

PASSIVE COOLING & HEATING BENEFITS OF CONCRETE

Concrete has excellent thermal mass properties that can help naturally cool and heat your home, reducing energy costs.

What's thermal mass?

Thermal mass is a term used to describe the ability of a material to absorb and store heat. Construction materials with high thermal mass can help reduce temperature fluctuations inside a well-designed home, providing a more stable and temperate living environment. (See figure 1 overleaf).

To reap the maximum benefits of thermal mass, your home's construction materials should tick three boxes:

1. A **high specific heat capacity**. In other words, an ability to maximise the heat squeezed into every kilogram of the material.
2. A **high density**. The heavier the material, the more heat it can store.
3. **Moderate thermal conductivity**. Ideally, the rate heat flows in and out of the material should be roughly in sync with the daily heating and cooling cycle of the building.

While all materials have thermal mass, it's denser, heavier materials such as concrete, brick and stone that perform the best. (Timber generally has a high heat capacity but low thermal conductivity, while steel has very high conductivity – in both cases, it means heat absorption and release is out of sync with the natural temperature cycle).

How does concrete's thermal mass properties support comfortable living?

As part of a passively designed home, concrete's high thermal mass can help cool and warm your internal living spaces naturally, reducing or even eliminating the need for additional air-conditioning and/or heating devices.

And when you consider that air conditioning is one of the fastest growing global energy applications¹, that's good news for the planet and your hip pocket.

A concrete ground slab can be either coupled (uninsulated) or decoupled (insulated), depending on the climatic region where you live. The Australian Government's Your Home website² has a great explanation of what works best across Australia's eight main climate zones (as defined in the National Construction Code).

For example, ground coupling in mild climate zones such as Perth, Brisbane or coastal New South Wales allows the slab of a well-insulated house to achieve the stable temperature of the earth - cooler in summer, warmer in winter. (An uninsulated slab in a good passively designed house has a surface temperature about the same as the stable ground temperature at about 3m depth.)

In climates with colder winters, such as Melbourne or the NSW Southern Highlands (where the deep ground temperature is lower) it's recommended to insulate the slab from the ground, which then reduces the amount of heat required to achieve comfortable indoor temperatures.

However, it's not just concrete ground slabs that can be incorporated into a passive design solution. Solid concrete walls – internal or external, insitu or precast – as well as suspended concrete upper floors can also be utilised as part of the overall solution.

1. *According to the International Energy Agency, demand for cooling is expected to more than triple by 2050 unless action is taken to address energy efficiency.*
2. *yourhome.gov.au*

**SUSTAINABLE
FOR LIFE**

www.futureproofwithconcrete.com.au

Since the information provided is intended for general guidance only and in no way replaces the services of professional consultants on particular projects, no legal liability is accepted by Cement Concrete & Aggregates Australia for its use and/or reliance on it by any person.

Concrete.
FUTUREPROOF
your build™

PASSIVE COOLING & HEATING BENEFITS OF CONCRETE

Passive design: unlocking the benefits of concrete's high thermal mass

The basic principle of good passive design is to design and build a home in such a way as to work with – rather than against – the prevailing climatic and environmental conditions. This means focusing on things like orientation, thermal mass, insulation and glazing to minimise unwanted heat gain and loss.

In older, more traditional homes, internal temperatures can fluctuate wildly over the course of a day and night. To even this out, many homeowners rely on air-conditioning or heating which, while effective, can send the household energy bill spiralling.

When designed and used correctly, concrete slabs and walls can help moderate internal temperatures, significantly increasing comfort and reducing energy usage. That's because the slab helps regulate the internal temperatures in your home by averaging out the day–night (diurnal) extremes.

How does it work?

In all but the hottest, most humid climates*, living areas and windows should ideally be oriented to the north, and the eave overhang calculated to regulate how much direct sunlight enters the home, depending on the season.

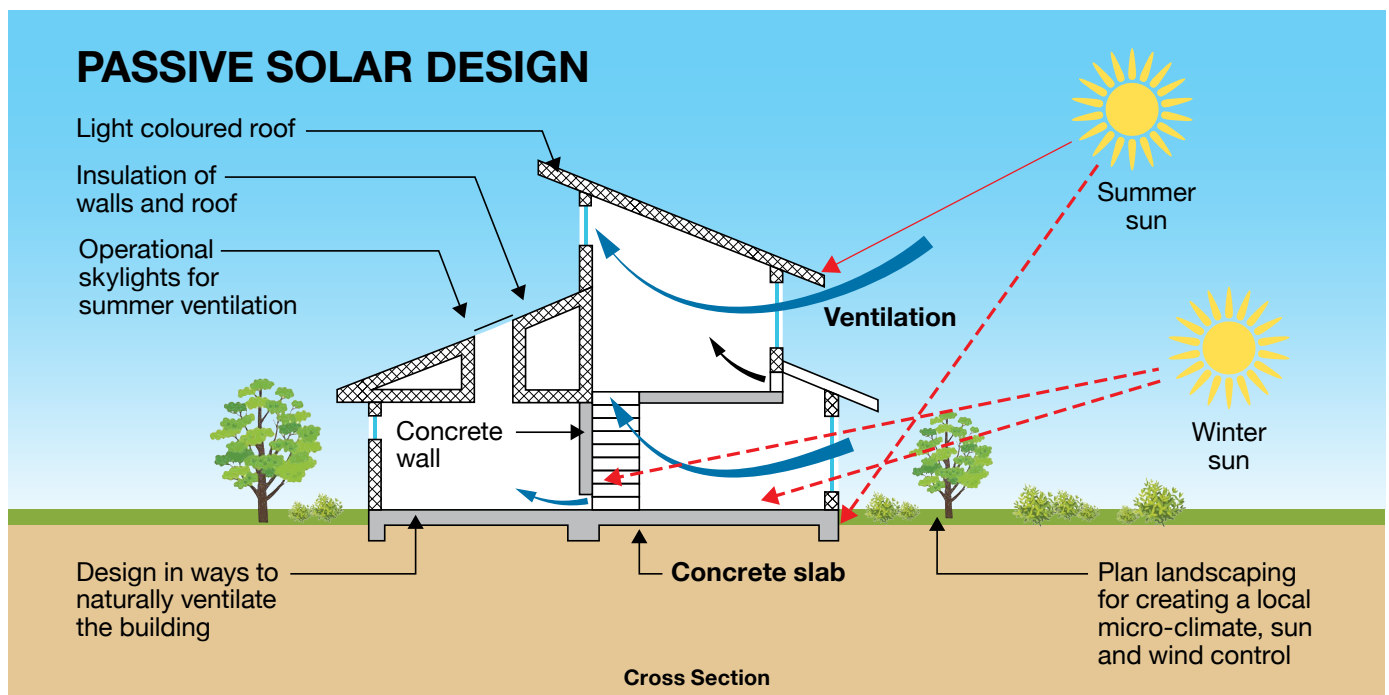
During winter, when the sun sits lower in the northern sky and the sunlight can penetrate under the eaves and into the interior of the home, the heat is absorbed into the concrete during the day and released slowly at night.

In summer, when the sun sits higher in the sky, the eaves provide protection of the interior from direct sunlight. At the same time, the concrete slab and internal walls act as a heat sink, absorbing whatever heat enters or would otherwise build up inside the home.

To maximise the benefits of the cooling cycle in summer, good cross-ventilation is a must. At night, the cooler outside air flowing through the home will remove the heat stored in the building fabric during the day.

** North of the Tropic of Capricorn, it's more about orienting the home to capture cooling breezes and maximising shade.*

Figure 1



So, by choosing concrete, you are choosing a material that can help support more comfortable temperatures in your home, and help reduce energy related costs and emissions.

**SUSTAINABLE
FOR LIFE**

www.futureproofwithconcrete.com.au

Since the information provided is intended for general guidance only and in no way replaces the services of professional consultants on particular projects, no legal liability is accepted by Cement Concrete & Aggregates Australia for its use and/or reliance on it by any person.

Concrete.
FUTUREPROOF
your build™