LARGE BUILDING ENERGY EFFICIENCY

A large building has a floor area greater than 300 m² and is not a dwelling. Such structures have particular energy-efficiency requirements in the New Zealand Building Code.

By **David Cogan**, Consulting Engineer, Wellington

Energy efficiency for buildings was introduced as a purpose of the 1991 Building Act at a late stage of its development. It was given Clause H1 *Energy efficiency* in the Building Code but work on a full set of compliance documents was not undertaken until 1994–96. Much of the impetus for the work came from the Energy Efficiency and Conservation Authority. Today, the Acceptable Solution for large building energy efficiency is the standard NZS 4243: 1996 *Energy efficiency – large buildings*.

Each building is different

As buildings get larger, the ratio of floor-to-wall area increases, and the internal heat loads from lighting, people and equipment become significant. The largest buildings may be individually designed with special attention paid to their performance. Because each is different, the Standard for large building energy efficiency does not describe good practice; it merely prevents worst practice and encourages designers to do better.

The Standard can be applied to any large building, but is not mandatory for all of them. It concentrates on two aspects of building energy use: heat flow through the building envelope and artificial lighting. The heat flow requirements apply to large buildings with 'conditioned spaces' – that is, to buildings with heating, cooling or both. The lighting requirements apply principally to commercial and 'communal non-residential buildings' but may be used for other large buildings on a voluntary basis.

Thermal envelope requirements

The Standard needs to be flexible as it covers buildings with floor areas from 300 m^2 to tens of thousands of square metres. There are three ways of complying with its thermal envelope requirements. The simplest method is the 'schedule method', which places limits on the area of glazing and the thermal conductance of the other building surfaces. These vary depending on the climate zone that the building is in.

It is possible to deviate from the schedule method by using the 'calculation method'. A simple calculation is used to demonstrate that the overall thermal performance is no worse than if the schedule method were adhered to.

For quite different buildings, computer modelling can be used to calculate the thermal performance. Any good modelling tool is acceptable, providing it gives a reasonably accurate answer when modelling a standard building in the evaluation procedure used by the International Energy Agency's 'Building Energy Simulation Test and Diagnostic Method' – known as BESTEST.

The modelling method uses a comparative procedure to set a limit on building energy use. Two buildings of the same size on the same site are modelled using the same modelling tool. One is the building as proposed. The other, the reference building, is a building that conforms to the requirements of the schedule method. The energy used by the proposed building must not exceed that used by the reference building. In an Appendix, NZS 4243 details the modelling requirements.

Lighting requirements

The Standard's requirement for artificial lighting is that the lighting power density – the watts per square metre of connected lighting load – may not exceed the appropriate limit, which depends on the use of the building. Standard limits are set for certain common building types, such as office buildings. For other building types, and for buildings with a mix of uses, it is possible to calculate the overall lighting power density limit by reference to the illuminance levels recommended by the lighting design standard.

Splitting the Standard

The lighting design Standard has recently changed from NZS 6703: 1984 *Code of practice for interior lighting design* to the AS/NZS 1680 *Interior lighting* series. The new Standard uses maintained illuminance, which is different from the service illuminance of the older Standard. To bring the lighting part of NZS 4243 up to date it was expedient to split the Standard into two parts. These were published in April this year.

NZS 4243 Part 1 contains the requirements for the building thermal envelope. Apart from clause renumbering and minor text changes the requirements are as in the 1996 edition.

Part 2 contains the requirements for lighting. The change in the referenced lighting design standard coupled with improvements in lamp technology result in some lighting power density limits being reduced. For example, the limit for office areas changes from 18 W/m^2 to 12 W/m^2. Apart from the changes to adapt to AS/NZS 1680, the main difference is an allowance for certain types of lighting controls.

The building envelope requirements need to be updated in the near future. An area of interest is the provision of daylight. Improved daylight will not affect the lighting power density, as daylight is not always available, but it can reduce the energy used for lighting. However, too much glazing can result in the building requiring more energy for both heating and cooling. Changed requirements arising from the current review of the whole Building Code are also likely to affect any revision.

Meanwhile, there is nothing stopping building designers from producing designs that use much less energy than those designed to meet the minimums in NZS 4243.