

Behavioural Analysis of Lattice Bridge by Using ANSYS

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ABSTRACT: In this work we analysis the behaviour of lattice bridges. A lattice bridge is a form of truss bridge that uses a large number of small and closely spaced diagonal elements that form a lattice. Lattice girder is a triangulated framework of members where loads in the plane of the truss or girder are resisted by axial forces in the individual members. The terms are generally applied to the planar truss. A 'space frame' is formed when the members lie in three dimensions. The principle of a truss is simple. The structure is composed of top and bottom chords triangulated with diagonals in the webs so that each member carries purely axial load. Additional effects do exist but in a well-designed truss these will be of a secondary nature. A global moment on a truss is carried as compression and tension in the chords. A global shear is carried as tension or compression in the diagonal members. In the simplified case, where joints are considered as pinned, and the loads are applied at the panel points, the loading creates no bending moment, shear, or torsion in any single member. Loads applied in such a way as to cause bending, shear, or torsion will usually result in inefficient use of material.

KEYWORDS: Truss supported structure; behavioural analysis;

I. INTRODUCTION

The truss or lattice girder is a triangulated framework of members where loads in the plane of the truss or girder are resisted by axial forces in the individual members. The terms are generally applied to the planar truss. A 'space frame' is formed when the members lie in three dimensions.

The main uses are:

- In buildings, to support roofs and floors, to span large distances and carry relatively light loads, see Figure 1.
- In road and rail bridges, for short and intermediate spans and in footbridges, as shown in Figure 2.
- As bracing in buildings and bridges, to provide stability where the bracing members form a truss with other structural members such as the columns in a building. Examples are shown in Figure 3.

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Trusses and lattice girders are classified in accordance with the overall form and internal member arrangement. Pitched trusses are used for roofs. Parallel chord lattice girders are used to support roofs and floors and for bridges, although in continuous bridges, additional depth is often required at the piers. In the past, proper names were given to the various

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types of trusses such as the Fink truss, Warren girder, etc.. The most commonly used truss is single span, simply supported and statically determinate with joints assumed to act as pins.

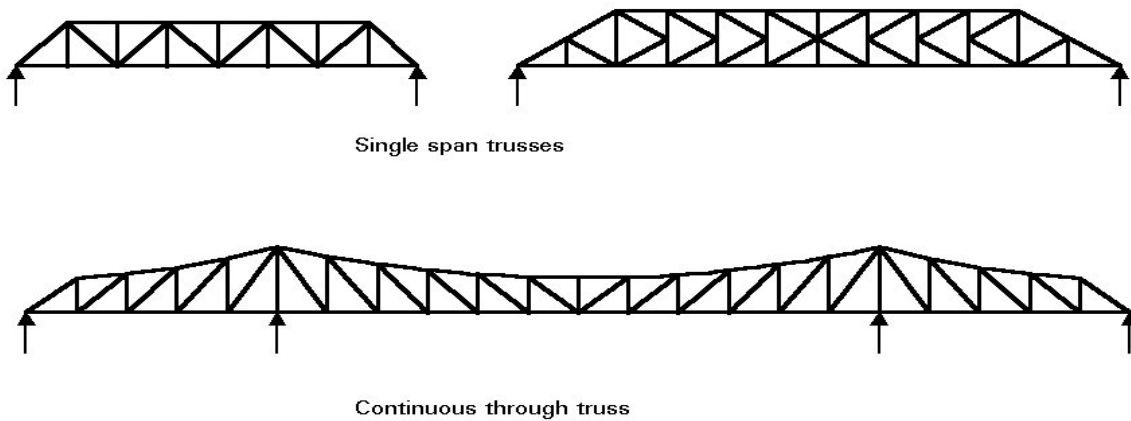


Figure 2 Bridge trusses

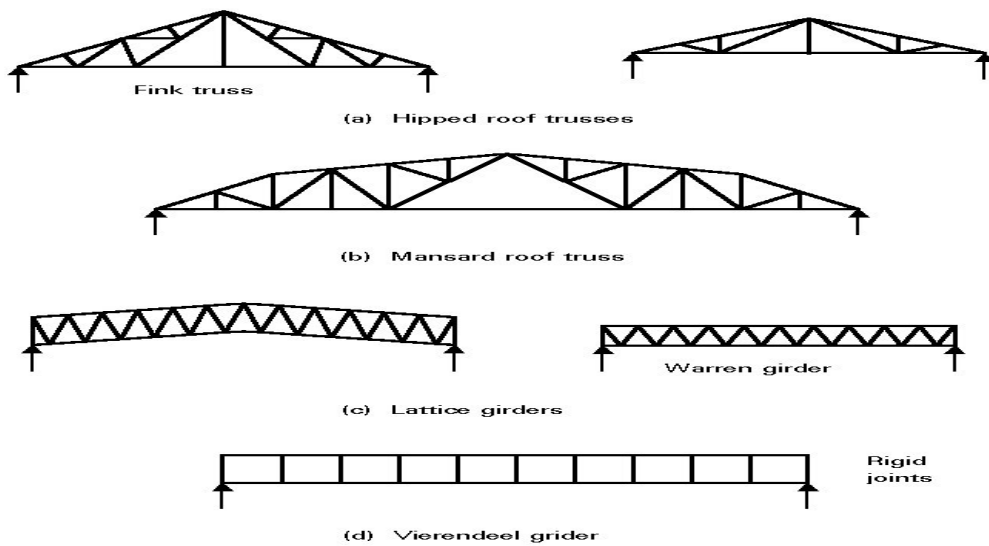


Figure 1 Trusses and lattice girders in buildings

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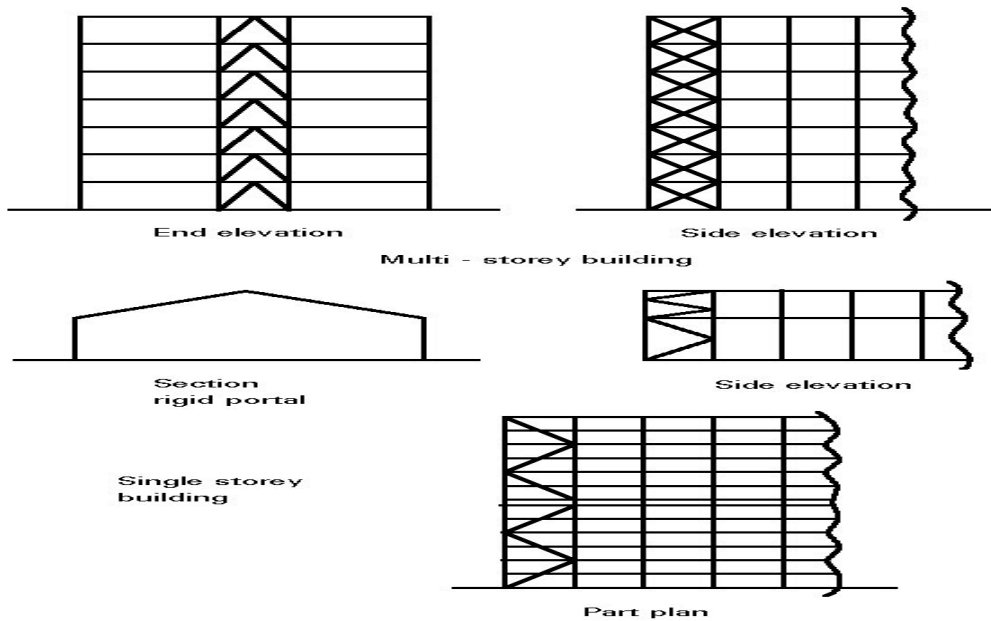
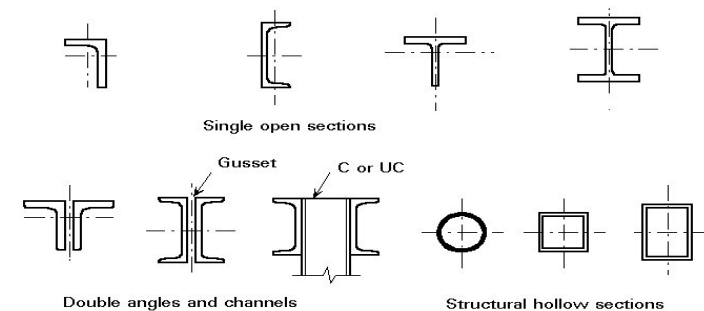


Figure 3 Bracing in buildings

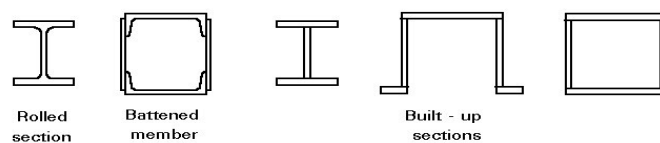
II. METHODOLOGY

Truss, lattice girder and bracing members for buildings are selected from:

- Open sections, primarily angles, channels, tees and joists.
- Compound sections, i.e. double angle and channels.
- Closed sections, in practice structural hollow sections.



(a) Buildings - truss, lattice girder and bracing members



(b) Bridge truss members

Figure 4 Members used in trusses and lattice girders

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For bridges, members are selected from:

- Rolled sections.
- Compound sections.
- built-up H, top hat and box sections

III. LOADS ACTING ON TRUSSES AND LATTICE GIRDERS

The main types of loads on buildings are shown in Figure 5, namely:

1. Dead loads. These are caused by self-weight, sheeting, decking, floor or roof slabs, purlins, beams, insulation, ceilings, services and finishes. Dead loads for the construction to be used in any particular case must be carefully estimated from material weights given in handbooks and manufacturers' literature.
2. Imposed loads. These are given in Eurocode 1 [1] for floors in various types of building and for roofs with or without access. The imposed load may cover the whole or part of the member and should be applied in such a way as to cause the most severe effect.
3. Wind loads. These are given in Eurocode 1 [1] and can be estimated from the location of the building, its dimensions and the sizes of openings on its faces. Wind generally causes uplift on roofs and this can lead to reversal of load in truss members in light construction. In multi-storey buildings, wind gives rise to horizontal loads that must be resisted by the bracing.

In special cases, trusses resist dynamic, seismic and wave loads. A careful watch should be kept for unusual loads applied during erection. Failures may occur at this stage when the final lateral support system is not fully installed.

For bridges, in addition to the dead loads and the vertical effects of live loads due to highway or railway loading, horizontal effects of live load have to be considered. These include braking and traction effects, centrifugal loads and accidental skidding loads. Temperature effects are significant in some bridges.

IV. CONCLUSION

- Trusses and lattice girders are important elements in building where they are used to support floors and roofs and provide bracing.
- For bridges, trusses can be economic for spans of 30m to 200m. They can be assembled from small pieces and are particularly advantageous where site access is difficult.
- Statically determinate trusses are generally used. Keep the configuration simple, using a minimum of members and connections.
- Avoid eccentricity of loading and connections to reduce secondary stresses. Secondary stresses due to loads applied between the nodes must be calculated.
- Careful consideration must be given in design to the provision of lateral support.
- Fatigue effects have to be considered in bridges and in some elements of buildings.
- Configuration of members and careful design of connections are particularly important.
- Avoid potential corrosion areas on all exposed steelwork.

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