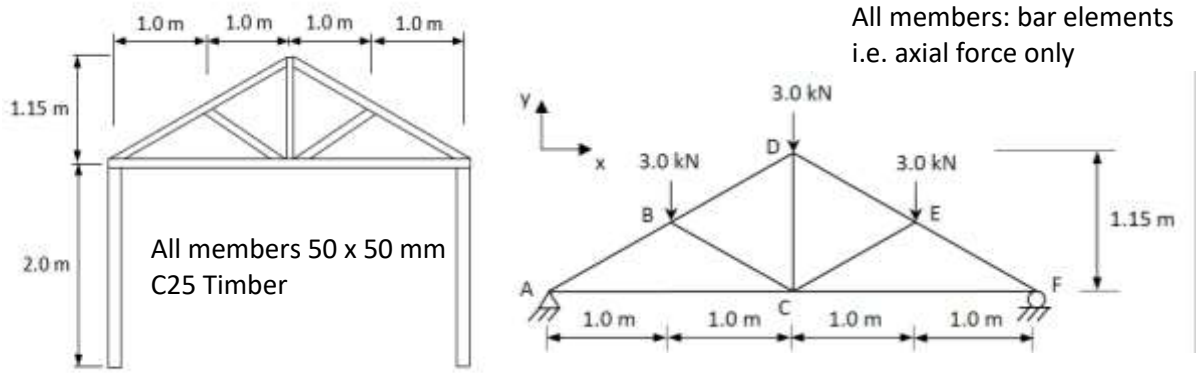
Comparison of engineering and analysis models

Figure 1 shows an engineering model and an analysis model of a roof truss. The purpose of the engineering model is to define what the structure will be - so that it can be assessed and built. The purpose of the analysis model is to provide information for a mathematical model to predict the behaviour of the structure under load.



(a) Engineering model (b) Analysis model

Figure 1 Engineering and analysis models

The differences between the types of information provided for these models is shown in Table 1.

Table 1 Comparison of information types

Engineering model	**Analysis model**
Geometry	Geometry
-	Member type: bar beam, etc.
Cross-section sizes	Cross-section properties – *A, I, J*
Material type/grade	Material properties: *E*
Connection details	Connection specification: pinned, moment connection, etc.
Support details	Restraint specification: pin, roller, fixed
Specification for materials	Loading

Support specifications

As an example, consider the specifications for the supports:

In the engineering model, the truss is supported on columns and there is no evidence that the ends of the truss have moment connections to the columns. It is therefore assumed in the analysis model that that the supports for the truss are free to rotate relative to the ends of the column. The symbol at the left-hand support in the analysis model is for a pin support. The symbol at the right-hand support is for a roller support. This combination of supports results in the frame being 'simply supported' i.e. the support conditions are statically determinate. This means that the support reactions can be calculated using only the principle of equilibrium.

Figure 2 shows (to an exaggerated scale) the deformed shape of the loaded truss from a computer model (using LUSAS). The engineering model does not show how the truss is restrained horizontally but the displacements of the analysis model have to be fixed in relation to a reference point. The reference point in this case is the left-hand support that is restrained vertically and horizontally. Note the horizontal movement at the right-hand support.

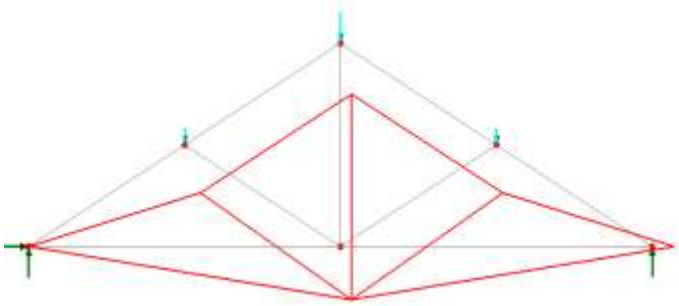


Figure 2 Deflected shape of the truss

Validation of the analysis model.

Validation is the assessment of how well the analysis model will predict the behaviour of the real structure that is represented by the engineering model. This is a crucial issue in the use of structural analysis. In most cases the predictions will be adequate but there can be problems. For example in the analysis of the London Millennium Bridge, an important loading condition was neglected because little was known about it

Metadata

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