PASSIVE SOLAR DESIGN

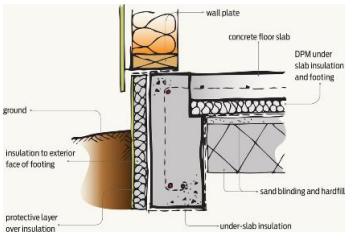
FOR NEW ZEALAND HOMES *# EXTRA INFO*

INFORMATION SHEET 4.1

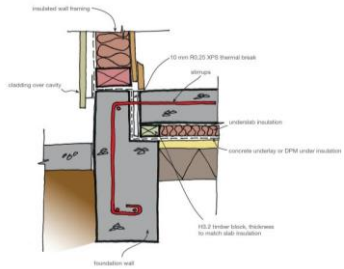
In passive solar building design, windows, walls, and floors are made to collect, store, and distribute solar energy in the form of heat in the winter and reject solar heat in the summer. This is called passive solar design because, unlike active solar heating systems, it does not involve the use of mechanical and electrical devices.

THE THERMAL ENVELOPE:

It is primordial to keep the thermal envelope continuous, to avoid any thermal bridges (Where the heat will escape). One of the key element of the thermal envelope would be to insulate the edge of your concrete slab.



Edge insulation: Solution 1



Edge insulation: Solution 2

No edge insulation: you're also heating your garden

Edge insulation is a key element for using the thermal mass of a concrete slab.

WINDOW DESIGN

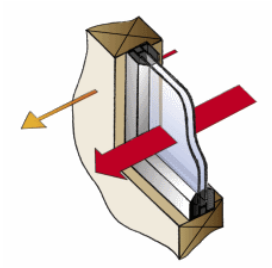
Windows are complex and interesting elements in the fabric of a home. They let in light and fresh air and offer views that connect interior living spaces with the outdoors. However, windows can be a major source of unwanted heat gain in summer and significant heat loss in winter.

It is important to note that optimum levels of glazing for solar houses are no larger in area than is normally found in New Zealand houses, all depend on the orientation and sizes:

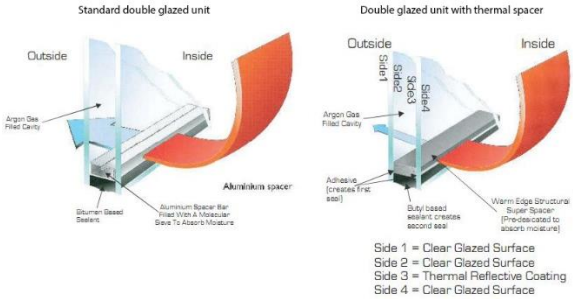
- Reasonably large areas of northern glazing (windows/skylights) are required to collect solar heat in winter. A maximum of 50% of the north facing wall should be glazed to avoid any overheat.
- West-facing windows can cause late afternoon overheating at any time of the year. They should be shaded on the outside of the home in summer.
- Easterly windows help early morning warming and can be a little larger than westerly windows.
- South facing glazing should be kept to the minimum required for ventilation.

It is very important that the total area of northern windows is balanced with the amount of thermal mass available to absorb the heat.

Glazing is also the biggest area of heat loss.
Energy efficient windows make your home more comfortable, dramatically reduce your energy costs and help to create a brighter, cleaner and healthier environment.



Glazing and thermal performance: Principle of good window combination



Good to know: the Resistance (R-value) of a window results of the combination for the R-value of the frame and the R-value of the glass. Thermally broken frame with double glazed glass (with thermal spacer) is a must have with new building.

You can achieve good passive solar performance at minimal cost if your site has the right characteristics. Where possible, choose a site that can accommodate north-facing daytime living areas that flow to outdoor spaces with similar orientation. In tropical areas, northerly solar access is not desirable: sites that allow maximum exposure to cooling breezes and designs that draw or funnel them through the building are preferable.

This simple configuration allows for passive heating of living areas during the day and cooler, southerly sleeping area.

THERMAL MASS

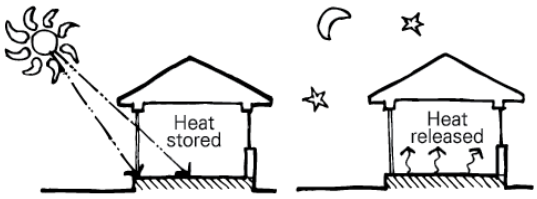
Thermal mass is the ability of a material to absorb and store heat energy. A lot of heat energy is required to change the temperature of high density materials like concrete, bricks and tiles. They are therefore said to have high thermal mass. Lightweight materials such as timber have low thermal mass. Appropriate use of thermal mass throughout your home can make a big difference to comfort and heating and cooling bills.
Thermal mass can store solar energy during the day and re-radiate it at night. (8h delay)

Correctly used, the thermal mass, moderates internal temperatures by averaging out diurnal (day–night) extremes. This increases comfort and reduces energy costs.

Poor use of thermal mass can exacerbate the worst extremes of the climate and can be a huge energy and comfort liability. It can radiate heat to you all night as you attempt to sleep during a summer heatwave or absorb all the heat you produce on a winter night.

Winter

Allow thermal mass to absorb heat during the day from direct sunlight or from radiant heaters. It re-radiates this warmth back into the home throughout the night.



Summer

Allow cool night breezes and/or convection currents to pass over the thermal mass, drawing out all the stored energy. During the day protect the thermal mass from excess summer sun with shading and insulation if required.