



SNS COLLEGE OF TECHNOLOGY

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BEAM

A beam is a structural member resists loads applied laterally to its axis. Its primary mode of deflection is bending. Loads applied to the beam cause reaction forces at its support points. The sum of all the forces acting on the beam produces shear forces and bending moments within the beams, which cause internal stresses, strains, and deflections.

Beams are distinguished by their support method, profile, equilibrium conditions, length, and material. In this article, we will discuss various types of beams, such as Cantilever beams, simply supported beams, Overhanging beams, Fixed beams, and Continuous beams, with appropriate examples.

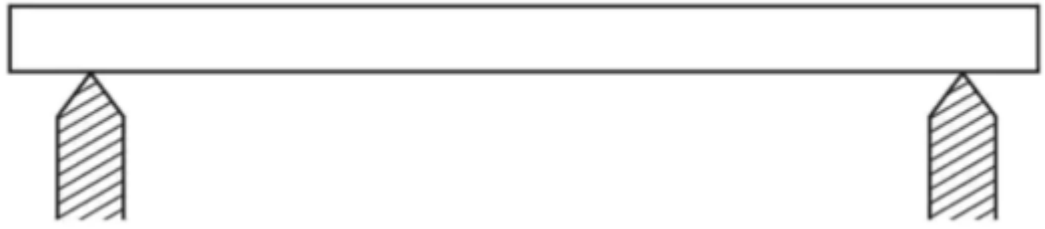
Cantilever Beam

A cantilever beam is a member with one end protruding beyond the point of support, allowing it to move vertically under the impact of vertical loads placed between the free end and the support.



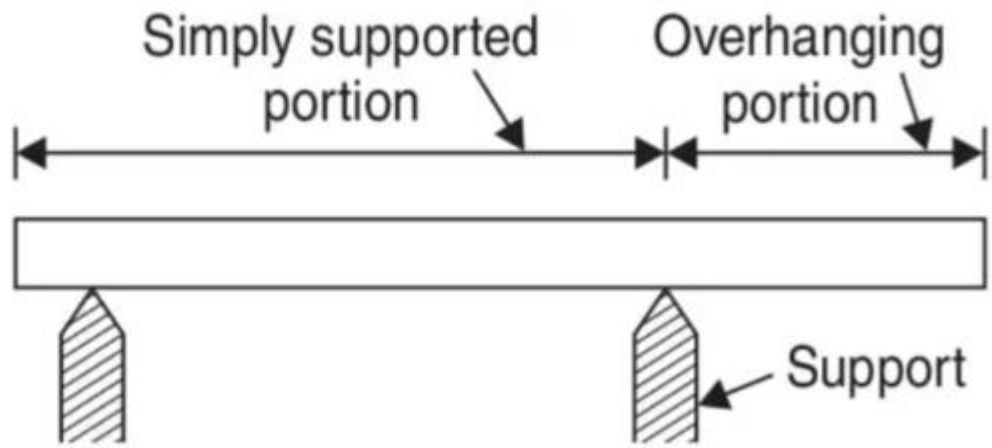
Simply Supported Beam

A simply supported beam is one that is supported by two points and can travel horizontally. Bridges, beams in structures, and machine tool beds are examples of typical practical applications of simply supported beams with point loadings.



Overhanging Beam

When the end of a beam extends beyond the support, it is referred to as an overhanging beam. Overhanging can occur on one or both sides of the supports.



Fixed Beam

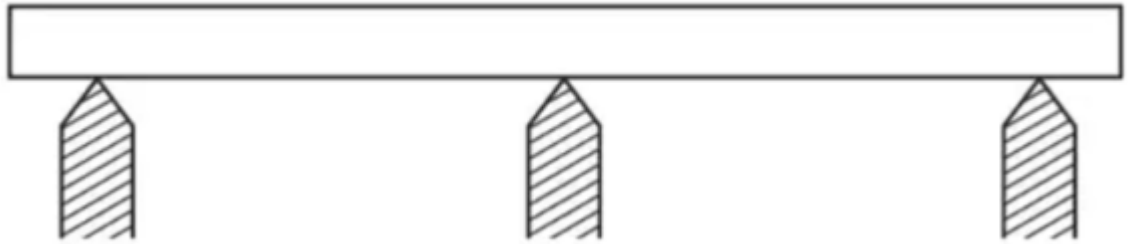
Two fixed ends hold up a fixed beam. It's also known as a fixed-end beam, built-in beam, or constrained beam. It is classed as a statically indeterminate beam since there are more than three unknowns and the static equilibrium equations alone are insufficient to identify the support reactions. The Fixed beam is shown below:



Continuous Beam

Continuous steel beams are made up of two or more beams that are welded together and reinforced by additional beams to form a strong but flexible component for large-scale

structures. Continuous beams, for example, are utilized in bridges, multi-story buildings, complex roof structures, and other construction projects.



Types of Beam Support

For stability, a structure relies less on the weight and stiffness of a material and more on its shape. Whatever the condition, a certain degree of stiffness is required for connection designs. The form of support connection influences the load-bearing capability of each member that makes up a structural system. Each support condition has an effect on the behaviour of the elements and, thus, the system. Horizontal-span support systems and vertical building structure systems are two types of structures.

- Roller supports
- Pinned support
- Fixed support
- Hanger support
- Simple support

COLUMN

A compression member is a structural element that predominantly carries the axial compressive load. The most commonly encountered compression member in building constructions is a column. A column is a compression member that transfers load from beam and slab to the structure's foundation.

The columns in construction are essential components. The structure collapses as a result of the column failing. Different types of columns are employed in the construction of buildings.

There are many distinct kinds of columns that are utilised in various portions of construction. A column is a vertical structural component that primarily supports compression loads. It may distribute the weight from a beam to a floor or foundations, or from a ceiling, floor slab, roof slab, or other slabs. The bending moments about one or both of the cross-section axes are frequently present in columns. The different types of columns based on several factors are listed below.

- Based on shape
- Based on the type of reinforcement
- Based on the type of loading
- Based on the slenderness ratio
- Based on the type of material

Types of Columns Based on Shape

Columns can be divided into different types based on the shape of their cross-section. In this category, the most common types of columns are square/rectangular, circular columns, L-type columns, T-type columns and Y-type columns. These are further explained below.

Square/Rectangular columns- These are generally used in building constructions. Due to the ease of shuttering and reinforcement placement, these types of columns are both cost-effective and simple to construct.

Circular columns- Circular columns are commonly used in piling and elevation of buildings. It is also used as bridge pillars. They provide better bending resistance than square or rectangular column

L-type columns- These types of columns are commonly used at the corners of boundary walls.

T-type columns- These types of columns are quite commonly used in bridge construction.

Y-type columns- They are used in bridge and flyover construction.

Types of Columns Based on the Type of Reinforcement

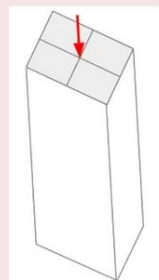
Based on the reinforcement, different types of columns are used in their construction. In this classification, we have 3 types of columns: tied columns, spiral columns and composite columns

Types of Columns Based on the Type of Loading

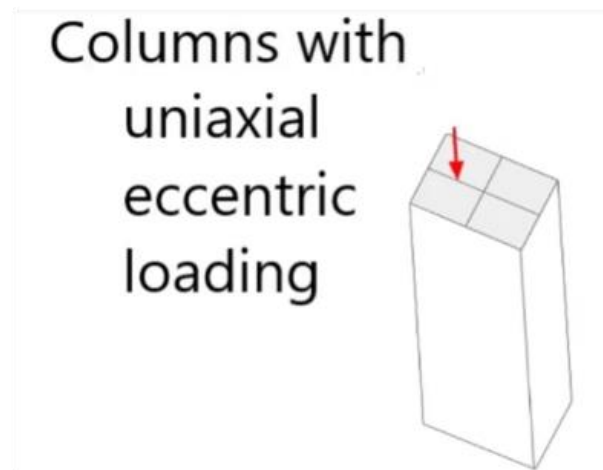
Columns can also be categorized based on how the load is acting on the cross-section of the columns. Different types of columns are defined based on whether the load is concentric or eccentric and if eccentricity is present, is it uniaxial or biaxial? Based on the above criteria, different types of columns are specified below.

Columns with axial loading (applied concentrically)- Axially loaded columns are the types of columns which has vertical axial loads acting on the centre of gravity of the cross-section of the column. These types of columns are not generally used in construction due to impracticality in coinciding vertical loads acting at the column's centre of gravity.

Columns with axial loading (applied concentrically)

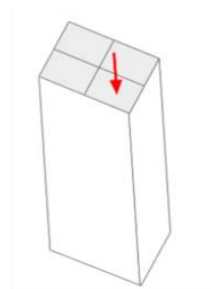


Columns with uniaxial eccentric loading- A uniaxial eccentrically loaded column is one in which the axis of vertical loads does not coincide with the C.G. of the cross-section of the column, but rather acts eccentrically on either the X or Y axis of the column cross-section. These types of columns are generally used in columns rigidly connected to beams from one side such as edge columns.



- Columns with biaxial eccentric loading- A biaxial eccentrically loaded column is one in which the vertical loads on the column do not correspond with the centre of gravity of the column cross-section and do not act on either X or Y-axis. These types of columns are used in columns with beams rigidly connected at right angles at the top of columns such as corner columns.

Columns with biaxial eccentric loading



Types of Columns Based on the Slenderness Ratio

- The slenderness ratio of a compression member is defined as the ratio of its effective length to its lateral dimensions. It provides a measure of the column's susceptibility to buckling failure. Columns can be divided into two types of columns based on the slenderness ratio.

- **Short column-** The column is referred to as a short column if the ratio of the effective length of the column to the least lateral dimension is less than 12. The failure of a short column is due to crushing (pure compression failure).
- **Long columns-** A long column is defined as one in which the ratio of the effective length of the column to the least lateral dimension is more than 12. Bending or buckling is how a long column fails.

Types of Columns Based on the Type of Material

Columns can also be classified based on the material used for their construction. Stone, brick, concrete, timber, steel, etc. are commonly used to make columns. Under this classification, different types of columns are listed below.

- Reinforced concrete column
- Steel column
- Timber column
- Stone Column
- Brick column