



NATURAL VENTILATION STATEMENT

KENT ROAD PUBLIC SCHOOL

WE364-01F03(REV5)- NVS REPORT

NOVEMBER 6, 2018

Prepared for:

Gardner Wetherill Associates

Level 2, Suite 2.01, 460 Pacific Highway

St Leonards NSW, 2065

WINDTECH Consultants Pty Ltd

Head Office: 607 Forest Road, Bexley, NSW 2207, Australia

P +61 2 9503 0300 **E** reception@windtechglobal.com **W** www.windtechconsult.com

Sydney | Abu Dhabi | Hong Kong | London | Melbourne | Mumbai | New York | Singapore

DOCUMENT CONTROL

Date	Revision History	Issued Revision	Prepared By (initials)	Instructed By (initials)	Reviewed & Authorised by (initials)
August 17, 2018	Initial.	0	TH	TR	TH
August 30, 2018	Updated with comments.	1	TH	TR	TH
September 4, 2018	Updated figure.	2	TH	TR	TH
September 13, 2018	Updated drawing set.	3	TH	TR	TH
October 22, 2018	Inclusion of SSD description	4	TH	TR	TH
November 6, 2018	Client Comments	5	TH	TR	TH

The work presented in this document was carried out in accordance with the Windtech Consultants Quality Assurance System, which is based on International Standard ISO 9001.

This document is issued subject to review and authorisation by the Team Leader noted by the initials printed in the last column above. If no initials appear, this document shall be considered as preliminary or draft only and no reliance shall be placed upon it other than for information to be verified later.

This document is prepared for our Client's particular requirements which are based on a specific brief with limitations as agreed to with the Client. It is not intended for and should not be relied upon by a third party and no responsibility is undertaken to any third party without prior consent provided by Windtech Consultants. The information herein should not be reproduced, presented or reviewed except in full. Prior to passing on to a third party, the Client is to fully inform the third party of the specific brief and limitations associated with the commission.

EXECUTIVE SUMMARY

This report is in relation to the proposed redevelopment of the Kent Road Public School, Marsfield, and presents an opinion on the natural cross ventilation performance and characteristics of the various Shared PAA/Presentation and Open Plan Areas A to C of Blocks P and Q.

The conclusions of this report are drawn from our extensive experience in this field and are based on the latest architectural drawings prepared by the project architects Gardner Wetherill Associates & Butler & Co Architects, received September 2018. No wind tunnel testing has been undertaken for this assessment. Hence this report addresses only the general wind effects and any localised effects that are identifiable by visual inspection.

The results of the assessment indicate the various Shared PAA spaces that opens directly onto the covered walkway on all levels of Blocks P and Q have the potential to generate adequate natural cross ventilation airflow through the internal space due to the significantly different pressure regions at the northern openings; exposed to the direct north-easterly winds, and the leeward openings into the Learning Street that can be exhausted out through the louvers/doors at the ends of the Learning Street. The proposed mechanical assisted ventilation system is expected to be effective in driving airflow through the internal space on days when air movement is still and hot; hence it is recommended to be retained.

The various Shared Presentation spaces on all levels of Blocks P and Q has openings in the form of access doors into the Learning Street. The Learning Street has openings to the outdoor environment in the forms of louvers and doors at each end of the Learning Street. The Shared Presentation Space as such will be borrowing ventilation from the Learning Street that may be adequate depending on the intensity of the prevailing winds. It should be noted that a mechanical assisted ventilation system is also proposed within the Shared Presentation space and appropriate airflow through the Shared Presentation spaces can be mechanically induced by the ventilation system on days when air movement is still and hot; hence it is recommended to be retained.

The various Open Plan Areas A to C on all levels of Blocks P and Q have excellent potential to generate natural cross ventilation airflow through their respective internal spaces. However the natural cross ventilation performance through the various Open Plan Areas may be impeded or limited to servicing certain areas. Hence, generating optimal cross ventilation airflow with the potential to service the majority of the internal space, the following openings (minimum total of 5% of the floor area) of Open Plans Areas A to C on all levels of Blocks P and Q is achieved through the following openings as indicated in the architectural drawings and in the form of marked up plan within the report:

Open Plan Area A

- The proposed openings located near the southern corner of the south-western aspect; adjacent to the Passive Outdoor Area A.

- The proposed openings located on the south-eastern aspect facing onto Passive Outdoor Area B.
- The proposed openings located near the northern corner of the north-western aspect; adjacent to the covered walkway.

Open Plan Area B

- The proposed openings located near the western corner of the south-western aspect; adjacent to the Passive Outdoor Area A.
- The proposed openings located on the north-eastern aspect facing onto Passive Outdoor Area B.
- The proposed openings located near the eastern corner of the south-eastern aspect; adjacent to the Passive Outdoor Area B.

Open Plan Area C

- The proposed openings located on the south-western aspect facing onto Passive Outdoor Area B.
- The proposed openings located near the southern corner of the south-eastern aspect; adjacent to the Passive Outdoor Area B.
- The proposed openings located near the northern corner of the north-eastern aspect; adjacent to the covered walkway.

The remaining proposed openings on the external building façade of the various Open Plan Areas are recommended to be fixed so as to not reduce the effectiveness of the pressure driven airflow generated by the above-mentioned openings servicing the internal space.

It should be noted for the scenario where the access door openings to the Learning Street are closed, the natural ventilation performance of the abovementioned recommended openings within the various Open Plan Areas will not be affected as the pressure driven airflow through these internal spaces do not rely on the access door openings to the Learning Street. Although closing the access door openings to the Learning Street will limit the natural cross ventilation airflow through the various Shared PAA spaces, the proposed mechanical assisted ventilation system is expected to be effective in driving airflow through the internal space on days when air movement is still and hot.

1 DESCRIPTION OF THE SSD DEVELOPMENT AND SURROUNDINGS

The Development Application (DA) seeks approval for the redevelopment of Kent Road Public School, including:

- Site preparation;
- Construction of three (3) new two (2) to three (3) storey buildings to allow for increased student population from 750 to 1,000, containing;
 - 34 Homebase spaces;
 - Canteen;
 - Administration facilities;
 - Special program/counselling rooms;
- Construction of a new entry canopy
- Reconfiguration of car drop off / pick up arrangements on Kent Road;
- Landscaping and fencing and
- Tree removal.

The development site is bounded by Kent Road to the east, Herring Road to the north and low-rise private residential housing along the remaining boundaries. Surrounding the site are predominantly low-rise private residential housing with the open parkland of ELS Hall Park and the Ryde Community Sports Centre located along the eastern boundary. A survey of the land topography indicates a rise in elevation through the site towards the north. The site location is shown in Figure 1.

The existing public school development site is comprised of a series of low-rise buildings and demountable units spread throughout the site.

The internal spaces associated with Blocks P and Q of the proposed development, which are the focus of this assessment with regards to natural cross ventilation, are detailed as follows:

- Shared PAA – located along the northern boundary of Blocks P and Q on the Ground Level to Level 2 and with windows at one end and sliding doors on two sides.
- Shared Presentation – located at the centre of Blocks P and Q on the Ground Level to Level 2 with sliding doors on two sides.
- Open Plan Area A – located along the western boundary of Blocks P and Q on the Ground Level to Level 2 with window openings at opposite ends of the space.

- Open Plan Area B – located along the southern boundary of Blocks P and Q on the Ground Level to Level 2 with window openings at opposite ends of the space.
- Open Plan Area C – located along the eastern boundary of Blocks P and Q on the Ground Level to Level 2 with window openings at opposite ends of the space.

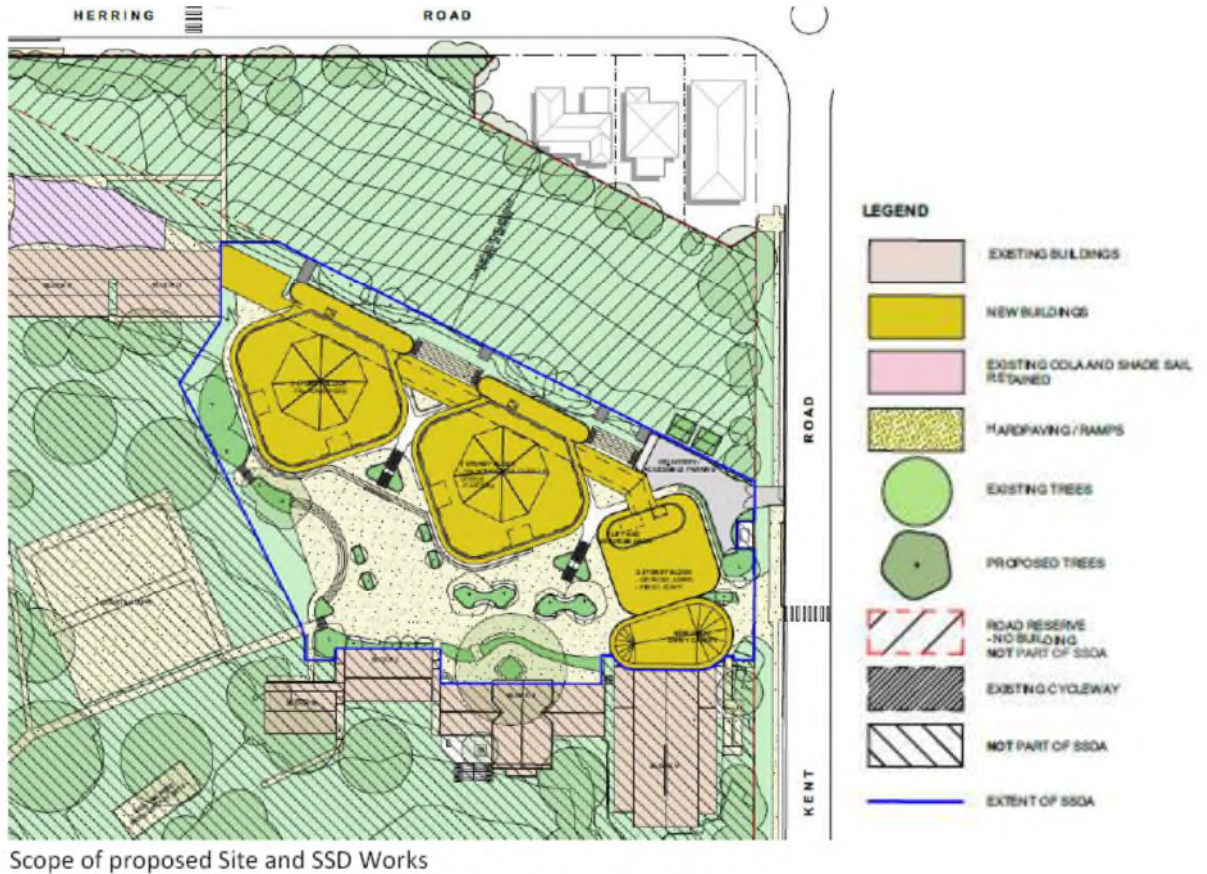


Figure 1: Site Location

2 WIND CLIMATE OF THE SYDNEY REGION

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, south 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 Kingsford Smith Airport between 1995 and 2016.

Natural ventilation for a residential apartment is most beneficial during the summer months 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 Sydney wind climate data for the 6 warmer months of the year (October to March), indicates that the north-easterly and southerly winds are dominant for this period, while the westerly winds are more predominant during the winter months.

Table 1: Principal Time of Occurrence of Winds for Sydney

Month(s)	Prevailing Wind Direction		
	North-Easterly	Southerly	Westerly
January	X	X	
February	X	X	
March	X	X	
April		X	X
May			X
June			X
July			X
August			X
September		X	X
October	X	X	
November	X	X	
December	X	X	

Directional plots of the daily average winds for the Sydney region is shown in Figures 2a and 2b below. These plots have been produced based on an analysis of recorded wind speed data obtained from Sydney's Kingsford Smith Airport from 1995 to 2016. Figure 1a is applicable for natural ventilation from an air quality standpoint. Figure 2b is for the prevailing wind conditions when temperatures are between 20-29.5°C which is the thermal comfort zone range for the Sydney Region, applicable for occupant thermal comfort

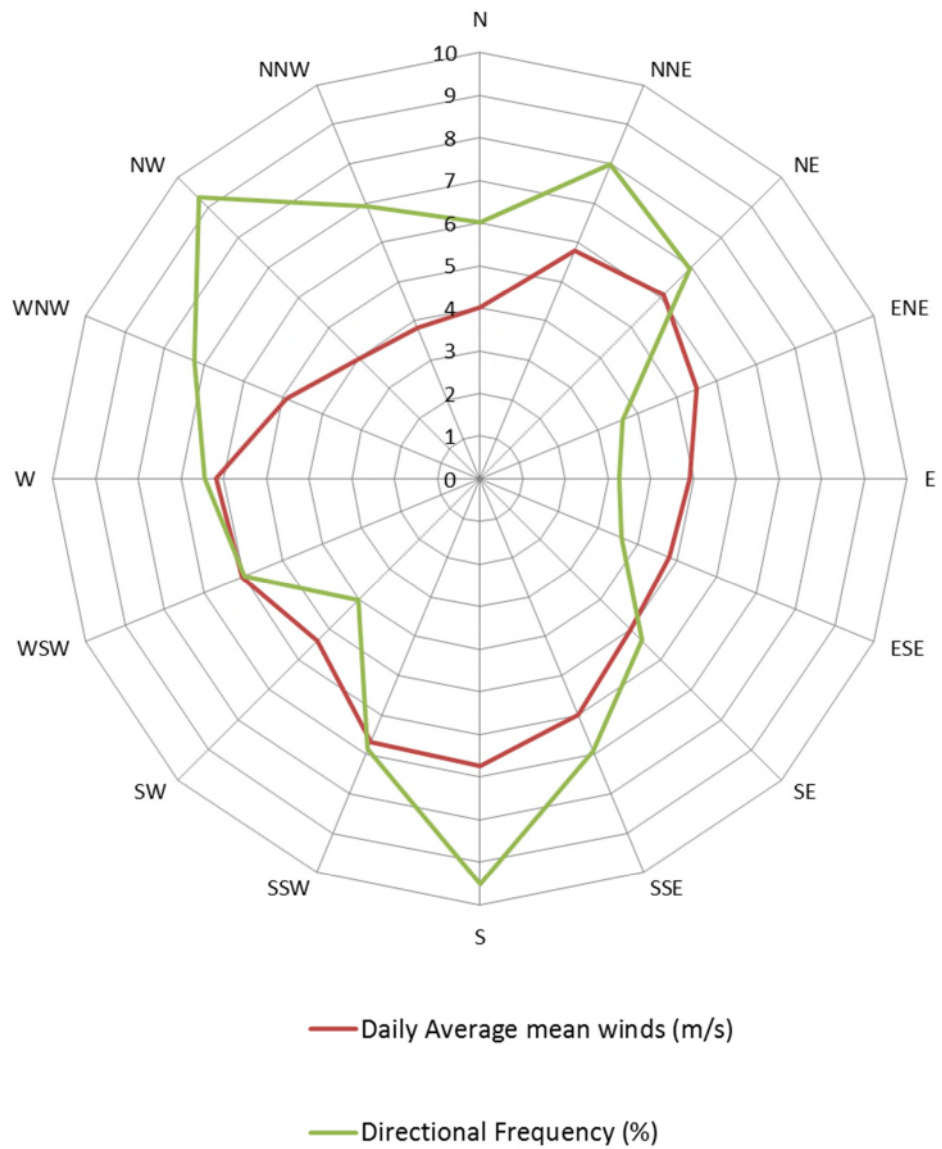


Figure 2a: Daily Average Hourly Mean Wind Speeds, and Frequencies of Occurrence, for the Sydney Region (based on observations from Kingsford Smith Airport from 1995 to 2016, corrected to open terrain at 10m)

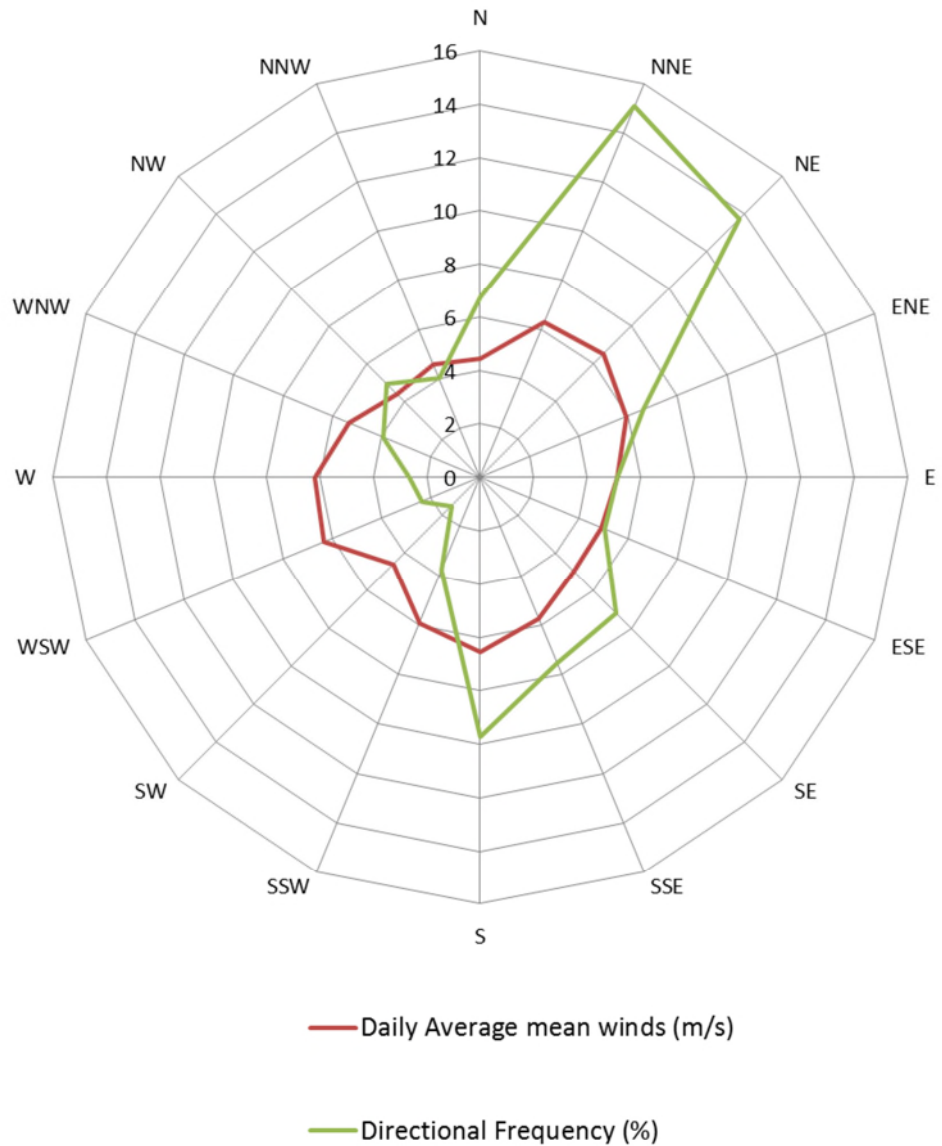


Figure 2b: Daily Average Hourly Mean Wind Speeds, and Frequencies of Occurrence, for the Sydney Region for Outdoor Temperatures between 20-29.5°C (based on observations from Kingsford Smith Airport from 1995 to 2016, corrected to open terrain at 10m)

3 NATURAL CROSS VENTILATION ASSESSMENT

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. To achieve adequate natural ventilation, the building design must address the orientation of the building, the layout of the internal space and external building envelope.

Natural cross ventilation is a product of air flow between dual openings on aspects located in significantly different pressure regions. This is typically achieved through building design with openings in dual aspects in a "cross-through" configuration where the openings are located on directly opposite aspects or "corner" configuration where the openings are located on typically orthogonal aspects.

The pressure driven air flow through the internal space travels from the opening on the more positively pressurised aspect; typically the windward aspect that is exposed to the prevailing wind to the neutral or negatively pressurised aspect on the opposite leeward aspect in a "cross-through" configuration or the orthogonal sideward aspect in a "corner" configuration.

The predominant wind directions for the Sydney region has been analysed in Section 2 of this report, and from this analysis only the north-easterly and southerly winds should be considered as contributors to natural ventilation for occupant comfort purposes, since these are the predominant wind directions during the warmer months of the year. The westerly winds are predominant during the cooler winter months and would be beneficial for air quality purposes only.

An analysis of the natural cross ventilation characteristics of the various Shared PAA/Presentation and Open Plan Areas A to C will be undertaken taking into account the interaction between the prevailing wind directions for the Sydney Region and the building morphology of the abovementioned internal spaces.

4 RESULTS AND DISCUSSION

The results of the assessment of the natural cross-ventilation characteristics of the various Shared PAA/Presentation and Open Plan Areas A to C are discussed in the following sub-sections as follows:

4.1 Shared PAA

The results of the assessment indicate the Shared PAA spaces within Blocks P and Q on all levels have the potential to generate adequate natural cross ventilation airflow through the internal space from the opening along the northern aspect and exiting through the opening on the western aspect into the Learning Street. This is due to the significant pressure differences at the openings where the northern opening being more positively pressurised due to its exposure to the prevailing north-easterly winds from the covered walkway, and the western opening to the Learning Street to be more neutral or negatively pressurised due to the sideward orientation to the prevailing north-easterly winds that can be exhausted out through the louvers/doors at the opposite end of the Learning Street.

Note that a mechanical assisted ventilation system is also proposed within the Shared PAA space. The mechanical assisted ventilation system is expected to be effective in driving airflow through the internal space on days when the air movement is still and hot; such as when the access doors into the Learning Street from the Shared PAA space is closed, as it can provide a neutral or more negatively pressurised opening to generate the pressure driven airflow, or alternatively mechanically induced the air flow through the internal space.

Hence the mechanical assisted ventilation system is recommended to be retained and the natural cross ventilation and mechanical assisted ventilation flow paths through the Shared PAA spaces are indicated on a typical floorplan layout in Figure 3.

4.2 Shared Presentation

The various Shared Presentation spaces on all levels of Blocks P and Q has openings in the form of access doors into the Learning Street. The Learning Street has openings to the outdoor environment in the forms of louvers and doors at each end of the Learning Street. The Shared Presentation Space as such will be borrowing ventilation from the Learning Street that may be adequate depending on the intensity of the prevailing winds. It should be noted that a mechanical assisted ventilation system is also proposed within the Shared Presentation space and appropriate airflow through the Shared Presentation spaces will be possible as it can be mechanically induced by the ventilation system.

Hence the mechanical assisted ventilation system is recommended to be retained and the mechanical assisted ventilation flow paths through the Shared Presentation spaces are indicated on a typical floorplan layout in Figure 3.

4.3 Open Plan Area A

The results of the assessment indicate the Open Plan Area A spaces within Blocks P and Q on all levels have the potential to generate natural cross ventilation airflow through the internal space. A review of the architectural drawing indicates there are openings in the form of windows or doors proposed along both ends of the eastern aspect into the Learning Street, the south-eastern aspect onto the passive outdoor area and the south-western to western aspects of the external building façade.

Although the various proposed openings can be used to generate natural cross-ventilation airflow through the internal space, depending on the combination of dual openings, the potential airflow generated may be impeded or capable of only service a small area of the internal space. Thus, optimal cross ventilation airflow with the potential to service the majority of the internal space can be generated via the following openings along the Open Plan Area A façade; summarised below and indicated in Figure 3:

- The proposed openings located near the southern corner of the south-western aspect; adjacent to the Passive Outdoor Area A.
- The proposed openings located on the south-eastern aspect facing onto Passive Outdoor Area B.
- The proposed openings located near the northern corner of the north-western aspect; adjacent to the covered walkway.

The combination of the above-mentioned openings can generate the natural cross-ventilation airflow through the majority of the internal space as the opening on the south-western aspect will be more positively pressurised due to its direct exposure to the prevailing southerly winds and the opening on the opposite end is expected to be more neutral or negatively pressurised as the opening will be on a side to leeward orientation to the prevailing southerly wind.

The remaining proposed openings on the external building façade are recommended to be fixed so as to not reduce the effectiveness of the pressure driven airflow generated by the above-mentioned openings servicing the internal space.

Furthermore it should be noted that closing the openings to the Learning Street will not affect the ability of Open Plan Area A from achieving good natural cross ventilation as the abovementioned design does not rely on these openings to generate pressure driven airflow through the internal space.

4.4 Open Plan Area B

The results of the assessment indicate the Open Plan Area B spaces within Blocks P and Q on all levels have the potential to generate natural cross ventilation airflow through the internal space. A review of the architectural drawing indicates there are openings in the form of windows or doors proposed along the north-eastern and north-western aspects into the Learning Street, the south-eastern to south-western aspects onto the passive outdoor area and the south-eastern to south-western aspects of the external building façade.

Although the various proposed openings can be used to generate natural cross-ventilation airflow through the internal space, depending on the combination of dual openings, the potential airflow generated may be impeded or capable of only service a small area of the internal space. Thus, optimal cross ventilation airflow with the potential to service the majority of the internal space can be generated via the following openings along the Open Plan Area B façade; summarised below and indicated in Figure 3:

- The proposed openings located near the western corner of the south-western aspect; adjacent to the Passive Outdoor Area A.
- The proposed openings located on the north-eastern aspect facing onto Passive Outdoor Area B.
- The proposed openings located near the eastern corner of the south-eastern aspect; adjacent to the Passive Outdoor Area B.

The combination of the above-mentioned openings can generate the natural cross-ventilation airflow through the majority of the internal space as the opening on the south-western aspect will be more positively pressurised due to its direct exposure to the prevailing southerly winds and the openings on the opposite end is expected to be more neutral or negatively pressurised as the opening is within recessed zone and on a leeward orientation to the prevailing southerly wind.

The remaining proposed openings on the external building façade are recommended to be fixed so as to not reduce the effectiveness of the pressure driven airflow generated by the above-mentioned openings servicing the internal space.

Furthermore it should be noted that closing the openings to the Learning Street will not affect the ability of Open Plan Area B from achieving good natural cross ventilation as the abovementioned design does not rely on these openings to generate pressure driven airflow through the internal space.

4.5 Open Plan Area C

The results of the assessment indicate the Open Plan Area C spaces within Blocks P and Q on all levels have the potential to generate natural cross ventilation airflow through the internal space. A review of the architectural drawing indicates there are openings in the form of windows or doors proposed along the western aspect into the Learning Street, the south-western aspect onto the passive outdoor area and the south-eastern to north-eastern aspects of the external building façade.

Although the various proposed openings can be used to generate natural cross-ventilation airflow through the internal space, depending on the combination of dual openings, the potential airflow generated may be impeded or capable of only service a small area of the internal space. Thus, optimal cross ventilation airflow with the potential to service the majority of the internal space can be generated via the following openings along the Open Plan Area C façade; summarised below and indicated in Figure 3:






- The proposed openings located on the south-western aspect facing onto Passive Outdoor Area B.
- The proposed openings located near the southern corner of the south-eastern aspect; adjacent to the Passive Outdoor Area B.
- The proposed openings located near the northern corner of the north-eastern aspect; adjacent to the covered walkway.

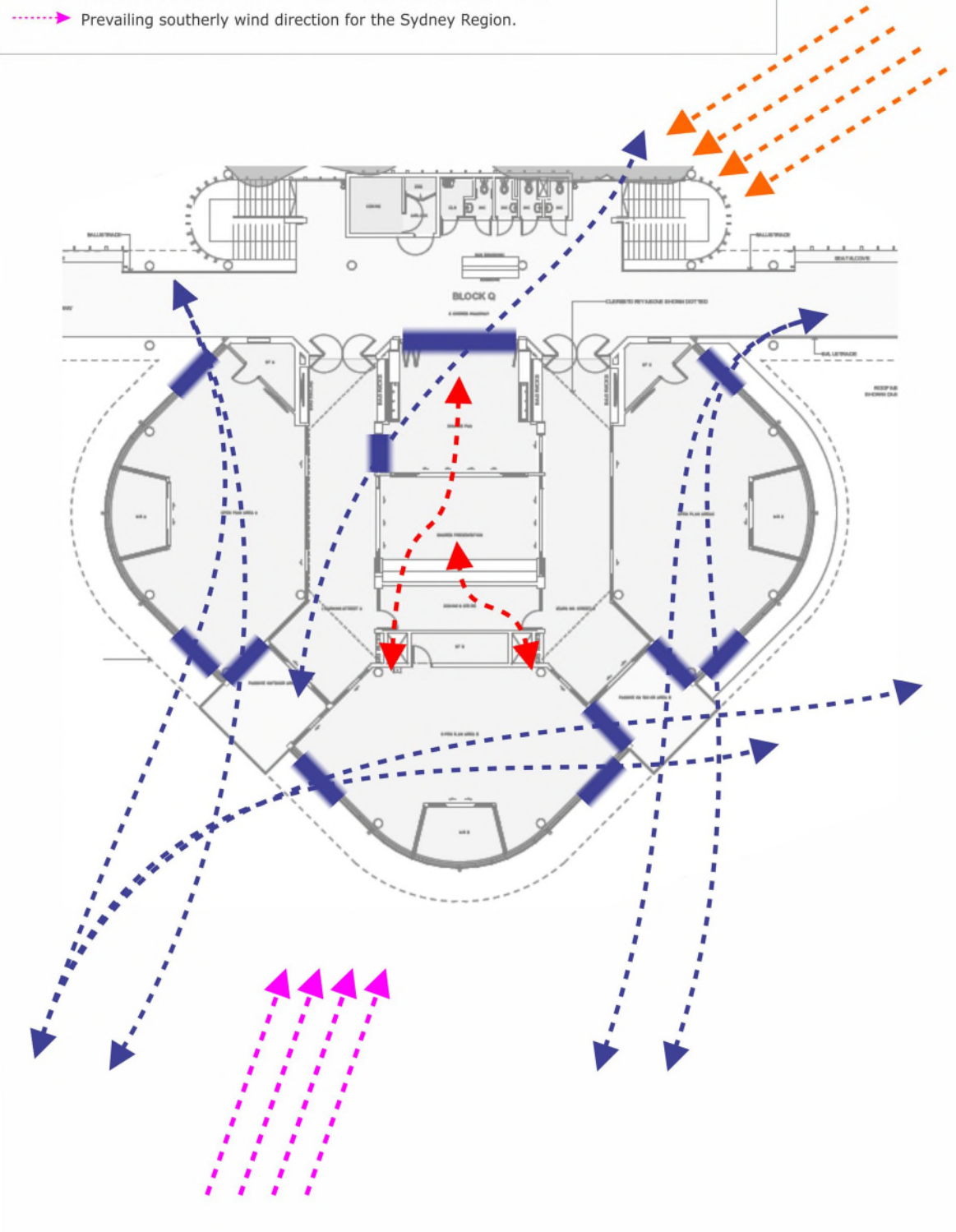
The combination of the above-mentioned openings can generate the natural cross-ventilation airflow through the majority of the internal space as the opening on the south-western aspect facing Passive Outdoor Area B will be more positively pressurised due to its direct exposure to the prevailing southerly winds as it side-stream along the south-eastern building façade, and the opening on the opposite end is expected to be more neutral or negatively pressurised will be on a leeward orientation to the prevailing southerly wind.

The remaining proposed openings on the external building façade are recommended to be fixed so as to not reduce the effectiveness of the pressure driven airflow generated by the above-mentioned openings servicing the internal space.

Furthermore it should be noted that closing the openings to the Learning Street will not affect the ability of Open Plan Area C from achieving good natural cross ventilation as the abovementioned design does not rely on these openings to generate pressure driven airflow through the internal space.

Legend

-  Openings in the facade in the form of windows, doors etc.
-  Natural cross ventilation flow path through the internal space.
-  Mechanically assisted ventilation flow path through the internal space on days when air movement is still and hot.
-  Prevailing north-easterly wind direction for the Sydney Region.
-  Prevailing southerly wind direction for the Sydney Region.



**Figure 3: Natural Cross & Mechanically Assisted Ventilation Flow Paths
Typical Floorplan Layout**