DESIGN RIGHT

Garages and insulation

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THE BRANZ HELPLINE REGULARLY GETS ASKED WHETHER TO INCLUDE GARAGES IN A BUILDING'S THERMAL ENVELOPE AND WHICH PARTS SHOULD BE INSULATED. EACH SITUATION IS DIFFERENT, BUT TO HELP ANSWER THESE QUESTIONS, BRANZ HAS CARRIED OUT SOME THERMAL MODELLING.

THREE COMMON QUESTIONS to the BRANZ helpline around the design and insulation of attached garages are:

- Does a framed dividing wall between the conditioned spaces of a house and the unconditioned space of the garage require insulation, and does steel framing need a thermal break?
- What are the benefits of an insulated garage door?
- Is insulating the garage part of the floor slab worthwhile?

Data in model

To answer these questions, BRANZ modelled a typical 200 m² floor slab with a large attached double garage that shares the end and one side wall with the house (see Table 1). Modelling was done for both a single-storey house with a roof over the garage and a 2-storey house with a conditioned space above the garage.

The interior temperature of the house was set to 23ºC and the exterior temperature to 0ºC. The heat losses are therefore higher than would be expected in practice, but it is the relative difference in heat flow that is of interest.

Looking at various heat losses

The study investigated the:

- heat loss from two parts of the floor – the house and garage
- heat loss through the two dividing walls between house and garage
- heat loss through the garage door
- average surface temperature in the garage.

The results are summarised in Table 2.

Ordered in decreasing heat loss

In Tables 1 and 2, the models are ordered in decreasing combined heat loss from the house floor and the two internal walls between house and garage.

For model 1, there is no insulation of the slab or garage, whereas at the other extreme, model 7 has a fully insulated garage, including garage door and the two internal walls between garage and house.

For models 2 and 3 only, the internal walls between the garage and house are not insulated, so the thermal envelope for Building Code compliance includes the door and external walls of the garage.

For models 6 and 7 only, both the garage and the internal wall between garage and house are insulated, so the thermal envelope can include the garage.

Some findings

Comparing models 1 and 4 shows that insulating the slab under the house has minimal impact on the temperature of the garage but has the most significant impact on the heat loss of all of the possible insulation options.

Comparing modules 4 and 5 would suggest that, when the walls of the garage are not insulated, insulating the garage part of the floor slab has minimal additional impact or benefit.

Comparing models 2 with 3 and 6 with 7 suggests that insulating the garage door increases the temperature in the garage but does not significantly reduce the heat loss from the house. Not surprisingly, the increase in garage temperature is greater if the internal wall between garage and house is not insulated.

What does this mean?

Thermal break

Yes, in general, a framed dividing wall will require insulation and steel framing will require a thermal break because the garage door will not be particularly airtight, making the garage interior close to the exterior temperature – it won't be an insulated airspace.

Garage doors

Using an insulated garage door is one way to increase the temperature in the garage but it will not significantly reduce the heat loss from the house. Gains will only be made if the door is specifically designed to prevent wind entry.

Thermal envelope

Making the exterior walls, floor and ceiling part of the house's thermal envelope will typically reduce the ratio of total window to wall area and may allow either more window area for the house or avoid the Building Code requirement for double glazing.

Insulating the garage would be useful if the space is sometimes used as a temporary work area and may help protect sports equipment and other items stored in the garage.

Garage floor slab

Insulating the garage part of the floor slab probably only provides an advantage when the garage is also insulated and therefore part of the conditioned space.

Table 1

INSULATION AND HEAT LOSS MODELS

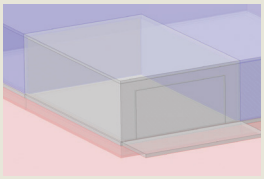
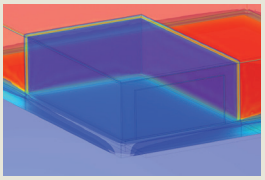
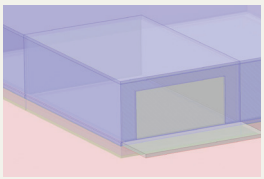
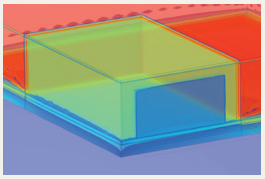
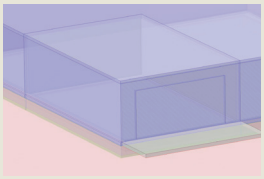
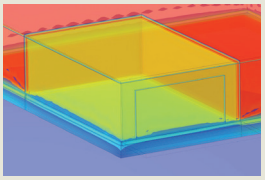
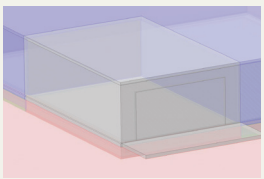
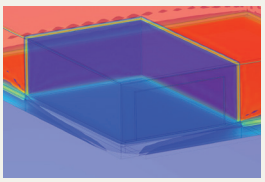
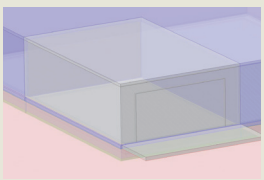
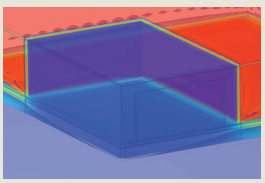
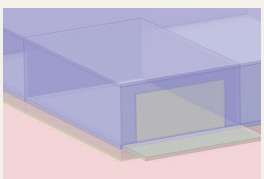
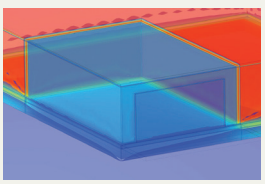
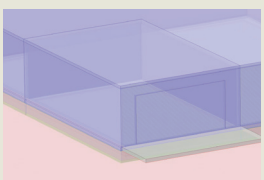
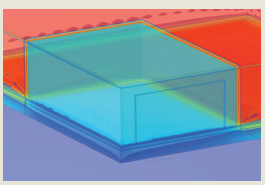
	INSULATION OPTIONS (PURPLE = INSULATION)		MODELS SHOWING TEMPERATURE (BLUE = COLD, RED = WARM)
MODEL 1	Uninsulated house slab, perimeter and garage. Insulated internal walls to garage.		
MODEL 2	Uninsulated internal walls to garage and garage door. Insulated house slab and perimeter, garage slab, perimeter, external walls and ceiling.		
MODEL 3	Uninsulated internal walls to garage. Insulated as in model 2 plus garage door.		
MODEL 4	Uninsulated garage slab, perimeter, external walls, ceiling and door. Insulated house slab, perimeter and internal walls to garage.		
MODEL 5	Uninsulated garage external walls, ceiling and door. Insulated as in model 4 plus garage slab and perimeter.		
MODEL 6	Uninsulated garage door. Insulated as in model 5 plus garage external walls and ceilings.		
MODEL 7	Everything insulated, including internal walls to garage and garage door.		

Table 2

HEAT LOSS MODELLING – SINGLE AND 2-STOREY

SINGLE-STOREY						2-STOREY					
HOUSE HEAT LOSS (W)			GARAGE HEAT LOSS (W)		GARAGE AVERAGE SURFACE TEMP	HOUSE HEAT LOSS (W)			GARAGE HEAT LOSS (W)		GARAGE AVERAGE SURFACE TEMP
INTERNAL WALL AND FLOOR	FLOOR	INTERNAL WALL	FLOOR	DOOR		INTERNAL WALL AND FLOOR	FLOOR	INTERNAL WALL	FLOOR	DOOR	
2550	2230	320	-180	150	4ºC	2570	2250	320	-230	100	3ºC
2200	1370	830	80	400	11ºC	2150	1370	780	80	410	11ºC
2010	1350	660	140	110	14ºC	1950	1350	600	150	110	14ºC
1780	1450	330	-120	130	4ºC	1800	1470	330	-170	90	2ºC
1810	1450	360	-140	80	2ºC	1770	1450	320	-140	80	2ºC
1720	1420	300	-70	180	5ºC	1670	1420	250	-70	190	5ºC
1670	1400	270	-20	60	7ºC	1620	1400	220	-20	60	7ºC

WARMEST GARAGE

BENEFIT IN INSULATING GARAGE AND INTERNAL WALLS