Timber framing essay

Timber wall framing was developed in North America and it slowly evolved until it has become, in the Australian context, one of the most efficient and economic building systems used in the building industry. It is also forgiving – make a mistake when working in timber and it is likely that it can be fixed with the minimum of inconvenience. Timber wall framing aims to make use of relatively small section timber members called scantling, to build strong, rigid wall frames. Wall frames are fabricated lying down, either on site, or, in the project home industry – in a factory.

The frame consists of the following parts like wall plates, studs, noggings and bracing.

Wall plates are horizontal parts that spread the loads along the frame from ceiling level to floor frame. There are essentially two types – top and bottom plates. The top

plate takes the load from the roof structure and transfers it into the vertical studs and these transfer the loads to the bottom plate. Studs are the vertical parts of the frame. In order to reduce the size of the studs and plates it is common to ensure that the studs are located directly under each rafter or truss so that the loads are transferred directly into the stud. If this is not the case then it will be necessary to increase the size of the top plate. Noggings are the bracing parts fixed between studs to stop bending of the individual studs – they reduce the effective slenderness ratio of the studs. Bracing are diagonal members used to prevent the wall from racking. Sheet bracing and pairs of diagonal metal tension straps also provides effective bracing fixed to external face of frame to manufacturers specification. The plates, studs and

noggings are the basic components of a timber framed wall. Bracing is required to stop the house from being blown over by gusts of wind. As for the wall plates, they should be provided along the full length of all walls including over openings. Bottom plates should be provided along the full length of all walls except at door openings. Bottom plates may be butt jointed provided both ends are fixed and supported by floor hoists, solid blocking or a concrete slab. Jack studs shall be provided in all cases between the lintel and the top plate or trimmer. Jack studs shall be the same size and spacing as the common studs. External walls shall be laterally supported against wind forces. External walls supporting ceiling joists, rafters or trusses are deemed to have adequate lateral support. Non load bearing external walls, such as gable end walls and verandah walls, where trusses are supported by a verandah plate or other beam, shall be restrained laterally at a maximum of

3000 mm centers by means of Intersecting walls, ends of hanging or strutting beams, continuous timber ceiling battens or tie members. Non-load bearing walls shall be kept a minimum of 10 mm below the underside of the bottomchord, or ceiling battens when used.

The size of studs in single or upper storey load bearing walls shall be determined from Timber Framing Code Tables A9 and A10 for studs at 450 mm centers, Tables A11, and A12 for studs at 600 centers. The size of studs in lower storey of two-storey load bearing walls shall be determined from Tables A40 and A41 for studs at 450 mm centers, Tables A42, and A43 for studs at 600 mm centers. The Span Tables provide fro the design of notched and not notched wall studs. Where cut-in or metal angle bracing is used, the

studs shall be designed as notched. For doorway openings up to 900 mm, jamb studs may be the same size as the common studs provided jamb linings or other comparable stiffeners are used and these stud do not support concentrated loads.

Many people believe that it was not until cyclone Tracy happened in Darwin that tie-down and bracing provisions were considered important in house frame construction. There may be an element of truth in that. However, previous cyclones in Townsville and Bowen helped the authorities and industry realize that there were problems occurring. Tie-down and bracing were always considered during construction especially in high wind areas. What did evolve however was a change in the method of construction and the use of materials to facilitate better economy. Where, before the T & G – VJ was used as walls and ceilings, the VJs were nailed to the bearers or joists with a cut in floor and ceiling. The VJs provided not only tie-down but a certain amount of bracing as well. The VJ ceilings acted as a diaphragm ceiling adding additional stability to the structure.

The modern system of construction evolved into platform floor construction for ease and sped with wall frames of cypress pine. Skew nailing has become a thing of the past. It was

clear that tie-down with this form of construction was poor and the cyclones proved that fact.

Bracing also requires good tie-down fixing at the top and bottom of the bracing panels to work effectively. The aim of proper tie-down is to building continuity and structural integrity into the frame for the frame to withstand

the effects of high wind. As the wind hits the building, uplift forces are caused by the build-up of internal pressure within the building space, combining with the suction effect on the roof as the wind passes over. These forces have a tendency to lift a building, so it is necessary to anchor down its component parts. Roof overhangs, awnings, verandah, patio roofs and flat roofs are subjected to greater uplift than other parts of the building. The internal pressure build-up can also cause walls, windows and doors to blow out. During strong winds, open windows or doors on the opposite side to the wind direction to reduce this internal pressure. Tie-down is easier with a truss roof as it is only necessary to provide tie-down fixings at the support points. Bracing is generally provided by strap metal braces in a cross configuration and all roofs including hip and valley require cross wind bracing. Permanent bracing shall be provided to enable roof, wall and floor framework to resist horizontal wind forces applied to the building. Appropriate connections shall be provided to transfer these forces through the framework and sub-structure to the building’s foundations.

One of the most important parts of the timber framing is roof modeling or construction. The cut on site roof, or conventional roof construction, comprises parts which are intended

to support only their own dead weight and the dead weight of the roof coverings, ceilings where relevant, and loads or combination of loads occurring from wind pressure and to occasional construction or maintenance workloads. The pitch and style of the roof will determine the configuration of members, construction methods and material to be used. As for the roof styles there are a considerable number of different pitches (angle of

inclination of the roof in the horizontal plane) and styles like Hip Roof, Belcote Roof, Gable Roof, Boxed Gable Roof, Broken Hip & Valley Roof, Gable or Skillion Roof, Dutch Gable Roof, Jerkin Head Roof (Hipped Gable Roof), Flat Roof, Skillion Roof and Clerestory Roof. The ceiling joists are parts that fulfill the double function of providing the structure on to which the ceiling is fixed and providing the member that connects or ties the lower ends of rafter couples and therefore prevents the rafters spreading and causing roof sag or collapse. Ceiling joists are normally horizontal members but can, with vaulted ceilings for example, be fixed on a slope.

The hanging beam is a timber beam located at 90 degrees to the ceiling joists. It has the

function of reducing the span of the ceiling joists and therefore allows them to be a more

economic and consistent section than may otherwise be the case. The hanging beam size must

be selected carefully. A hanging beam is required to be adequately supported at each support

point i. e. load bearing walls, by blocking pieces of the same timber as the ceiling joists. The

purpose of the blocking is to minimize problems associated with differential shrinkage between the block and the ceiling joists that is the cause of some ceiling defects. The ceiling joists are fixed on alternate sides to the hanging beam with hoop iron straps, or timber battens.

The ridge in a conventional framed roof is required not so much as a structural member but

more as a set-out member to make sure rafter couples meet at a consistent height to give a

horizontal ridgeline free from deflection. If the ridge is required to act as a beam that is to give strength to the roof should be selected for size in accordance with AS1684. The hip rafter is located at an external angle change of roof direction, and its function is similar

to that of the ridge beam. It is used to assist in the location and support of rafter couples as they make the transition from one roof plane to another. Care must be taken to correctly size and support the hip rafter as they invariably have difficult and support join conditions, particularly at the roof crown. They also act as a brace to the roof when all are fixed in position.

The struts and props are specifically required in the roof frame to transfer the loads from under beams to the load bearing walls. Struts and props should be supported over

studs in timber walls and should have anti slip blocks where necessary to prevent them sliding horizontally. Struts and props generally are more efficient the closer they are to the vertical. Angles between struts and the horizontal of less than 45 degrees should be avoided.

The collar ties supplement the ceiling joists and resist the rafter couples spreading. They are

normally fixed at the position above the rafter connection and are located on alternate rafter couples or at a spacing not exceeding 1200mm whichever is the lesser. In roofs with rafter lengths in excess of 5000mm, additional collar ties may be required at two or more levels. A qualified consultant should check a roof of this scale before and after construction.

If to speak about ceilings, they may be fixed to the underside of ceiling joists, rafters or purlins or the bottom chord of trusses, with or without battens.

In general, timber framing is a very difficult process that requires a lot of knowledge from the people who work with it as well as it should be done in accordance with the set of rules established for this particular building style. There are several reasons to renew the rules of timber framing because of the weather influences as well as along with the development of building technologies and principles.