

PITCHED ROOF DESIGN

Pitched roof design and construction was a part of everyday life for builders and carpenters 50 years ago. Houses were small with a lot of internal walls to support from. About this time roof trusses started to be used. This meant that the internal walls no longer needed to be loadbearing, making foundation design much easier. The gathering pace of trussed roof systems and housing design changes to reflect this has, until a few years ago, put the pitched roof into obscurity (unless you are in Western Australia).

More recently, architecture has evolved and there are more instances in houses with raked ceilings and features which lend themselves to a pitched roof. This could be to increase light into a space, help with thermal regulation of a building, or just create aesthetic appeal. Mostly this is not the whole building but just in certain areas. For these areas the designer needs to integrate pitched roof members into the structural system.

AS1684.2 Section 7 deals with Roof Framing. This outlines design and construction requirements for roofs. As trussed roof systems are designed with software and installed to AS4440 this section is mainly focused on traditional pitched roof designs.

There are two main types of pitched roof construction:

1. NON-COUPLED ROOF

This is where each rafter is supported off walls and/or beams. Where there are opposing rafters in a non-coupled roof, traditionally called a cathedral roof, they require a ridge beam through the centre to support them. A skillion roof is another type of non-coupled roof in which the roof pitches in one direction only.

2. COUPLED ROOF

This is where there is no support at the ridge from a ridge beam so opposing rafters are connected using collar ties. The collar ties provide support to the pair of rafters and also help to reduce spreading at the external walls.

When designing a non-trussed roof the detailer should firstly work out which roof construction is required. The design of the rafters in each instance is the same but the layout and design of the supporting structure is quite different. For a coupled roof using AS1684.2 the pitch needs to be over 10° (under this the collar tie is not acting effectively). Also, the distance between external walls needs to be less than 6m for a sheet roof and less than 4m for a tile roof. Designs outside of this should be referred to an engineer to confirm they are still suitable. The advantage of a coupled roof is that only a ridgeboard is needed so you don't need to find support points in the centre of the building. One thing to take special note of in coupled roof construction is the layout of hip ends, making sure the apex point has support for the hip rafters.

A non-coupled roof does not require collar ties and can be any length based upon the rafter design but it needs supporting beams or walls at each point. This means for a cathedral roof you need to find support points for the ridge beam. If there are no walls to support off the ridge can be supported from strutting beams or a truss could be designed to support the beam at each end. If using strutting beams make sure they are restrained at the ends to stop them from rolling over. Examples of this are covered in Clause 7.2.26 of AS1684.2.

Once you have the main beams and rafters worked out there could be other items to consider which are mostly easier to design and accounted for in AS1684.2. These include ceiling joists, roof struts, gables and eaves. Table 7.6 has sizes for miscellaneous roof framing members that are not normally listed in span tables or design software. The standard also contains information on installation and connection details for pitched roof members including taper cuts on ends of beams.

Pitched roof design is becoming more prevalent and we should take a moment to re-visit the Australian Standard and familiarise ourselves with this information. If there are situations outside the scope of the standard then pass them on to an engineer who can do a specific design. They can also provide alternative methods of support or beam and truss configurations to make the roof more cost effective and to simplify site installation.