# FTMA TECH TALK

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## AWNING TRUSS DESIGN CONSIDERATIONS

An awning truss usually refers to a cantilevered truss with a collinear support configuration, e.g., attached to a vertical wall of a building. You may have seen them at the front of commercial shops providing shelter without impeding the flow of pedestrians since there are no post and beam supports at the cantilevered end. An example in housing would be mono trusses that form eaves or continuations of eave overhangs at ground floor roof level which "hangs off" an upper storey section – usually connecting to or being supported within the floor space as shown in Figure 1. This article will highlight some of the traps for the unweary estimator or designer.

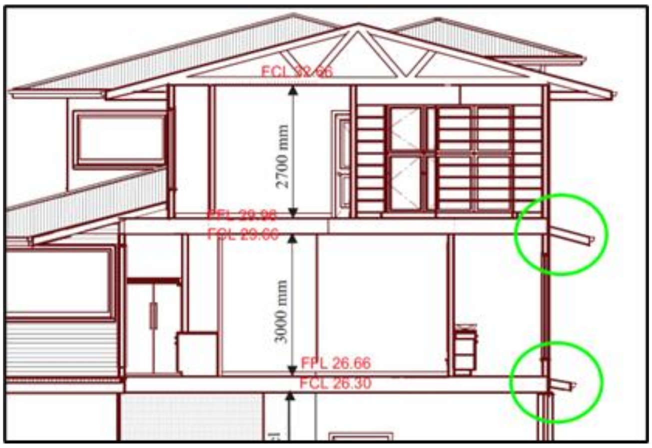



**Figure 1 – Example of cantilevered eave awnings**

### <u>Trafficable or Non-trafficable roof:</u>

Would such a small roof area be considered trafficable – especially if there's no access? For this article, we will focus on the smaller eave trusses more commonly found in residential designs but remember that awnings can certainly be much larger. Extract 1 shows Table 3.2 from our loading code AS/NZS 1170 Part 1, for roof actions (live loads) relating to different categories, activities, & specific uses of roof structures. Category "R1 Street awnings" might be obvious at first, which treats the structure like a floor, with upwards of 1.5 kPa & 1.8 kN live loads when there is direct access to the roof area.

TABLE 3.2

REFERENCE VALUES OF ROOF ACTIONS

| Type of activity/occupancy for part of the building or structure | Specific uses | Uniformly distributed actions kPa | Concentrated actions kN |
|---|---|---|---|
| **R1 Street awnings** (including cladding) | Accessible from adjacent windows, roofs or balconies | 1.5 | 1.8 |
| | Accessible only from ground level | 1.0 | 1.8 |
| **R2 Other roofs** | (i) Structural elements | $(1.8/A + 0.12)$ but not less than 0.25 (see Notes 1, 2 and 3) | 1.4 (see Note 3) |
| | (ii) Cladding providing direct support | As for structural elements | 1.1 |
| | (iii) Surfaces over which boards or ladders are required to be laid | — | 0.5 |

NOTES:

1 Structural elements supporting more than 200 $m^2$ of roof area shall be designed to support 0.25 kPa on the 200 $m^2$ of the supported area that gives the worst effect.

2 $A$ = the plan projection of the surface area of roof supported by the member under analysis, in square metres.

3 For structural elements in roofs of houses, the uniform distributed actions shall be 0.25 kPa and the concentrated actions shall be 1.1 kN.

**Extract 1 – Table 3.2 from AS/NZS 1170.2:2002**

"R2 Other Roofs, (i) Structural Elements" apply to most of our truss designs, with Note 3 giving a concession for housing allowing smaller live loads of 0.25 kPa & 1.1 kN, typically for maintenance and construction loads. Extract 2 provides further guidance from the commentary with some examples demonstrating the intent of this clause.

**C3.5 IMPOSED ACTIONS ON ROOFS, AND SUPPORTING ELEMENTS**

**C3.5.1 Roofs**

Roof Category R1 is intended to cover situations where people may gain unauthorized access through their own efforts to a roof not intended for such use. The lower load of 1.0 allows for greater difficulty in gaining access compared to the value of 1.5 where access may be facilitated by adjacent windows, balconies or other awnings. An example is a street awning on a multistorey building with openable windows.

It is not expected that people would walk on glass or other transparent or translucent materials such as plastic sheeting. Therefore, allowance has been made for transparent surfaces to be treated as an area where supports (e.g., boards) would be placed over the surface when access is necessary (usually for maintenance).

The limit of 0.25 kPa in Table 3.2 is intended to cover situations not covered elsewhere in the loading Standards, such as stacking of materials for maintenance or for local accumulations of hail.

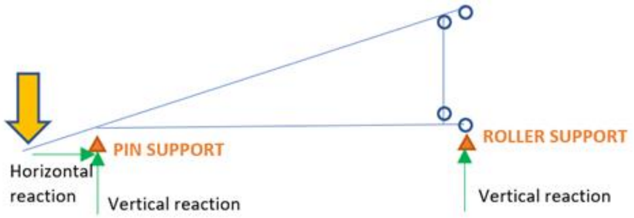
**Extract 2 – Commentary for Cl. 3.5.1 of AS/NZS 1170.2:2002**

We can clearly rule out category R1 since a small eave awning is not intended as a trafficable area but there can be some arguments made that even category R2 should not apply since no one would be stupid enough to stand at the ends, right?

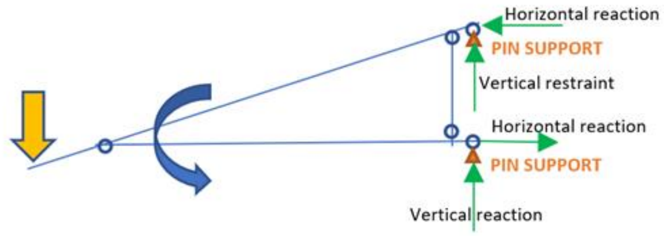
However, consider that someone must construct this area, lay the roof battens, install the roof linings etc…, and it's certainly possible that a maintenance person could set up their ladder against the gutter for access at some stage of the building life. Would you ignore the 0.25 kPa & 1.1 kN live loads with this in mind?

**Analogue model, support conditions and connections:**

When designing an awning truss using normal support assumptions (Pin–Roller or Roller–Pin) the result is an unstable system due to the supports being collinear, e.g., along a single vertical axis, where a vertical roller support cannot provide any horizontal restraint. For this reason, both supports must be modelled as Pin supports, and in doing so the connections must be designed to withstand both a horizontal and vertical reaction at each support.




**Typical truss analogue – Pin & Roller supports**




**Awning truss analogue – Pin & Pin supports**

Horizontal and vertical support stiffness values should be carefully considered in the design to correctly model deformations and member forces which are influenced by the connection stiffness properties. For example, connections formed with screws will have larger stiffness compared to the same connection formed with nails.

Various software packages will have differing levels of access to these properties, but the common caveat is that you will require some form of engineering support to complete these types of designs.

**Caution for Horizontal reactions:**

Horizontal support reactions imparted on the supporting structure can have an impact, such as on lintels over large openings, which would need to be checked for bi-axial bending (bending in both axis) rather than their default design criteria of vertical loads in one axis only. Studs, jamb studs and critical studs may also require verification due to the applied reactions from awning trusses.

**Detailing tips and tricks:**

Always try and introduce a fascia beam to support the ends when possible since it is much easier to design, with the ends of fascia beam supported by a main truss or wall frame. Even if this is not possible, it is good practice to introduce some form of continuous member to tie the ends of the trusses together and help with load sharing.

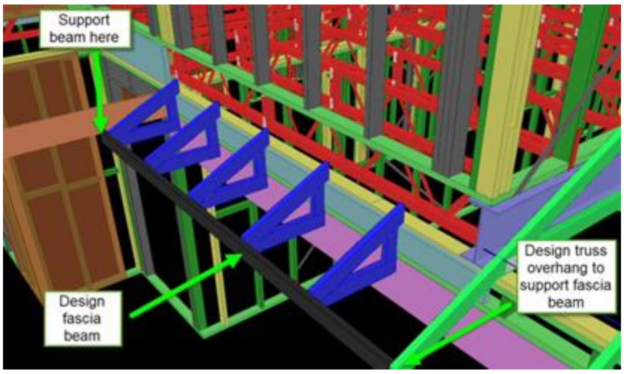



**Figure 2 – Fascia beam support option where possible**

Awning truss designs will need engineering assistance in one form or another, so it is best to identify them as early as possible and involve the engineering team from your software supplier to ensure you don't get caught out with inadequate designs and connections.

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This edition of FTMA Tech Talk was written by Cici Cai, Structural Engineer of our Principal Parnter, Pryda.

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