Introduction to Civil Engineering

Module 2 (Theory)

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SUPPORT

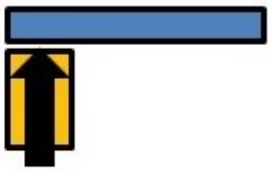
Supports are structures which prevent the beam or the body from moving and help to maintain equilibrium.

Types of Supports

1. Simple support

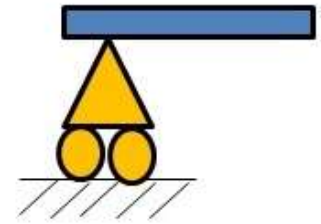
- This is a support where a beam rests freely on a support.
- The beam is free to move only horizontally and also can rotate about the support.
- In such a support one reaction, which is perpendicular to the plane of support, is developed.

Simple Support

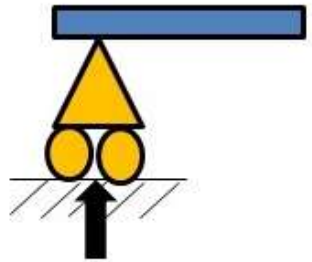


Reaction Force

Types of Supports



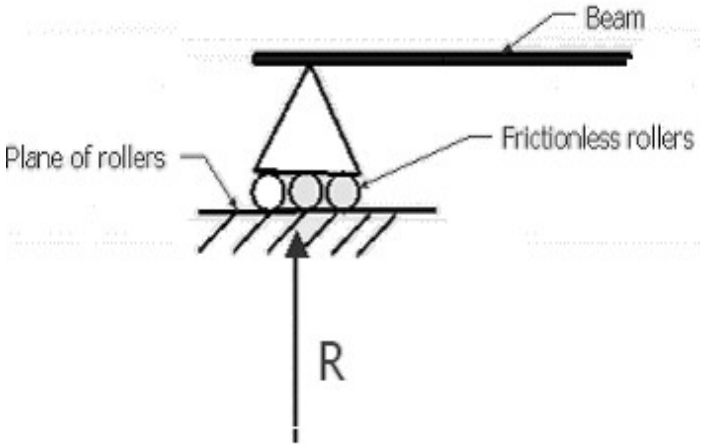
Roller Support

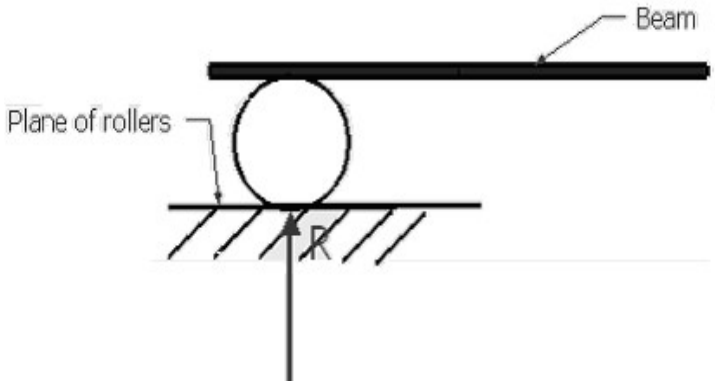


Reaction Force

2. Roller support

- This is a support in which a beam rests on rollers, which are frictionless.
- At such a support, the beam is free to move horizontally and as well rotate about the support.
- Here one reaction which is perpendicular to the plane of rollers is developed

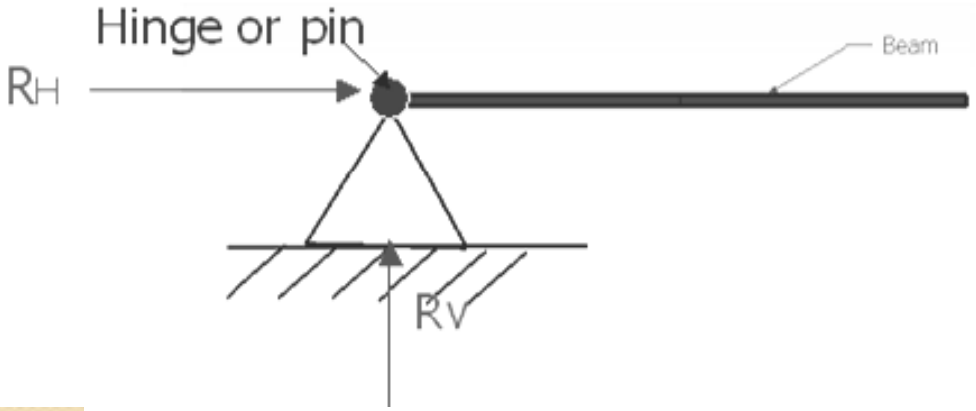




Types of Supports

3. Hinged support

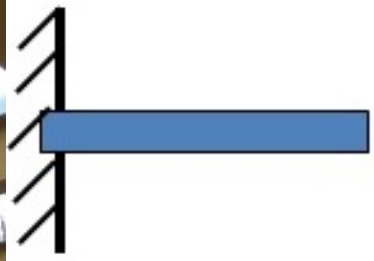
- This is a support in which the beam is attached to a support by means of a hinge or pin.
- The beam is not free to move in any direction but can rotate about the support.
- In such a support a horizontal reaction and a vertical reaction will develop.



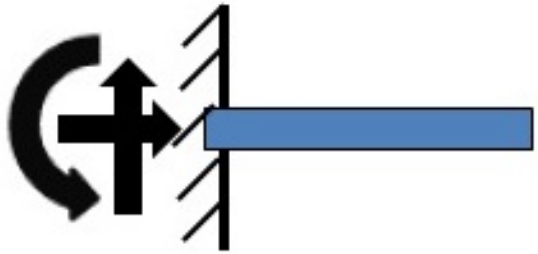
Types of Supports

4. Fixed support

- This is a support which prevents the beam from moving in any direction and also prevents rotation of the beam.
- In such a support a horizontal reaction, vertical reaction and a Fixed End Moment are developed to keep the beam in equilibrium.



Fixed Support

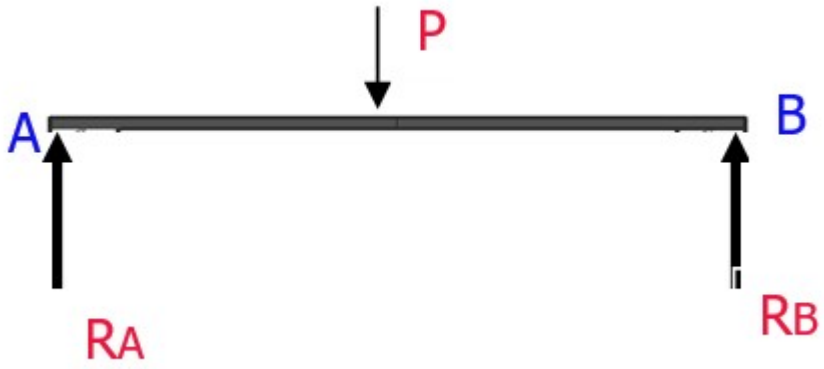


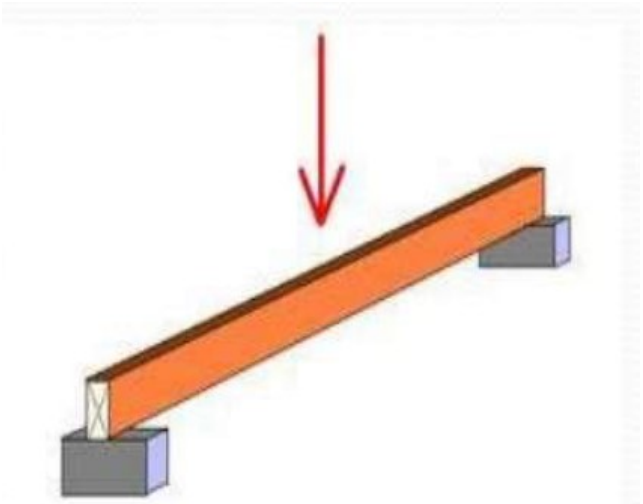
Reaction Force

LOADS

1. Point load or Concentrated load

- If a load acts over a very small length of the beam, it is assumed to act at the mid-point of the loaded length and such a loading is termed as Point load or Concentrated load.

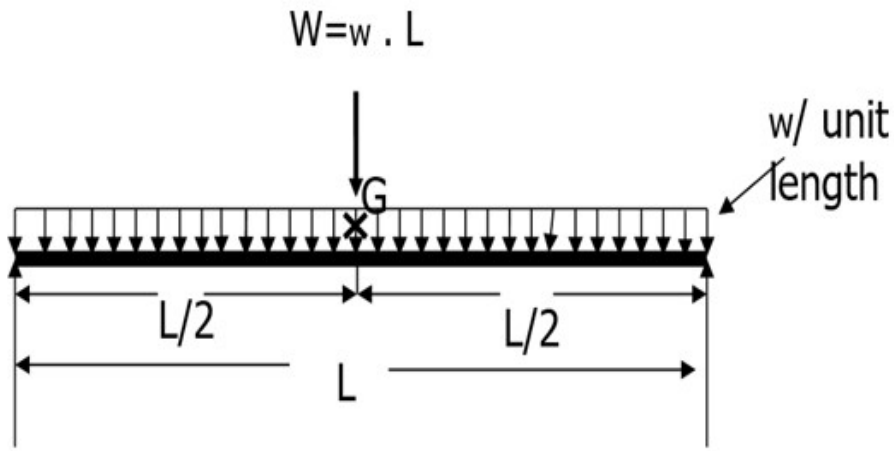


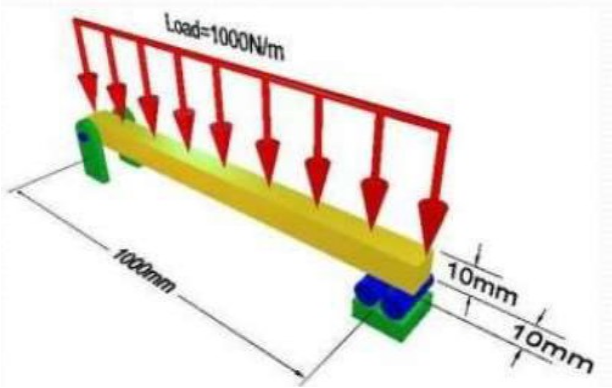


LOADS

2. Uniformly distributed load (UDL)

- If a beam is loaded in such a manner that each unit length of the beam carries the same intensity of loading, then such a loading is called UDL.
- The UDL should be replaced by an equivalent point load or total load acting through the mid point of the loaded length.

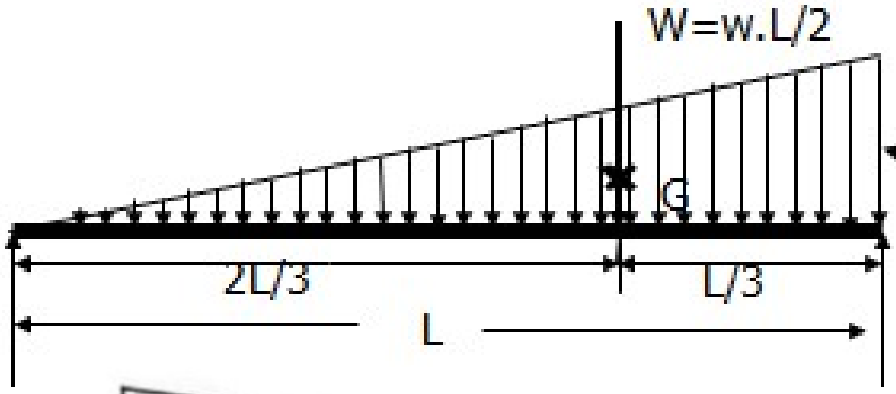


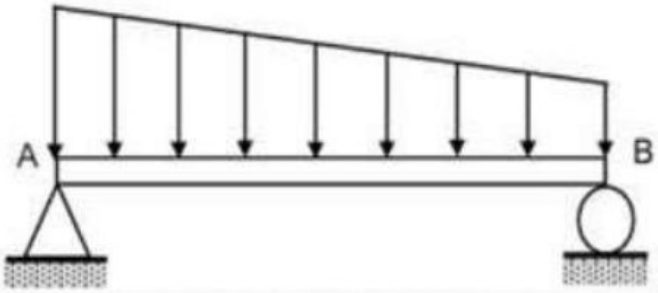


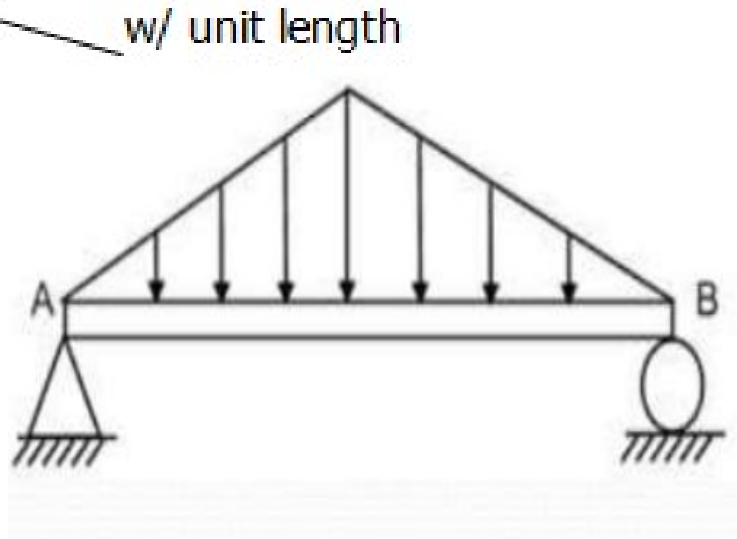
LOADS

3. Uniformly varying load (UVL)

- If a beam is loaded in such a manner, that the intensity of loading varies linearly or uniformly over each unit distance of the beam, then such a load is termed as UVL.



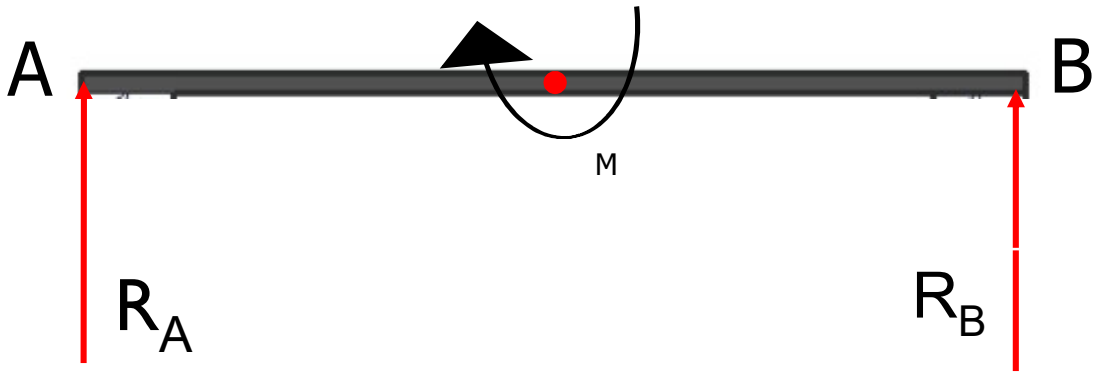




LOADS

4. External Moment

- A beam can also be subjected to external moments at certain points as shown in figure.
- These moments should be considered while calculating the algebraic sum of moments of forces about a point on the beam.



BEAMS

- It is a structural element that is capable of withstanding load primarily by resisting its bending forces.
- They are made of steel or reinforced concrete (RCC) or steel.

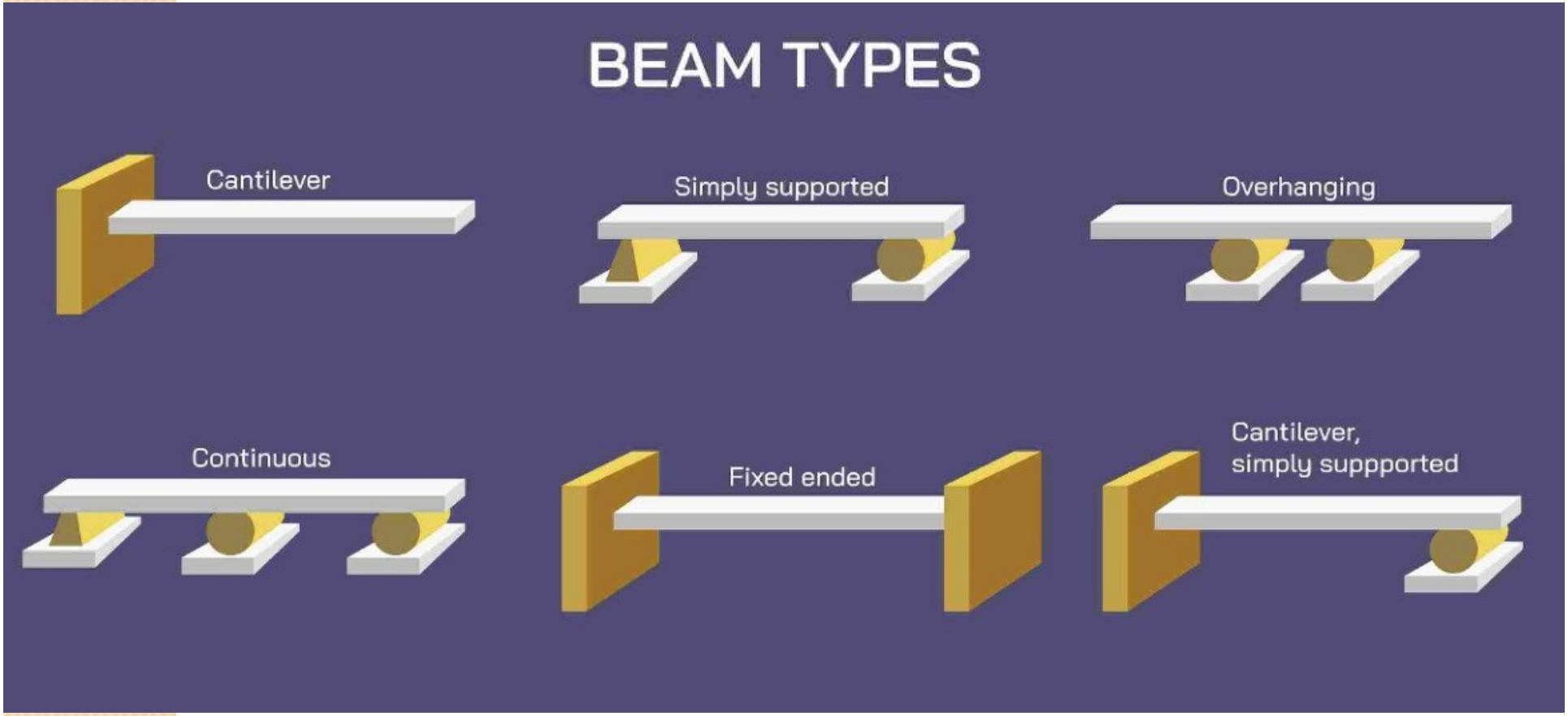
Beams are used in the structure to

1. Resist loads
2. Counter bending moment and shear forces.
3. Connect the frame.
4. Provide a uniform distribution of loads

BEAMS

Classification of beams:

According to the support conditions



BEAMS

Functions of Beam:

- The primary function of beam is to **carry and transfer the loads imposed on a structure.**
- Beams support the **weight of floors, walls, roofs, and any other** imposed loads such as furniture, equipment, or people. They distribute these loads to the columns.
- Beams prevent **sagging, deflection, or excessive** bending of the structural members they support.
- They improve overall **stability of the building**.

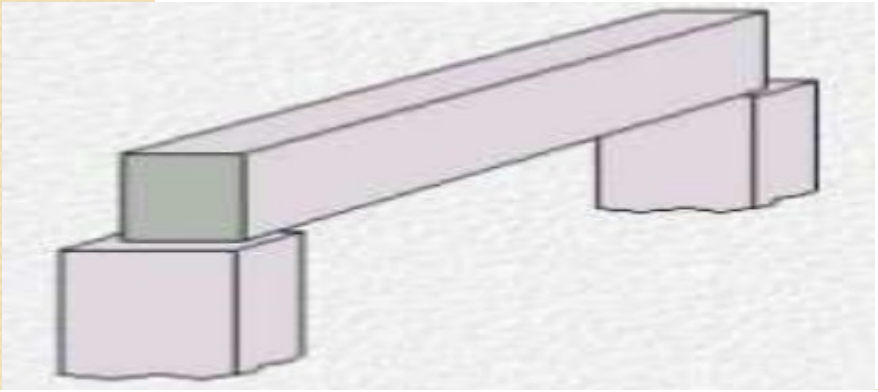
Types of beams

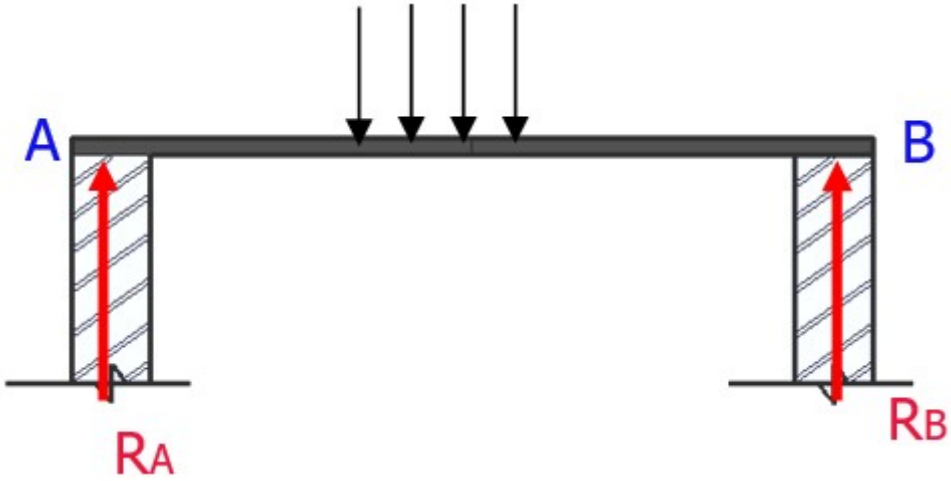
A) Statically Determinate Beams

The equations of static equilibrium are sufficient to find all the unknown reactions. The types of beams which are statically determinate are as follows:

1) Simply Supported Beams

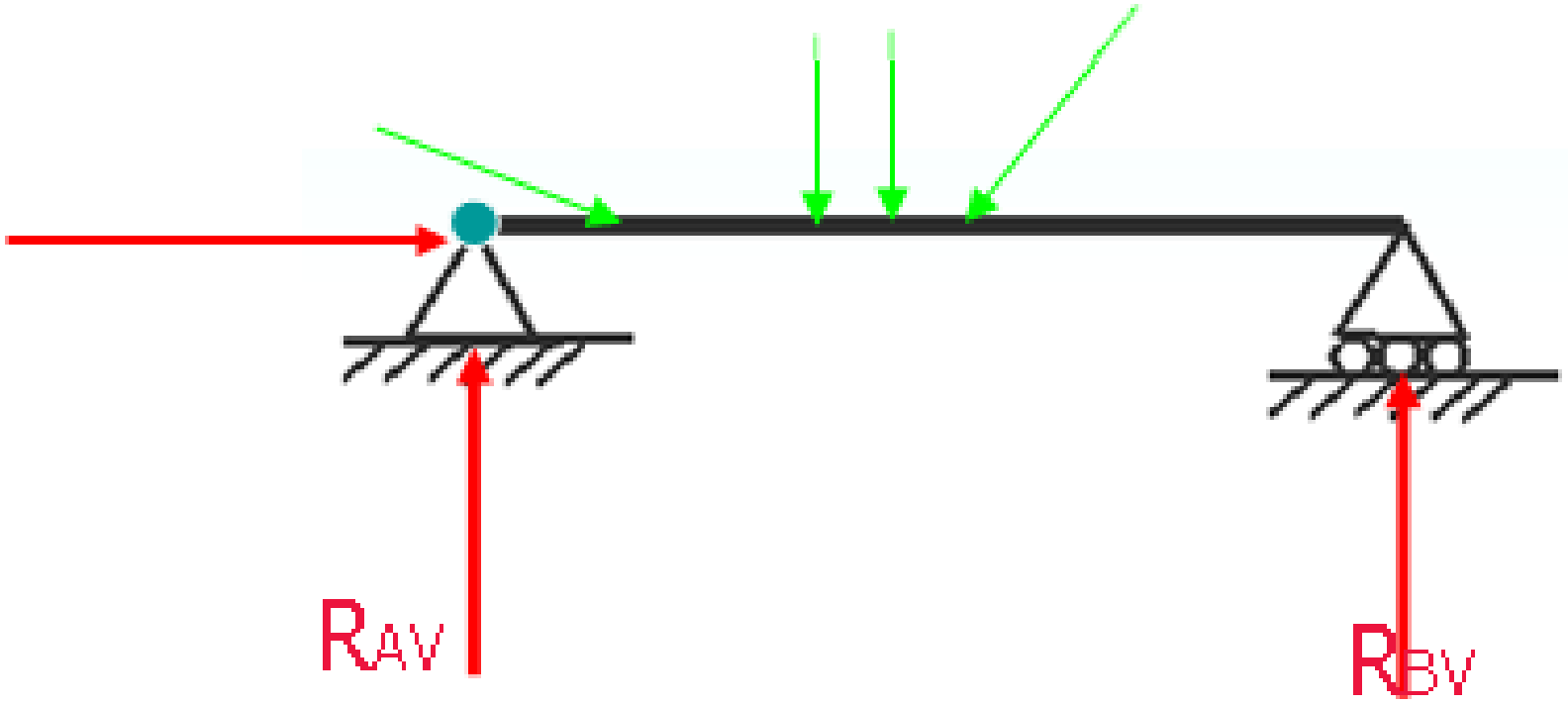
A beam is said to be simply supported when both ends of the beam rest on simple supports. Such a beam can carry or resist vertical loads only.





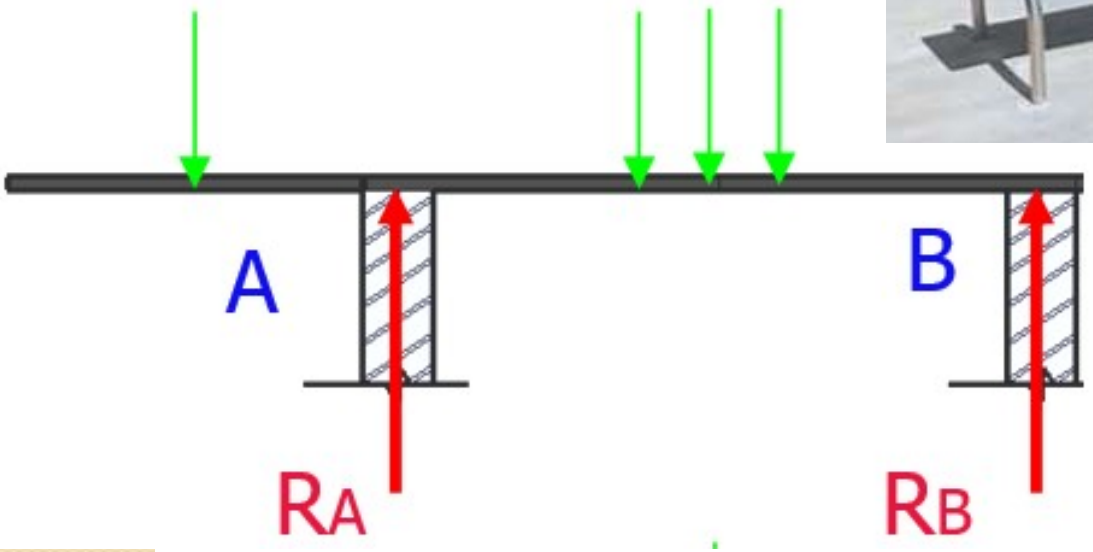
2) Beam with one end hinged & other on rollers

It is a beam where one end of the beam is hinged to a support and the other end rests on a roller support. Such a beam can carry any type of loads.



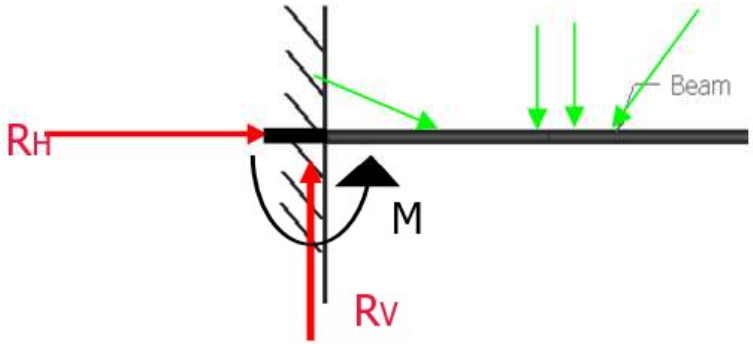
3) Over hanging beam

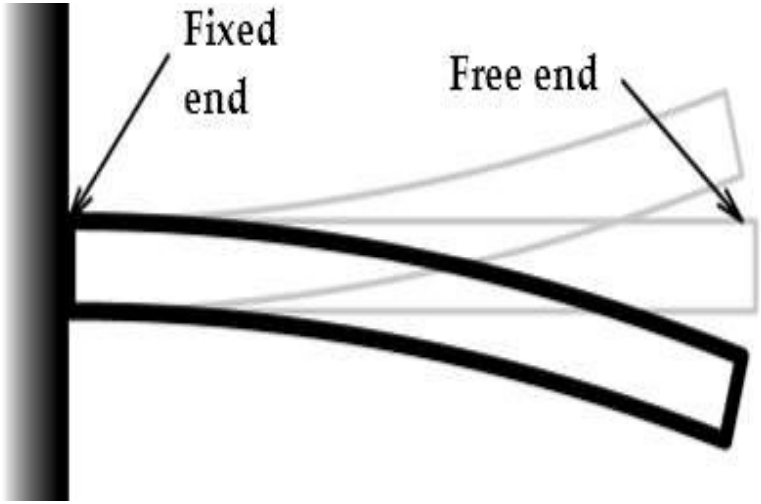
It is a beam which projects beyond the supports. A beam can have over hanging portions on one side or on both sides.



4) Cantilever Beams

It is a beam, with one end fixed and other and free. Such a beam can carry loads in any directions.



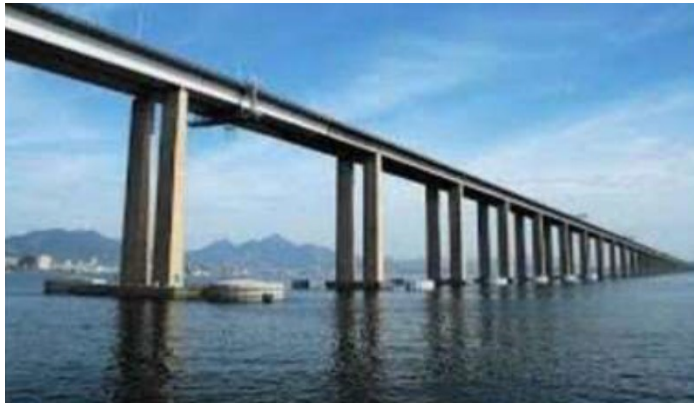


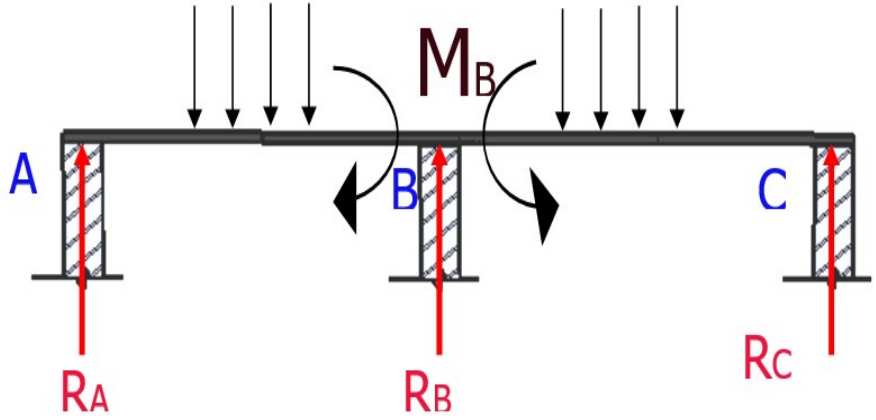
B) Statically Indeterminate Beams

In statically indeterminate beams, the number of unknown reactions exceeds the number of equations of static equilibrium and hence cannot be solved completely using these equations alone.

1) Continuous Beams

It is a beam which rests over a series of supports at more than two points.

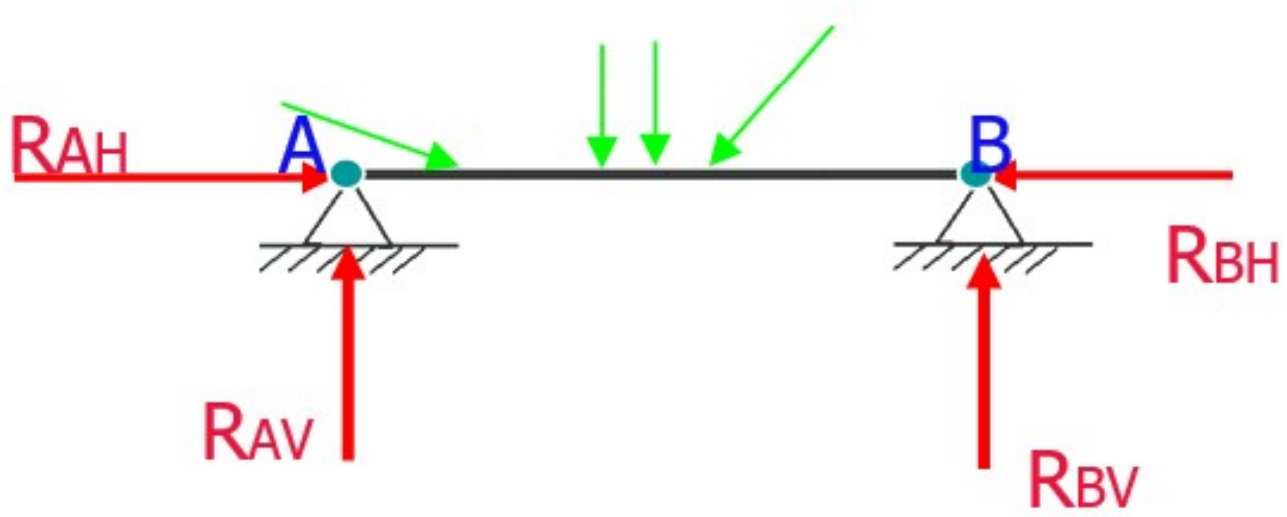




2) Hinged Beam (Beams with both ends hinged)

It is a beam which is hinged to supports at both ends.

Such a beam can carry loads is any direction.



3) Propped Cantilever Beam

It is a beam which has a fixed support at one end and a simple support at the other end.