CONSTRUCTION DETAILS FOR COOL TEMPERATE CLIMATES

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With increased insulation levels, many in the building industry are overlooking or unaware of the importance in a cool temperate climate of the details dealt with in this pamphlet – cold bridging, reverse brick veneer walls, condensation, sealing construction gaps, edge insulation and "super" insulation.

It's the construction details that are the building blocks, the stock in trade of anyone designing or building a home. The whole of a building is obviously the sum of its parts – without details a coherent, graceful and functional whole cannot be created. The details in this pamphlet show how some architects have set about solving the particular problems posed by these issues. Hereby is the detail arrived at. The ultimate solution. Often it is a starting point for adaptation and development.

The art of building is largely an empirical art, which acquires refinement and maturity by a process of successive technical and aesthetic developments. Thanks are due to all the Builders, Architects, Designers and Householders who have given criticism, comment, and sketches for the development of the details in this pamphlet.
**Fig 1** SIX STAR REVERSE BRICK VENEER
Minimum total system R-values for 6-star dwellings in Climate Zone 7:
- **Roof/Ceiling:** R4.1/R4.6/R5.1
- **Walls:** R2.9
- **Floors:** R2.75

**Fig 2** SIX STAR REVERSE BRICK VENEER
The bricks are on the inside where they’re needed to store the heat, and the insulation is on the outside where it’s needed to keep the heat in. Some amount of materials, no extra cost, more comfortable house.

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**Roof/ceiling insulation**
- **Roof blanket over roof batters – 75 mm thick foil faced blanket.** 75 mm max depth when fixing roof through the blanket. Ensure blanket is pressed fully into corrugations to prevent condensation on 1/4 of iron. Blanket also dampens sound of roof movement. Shiny side to face down to still air space for an extra R0.50 of roof insulation.
- **Ceiling batts:** 50 mm thick wall batts.
- **Vapour barrier:** Foil on warm side acts as vapour barrier & its shiny side faces to cavity of still air provides an extra R0.6 insulation.
- **Total R-value of roof/ceiling system = R7.2**

**Brick detailing**
- For solid clay or concrete bricks, **brick on and mortar with recessed joint to ceiling.**
- **Reinforced brick lintel – longue bar or 3 x 20mm bars with 12g wire shims at each end and for spans to 1.000 m.**
- **Drill on edge** head, architraves and sill. Concrete slab on rigid insulation
- **Total R-value of floor system = R2.75**

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**COLD BRIDGING reduces R-values**
The cold bridge is a by-pass in the thermal insulation system along which heat can flow more readily than through the insulation. Once insulation levels get above R0.8 cold bridging reduces the effectiveness of insulation. Common sources are the structural bridge (Fig 5,6,7), the air bridge (Fig 8), the circulation bridge (Fig 9) and the compressed batt – where too large a batt in the space probably reduces its R-value by 20%.

*Source: H A Thesleff (FRANZ) in Thermal Insulation, May 1900.*
**Fig 3** "SUPER-INSULATED" REVERSE BRICK VENEER

With the bricks on the inside the heat they store interacts with the internal environment, not the outside weather. You let the climate do your heating and large heaters become unnecessary.

**Fig 4** "SUPER-INSULATED" REVERSE BRICK VENEER

Passive solar design of housing is the key to providing a sustainable lifestyle. A passive solar house has "thermal mass" on the inside. This gives you the marketing edge over standard housing.

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**Roof/ceiling insulation**

Same as Figs 1, 2 except 165 thick batts over rafters increases the R-value.

*R-value of roof/ceiling system = R8.2*

**Reverse brick veneer wall**

*External wall* of nom 70 x 30 studs inside (structural) and 70 x 30 battens outside, offset from nogging, to reduce the amount of cold bridging through the wall from 10% to less than 2%, improving the effective insulation value of the 0.2,1" High Performance batts (Fig. 6) Glazing such as fibro or ply finished with cement based paint such as "Murbond".

*Vapour barrier:* Foil on warm side acts as vapour barrier and if shiny side faces a cavity of still air it provides an extra R0.6 insulating space.

*Internal wall:* Solid brick with flush joints and face fixed wall ties. Solid brickwork weighs 550 - 630 kg/lin. m, so you need to have bearing checked by a structural engineer.

*Total R-value of wall system = R6.2*

**Fig 7** Structural Ridge

Projecting balcony floor slab.

**Fig 8** Air Ridge

Shrinkage or workmanship creates gaps around parts of the insulation.

**Fig 9** Circulation Ridge

Gaps of a few mm can set up convection currents resulting in a drop to about half the rated value. It probably won't drop much further.
SEALING CONSTRUCTION GAPS
A house usually has about half a tonne of air, which is replaced between one and six times an hour, depending how leaky it is. In cool temperate climates the new air must be heated to maintain indoor comfort. Obviously reducing the number of times per hour the air needs to be heated is going to reduce heating costs.

By paying careful attention to sealing gaps, filling sheeting, window & door seals and flue dampers as the house is being built it is possible to reduce this irritation rate to one or two air changes per hour. A healthy indoor environment is maintained, heat losses are reduced and large heaters become unnecessary.

Fig 10 Window & Door Head
Source: Nigel Page Architect, 2012

Wall construction
90 thick stud wall with 70 thick High Performance R2.1 batts with 20 spaces to wall facing 20 air space puts the vapour barrier on the warm side and provides an extra R0.6 insulation. Pack all tolerance and construction gaps with insulation cut-outs or fractured insulation.

Double glazing
A wood framed window or door with a 4/12/4 sealed unit has an approximate R-value of R0.7. If low-e glass is used then it’s R0.53. Framed are usually made of wood, plastic or aluminum. Metal frames act as a heat sink and considerably reduce the R-value of a window unless a thermal break is fitted in the frame.

Insulative air spaces
For an airspace to insulate it must be sealed to prevent air-flow. Felt or similar under the floor of dust in air spaces and must face the airspace, the side is unimportant.

Fig 11 Window & Door Sills
Source: Nigel Page Architect, 2012

CONденSATION
Water vapour is a component of air and is always present within a house. Varying with the season and the household’s domestic habits. In cool winter, vapour pressure is greatest indoors than outdoors and because most building materials are permeable the water vapour diffuses outdoors as surely as water flows down hill. As it moves through the wall it temperature drops and when the dew point is reached the water condenses into liquid water. In places with consistently cold weather, say a mean min winter temperature of 4°C or lower, this condensation can accumulate to the point of doing damage such as staining, rotting, corroding, and mildew growth. Some places with a mean min winter temperature 4°C or lower, this condensation can accumulate to the point of doing damage such as staining, rotting, corroding, and mildew growth. Some places with a mean min winter temperature 4°C or lower, this condensation can accumulate to the point of doing damage such as staining, rotting, corroding, and mildew growth.

Water vapour can be prevented from getting into the structure by placing a vapour barrier on the warm side of the walls. Floors and ceiling. A vapour barrier must keep a permeance of no more than 1 perm – aluminium foil is perfect. For it to be effective all punctures and holes must be sealed with tape. Getting continuity between ceiling, walls and floors can be difficult with some construction methods. Perhaps only a minor reduction can be achieved, so it becomes important when re-erupation occurs for the vapour to reach outdoors without further hindrance - that all layers on the cold side are permeable. Wet and soggy insulation loses its insulation value.

Further Information
Your Home is Australia's guide to environmentally sustainable house design and construction (400 pages). The 4th edition may be downloaded from www.yourhome.gov.au or purchased from Sustainable Living Tasmania.

This pamphlet, part of the Solar Kit for cool temperate climates, is produced by the Tasmanian branch of the Australian Solar Council, www.solar.org.au
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