FTMA TECH TALK

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ATTIC TRUSS DESIGN CONSIDERATIONS

Before powerful computer software made attic truss design a matter of a few clicks, one method to achieve the result would have been to utilise separate components – roof trusses, floor joists or floor trusses, capping trusses or conventionally pitched rafters and parallel chord girders. Alternatively, a special attic truss design could be provided by engineers from your software provider.

Fig. 1 - Separate elements forming attic space.

Attic truss designs are all but handled in-house nowadays with software capable of handling the different methods to achieve the outcome. With this comes the need for users to understand any software limitations, caveats and what other factors or considerations need to be accounted for when your design is outside these limits. This article will highlight just a few key factors to keep in mind.

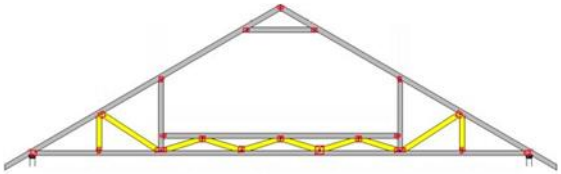

Fig. 2 - Example of full attic truss design

Access ladders or stair openings

Easy right, what's to consider? Well, you would be surprised how often access to the attic space is overlooked for one reason or another. When correctly documented on architectural plans, e.g., if a staircase is drawn on plans, this can be obvious and hard to miss. The issues often arise when the attic space is an afterthought or add-on where access is not given much thought at all. Always consider how the attic space is intended to be accessed and what measures you need to incorporate into your layout & design.

Habitable vs Non-Habitable space

There is a big difference between designing for a habitable attic void space versus a non-habitable or general void space. Habitable spaces need to consider access, room heights, incorporate floor loading requirements and also account for linings to the vertical, sloping and horizontal surfaces. Other times, the client might just be asking for a non-habitable void space for the purpose of services or the old "general household storage" reasons (Yikes!!). Make sure you understand the full implications of the space you are designing and read on for storage purposes.

To storage or not to storage...

Designing for storage loads can be very tedious and should be in accordance with Part 0 & 1 of the loading code AS/NZS 1170. "Part 0 - General principles" outlines the load combinations needed for designing to ultimate & serviceability limit states including short-term, long-term & combination factors that form certain load combinations. "Part 1 - Permanent, imposed and other actions" deals with many types of loads (or actions) including storage, which can be a function of the occupancy type, materials being stored and height within the storage area.

TABLE 3.1 (*continued*)

Type of activity/occupancy for part of the building or structure	Specific uses	Uniformly distributed actions kPa	Concentrated actions kN
E Warehousing and storage areas. Areas subject to accumulation of goods. Areas for equipment and plant	Reading rooms with book storage, e.g. libraries	4.0	4.5
	General storage other than those specified	2.4 for each metre of storage height	7.0
	Free rolling office compactus, for general filing, up to 2 m high	3.0 for each metre of storage height	to be calculated
	File rooms, office storage space, vaults and strongrooms	5.0	4.5
	Stack rooms (books)	3.3 for each metre in storage height	7.0
	Paper storage for printing plants and stationery stores, packed book storage	4.0 for each metre of storage height	9.0
	Mobile stacking, mechanically operated heavy shelving (wheels on rails, e.g. compactus)	4.0 for each metre of storage height but not less than 10.0	to be calculated
	Cold storage	4.5 for each metre of storage height but with a minimum of 15.0	9.0
	Plant rooms, fan rooms, etc., including weight of machinery	5.0	4.5
	Areas around equipment in boiler rooms (weight of equipment to be determined)	5.0	4.5

Fig. 3 – Partial extract of Table 3.1 AS/NZS 1170.1

Unless your software package includes functionality for storage design it would be wise to seek advice from your nailplate engineer since the imposed loads must consider both distributed and concentrated live loads on the floor. These loads, which can get extremely large, will inevitably impact other factors such as the flooring material and not just the truss design.

Exercise extreme caution when you are asked to design for a specific amount of storage loading in contrary to the requirements in the loading code. Unless you can develop and implement mitigating risk strategies to avoid overloading of the storage area it is best to avoid this practice. Just because your client (builder or owner etc...) claims that the area will only be for "general household storage", it can be difficult to ensure this will be the case in reality, not to mention throughout the life of the structure which could change hands between multiple homeowners.

Flooring material vs truss spacing

It's possible to design trusses for loading over different truss spacings however you also need to consider whether the flooring material can span across the truss spacing to support the loading – no different to considering a normal floor system. For example, there's no point designing your trusses at 900mm ctrs. for 3.0 kPa distributed floor live load & 2.7 kN concentrated live load if the flooring being used is 19mm particleboard. This is obviously an extreme example, but it's surprising how often this is overlooked when designers treat the attic roof trusses like they were normal roof trusses, with no due consideration to how the spacing will impact flooring material. Providing additional floor joists supported on top of the truss bottom chord (laid perpendicular to trusses) can be one way to resolve the issue. Other options may involve using a different type of flooring material (e.g., plywood), thicker flooring or providing multiple layers of flooring to accommodate the loading requirement.

Deflection considerations

Attic truss designs would typically require more extensive timber & nailplates compared to a normal roof truss purely due to the somewhat untriangulated void space and the additional dead & floor loads.

Even a moderate 9m span truss, 600mm ctrs., 3m wide attic space, supporting sheet roof & ceiling with domestic floor loads would result in dead load deflections in the order of 12mm as shown in the example below.

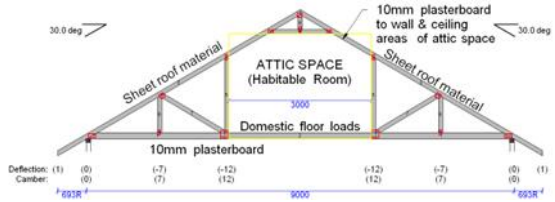

Fig. 4 – Deflection example on attic truss design

Pay attention to differential deflection when you have a series of attic trusses transitioning to or located in-between normal roof trusses. The large differences in deflections can lead to problems with ceiling linings and other finishes if not properly assessed and accounted for. Another example would be where an internal wall is used as load bearing to support a run of attic trusses. Depending on where this internal wall is located relative to the attic void space, you could end up with non-symmetrical deflection values which can also be magnified under the right loading conditions.

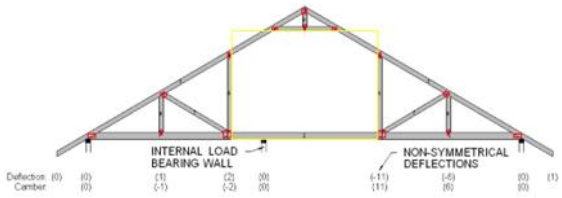

Fig. 5 – Internal support influence on deflection

Conclusion

There are many other factors which can't be dealt with in a short article such as this so please consult with the engineering team from your software supplier if you have any concerns or require further design assistance.

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