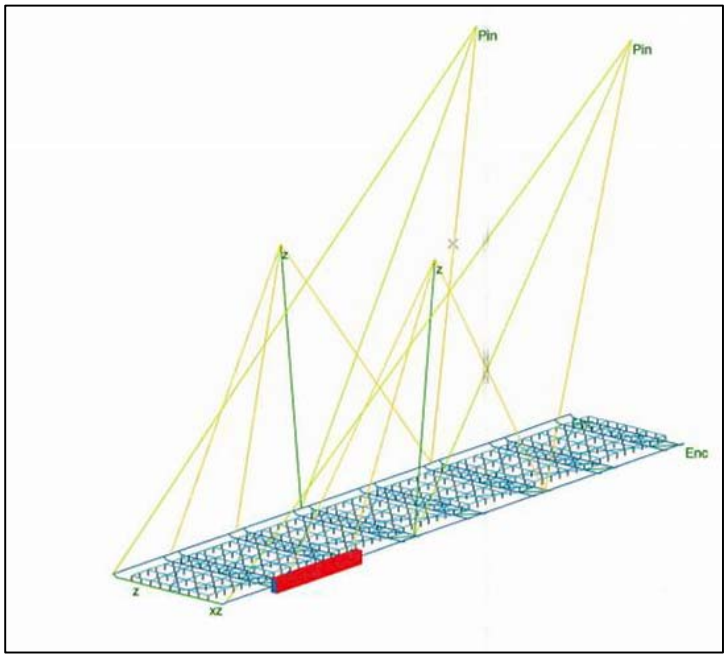
Overview of Discipline
Engineer

Engineering in this professional context is the discipline of applying technical, scientific and mathematical knowledge and skills in order to design and implement the building objective, (utilizing natural laws and physical resources).

A crucial and unique task of the engineer is to identify, understand and interpret the constraints on a design in order to produce a successful result. By understanding the constraints, engineers derive specifications for the limits within which a viable object or system may be produced and operated.

Structural engineers are some of the first people involved in tackling a new steel project. Usually multiple reasonable solutions exist, so engineers must evaluate the different design choices on their merits and choose the solution that best meets their requirements.

One of the most widely used tools in the profession is computer-aided design (CAD) software which enables engineers to create 3D models, 2D drawings, and schematics of their designs. CAD together with Digital mockup (DMU) and CAE software such as finite element method analysis or analytic element method allows engineers to create models of designs that can be analyzed without having to make expensive and time-consuming physical prototypes.



Analysis image courtesy of: Arup

These allow components to be checked, assess fit and assembly and to analyse static and dynamic characteristics of systems such as stresses, temperatures, fluid flows and kinematics.

The broad discipline of engineering encompasses a range of more specialized sub-disciplines, each with a more specific emphasis on certain fields of application and particular areas of technology.

Each of the various engineering disciples, such as Civil, Structural, Electrical, Mechanical, Air Conditioning, Hydraulics, Fire Protection/Detection and Acoustics, generally utilise a particular 3D software to import the crucial geometrical elements from the Architect's 3D model.

This dimensionally correct information is vital in enabling them to 'fit' their specific assignment within the confines of the structure and thus ensuring a clash free environment with the other elements or services.

The culmination of this information is the basis for the formation of a Building Information Model (BIM). The utilization of this BIM allows the reviewing process to be sped up, which in turn helps to have the final design locked-in much earlier.

Leading engineering companies, utilise the 3D model in a number of ways:

- Bid and scheme modeling to define a geometry and give basic quantities at the earliest opportunity
- The model then moves into a preliminary design stage for clarification of geometry and through various analytical exchanges
- Detailed design and documentation
- Translation or direct documentation into a specialised 3D modeling and drafting program (e.g. Tekla Structures, Strucad, Prosteel, etc.) by taking responsibility for dimensional setting out directly or via integrated checking procedures with the architect.
- Integration of building services
- 4D construction planning applications, which enable clear visualisation of a construction program as an animated sequence
- Various visualizations and animations

The acceptance and use of a Building Information Model (BIM), by the leaders in the industry, has greatly reduced, and in some cases, eliminated costly project errors by providing seamless collaboration and sharing of information among all the project team members.

This improved communication with the members of the project team leads to reduced RFI's, reduced "change orders", reduced mistakes and a compressed schedule. The outcome is reduced costs, resulting in increased profits and ultimately a successful project.