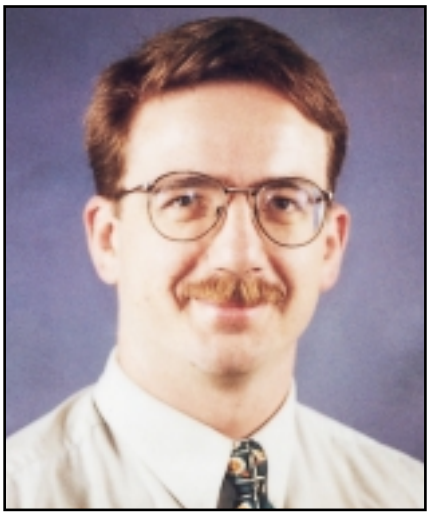
CEILING SYSTEMS AND BOTTOM CHORD RESTRAINT



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Under normal dead load conditions bottom chords of trusses are subjected to tension loads. However, with lightweight roofing or even heavy concrete tiles in extreme wind conditions, it is possible to have a nett wind uplift where the uplift forces of the wind can exceed the dead weight of the roof cladding.

Under these circumstances, the bottom chord load will change from a tension load to a compression load.

As the load carrying capacity of long slender compression members depends substantially on the lateral restraints we must therefore ensure that the ceiling construction provides this restraint. If it does not, additional bottom chord ties will be required.

The bottom chord is normally restrained from buckling sideways by the ceiling or the ceiling support. It is commonly assumed in most states that the direct fixed plasterboard ceiling restrains the bottom chord.

Direct fixing is assumed to have a restraining affect equivalent to battens at 600 mm centres.

Bottom chords in buildings with no ceilings or those that have ceilings that are suspended from rods do not provide lateral restraint, so permanent bottom chord ties must be installed - the spacing of these is critical to the truss design.

In these cases it is expected that the truss designer, usually the fabricator specifies the spacing for the permanent ties. Please note that permanent bottom chord ties are specified by the designer and are required to restrain the bottom chord from buckling throughout the life of the structure.

They are required in situations where a suspended ceiling is used.

Permanent bottom chord ties have a different function to temporary bottom chord ties which are specified in AS4440 the Australian Standard for the *"Installation of nail plated timber trusses"*.

The purpose of Temporary bottom chord ties is to stabilise the truss during installation and are placed at a 4000mm max centres. Although they remain in place in the finished roof, their function is temporary.

Where furring channels are used to support the ceiling, the lateral restraint depends on how the furring channels are fixed. The alternate method of fixing furring channel are:

1. If the furring channel is screwed directly to the bottom chord of the truss, they will provide lateral restraint at the fixing points.
2. If the furring channels are suspended on adjustable rods, they do not provide lateral restraint to the bottom chord and therefore the truss must be designed as a suspended ceiling system, i.e. permanent bottom chord ties need to be used and the truss designer needs to specify the spacing.
3. If metal brackets are used to the sides of the bottom chords into which furring channels "snap" the bottom chord also needs to be treated in the same way as the suspended ceiling system. These metal clips have no capacity to restrain the bottom chord from buckling.

AS4440 also provides sizing for 'permanent' bottom chord ties in Appendix F, and gives details on end bay bracing in Section 4.4.3. Note that the details shown there are for permanent bottom chord ties as described above.

The design of trusses for commercial structures usually require more attention to bottom chord restraints, as trusses are often of a larger span, the roof material is often lightweight, and the ceiling construction is unlikely to be direct fixed or battened.

However the specifications on a commercial project may only state furring channels and give no details as to their fixing methods. In this case the truss designer must seek confirmation before making an assumption that will affect the design of the trusses and hence the price.

Having to retrofit bottom chord ties is not an easy task, particularly when other services have already been installed. The moral - "If In Doubt - Find Out!".