

Gang-Nail Guide Lines No.25

WHAT IS THE CONSEQUENCE OF FAILURE?



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The ‘Consequence of failure classification’ was introduced into the Australian timber design code about six years ago.

Its purpose was to increase the factor of safety in critical timber assemblies in commercial buildings and other structures of an essential nature.

In 1997, the timber design code was revised.

It renamed and expanded the two ‘Consequence of failure classifications’ (‘Normal and High’) into three ‘Applications of structural member’.

Each application category has an associated capacity factor, which is essentially a safety factor that is applied in design.

The higher factors are only applied to **primary structural elements** in structures *other than houses*. (The explanation for different types of structures or buildings is provided in the table.)

Primary structural elements are defined as “members and joints whose failure could result in collapse of a structure”.

DEFINITION OF PRIMARY STRUCTURAL ELEMENT

If an ordinary standard truss in a roof should be damaged or fail, the load tends

to be redistributed by the battens to the other trusses beside it, thereby preventing total collapse.

But if a heavily loaded girder truss fails, there is nowhere for its load to be shed. A girder truss may therefore be regarded as a primary structural element.

In wall frames, the failure of a single ordinary stud should not result in collapse, as the load is likely to be shed onto other studs.

However, if the post/beam connection supporting a critical lintel was damaged, it could lead to collapse.

The post/beam connection may therefore be regarded as a primary structural element.

An important consideration is whether the total assembly is able to provide adequate load redistribution.

For example, single span purlins (with large truss spacing) do not provide a load shedding mechanism.

Consequently, even the standard trusses in this situation could be considered primary structural elements.

Another interpretation of a primary structural element is a component or assembly that supports more than 10m² of roof area.

APPLICATION OF STRUCTURAL MEMBER

The three ‘Application of structural member’ categories mentioned above are related to the use of the building as shown in the table.



As a rule of thumb for the truss fabricator, category H applications (‘Normal’ consequence of failure) refer to all trusses in houses, including girder trusses, and to all standard trusses spaced up to 1.2m apart in all other building types.

Categories C & E (‘High’ consequence of failure) apply to standard trusses that are spaced more than 1.2m apart and to all girder trusses in buildings other than houses.

It is advisable to consult the builder/project manager for a classification for buildings other than houses as their determination of the building’s function may affect the price of supply.

When put into perspective, being more conservative with girder trusses in medium to large-scale commercial buildings is a small price to pay compared with the potential consequence of failure.

Category	Application of structural member	Typical type of building
H (House)	All structural elements in houses and secondary structural elements in structures other than houses.	Houses, farm buildings and other light structures whose failure does not result in significant loss of life or property.
C (Commercial)	Primary structural elements in structures other than houses.	Commercial and industrial buildings, multi-residential buildings, school classrooms and other institutional buildings.
E (Essential)	Primary structural elements in structures intended to fulfil an essential services or post disaster function.	Essential services buildings such as fire stations, hospitals, civil emergency shelters (e.g. school assembly halls), communication centres, etc.

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