Course Code: ESC106A
Course Title: Construction Materials and Engineering Mechanics

Lecture No. 27:
Types of Loads

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Lecture Intended Learning Outcomes

At the end of this lecture, students will be able to:

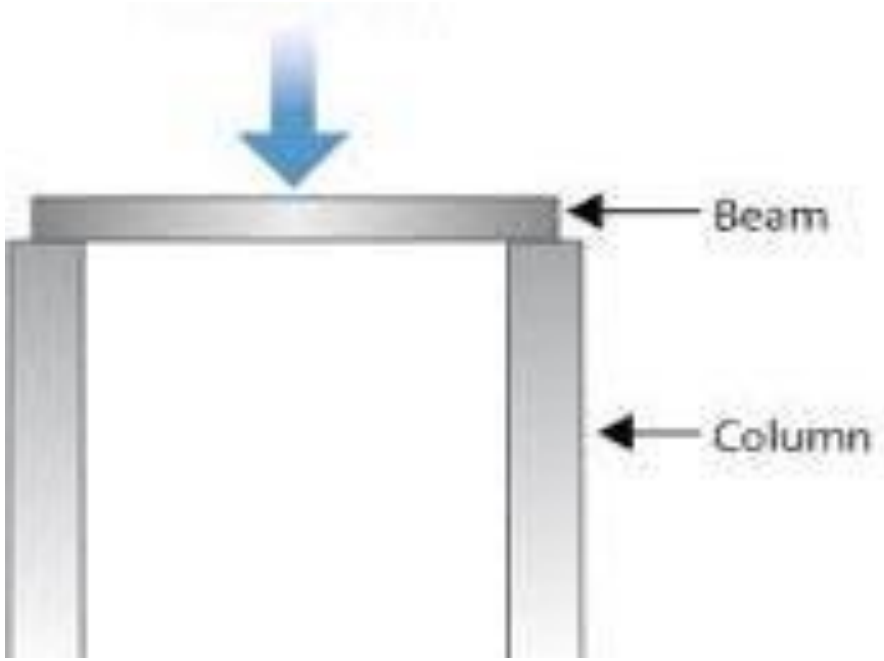
- Identify and explain different types of loads

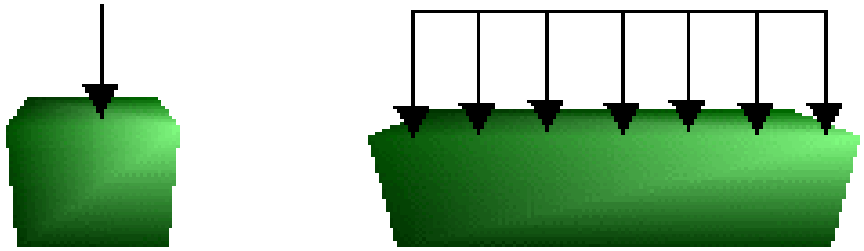
Contents

Types of loads, trusses and frames

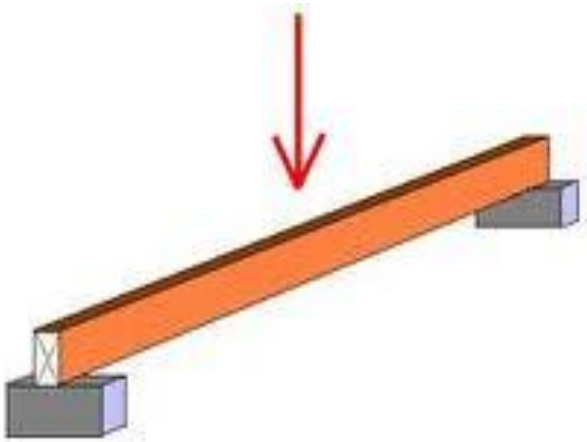
Types of Loads

- Point load (concentrated load)
- Distributed load
- Coupled load

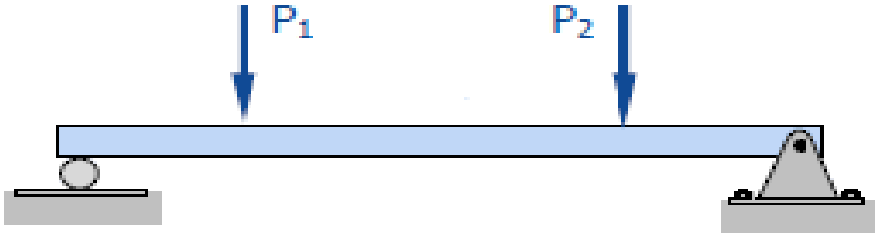




Point Load (Concentrated Load)



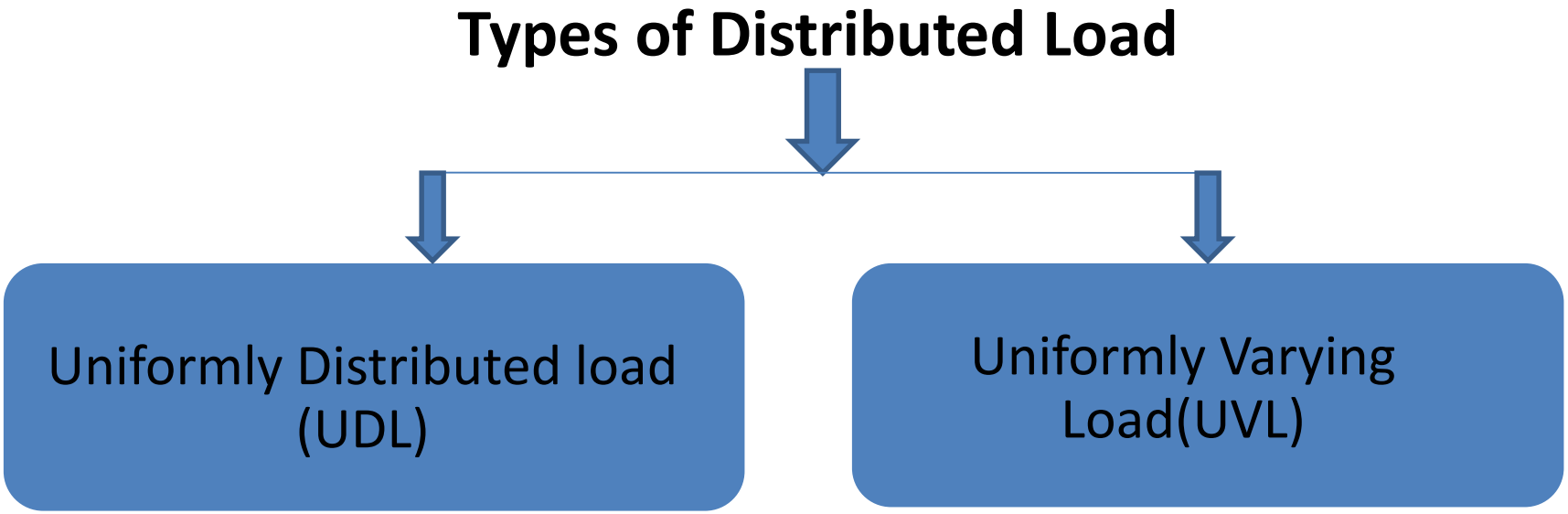
- Point load is that load which acts over a small distance
- Because of concentration over small distance this load can may be considered as acting on a point
- Point load is denoted by P and symbol of point load is arrow heading downward (↓)



Concentrated Loads

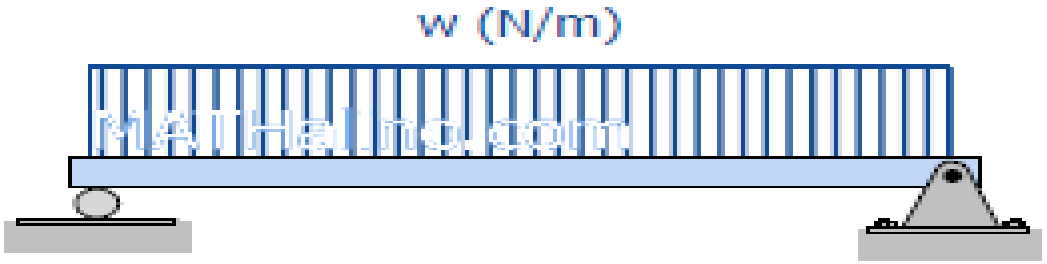
Distributed Load

- Distributed load is that acts over a **considerable length** or you can say over a length which is measurable.
- Distributed load is measured as **per unit length**



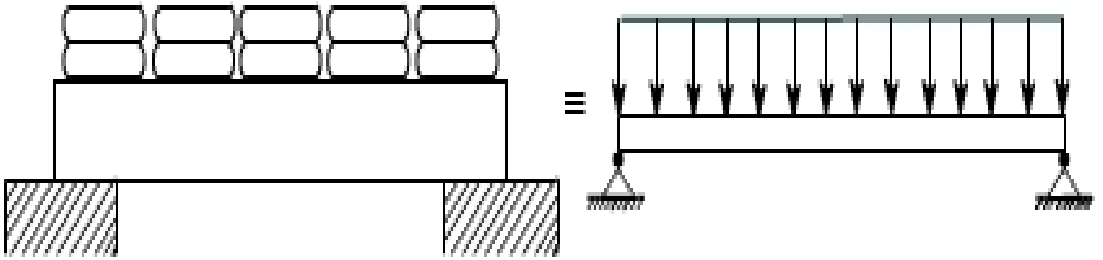
Uniformly Distributed Load (UDL)

- Uniformly distributed load is that whose magnitude remains uniform throughout the length.
- Uniformly distributed load is usually represented by **'W'** and is pronounced as intensity of Udl over the beam, slab etc



Uniform Load

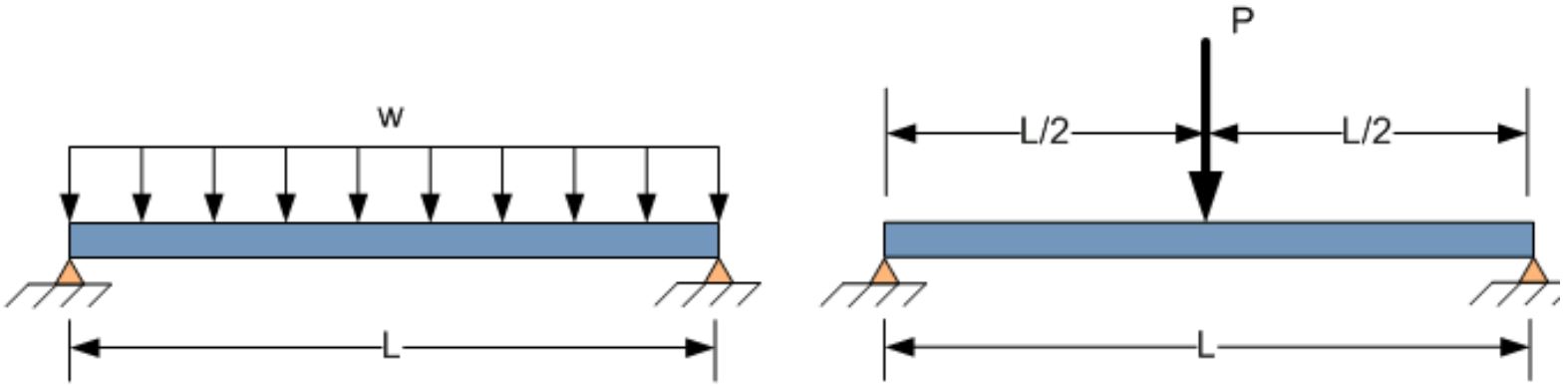
Bags of grains placed over a beam



Uniform Distributed Load To Point Load

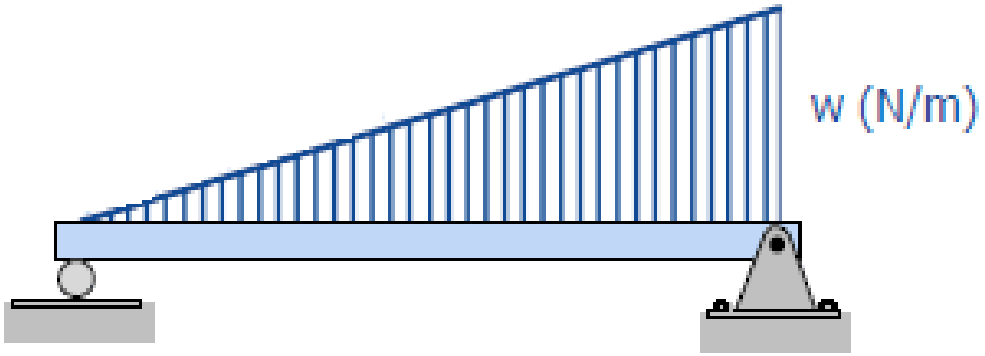
- Conversion of uniform distributed load to point load is very simple.
- By simply multiplying the intensity of Udl with its loading length.

Equivalent Concentrated load = Udl intensity (W) x Loading length



Uniformly Varying Load

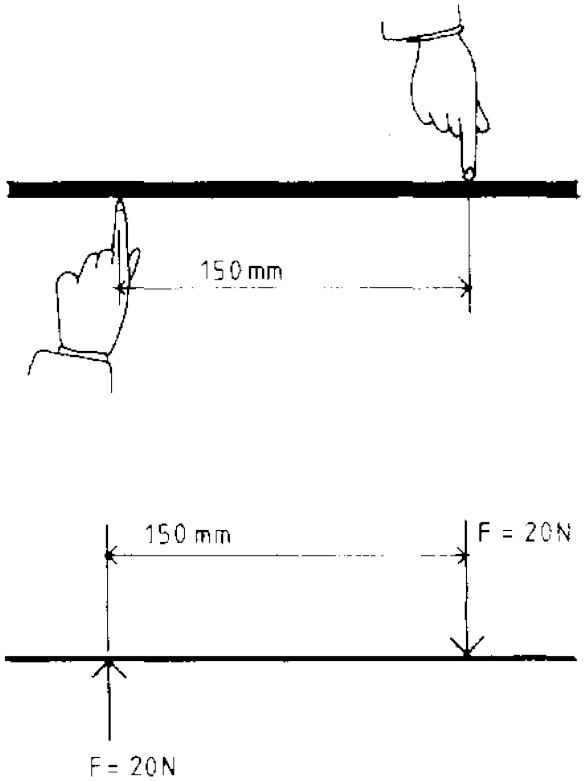
- Triangular load is that whose magnitude is **zero** at **one end** of span and increases constantly till the **2nd end** of the span



Uniformly Varying Load

Coupled load

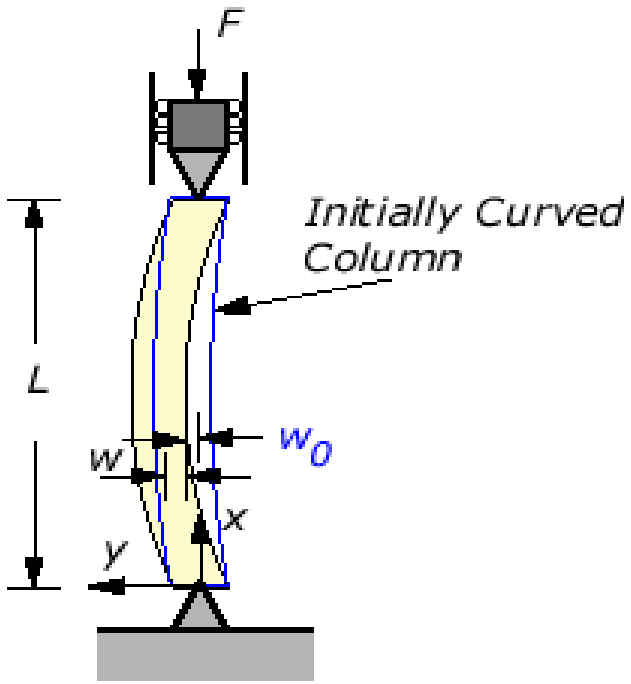
- Coupled load is that in which two equal and opposite forces acts on the same span.
- The lines of action of both the forces are parallel to each other but opposite in directions.
- This type of loading creates a couple load.



Classification of Structures

Axial Force Members

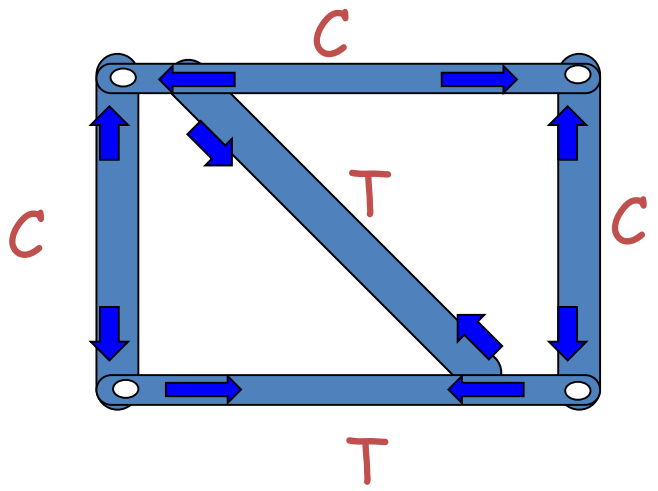
- Members with length significantly greater than the largest cross-sectional dimension and with loads applied along the longitudinal axis.



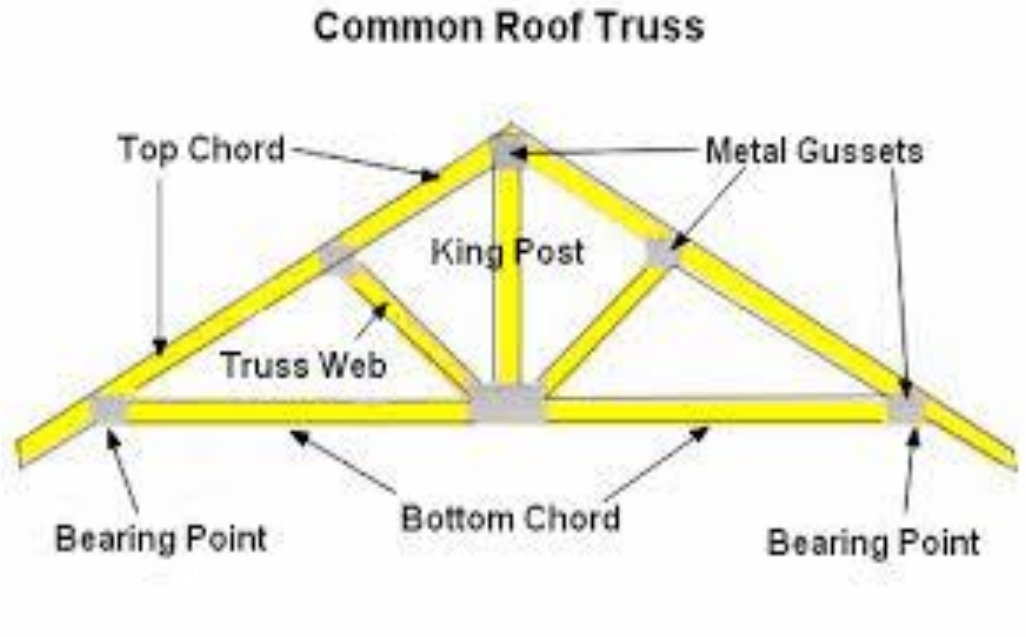
Simply supported column subjected to axial load F

Trusses

- A truss is a structure comprising five or more triangular units constructed with straight members whose ends are connected at joints referred to as nodes.



Forces in Truss Members

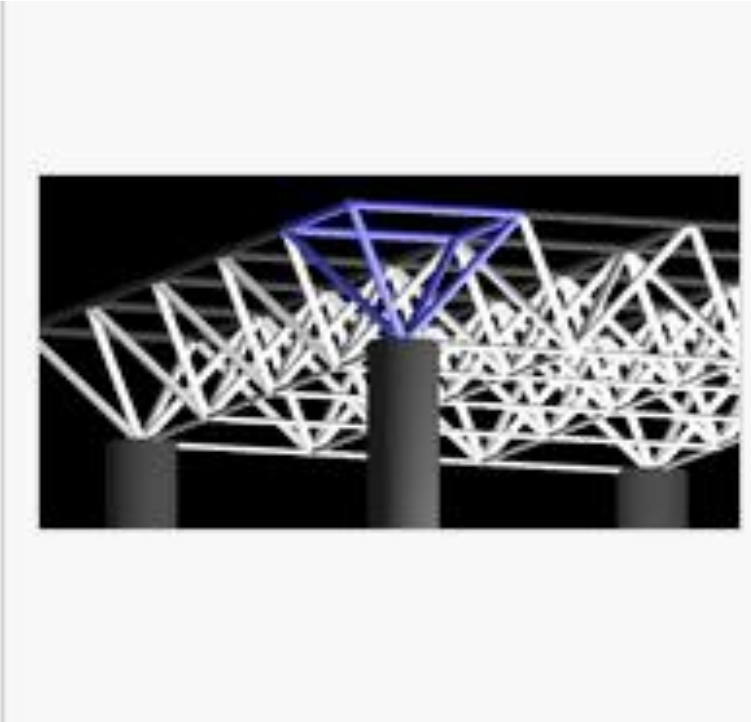


Planar truss

- The simplest form of a truss is one single triangle. This type of truss is seen in a framed roof consisting of rafters and a ceiling joist
- A planar truss lies in a single plane.
- Planar trusses are typically used in parallel to form roofs and bridges

Space Frame Truss

- A space frame truss is a three-dimensional framework of members pinned at their ends.
- A tetrahedron shape is the simplest space truss, consisting of six members which meet at four joints.

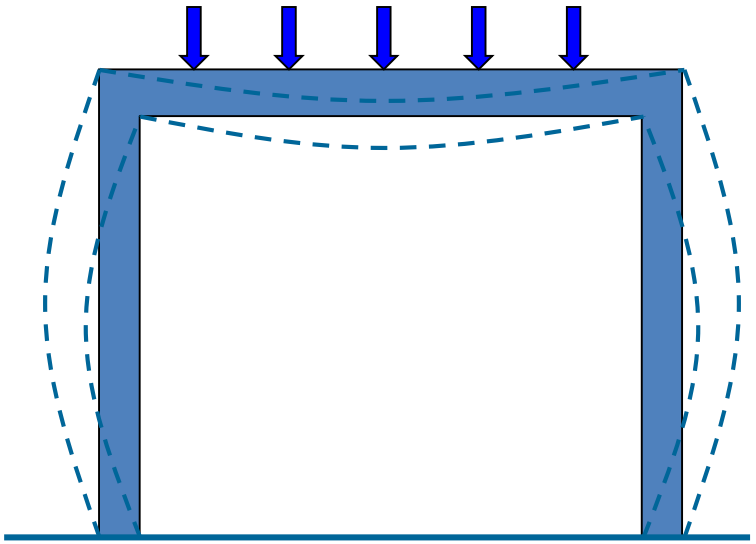


Frames

- Frame structures are the structures having the combination of beam, column and slab to resist the lateral and gravity loads.

  Types of frame structures: Frames structures can be differentiated into,

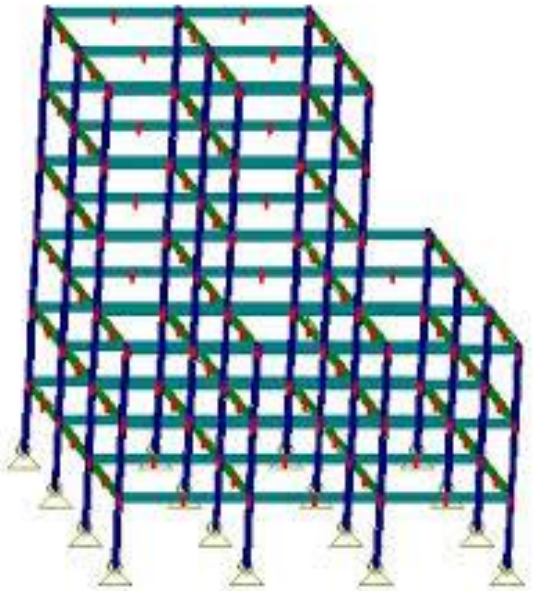
  – Rigid frame structure
  – Braced frame structure

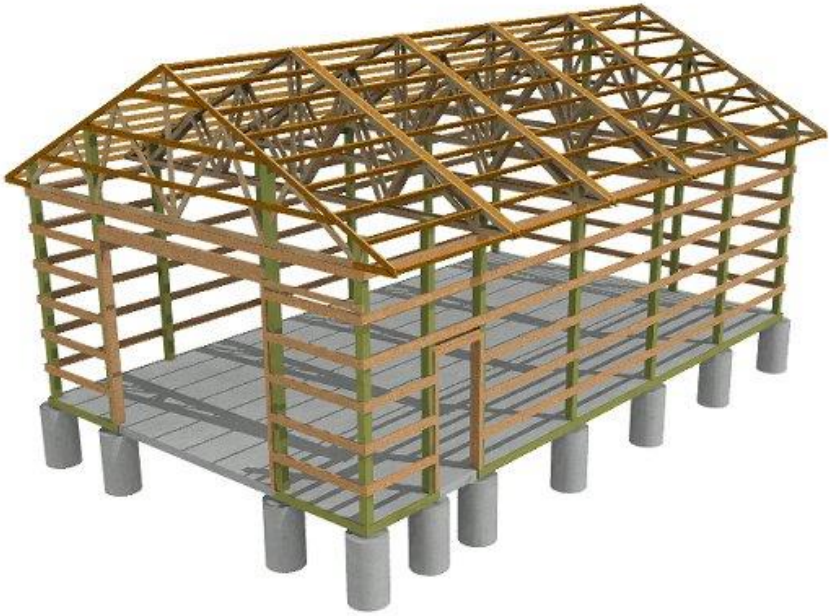


Frame

Advantages of Frame Structures

- One of the best advantages of frame structures is their ease in construction.
- It is very easy to teach the labor at the construction site.
- Frame structures can be constructed rapidly.
- Economy is also very important factor in the design of building systems.
- Frame structures have economical designs





Cables

- Cables carry applied loads & develop mostly tensile stresses - Loads applied through hangers - Cables near the end supporting structures experience bending moments and shear forces.
- It is used to transmit large tensile forces

Summary

- Loads are classified into point loads, distributed loads and coupled loads
- Point load is that load which acts over a small distance
- Distributed loads are further classified into uniformly distributed load and uniformly varying load
- Coupled load is that in which two equal and opposite forces acts on the same span
- A truss is a structure comprising five or more triangular units constructed with straight members whose ends are connected at joints referred to as nodes
- Frame structures are the structures having the combination of beam, column and slab to resist the lateral and gravity loads