | NO | YES |
| B2.3.03 | YES | YES |
| B2.3.04 | YES - Plenum Duct | YES |
| B2.3.05 | NO | YES |
| B2.3.06 | YES - Plenum Duct | YES |
| B2.3.07 | YES | YES |
| B2.3.08 | YES | YES |
| B2.3.09 | NO | YES |
| B2.3.10 | NO | YES |
| B2.3.11 | NO | YES |
| B2.3.12 | NO | YES |
| B2.3.13 | YES | YES |
| B2.4.01 | YES | YES |
| B2.4.02 | NO | YES |
| B2.4.03 | YES | YES |
| B2.4.04 | YES - Ventilated Skylight | YES |
| B2.4.05 | YES - Ventilated Skylight | YES |
| B2.4.06 | YES | YES |
| B2.4.07 | YES - Ventilated Skylight | YES |
| B2.4.08 | YES - Ventilated Skylight | YES |
| B2.4.09 | YES | YES |
| B2.4.10 | YES - Ventilated Skylight | YES |
| B2.4.11 | YES - Ventilated Skylight | YES |
| B2.4.12 | YES - Ventilated Skylight | YES |
| B2.4.13 | YES - Ventilated Skylight | YES |
| B2.5.01 | YES | YES |

Table 2b: Natural Ventilation Performance of Each Apartment (Stage 4)

| Unit Number | Meet ADG Requirements for Natural Cross-Ventilation | Distance from Opening less than 18m |
|-------------|---|-------------------------------------|
| A1.UG.01 | YES | YES |
| A1.1.01 | YES | YES |
| A1.1.02 | NO | YES |
| A1.1.03 | NO | YES |
| A1.1.04 | NO | YES |
| A1.1.05 | YES | YES |
| A1.1.06 | NO | YES |
| A1.1.07 | NO | YES |
| A1.1.08 | NO | YES |
| A1.1.09 | YES | YES |
| A1.2.01 | YES | YES |
| A1.2.02 | NO | YES |
| A1.2.03 | NO | YES |
| A1.2.04 | NO | YES |
| A1.2.05 | YES | YES |
| A1.2.06 | NO | YES |
| A1.2.07 | NO | YES |
| A1.2.08 | NO | YES |
| A1.2.09 | YES | YES |
| A1.3.01 | YES | YES |
| A1.3.02 | NO | YES |
| A1.3.03 | NO | YES |
| A1.3.04 | NO | YES |
| A1.3.05 | YES | YES |
| A1.3.06 | NO | YES |
| A1.3.07 | NO | YES |
| A1.3.08 | NO | YES |
| A1.3.09 | YES | YES |
| A1.4.01 | YES | YES |
| A1.4.02 | NO | YES |
| A1.4.03 | NO | YES |
| A1.4.04 | NO | YES |
| A1.4.05 | YES | YES |
| A1.4.06 | NO | YES |
| A1.4.07 | NO | YES |
| A1.4.08 | NO | YES |

| Unit Number | Meet ADG Requirements for Natural Cross-Ventilation | Distance from Opening less than 18m |
|-------------|---|-------------------------------------|
| A1.4.09 | YES | YES |
| A1.5.01 | YES | YES |
| A1.5.02 | NO | YES |
| A1.5.03 | NO | YES |
| A1.5.04 | NO | YES |
| A1.5.05 | YES | YES |
| A1.5.06 | NO | YES |
| A1.5.07 | NO | YES |
| A1.5.08 | NO | YES |
| A1.5.09 | YES | YES |
| A1.6.01 | YES | YES |
| A1.6.02 | NO | YES |
| A1.6.03 | NO | YES |
| A1.6.04 | NO | YES |
| A1.6.05 | YES | YES |
| A1.6.06 | YES - Ventilated Skylight | YES |
| A1.6.07 | NO | YES |
| A1.6.08 | NO | YES |
| A1.6.09 | YES | YES |
| A1.7.01 | YES | YES |
| A1.7.02 | NO | YES |
| A1.7.03 | YES | YES |
| A1.7.04 | YES - Ventilated Skylight | YES |
| A1.7.05 | YES - Ventilated Skylight | YES |
| A1.7.06 | YES | YES |
| A2.1.01 | NO | YES |
| A2.1.02 | NO | YES |
| A2.1.03 | NO | YES |
| A2.1.04 | NO | YES |
| A2.1.05 | YES | YES |
| A2.1.06 | YES | YES |
| A2.1.07 | YES | YES |
| A2.1.08 | YES | YES |
| A2.1.09 | YES | YES |
| A2.1.10 | YES | YES |
| A2.1.11 | YES | YES |
| A2.1.12 | YES | YES |
| A2.2.01 | NO | YES |

| Unit Number | Meet ADG Requirements for Natural Cross-Ventilation | Distance from Opening less than 18m |
|-------------|---|-------------------------------------|
| A2.2.02 | YES | YES |
| A2.2.03 | YES | YES |
| A2.2.04 | NO | YES |
| A2.2.05 | YES | YES |
| A2.2.06 | YES | YES |
| A2.2.07 | YES | YES |
| A2.2.08 | YES | YES |
| A2.2.09 | YES | YES |
| A2.2.10 | YES | YES |
| A2.2.11 | YES | YES |
| A2.2.12 | YES | YES |
| A2.3.01 | NO | YES |
| A2.3.02 | YES | YES |
| A2.3.03 | YES | YES |
| A2.3.04 | NO | YES |
| A2.3.05 | YES | YES |
| A2.3.06 | YES | YES |
| A2.3.07 | YES | YES |
| A2.3.08 | YES | YES |
| A2.3.09 | YES | YES |
| A2.3.10 | YES | YES |
| A2.3.11 | YES | YES |
| A2.3.12 | YES | YES |
| A2.4.01 | NO | YES |
| A2.4.02 | YES | YES |
| A2.4.03 | YES | YES |
| A2.4.04 | NO | YES |
| A2.4.05 | YES | YES |
| A2.4.06 | YES | YES |
| A2.4.07 | YES | YES |
| A2.4.08 | YES | YES |
| A2.4.09 | YES | YES |
| A2.4.10 | YES | YES |
| A2.4.11 | YES | YES |
| A2.4.12 | YES | YES |
| A2.5.01 | NO | YES |
| A2.5.02 | YES | YES |
| A2.5.03 | YES | YES |

| Unit Number | Meet ADG Requirements for Natural Cross-Ventilation | Distance from Opening less than 18m |
|-------------|---|-------------------------------------|
| A2.5.04 | NO | YES |
| A2.5.05 | YES | YES |
| A2.5.06 | YES | YES |
| A2.5.07 | YES | YES |
| A2.5.08 | YES | YES |
| A2.5.09 | YES | YES |
| A2.5.10 | YES | YES |
| A2.5.11 | YES | YES |
| A2.5.12 | YES | YES |
| A2.6.01 | YES - Ventilated Skylight | YES |
| A2.6.02 | YES | YES |
| A2.6.03 | YES | YES |
| A2.6.04 | YES - Ventilated Skylight | YES |
| A2.6.05 | YES | YES |
| A2.6.06 | YES | YES |
| A2.6.07 | YES | YES |
| A2.6.08 | YES | YES |
| A2.6.09 | YES | YES |
| A2.6.10 | YES | YES |
| A2.6.11 | YES | YES |
| A2.6.12 | YES | YES |
| B1.UG.01 | NO | YES |
| B1.UG.02 | NO | YES |
| B1.UG.03 | NO | YES |
| B1.UG.04 | NO | YES |
| B1.1.01 | NO | YES |
| B1.1.02 | YES | YES |
| B1.1.03 | YES | YES |
| B1.1.04 | YES | YES |
| B1.1.05 | YES | YES |
| B1.2.01 | NO | YES |
| B1.2.02 | NO | YES |
| B1.2.03 | YES | YES |
| B1.2.04 | NO | YES |
| B1.2.05 | YES | YES |
| B1.2.06 | YES | YES |
| B1.2.07 | YES | YES |
| B1.3.01 | NO | YES |

| Unit Number | Meet ADG Requirements for Natural Cross-Ventilation | Distance from Opening less than 18m |
|-------------|---|-------------------------------------|
| B1.3.02 | NO | YES |
| B1.3.03 | YES | YES |
| B1.3.04 | NO | YES |
| B1.3.05 | YES | YES |
| B1.3.06 | YES | YES |
| B1.3.07 | YES | YES |
| B1.4.01 | NO | YES |
| B1.4.02 | NO | YES |
| B1.4.03 | YES | YES |
| B1.4.04 | NO | YES |
| B1.4.05 | YES | YES |
| B1.4.06 | YES | YES |
| B1.4.07 | YES | YES |
| B1.5.01 | NO | YES |
| B1.5.02 | NO | YES |
| B1.5.03 | YES | YES |
| B1.5.04 | NO | YES |
| B1.5.05 | YES | YES |
| B1.5.06 | YES | YES |
| B1.5.07 | YES | YES |
| B1.6.01 | NO | YES |
| B1.6.02 | NO | YES |
| B1.6.03 | YES | YES |
| B1.6.04 | NO | YES |
| B1.6.05 | YES | YES |
| B1.6.06 | YES | YES |
| B1.6.07 | YES | YES |
| B1.7.01 | NO | YES |
| B1.7.02 | YES | YES |
| B1.7.03 | YES | YES |
| B1.7.04 | YES | YES |
| B1.7.05 | YES | YES |
| B1.7.06 | YES | YES |
| B2.1.01 | NO | YES |
| B2.1.02 | NO | YES |
| B2.1.03 | NO | YES |
| B2.1.04 | YES | YES |
| B2.1.05 | YES | YES |

| Unit Number | Meet ADG Requirements for Natural Cross-Ventilation | Distance from Opening less than 18m |
|-------------|---|-------------------------------------|
| B2.1.06 | NO | YES |
| B2.1.07 | YES | YES |
| B2.1.08 | NO | YES |
| B2.1.09 | NO | YES |
| B2.1.10 | NO | YES |
| B2.2.01 | NO | YES |
| B2.2.02 | NO | YES |
| B2.2.03 | NO | YES |
| B2.2.04 | YES | YES |
| B2.2.05 | NO | YES |
| B2.2.06 | NO | YES |
| B2.2.07 | YES | YES |
| B2.2.08 | NO | YES |
| B2.2.09 | NO | YES |
| B2.2.10 | YES | YES |
| B2.3.01 | NO | YES |
| B2.3.02 | YES | YES |
| B2.3.03 | YES | YES |
| B2.3.04 | NO | YES |
| B2.3.05 | YES | YES |
| B2.3.06 | NO | YES |
| B2.3.07 | NO | YES |
| B2.3.08 | YES | YES |
| B2.4.01 | NO | YES |
| B2.4.02 | YES | YES |
| B2.4.03 | YES | YES |
| B2.4.04 | NO | YES |
| B2.4.05 | YES | YES |
| B2.4.06 | NO | YES |
| B2.4.07 | NO | YES |
| B2.4.08 | YES | YES |
| B2.5.01 | YES | YES |
| B2.5.02 | YES | YES |
| B2.5.03 | YES | YES |
| B2.5.04 | NO | YES |
| B2.5.05 | NO | YES |
| B2.5.06 | YES | YES |
| B2.6.01 | YES | YES |

| Unit Number | Meet ADG Requirements for Natural Cross-Ventilation | Distance from Opening less than 18m |
|-------------|---|-------------------------------------|
| B2.6.02 | YES - Ventilated Skylight | YES |
| B2.6.03 | YES | YES |
| B2.6.04 | YES - Ventilated Skylight | YES |
| B2.6.05 | YES - Ventilated Skylight | YES |
| B2.6.06 | YES | YES |

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