# Home comforts

Designing a home with a comfortable indoor environment can be complex, requiring environmental factors to be considered together, not in isolation. Individual comfort levels also vary, adding to the task.

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**NEW ZEALANDERS** spend over 80% of their time indoors, so the quality of the built environment has a substantial impact on our health and wellbeing. While it can be straightforward to design a building that performs well under external environmental conditions such as wind, rain and sun, designing an adequate indoor environment can be quite complex.

### *Many factors influence indoor environmental quality*

Interlinking factors such as thermal comfort, acoustics, lighting, airflow and air quality are crucial parameters in defining the performance of a building and its effect on the occupant. These factors are often grouped together under the general term of indoor environmental quality (IEQ).

Overseas research indicates that the relationship between IEQ and wellbeing can be quite complex and often depends on the individual preferences of the occupant. In severe cases, inadequate IEQ has been linked to mental and physical ill health.

Sometimes these issues go unnoticed in the short term but can lead to

major long-term problems such as cardiovascular diseases and asthma-related issues. Major health issues are often identified as sick building syndrome with many contributing factors, the majority relating to IEQ.

At the other end of the spectrum, effects range from lost productivity to a general feeling of discomfort brought about by the indoor conditions. This could be due to glare or overheating from poorly placed windows and inadequate solar shading or conversely due to not enough natural light, flickering internal lights or poor ventilation.

### *Design must consider all parameters*

When designing a comfortable indoor environment, it is important to consider a wide range of parameters together, including the building's purpose and occupancy.

Addressing each IEQ component in isolation often fixes one issue at the expense of creating another one. A common example can be seen in kitchen rangehoods. While the IEQ issue of pollutants and moisture generated from cooking is addressed through extract ventilation, it can be replaced with an acoustic issue when an overly noisy fan is used to provide the extract.

### *People have varying comfort levels*

To further complicate matters, what is considered comfortable for each IEQ factor varies for different occupants, influenced by gender, age, physiological adaption and repeated exposure.

This makes it difficult to design an indoor environment to suit everyone's comfort levels. For example, what one person considers to be a comfortable indoor temperature may be considered too hot or cold by another.

This is acknowledged in NZS 4303:1990 *Ventilation for acceptable indoor air quality*. For indoor air quality, it states that 'a substantial majority - 80% or more - of people should not express dissatisfaction'.

### *Thermal comfort is critical*

The most noticeable and easily defined IEQ parameter is thermal comfort. Being too hot or too cold will lead to occupant dissatisfaction, but even a moderate temperature can be uncomfortable. The World Health Organization states that a temperature range of 18–24°C for healthy, sedentary people has no demonstrable health risk. For some vulnerable groups, a minimum of 20°C is recommended.

This guideline assumes appropriate clothing, insulation, humidity, radiant temperature, air movement and stable physiology. There are many ways to achieve these assumed factors, and some of them can have a huge influence on the perceived thermal comfort of an occupant.

Thermal comfort is dependent on the radiant temperature of surrounding surfaces, humidity, air velocity, air temperature, clothing and activity levels. The first four can all be designed for.

### *Well designed ventilation can improve thermal comfort*

As with the rangehood example, we must be careful we're not fixing one issue by creating another. The relationship between humidity and thermal comfort is a good example. A warm room with high relative humidity often feels clammy and uncomfortable compared to a similarly warm room with dry air.

To improve comfort levels, moisture can be removed from the air, generally through ventilation. This also has the added benefit of helping to remove airborne pollutants and odours while reducing mould risk from high moisture levels.

However, a poorly designed ventilation system can create excessive air movement or draughts. This is largely undesirable since air movement removes moisture and heat from the body, which can make people feel colder than in a room at the same temperature with no draught - the same principle as wind chill factor when outside.

In this case, by fixing the issue of overly damp air through ventilation, a thermally uncomfortable environment has been created, trading one IEQ issue for another.

### *Uniform conditions, thermal bridges and glazing*

A comfortable indoor environment should have uniform temperature and airflow conditions throughout the entire living space. Crucially, this includes the surface temperature of walls, floors, ceilings and furnishings as the radiant heat these provide also influences the perceived thermal comfort.

Avoiding thermal bridges such as around window frames and at wall, ceiling and floor junctions helps maintain uniform surface temperatures inside, improving the thermal comfort in the living space.

Extensive glazing is often utilised to provide efficient solar heating, but care must be taken to avoid undue reflection off light-coloured interior surfaces creating a glare. Good design is also needed to shade the summer sun, avoiding discomfort from overheating.

### *Some trade-off likely*

The many different aspects that contribute to a comfortable indoor environment are not easily treated in isolation, and thought must be given to avoiding unintended consequences.

Some level of trade-off is likely to be required when providing a comfortable indoor environment and balancing the different IEQ components.