April, 2004

GANG-NAIL GUIDELINES No.83

ANOTHER MITEK ADVANTAGE

MiTek®

CONTINUOUS SPANS - PITFALLS TO AVOID

(PART 1)

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Trusses and beams, which have been designed with internal supports that are too close to other supports, face a potential danger of failure.

The problem arises when the support reaction at one end is reversed in direction.

In other words, instead of holding the truss up under gravity load, the support is instead trying to act as a ballast to pull it down.

Fabricators in Australia benefit from an excellent range of proprietary design software for trusses and beams that are able to design continuous span beams and trusses with internal supports.

The main appeal of designing components with multiple supports is the reduction in member size and deflection gained by the continuous span effect.

Performance is improved with a corresponding reduction in component cost. (Refer to Guidelines No. 10)

Unfortunately, a few fabricators have been caught out with apparent failures of these components.

The deflection at mid-span turns out to be considerably more than predicted and the detailer is bewildered as to the reason why.

The pitfall is in the ability of the supports to provide a <u>fully rigid counter-balancing anchorage</u> that is assumed in design when the span ratios are too lopsided.

A fully rigid tie down is actually much harder to achieve than is commonly realized. The slightest rise at the ballast end will result in a significantly higher deflection at the other span.

This is usually made worse by a lighter member size that has been designed due to the continuous span assumption.

To illustrate this, Figure 1 pictures a simple beam with a small cantilever. The beam is allowed to deflect normally at mid-span as the cantilevered end lifts.

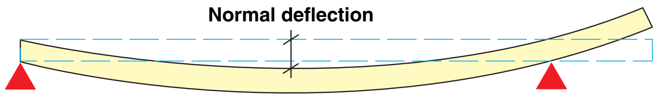

Figure 1
End of beam allowed to rise naturally

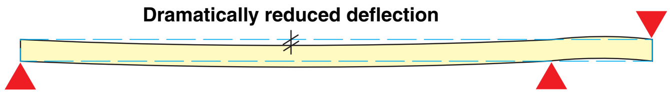

Figure 2
End of beam rigidly held down

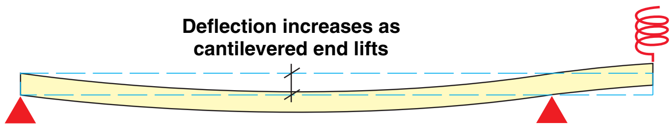

Figure 3
Flexible support

If the end of the cantilever was rigidly held down as shown in Figure 2, then the deflection observed at mid-span would be considerably less.

If the hold down on the cantilevered end slips, depicted as a spring in Figure 3, then the mid-span deflection would be somewhere in between.

It is very difficult to provide a totally rigid tie down in timber framing construction.

It is dependent not only on the stiffness of the fastener but also of the structure that it is connected to and on the construction method.

For example, most truss tie downs are fixed to the top plate.

In turn, the top plate is only weakly held down with two nails into the end grain of the studs below that would easily give way under uplift.

Unless a structural engineer (who is made aware of the truss or beam reliance upon a rigid tie down) is involved, it is unwise to design any truss or beam that contains heavily lopsided internal supports.

Recommendations

1. Designers should avoid locating closely spaced supports into beams or trusses.
   As a general rule of thumb, the ratio between long/short spans should be less than 2 for beams and 5 for trusses.
2. The support reactions of beams or trusses with multiple supports should always be checked as a routine.
   If a reverse reaction appears at any support, that support should be removed from the design analysis. (In spite of this, any nominal connection could still be acceptably installed here.)

Adherence to these simple checks will ensure the maximum benefits that can be gained from utilising continuous supports.