



RAMAIAH
Institute of Technology

BASICS OF CIVIL ENGINEERING & MECHANICS

Course code:CV14/CV24

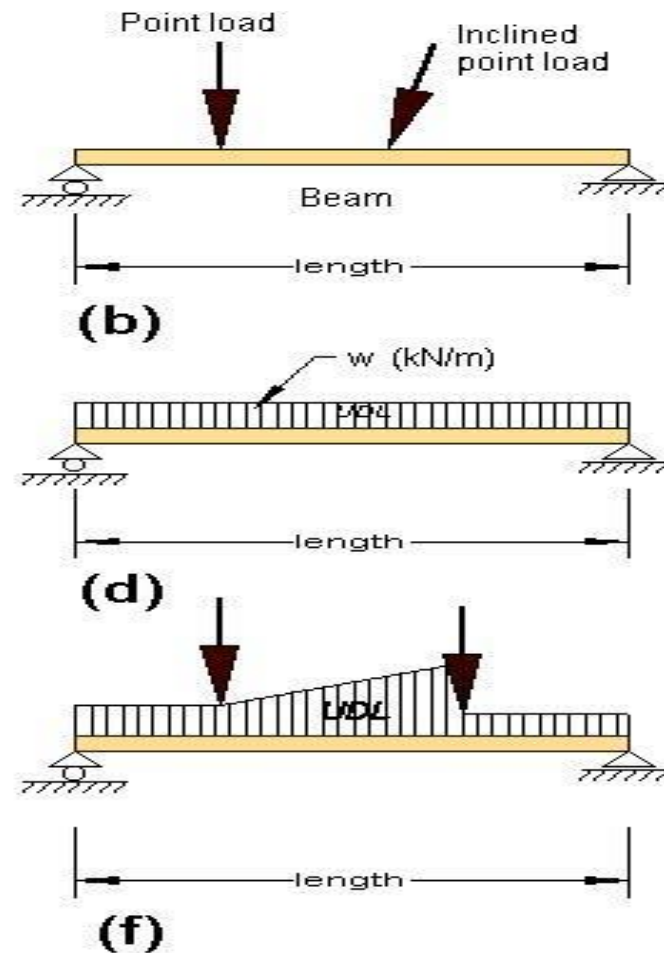
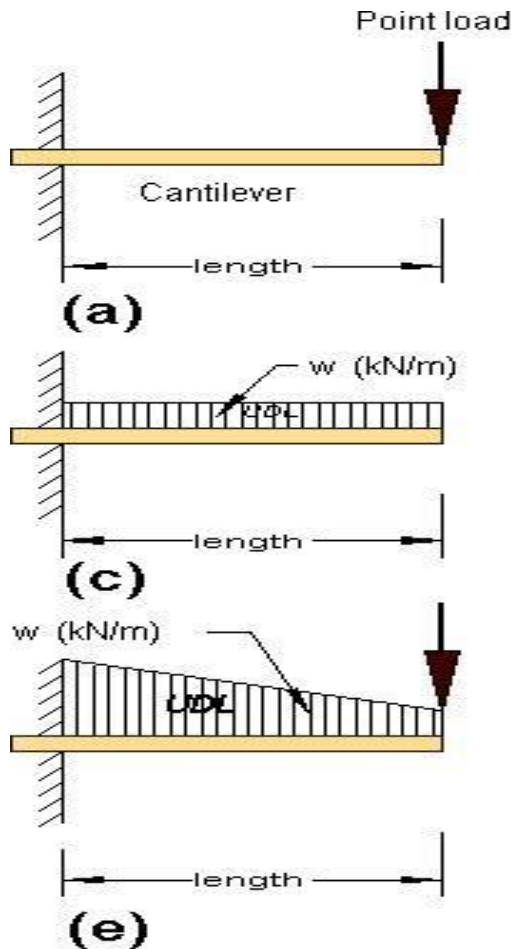
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Topics Covered

*Equilibrium of Non
Concurrent Force System*



Types of loads





What is a structural support ???

Any thing which **take up** the **loads** coming from the **super structure** and **transfer** to **substructure**

- **Structural systems transfer their loading through a series of elements to the ground.**
- **Each connection is designed so that it can transfer or support a specific type of load or loading condition.**
- **In order to analyze a structure it is necessary to be clear about the forces that can be resisted and transferred at each level of support throughout the structure.**



The **actual behavior** of a **support or connection** can be **quite complicated** if **all conditions** were **considered** and the **design** of each support would be a **terribly lengthy process**.

For ex:

1. hinge support is considered as 100% friction free but it is not true.
2. There will also be vertical deformations in the elastomeric bearings which is ignored while designing.
3. While designing its no where considered temperature effects on the structural supports.



Structural steel systems → welded or bolted connections

Precast RCC or PSC systems → mechanically connected

Cast-in-situ → monolithic connections

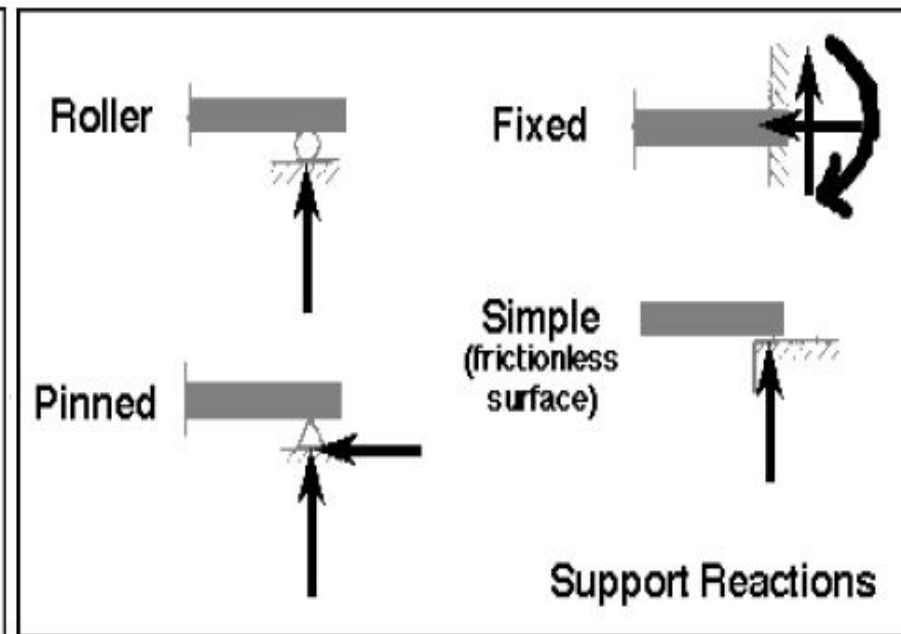
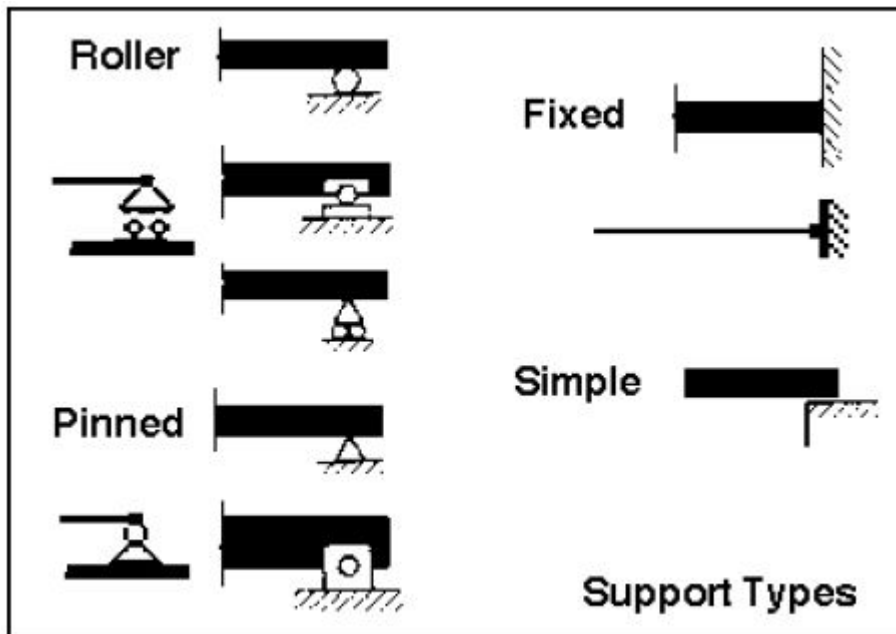
Timber systems → nails, bolts, glue
& engineered connectors.

No matter the material the connection must be designed to have a specific rigidity.



There are generally four type of supports

- Roller support
- Hinge or pin support
- Fixed support
- Simple support







- **Roller supports are free to rotate and translate** along the surface upon which the roller rests. The **surface** can be **horizontal vertical or sloped** at any angle.
- The **resulting reaction force** is always a **single force** that is **perpendicular** to the
- Roller supports are **commonly located at one end of long bridges** . This **allows** the bridge structure to **expand and contract** with **temperature changes**.
- Roller supports can also **take the form of rubber bearings ,rockers** which are designed to **allow a limited amount of lateral movement**.





- **A pinned support can resist both vertical and horizontal forces but not a moment.**
- **They will allow the structural member to rotate but not to translate in any direction.**
- **Many connections are assumed to be pinned connections even though they might resist a small amount of moment in reality.**
- **It is also true that a pinned connection could allow rotation in only one direction providing resistance to rotation in any other direction.**

Ex :Pen stand is the example for the pin support which can allow rotation in all directions and also about its own axis.

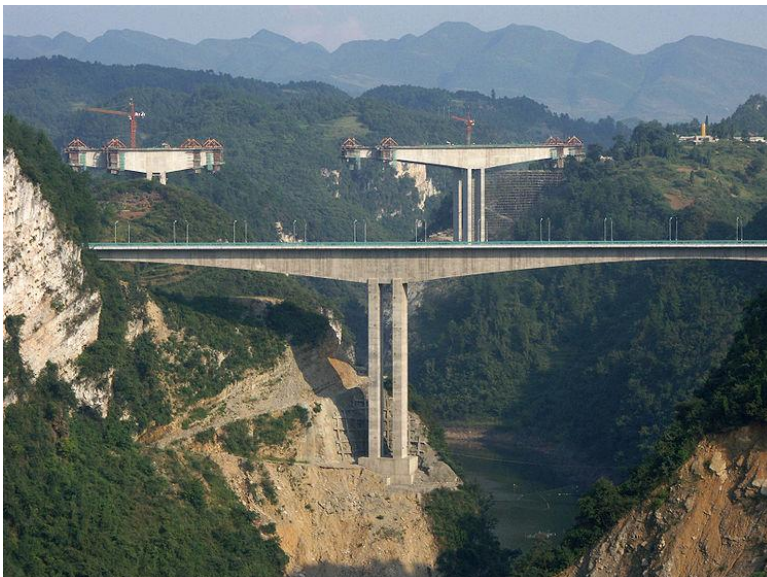


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Some of the fixed support





- **Fixed supports can resist vertical and horizontal forces as well as a moment. Since they restrain both rotation and translation they are also known as rigid supports.**
- **This means that a structure only needs one fixed support in order to be stable. All three equations of equilibrium can be satisfied.**

Ex: A flagpole set into a concrete base is a good example of this kind of support.



- **Fixed connections demand greater attention during construction and are often the source of building failures.**
- **Fixed connections are very common both in RCC and steel structures.**
- **Steel structures welded together can be considered as fixed connections.**
- **A cast-in-place concrete structure is automatically monolithic and it becomes a series of rigid connections with the proper placement of the reinforcing steel.**



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Some of the simple support





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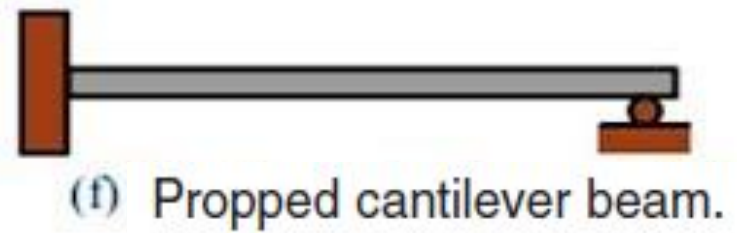
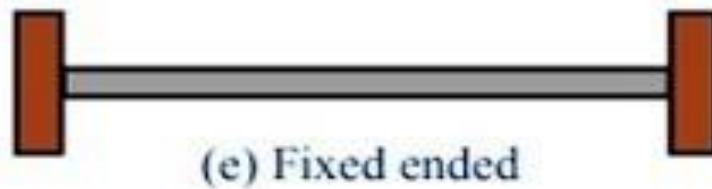
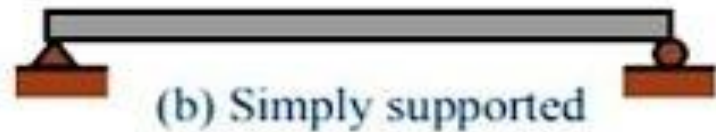




- Simple supports are **idealized** by some **to be frictionless surface supports**.
- This is correct in as much as **the resulting reaction** is always a **single force** that is **perpendicular** to and **away from the surface**.
- However are also **similar to roller supports in this**. They are **dissimilar in** that a simple support **cannot resist lateral loads** of any magnitude.
- A simple support **can be found as a type of support for long bridges** or roof span. **Simple supports are often found in zones of frequent seismic activity**.



Types of Beams





Determinate beams

In beams, if the reaction forces can be calculated using equilibrium equations alone, they are statically determinate.

Ex: simply supported beams, cantilever beams, single and double overhanging beams,

In determinate beams

In beams, if the reaction forces cannot be calculated using equilibrium equations alone, they are indeterminate.

Ex: fixed beams, continuous beams