GANG-NAIL GUIDELINES No.167

ANOTHER MITEK ADVANTAGE

DIFFERENTIAL DEFLECTIONS

A designer should not ignore deflections even if every truss has been designed within its deflection limits.

Unless the effects of differential deflections are recognized and corrected beforehand, the finished levels may end up appearing quite uneven.

Trusses that are different from each other deflect differently.

It goes without saying that long trusses deflect more than short ones, shallow trusses more than deep ones, heavily loaded trusses more than lightly loaded ones, longer overhangs more than shorter ones and so on.

When trusses side by side deflect at different rates, there is potential for unevenness to occur, even if both have been pre-cambered to level out evenly after loading.

In some cases, a significant difference in relative pre-camber creates problems during construction, such as ceiling installation.

In other cases, some trusses are difficult to pre-camber, e.g. scissor trusses and non-triangulated trusses such as attic trusses.

Trusses with large cambers also pose additional difficulties that should be avoided, e.g. truncated girders with large cambers that cause the overlaying rafters/jack overhang to project high above the hip apex.

Some situations where differential deflections are known to pose a problem are:

Case 1: A run of standard gable trusses transforming into scissor trusses (or attic trusses) and vice versa. The ridge tends to dip at the scissor trusses.

Case 2: A heavily cambered girder truss parallel and adjacent to lightly cambered standard trusses.

Case 3: A mixed run of very different trusses of which one side defines an extensive and visible common roof plane. (See Figure 1)

When a computer designs trusses, it predicts the expected deflections and reports them as cambers.

But building a camber into trusses does not necessarily resolve all deflection issues.

One has to view the predicted deflections or cambers in relation to other trusses beside them.

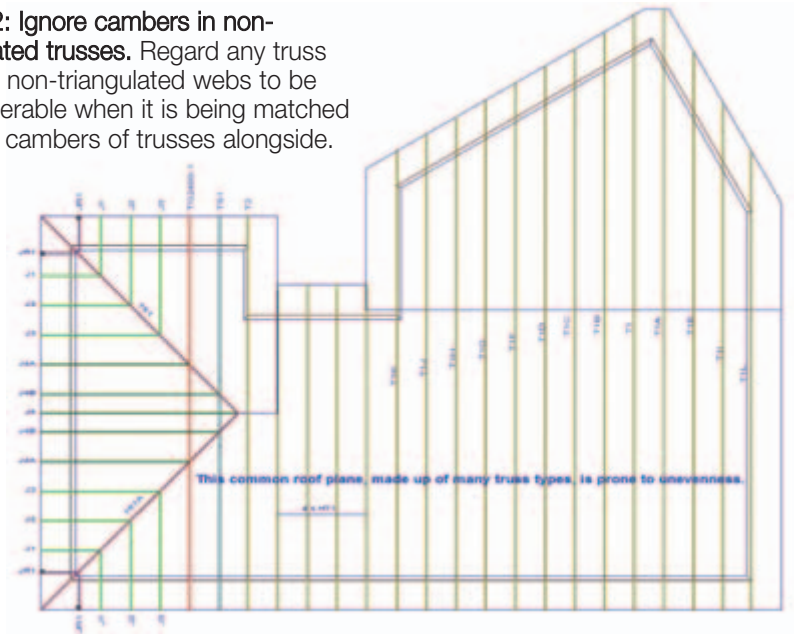
By ROBERT TAN
Technical Services Manager, MiTek Australia Limited

In cases where web formations are not fully triangulated, thereby making it difficult for a truss to achieve a reliable camber, the relative camber or differential deflection test has to be even stricter.

These are some recommended strategies to tackle differential deflections:

Rule 1: Limit relative cambers. A good rule of thumb is to limit the relative cambers between adjacent parallel trusses to less than 1% of truss spacing. Do not neglect to also compare the deflection at the end of a cantilever.

Rule 2: Ignore cambers in non-triangulated trusses. Regard any truss that has non-triangulated webs to be uncamberable when it is being matched with the cambers of trusses alongside.



In other words, compare the calculated camber of a fully triangulated truss against an assumed zero camber in the non- or partially triangulated truss even if the computer indicates a camber for it.

Rule 3: Tie trusses together. Where appropriate, trusses may be tied together with hanging beams or underpurlins intersecting through several trusses to even out relative deflections.

In the case of an overhang, the addition of a structural fascia has the same effect.

Rule 4: Beware of compounding deflections. An example of this is a run of identical span trusses in the bedroom wing of a rest home where each unit has a verandah alcove so that the external load bearing wall regularly steps in and out.

A wide sliding door that accompanies every verandah has a long span lintel over it supporting cantilever trusses.

The lintel deflection accentuates overhang deflections at the end of the truss cantilever.

Consequently, the long fascia line in this situation tends to dip regularly at verandah alcoves.

One way of improving this is to include a stiffening beam at the heel of the cantilevered truss.

Rule 5: Avoid long panel lengths. Related to Rule 4, mid-panel deflections add to panel point deflections predicted in cambers.

This is critical when panel lengths are long, which is one reason why they should be avoided.

For the smooth operation of your business, addressing the complexities of deflection and camber at design stage will always be a far better option than rectifications at a later date. TTN