STRUCTURAL SYSTEMS FOR BUILDINGS
Structure of a Building

The primary function of a building structure is to support and transmit the building loads and forces to the ground.

Photos courtesy Tilt-up Concrete Association
System Description

A Framed Building is a structure whose weight is carried by the framework instead of by load-bearing walls. The term includes modern metal and reinforced concrete structures as well as timber-framed buildings.
Characteristics of a Structure

- Strength
- Stability
- Economic Value
Types of Structural Systems

- Load bearing structures
- Partial load bearing structures
- Frame Structures
- Truss Frame Structures
Structural Sub-System

• Made up of many smaller structural sub-systems that work together to provide a strong, stable, and cost-effective structure.

• Examples of these smaller structural sub-systems include:
  - Roof
  - Walls
  - Floors
  - Framing
  - Foundations
Structural Sub-System

- Made up of many structural elements that work together to provide a strong, stable, and cost-effective system.
- Basic structural elements include:
  - Beam
  - Column
  - Truss
  - Arch
  - Dome
Forces and Loads

- A force is any action that causes a change in the shape or motion of an object.
- A load is a force that is supported by a structural element.
- The terms force and load are often used interchangeably.
Loads

External forces or loads on a structures are determined after finding the structural dimensions.

The loads define the type of structure to be constructed.

Once the structural form has been decided, the actual design begins.
The design of structure starts with those elements which are subjected first to the primary loads.

For example, first the slabs are designed then beams, then columns and then footing.

External Forces / Loads are specified in:

- General Building Codes
- Design Codes
Types of Loads

- Dead Loads
- Live Loads
- Snow Loads
- Bridge Loads
- Wind Loads
- Earthquake Loads
- Hydrostatic and Soil Pressure
- Other Natural Loads
Loads

Static Loads

Dynamic Loads

Dead

Live
Difference of

DYNAMIC ANALYSIS & NONLINEAR ANALYSIS

Static Linear Analysis
Static Nonlinear Analysis
Dynamic Linear Analysis
Dynamic Nonlinear Analysis
Transmission of Loads

Gravity load resisting system

Lateral load resisting system
Loads to Consider

• **Dead Loads:**
  
  “*Dead loads* consist of the weights of the various structural members and the weights of any objects that are permanently attached to the structure.” (Hibbeler)

• **Live Loads:**
  - Wind Loads
  - Snow Loads
  - Earthquake Loads
  - Other Loads:
    - Blast Loads
    - Variance in temperatures
    - Uneven settling of soil
Beam Columns

A structural member that is subjected to axial compression and bending at the same time.

The moment is subjected to column from beams so it is termed as beam column.
How can we identify supports and design them in structure?

Hinge support
Roller support
Fix support
(refer to board lectures for these topics)
3. Overview Structural Systems

A. Truss
B. Beam&Column, Rigid Frame
C. Bearing wall
D. Floor Systems
E. Lateral Load Systems
A. Truss

- Plane Truss

- Space Truss
B. Beam & Column
Column
C. Wall Bearing
D. Floor Systems

• What is slab?
• How to consider?
Factors for Design and Cons.

- Load... LL., DL., FL.
- Span
- Thickness
- Deflection and Vibration
- Stiffness
- Methods....