



# ATTACHED GARAGES AND THERMAL ENVELOPE DESIGN

**When developing the insulation scheme for a domestic building, designers need to carefully consider any weak spots in the thermal envelope. Attached garages are an area of significant heat loss, so how should they be dealt with?**

By **Trevor Pringle**, BRANZ Principal Writer

**D**omestic buildings are now required to be insulated to higher levels than in the past. This has meant more thought needs to go into dealing with weak spots in the thermal envelope where there can be significant heat loss.

## What is the thermal envelope?

The New Zealand Building Code Clause H1.3.1 says that the thermal envelope of a building must be constructed to:

- provide adequate thermal resistance
- limit uncontrollable airflow.

The definition for 'building thermal envelope' given in NZS 4218:2004 *Energy efficiency – Small building envelope* and NZS 4243.1:2007 *Energy efficiency – Large buildings – Building thermal envelope* is 'the roof, wall, glazing and the floor construction, between unconditioned external spaces and conditioned spaces, enclosing all habitable spaces, bathrooms, kitchens and other rooms in the building likely to require conditioning'.

A conditioned space is defined by the standard as 'that part of the building within the building thermal envelope, including habitable spaces, that may be directly or indirectly heated or cooled for occupant comfort'.

## Garage often within thermal envelope

Until recently, it has been common for an attached garage to be included (often by default) within the thermal envelope of the building. The walls of the garage were required to be insulated (although it was often forgotten), but the walls and/or ceiling between the garage



Large metal garage doors can be a significant source of heat loss and air leakage when the garage is included within the thermal envelope of the building.

and the habitable spaces were not. The thermal performance of the garage door, and the air leakage around it, were not considered part of the overall thermal performance requirements.

## H1 has changed things

The third edition of Building Code Clause H1 requires door openings over 3 m<sup>2</sup> in area within the thermal envelope to be insulated to the same level as the adjacent wall area (see H1/AS1, Table 4). This means they must have a thermal resistance, or R-value, that is the same as the wall. Also, H1/AS1 paragraph 3.0.1 requires those doors to be constructed so they

can be fixed in the closed position to restrict excessive airflow.

So, decide whether to include or exclude any attached garage from the thermal envelope.

## Hard to include the garage

Although solid walls of a garage can be insulated, the biggest effect on the thermal performance is from the garage door itself. Typically, garage doors are a metal skin over a metal frame, which gives a thermal performance or R-value (using NZS 4214) for the door of approximately R0.12. Cladding a door with 12 mm cedar will still only give an R-value of R0.21. →

This low R-value over a significant portion of the wall area (typically around one-third of the external wall area of a garage) combined with the natural air leakiness of most garage doors, means that a significant amount of heat loss is likely when the garage is incorporated into the thermal envelope. It is difficult to demonstrate H1 compliance and prove that the heat loss through and around the door have been overcome in the thermal design.

Garages are commonly included within the thermal envelope in North America, but there garages are often heated because of the winter temperatures, and walls and doors are designed to provide higher levels of thermal performance and lower air leakage. In New Zealand, however, garages are seldom heated.

### **Better to exclude the garage**

BRANZ believes it will be easier to show compliance with the requirements of H1 where

the garage space is excluded from the thermal envelope. When this is done, the potential heat loss through the door region is removed from the performance calculation.

Common walls, ceilings and floors between the garage and the adjacent conditioned spaces must be insulated to the same level as the other thermal envelope elements. This will restrict heat loss from the conditioned spaces into the garage and negate the significant effect of the heat loss and air leakage through the garage door.

Designers need to clearly state in their consent application that the garage has been excluded from the thermal envelope and, therefore, from H1 compliance.

### **Still insulate garages outside envelope**

BRANZ recommends designers specify insulation to garage walls and ceilings, even when it's not included in the thermal envelope. ◀

## **Conservatories similar**

Attaching a conservatory to a building creates a similar situation to having an attached garage. While the heat generated within the conservatory can be a useful source of passive heating, the heat loss through the conservatory at night or in cold conditions can be significant.

To maximise insulation benefits, the conservatory must be isolated from the interior spaces by an insulated wall. This keeps the conservatory outside the thermal envelope. Double glazing is likely to be needed for glazed doors and windows between the conservatory and the adjacent conditioned space. ◀