

Buyers Guide – Good Passive Design

Introduction

Good passive design (i.e. does not require power) can slash your power bills by reducing the need for artificial lighting, mechanical heating, cooling and ventilation. In summer, your homes design should encourage cool air movement and exclude the harsh summer sun. In winter, your home should trap and store heat from the sun and minimise heat loss. Some passive design measures may counter other benefits so you will need to decide which is more important e.g. views, privacy, summer heating or winter cooling etc.

Passive Solar Design

Take advantage of the sun's warmth and light during the day by:

- Planning rooms around the sun's path from east to west on the northern side of a building.
 - Orientate or design the main daytime living areas to face within 20° of true north (in New Zealand, true north is approximately 22° west of magnetic north).
 - Because kitchens are used most in the early morning an E or NE location will maximize morning and/or daytime sun.
 - Bedrooms, utility and service areas (e.g. bathrooms, laundry, hallway, storage and garage) are not used much during the day so are best located on the S, SE or SW sides.
- High thermal mass materials (e.g. concrete and masonry floors and walls) in direct sunlight will store solar heat and slowly release during the night as temperatures fall.
- Darker surface colours will absorb more heat than lighter colours so consider these on the exterior roofing and internal surfaces in direct sunlight to encourage solar heat gain.
- Using and placing glazing carefully will allow natural light to enter the home to reduce artificial lighting needs.

- Consider sun angles throughout the year to ensure solar heating is maximized in winter and minimized in summer. Refer to sun angles below (and eaves and shading section later):

Sun Angles at Noon			
	December 22	June 22	March 21 & September 23
Whangarei	78°	31°	55°
Auckland	77°	30°	53°
Hamilton/BOP	76°	29°	53°
Wellington/Nelson	72°	25°	49°
Christchurch	70°	23°	47°
Dunedin	68°	21°	44°
Invercargill	67°	20°	44°

If mechanical heating is required, consider efficient heating systems such as heat pumps (air or ground source) or heat recovery ventilation systems.

Insulation – More is Better!

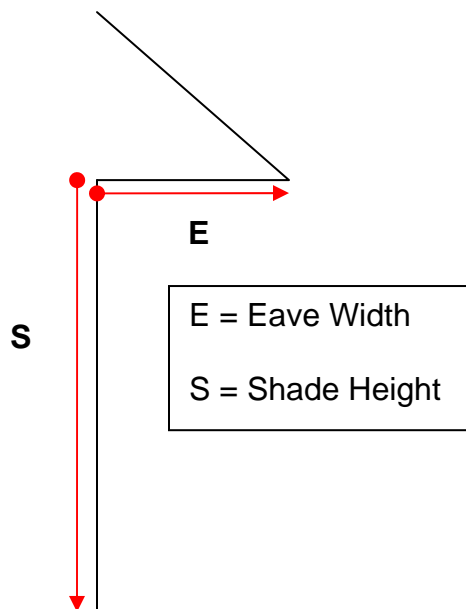
You should always aim to insulate above building code minimum if your budget allows. A few hundred dollars extra upfront will save you thousands of dollars in heating and cooling costs as well as less condensation and a healthier indoor environment.

- More heat escapes through the ceiling than walls so add more insulation in the ceiling first. You can also use thicker batts in a ceiling cavity than in standard 90mm walls.
- Most heat will typically escape through glazing so use double glazing whenever possible, unless you are in a very warm climate. Then consider low-e or argon filled double glazing and/or wood, PVC or thermally broken aluminium window frames.
- A lot of heat can escape through open recessed downlights, so specify closed abutted (CA rated) downlights where possible to eliminate the need for 200mm insulation clearances around downlight fittings.
- Increase insulation in walls and floors (use 50mm minimum polystyrene below concrete slab foundations and preferably around perimeters also.)

- Seal air leaks around surface penetrations, ducts and gaps. Use fillers and mastic tape where necessary or weather strips on windows and draught-stoppers on exterior doors if required.
- Use an insulated entrance door or enclosed entrance lobby to avoid heat escaping through the entrance way.
- Remember, higher insulation will keep your home warmer in winter as well as cooler in summer.

Eaves and Shading

Because the sun's angle changes throughout the year the effective shade provided from your eaves will also vary. Use the table below to work out the effective shading you will get from different eave widths. The measurements shown are the shading height (S) from underneath the edge of the eave.



Shade Height (S) (using 450mm Eaves)		
	Summer	Winter
Auckland	1940mm	260mm
Wellington	1400mm	220mm
Christchurch	1240mm	190mm
Dunedin	880mm	170mm

Shade Height (S) (using 600mm Eaves)		
	Summer	Winter
Auckland	2580mm	350mm
Wellington	1860mm	290mm
Christchurch	1650mm	250mm
Dunedin	1170mm	230mm

Shade Height (S) (using 900mm Eaves)		
	Summer	Winter
Auckland	3870mm	520mm
Wellington	2790mm	430mm
Christchurch	2480mm	380mm
Dunedin	1760mm	340mm

Passive Cooling

Passive cooling design tries to minimise heat gain while promoting heat loss.

- Use windows to allow cooling breezes. Casement windows that capture prevailing breezes work particularly well.
- Try to use openings at opposite sides of a room or building to encourage cross flow ventilation. Higher opening windows will allow rising hot air to be removed more efficiently.
- Open plan layouts with fewer internal walls will reduce barriers to cooling airflows.
- Where north facing glazing is used, use shading from eaves, verandahs, louvres, shade planting, window treatments or tinted glazing to reduce heat buildup. Use passive window vents or windows with security stays or double tongues to allow ventilation during the day.
- Use light coloured roofs and walls to reflect solar heat.

Where mechanical ventilation and cooling is required consider efficient systems such as reverse cycle heat pumps and ventilation systems.

We do hope you find this information useful. Good design and good living!



The Horizon Homes Team