



Design Guide Note

DGN001 – Natural Ventilation Requirements

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Overview

The purpose of this Design Guidance Note is to record and communicate the minimum natural ventilation openings and outdoor air quantity used in air conditioning systems

The intended audience for this Design Guidance Note is SINSW engaged architectural and services consultants with a view of ensuring good quality ventilation in both natural ventilation mode and in air conditioning mode.

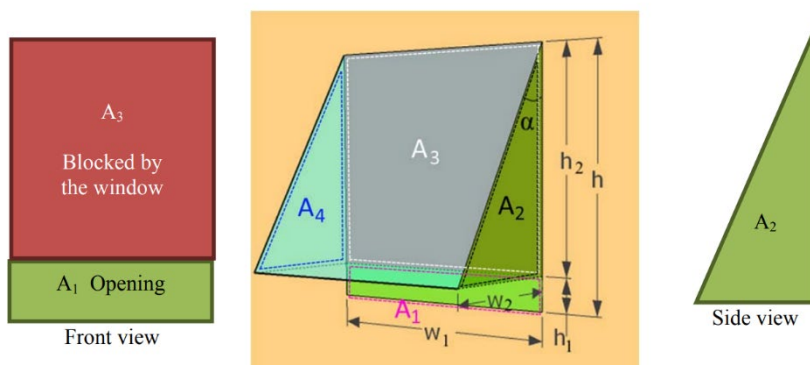
This Design Guidance Note is intended as a guideline only and it is considered that project specific circumstances will require these principles to be reviewed by each project team to confirm appropriateness.

Design Guide Note - Proposed Change

01. Natural Ventilation Opening

- The area of natural ventilation opening must a minimum of 6.25% of the floor area.
- It is noted that a performance solution may be achievable in line with the Professor de Dear study, however this cannot be relied upon.
- For this Design Guidance Note, the opening area must be measured as the cross-sectional area for the airflow path. For windows that have opening restrictions for safety reasons, then the opening area is the cross-sectional area when air flow through, and not the glazed area. NCC is not clear how the area of natural ventilation opening is calculated for awning type windows (most common type of windows in new schools). NCC method of calculation for the awning window ventilation area is questionable and challenged in the industry. See image below.

Image 01: Awning window dimensions and opening areas



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- In the case of louvres that are used for ventilation, the opening area must be nett of the louvre blades, frames and other operating components
 - For openings fitted with flyscreens, safety mesh and/or other safety elements, the open area must be nett of those elements
 - The location and distribution of the openings should be as even as possible and practically permissible, taking other design aspects into consideration

02. Minimum Outdoor Air Quantity

- As all General Learning Spaces are provided with air conditioning to handle extreme hot and cold weather days with windows being closed, the air conditioning system must be provided with a positively delivered outdoor air component.
- The minimum outdoor air quantity must be 10 l/s per person, for the whole population of the GLS.
- This minimum quantity must be maintained at all times of air conditioning operation for its population.
- The design quantity cannot be reduced for any filtration efficiency that may be allowed in other standards.

03. Other considerations

- Any other considerations that may arise due to unique circumstances must be brought to the attention of the SINSW protect team and project governance structure before any decision can be made.

The Design Guide Note provides the details of the proposed changes to Education Facilities Standards and Guidelines (EFSG) and/or design guidance for technical and project teams. If your projects are unable to meet these parameters, then please reach out to the Design and Infrastructure Standards (DaIS) team to assist. The DaIS team can help navigate achievable outcomes whilst informing ongoing development of SINSW projects.

Background

With the current COVID-19 pandemic, it has been recognized that well ventilated spaces are essential to minimize indoor transmissions. This is of particular importance to school environments.

With the opening of NSW and return to normal operations in NSW schools from late 2021, SINSW have commissioned several studies to ascertain parameters that would ensure General Learning Spaces (GLS) in schools are well ventilated and meet international and local standards.

One of the most relevant documents is the World Health Organization (WHO) “Roadmap to improve and ensure good indoor ventilation in the context of COVID-19” which recommended a minimum outdoor air flow rate of 10 l/s per person and strategy options of natural ventilation and mechanical ventilation.

Based on this, SINSW commissioned Steensen Varming to undertake a desktop study of typical GLS ventilation openings (windows, 5% of the floor area) compliant with NCC requirements based on standard GLS layout (65m² at 2.7 m ceiling height), and population (26 people), to ascertain whether typical GLS design compliant with local regulations will perform to the WHO recommendations. This study indicated that to be the case, the Steensen Varming report was also peer reviewed and supported by Arup.

After the desktop study, a further detailed research and study was commissioned to be undertaken by Professor Richard de Dear, Director, Indoor Environmental Quality Laboratory, The University of Sydney, to verify the Steensen Varming report.

Below in italics is a paraphrased extraction from the executive summary from the report provided by Professor de Dear.

The team of Professor de Dear conducted a mixed-method research program during January 2022, including a desktop review of classroom IAQ research literature, technical guidelines, and standards from different jurisdictions around the world. The second research activity comprised a statistical analysis of a database of continuous CO₂ data collected by SINSW in a large sample of occupied classrooms from October through December 2021. The third research activity consisted of 30 rigorously controlled ventilation studies in a sample of 10 different SINSW classrooms located in 5 different schools. Again, the findings were benchmarked against the CO₂ goal recommended to SINSW by Steensen Varming. The fourth and final research activity consisted of full-scale single-sided natural ventilation experiments using tracer gas techniques to derive two key ventilation metrics, namely air change rate and age of air. These metrics were benchmarked against the target proposed by Steensen Varming in order to achieve the

WHO Roadmap indoor air quality goal of 10 L/s per person for 26 occupants in a typical NSW classroom of 65 m² x 2.7 m height.

Taken together, the results of these controlled field studies reinforce the point that Steensen Varming's prescription of 5% window opening free area, if strictly applied, can meet the WHO Roadmap's IAQ targets in most cases, adverse meteorological conditions notwithstanding.

The tracer gas experiments in two test classrooms further validated the field study finding that the National Construction Code (2019) natural ventilation prescription of 5% window free opening area can meet the WHO Roadmap's recommendation (2021) of 10 L/s per person, even when wind speed and direction are less than ideal for the classroom's orientation.

Notwithstanding, AS1668.4 requires 6.25% of floor area as natural ventilation opening for classrooms (students under 16 years old). The practical application in a school is this applies to all classrooms. This is required as per the table below with a requirement of 5% with a factor of 1.25% for Students under 16 (practically all students)

AS 1668.4—2012

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TABLE 3.1
PERCENTAGE FLOOR AREA REQUIRED AS OPENINGS

Use of enclosure	Average adjusted metabolic rate watts/occupant	Net floor area per occupant, m ² (use highest applicable value)			
		<2	2 to 5	Over 5 up to 15	>15
Low activity	Up to 160	7.5%	5%	5%	2.5%
Medium activity	161–200	7.5%	5%	5%	2.5%
High activity	201–340	10%	7.5%	5%	5%
Very high activity	Over 341	15%	10%	7.5%	5%
Class 1 Class 2 Class 4	Any	5%			
Classroom (students under 16 years old)	Any	Multiply the percentage floor area required by 1.25			

This Design Guidance Note therefore has been prepared to clearly stipulate the requirement of the above ventilation requirements.