

## **STEEL AS A STRUCTURAL MATERIAL**

### **1.1 General**

Structural steel is a material used for steel construction, which is formed with a specific shape following certain standards of chemical composition and strength. They can also be defined as hot rolled products, with a cross section of special form like angles, channels and beams/joints. There has been an increasing demand for structural steel for construction purposes in the United States and India.

Measures are been taken by the structural steel authority for ready availability of structural steel on time for the various projects. The people at every level are working hard to realize the purpose of producing steel on time, like, service centers, producers, fabricators and erectors along with the general contractors, engineers and architects are all working hand in hand. Steel has always been more preferred to concrete because steel offers better tension and compression thus resulting in lighter construction. Usually structural steel uses three dimensional trusses hence making it larger than its concrete counterpart. There are different new techniques which enable the production of a wide range of structures and shapes, the procedures being the following:

- High-precision stress analysis
- Computerized stress analysis
- Innovative jointing

The structural steel all over the world pre-dominates the construction scenario. This material has been exhaustively used in various constructions all over the world because of its various specific characteristics that are very much ideally suited for construction. Structural steel is durable and can be well molded to give the desired shape to give an ultimate look to the structure that has been constructed. There is a mention of The Super dome situated in the United States and The Fukuoka Dome of Japan; both speak the unique language of the unique capabilities of the structural steel.

### **1.2 Types of structural steel:**

Various types of structural steel sections and their technical specifications are as follows:

- **Beams**
- **Channels**
- **Angles**
- **Flats**

#### **1.2.1 Steel Beams**

Steel Beams is considered to be a structural element which mainly carries load in flexure meaning bending. Usually beams carry vertical gravitational force but are also capable of carrying horizontal loads generally in the case of an earthquake. The mechanism of carrying load in a beam is very unique, like; the load carried by a beam is transferred to walls, columns or girders which in turn transfer the force to the adjacent structural compression members. The joists rest on the beam in light frame constructions.

The beams are known by their profile meaning:

- The length of the beam
- The shape of the cross section
- The material used

The most commonly found steel beam is the I beam or the wide flanged beam also known by the name of universal beam or stouter sections as the universal column. Such beams are commonly used in the construction of bridges and steel frame buildings.

The most commonly found types of steel beams are varied and they are mentioned below:

- I beams
- Wide flange beams
- HP shape beams

### **Typical characteristics of beams**

Beams experience tensile, shear and compressive stresses internally due to the loads applied to them. Generally under gravity loads there is a slight reduction in the original length of the beam. This results in a smaller radius arc enclosure at the top of the beam thus showing compression. While the same beam at the bottom is slightly stretched enclosing a larger radius arc due to tension. The length of the beam midway and at the bends is the same as it is not under tension or compression and is defined as the neutral axis. The beam is completely exposed to shear stress above the support. There are some reinforced concrete beams that are completely under compression, these beams are called pre-stressed concrete beams and are built in such a manner to produce a compression more than the expected tension under loading conditions.

The pre-stressed concrete steel beams have the manufacturing process like, first the high strength steel tendons are stretched and then the beam is cast over them. Then as the concrete begins to cure the tendons are released thus the beam is immediately under eccentric axial loads. An internal moment is created due to the eccentric axial load which in turn increases the moment carrying capacity of the beam. Such beams are generally used in highway and bridges.

### **Materials Used**

In today's modern construction the beams are generally made up of materials like:

- Steel
- Wood
- Reinforced concrete

#### **1.2.2 Steel Channels:**

Steel channels are used ideally as supports and guide rails. These are roll-formed products. The main metal used for making channels is steel along with aluminum. There are certain variations that are available in the channels category, the categorization is mainly on the shape of the channel, the varieties are mentioned below:

- **J channels:** This kind of channel has two legs and a web. One leg is longer. This channel resembles the letter-J.
- **Hat channels:** This channel has legs that are folded in the outward direction resembling an old fashioned man's hat.

- **U channels:** This most common and basic channel variety. It has a base known as a web and two equal length legs.
- **C channels:** In this channel the legs are folded back in the channel and resemble the letter-C. C channels are known as rests.
- **Hemmed channels:** In this kind of channel the top of the leg is folded hence forming double thickness. There are other variations of channels that are available, which are customized according to the customer's needs.

### **Application**

Steel channels are subjected to a wide array of applications. The application fields are:

- Construction
- Appliances
- Transportation
- Used in making Signposts
- Used in wood flooring for athletic purposes
- Used in installing and making windows and doors

A major variant of the channel is the mild steel channel. Such channels are generally used in heavy industries. They are used in the heavy machinery industry and automotive industry too.

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