

Indoor Air Quality and Thermal Comfort

This overview provides a summary of the new Indoor Air Quality and Thermal Comfort (IAQ&TC) guideline (version 1.0, September 2017). It replaces the Ministry's 2007 guidelines: Indoor Air Quality, and Heating and Insulation. This overview summarises areas that are covered in the IAQ&TC guideline, mandatory requirements, recommended outcomes, and some key design concepts.



The IAQ&TC guideline is written for architects, designers and engineers involved in the design and specification of the Ministry's school buildings. It should be used for new builds, redevelopments and building upgrades to address indoor air quality and thermal comfort. It addresses four key outcomes:

- Indoor air quality (CO₂ and other pollutants).
- Ventilation design (passive and mechanical).
- Indoor thermal comfort.
- The ability for users to control their environment.

The guide highlights mandatory requirements and those that are highly recommended.

Mandatory requirements and key information are in RED (look for the ⚠ symbol).

Ministry recommendations and other key concepts are in BLUE (look for the ✓ symbol).

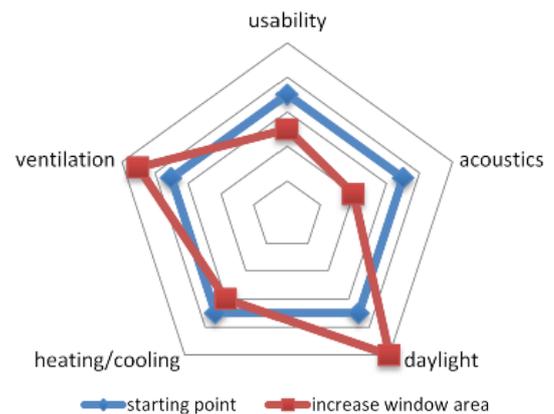
Summary of mandatory requirements

- CO₂ levels in occupied spaces should average 1000-1500 parts per million. Specialist spaces require specific ventilation design.
- Temperature levels in learning spaces are to be maintained between 18-25 °C, with limited time that temperatures above this range are allowed in summer months.
- Local control for users to see and manage CO₂ and/or temperature levels, using display panels central to each learning space.
- Design and specification should be appropriate for the local climate zone.
- Life cycle cost analysis for heating, ventilation and cooling system is to be carried out for projects over 300m² or greater than three teaching space equivalents, whichever is less.

Integrated design: taking a holistic approach

Taking an holistic and integrated approach to building design is the guiding principle of the IAQ&TC guidelines. The different design attributes can greatly influence acoustics, ventilation, daylight, heating and cooling, and most importantly building usability.

Changes to one design aspect can impact other areas. An integrated approach aims to acknowledge the relationship between the various areas, to get the balance right for each learning space.



It is important for multi-disciplinary design teams to 'workshop' solutions and options together, using the concept of 'everyone, everything, early'.

Good passive design principles

Passive design aims to draw on the local environmental conditions to naturally manage temperature, light and air quality in a building. Buildings with a high degree of passive design tend to be healthier and more pleasant to be in.

Passive design seeks to minimise a building's energy use, taking advantage of the local environment and climate, to enhance a building's condition and performance.

Passive design principles also align with the Ministry's focus on developing innovative learning environments and use of flexible learning spaces. The guideline discusses in depth those key building features that can improve passive design and usability.

Building proportion and orientation

The ratio of ceiling height to building depth is important for indoor air quality and thermal comfort. With well considered building proportions, better ventilation and heating/cooling can be achieved, along with other benefits such as acoustics and usability.

Subject to the site, an ideal building orientation for most of the country is $\pm 30^\circ$ of north. This orientation can minimise shading, glare and solar gain issues.

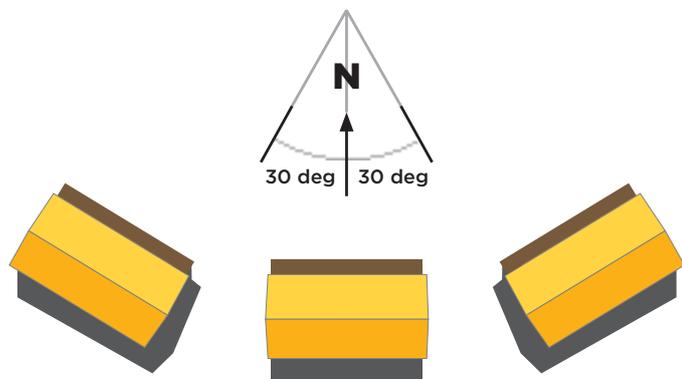
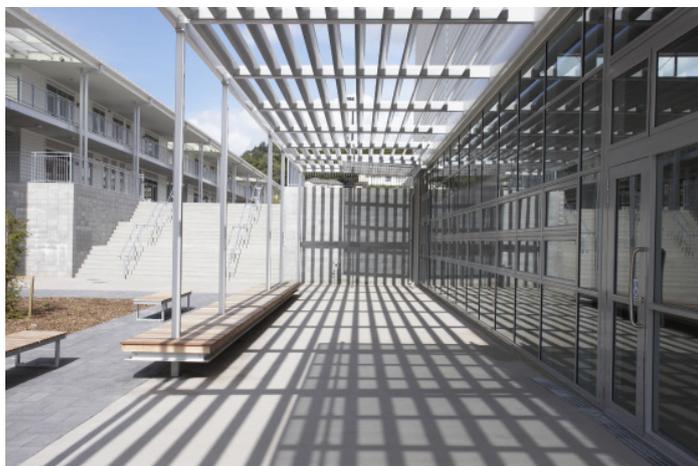


Diagram showing building orientation with shading.

Passive cooling strategies

In modern buildings, overheating from solar gain can be an issue. Window to wall ratio and glazing type can assist in managing thermal comfort. Including passive cooling options such as ventilation, shading and covered walkways can assist in maintaining a building's air quality and thermal comfort.



An example of shading to minimise solar gain.

Thermal mass in building components

Building components of high thermal mass can absorb heat during peak temperatures and offer passive cooling. In winter, thermal mass can absorb solar energy and distribute the retained heat through the building for warmth. If considering the inclusion of thermal mass, designers must refer to the Ministry's Structural and Geotechnical Guidelines for school buildings.

Natural ventilation

Window layout and design is another design feature that should be carefully considered. This guideline explains the various natural or passive ventilation options that can be selected.



An example of design that supports natural ventilation, using sliding doors and opening windows.

Well insulated buildings

Well insulated buildings that address the tradeoff between winter heat retention and summer heat loss is an important concept. Design should also address areas where thermal bridging could occur.

What else is covered in the guide?

The IAQ&TC guideline recognises that mechanical systems may be necessary for some designs. Mechanical system design should align with the Ministry's requirements. The guideline provides designers with information that may assist in the selection of heating and cooling options.

The guideline also assists designers to achieve good design outcomes by discussing different building components and the requirements of learning spaces, including:

- The thermal performance of different building materials.
- A section on specialist spaces, such as gymnasiums, libraries, music facilities, science and technology spaces, server rooms and toilets.
- Options for passive and active heating, cooling and ventilation.
- Life cycle cost considerations for selection of heating, ventilation and air conditioning systems. It includes their suitability for selection according to the school's climate and site.
- The importance of safety in design process as an integral part of any design process.

This is a brief overview of the Indoor Air Quality and Thermal Comfort guideline (version 1.0, September 2017). For all requirements please refer to the full version on the Ministry's website.

The Ministry has an in-depth range of design documents. To become familiar with all Ministry design processes, standards and guidelines, refer to the property section on the Ministry's website.