

Project No. 3

Types of Frames in Reinforced Concrete Structures

By

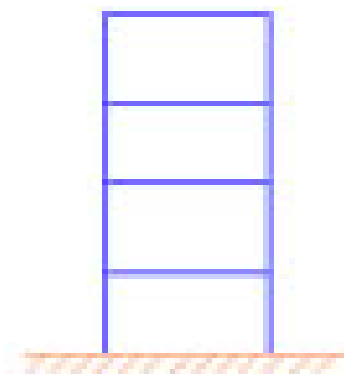
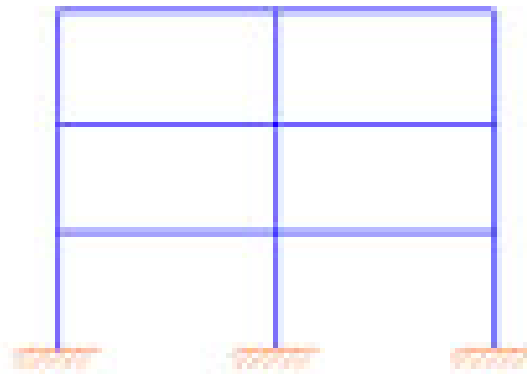
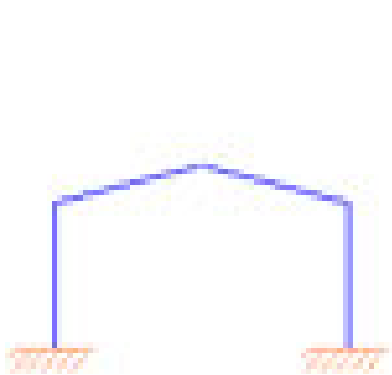
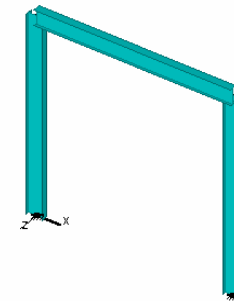
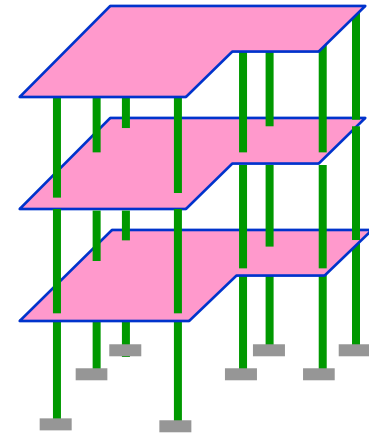
- | | |
|--------------------------|-----------|
| 1. Saliman Ali Al-hsinny | 425102268 |
| 2. Majed Al-Hodaeb | 425103799 |
| 3. Jihad Al-Sadhan | 425103101 |

Supervised by: Dr. Shehab Mourad



Frame – Definition

- ❖ A frame is a structure used to resist vertical forces (for example gravity loading) and lateral forces (for example wind, and earthquakes).
- ❖ They are used to prevent rotations in the structures.



Example of Frame Structures



5-story and multi-bay Reinforced Concrete Frame Structure

Types of Frames

```
graph TD; A[Types of Frames] --> B[Rigid Frames]; A --> C[Braced Frames]; B --> D[Pin-Ended Frames]; B --> E[Fix-Ended Frames]; C --> F[Gabled Frames]; C --> G[Portal Frames];
```

Rigid Frames

Braced Frames

**Pin-Ended
Frames**

**Fix-Ended
Frames**

**Gabled
Frames**

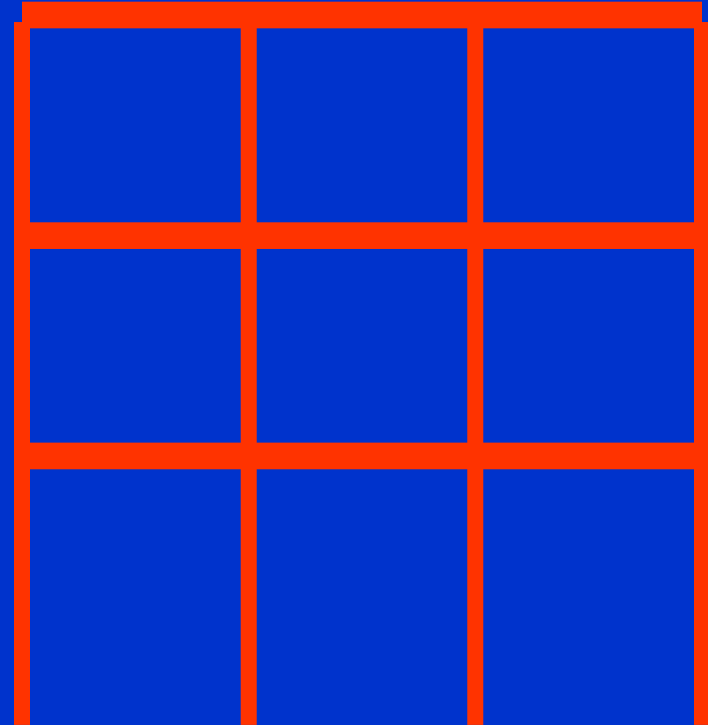
**Portal
Frames**

RIGID STRUCTURAL FRAMES

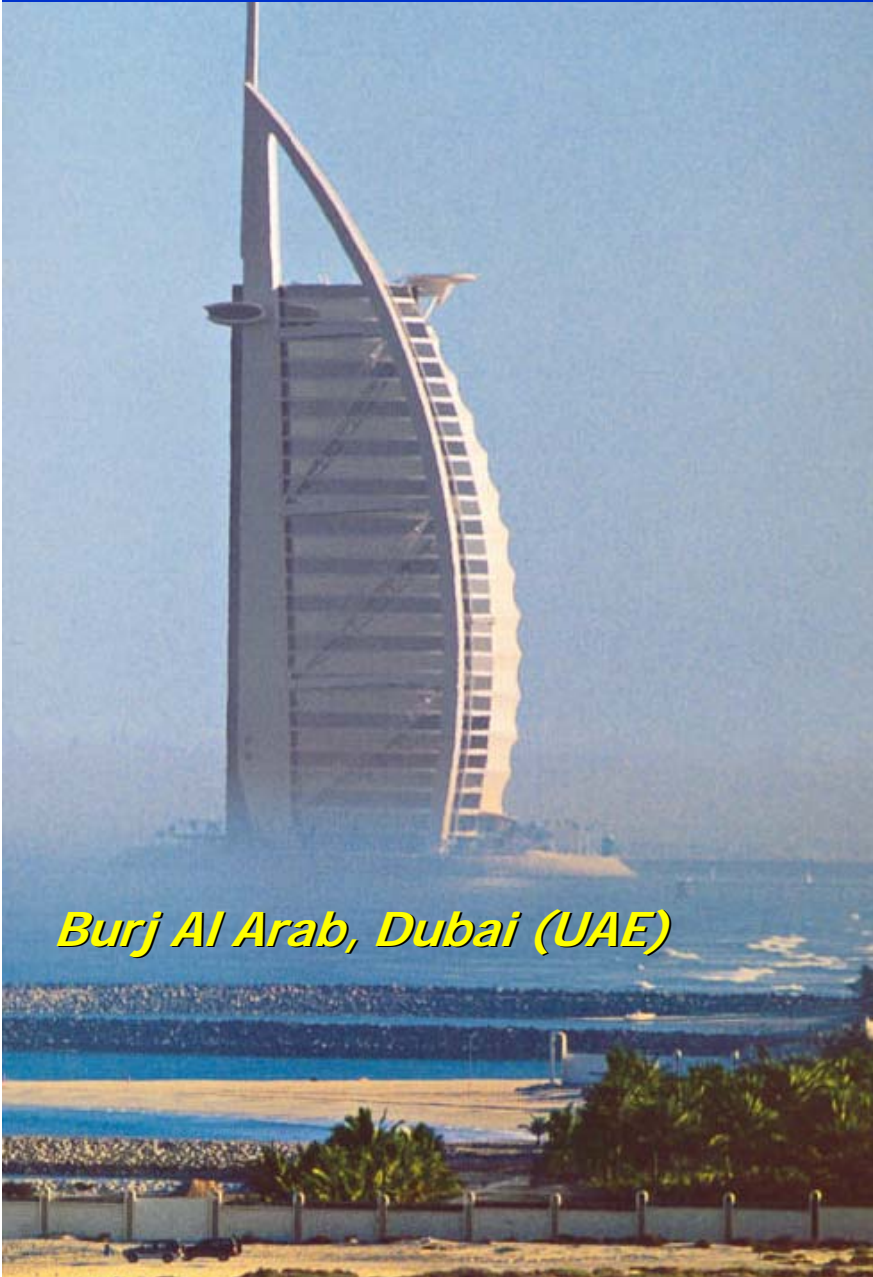
- ❖ Rigid frame structures are built at the site which may or may not be poured monolithically.
- ❖ Rigid frame structures provide more stability.
- ❖ Rigid frame structures resist rotations more effectively.

Advantages

- Rigid frame structures feature positive and negative bending moments throughout the structure due to interaction of walls, beams and slabs.



Examples of Rigid Frame Structures



Burj Al Arab, Dubai (UAE)

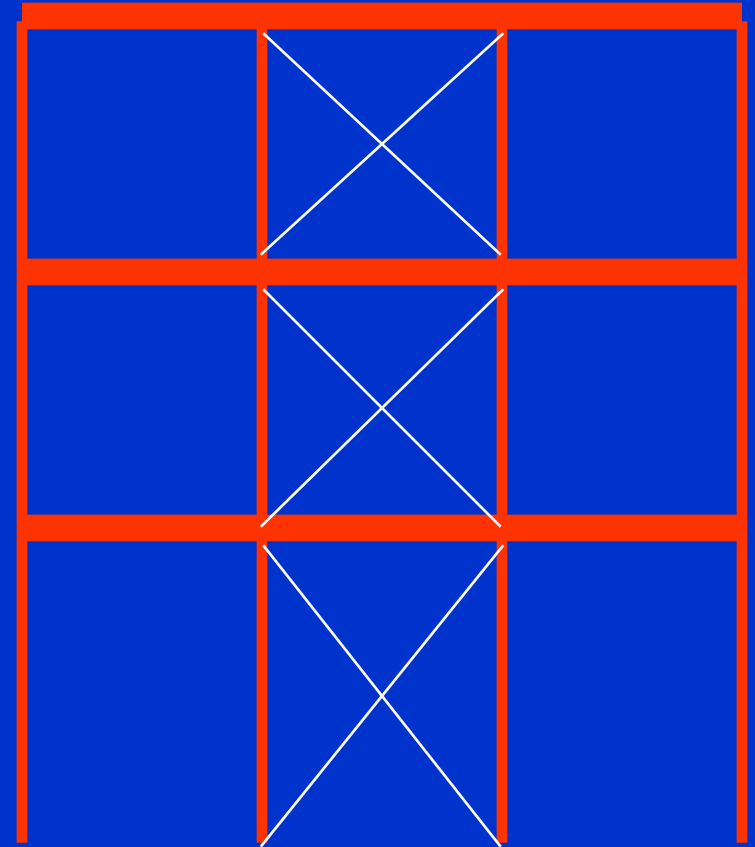


BRACED STRUCTURAL FRAMES

- ❖ Braced frame structures resist lateral forces by the bracing action of diagonal members.
- ❖ Braced frame structures are used to resist sideway forces.
- ❖ Buildings are braced by inserting diagonal structural members into the rectangular areas of a structural frame.

Advantages

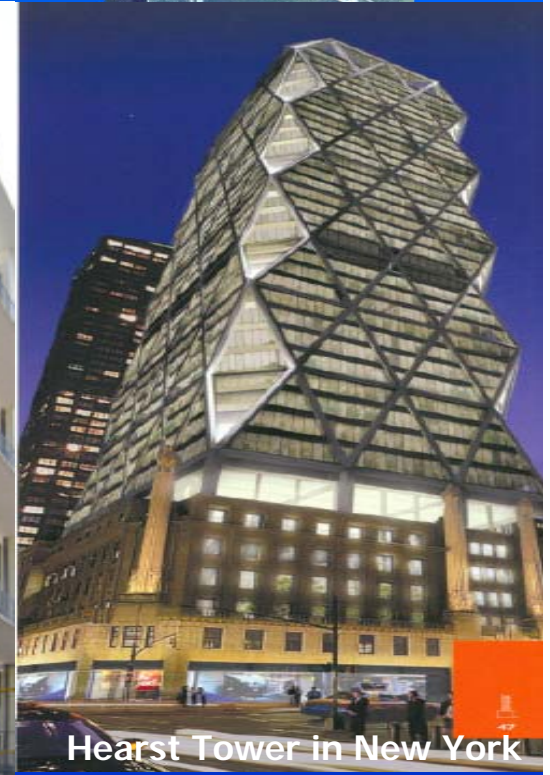
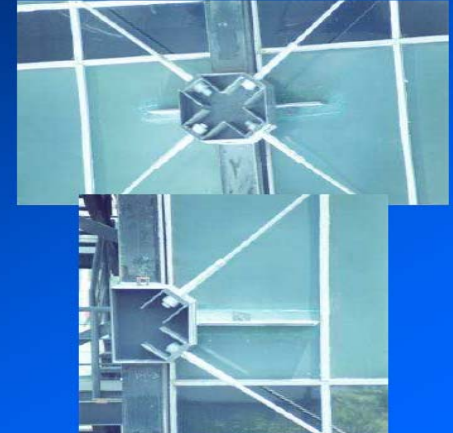
- To stabilize the frame against earthquakes and strong winds.
- Lateral forces are resisted by axial actions of bracing and columns.
- More efficient than a rigid frame.



Examples of Braced Frame Structures



Cable bracing for 12-story steel frame

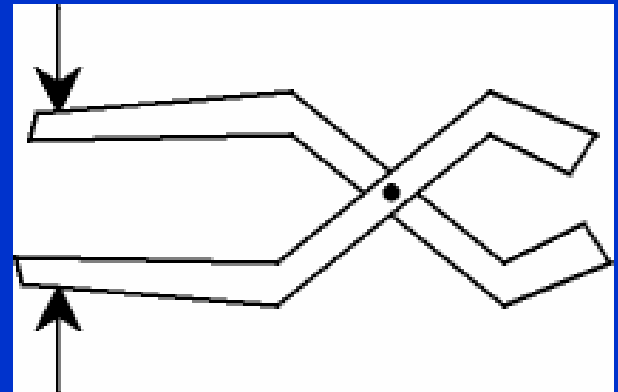
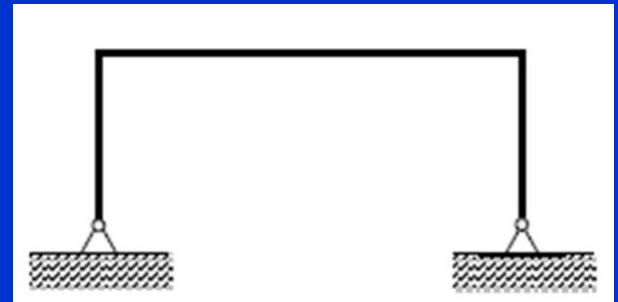


Hearst Tower in New York

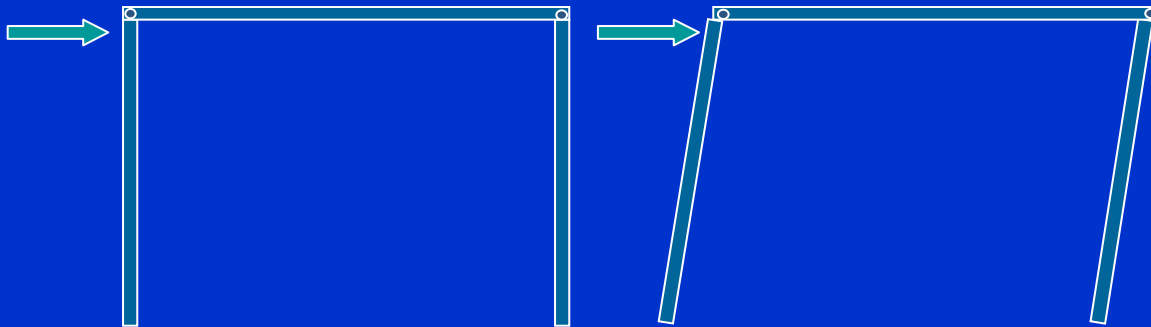
University of California, Berkeley, u. S. A.

PIN-ENDED STRUCTURAL FRAMES

- ❖ A pinned frame has members connected by pins considered non-rigid if it would collapse when the supports are removed. Considered rigid if it retains its original shape when the supports are removed.



Examples of Pin-ended Frames



(a) Racking Failure of Pinned Frame



Braced Frame

Infilled Frame

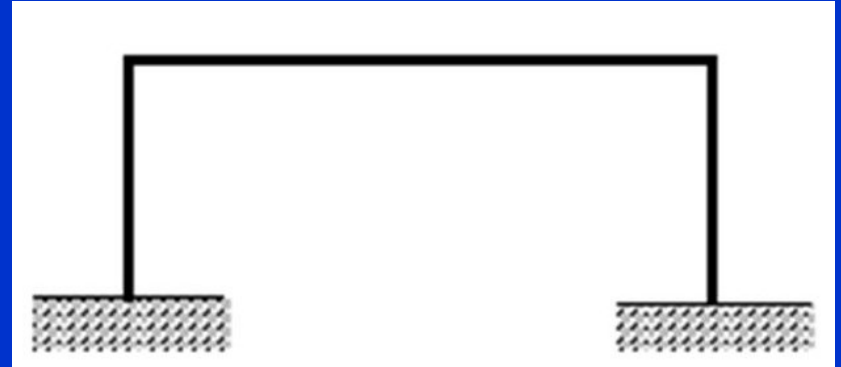
Rigid Joints

(b) Providing Stability for Lateral Loads

FIX-ENDED STRUCTURAL FRAMES



The structure in which one or more than one members are fully constrained.

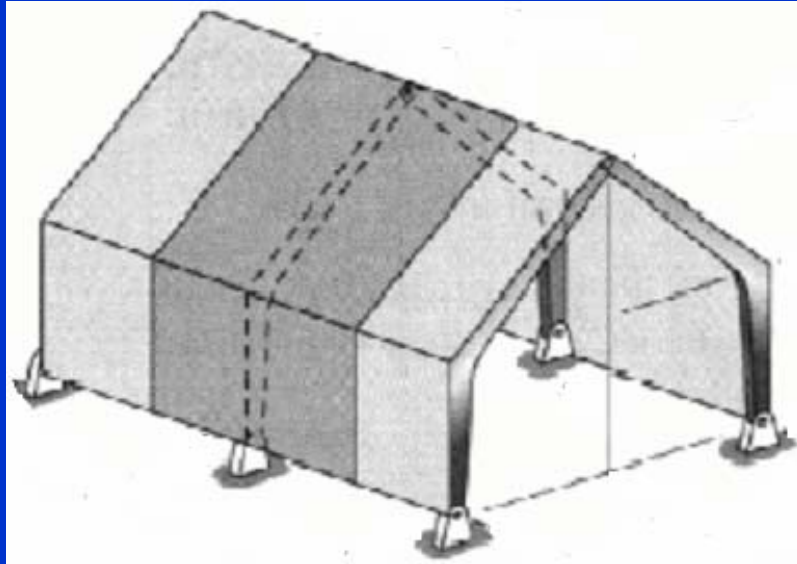


Examples of Fix-ended Frames



GABELED STRUCTURAL FRAMES

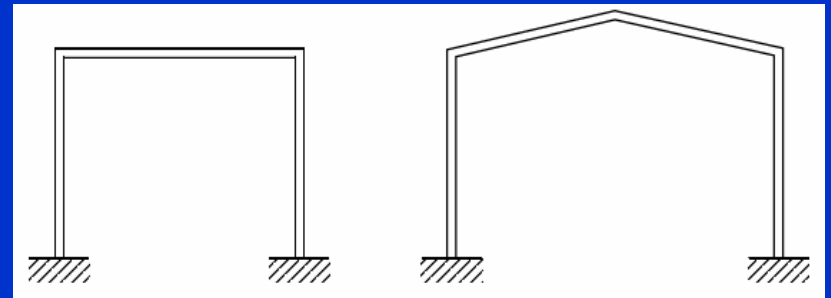
- ❖ Gabled Frames show a peak.



PORTAL STRUCTURAL FRAMES

❖ It resembles like a door. Multi-story, multi-bay portal frames are commonly used for commercial and industrial construction.

❖ The members are usually made up of curved laminates and the members are thickened in the region of the knee or eaves joint to allow for the large moment.

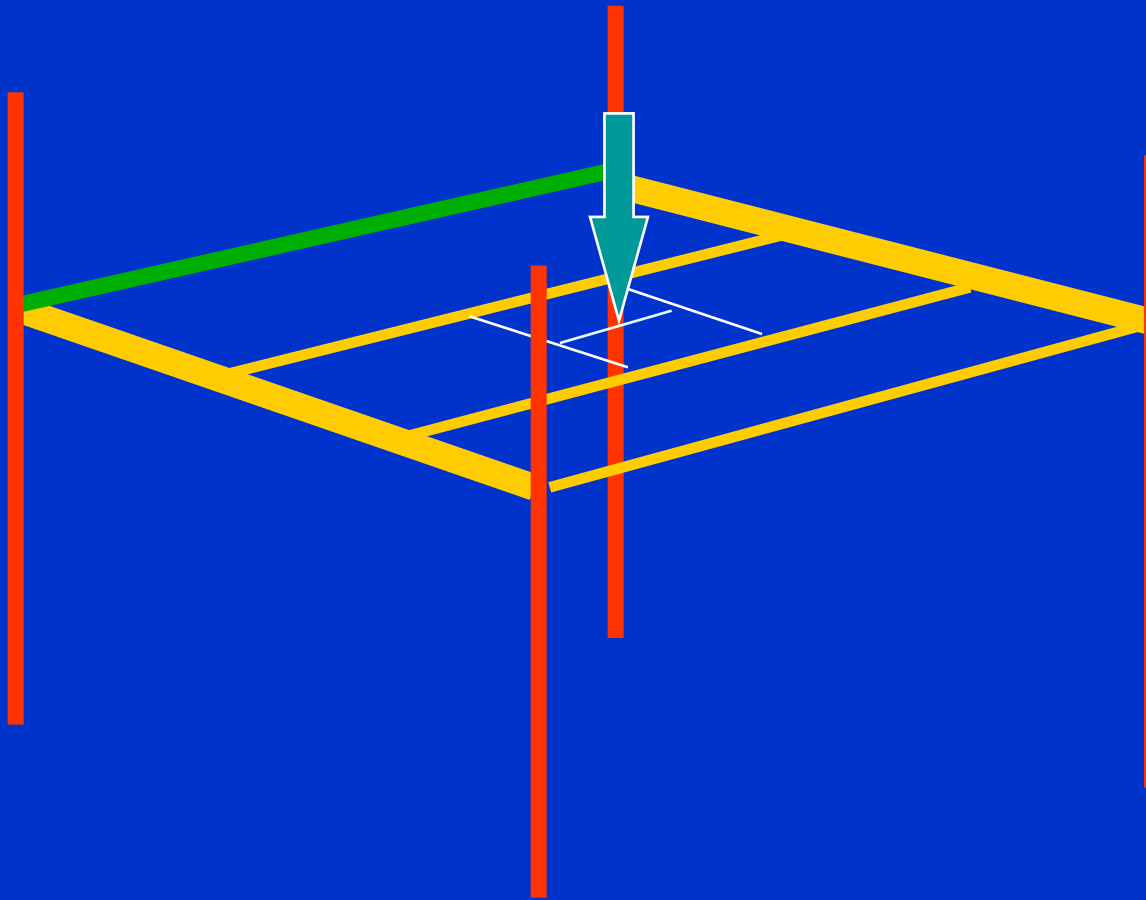


Examples of Portal Frames

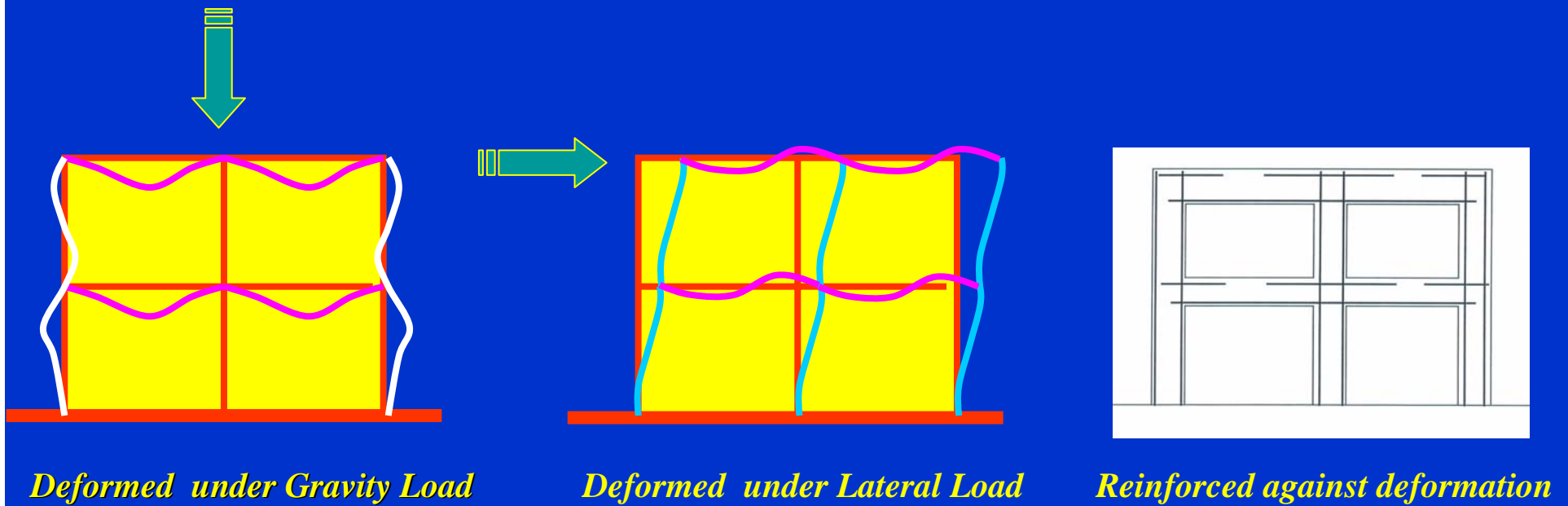


Load Path in Frame

- ❖ It is a path through which the load of a frame structure is transmitted to the foundations.



Behavior of Frame Structure under Load



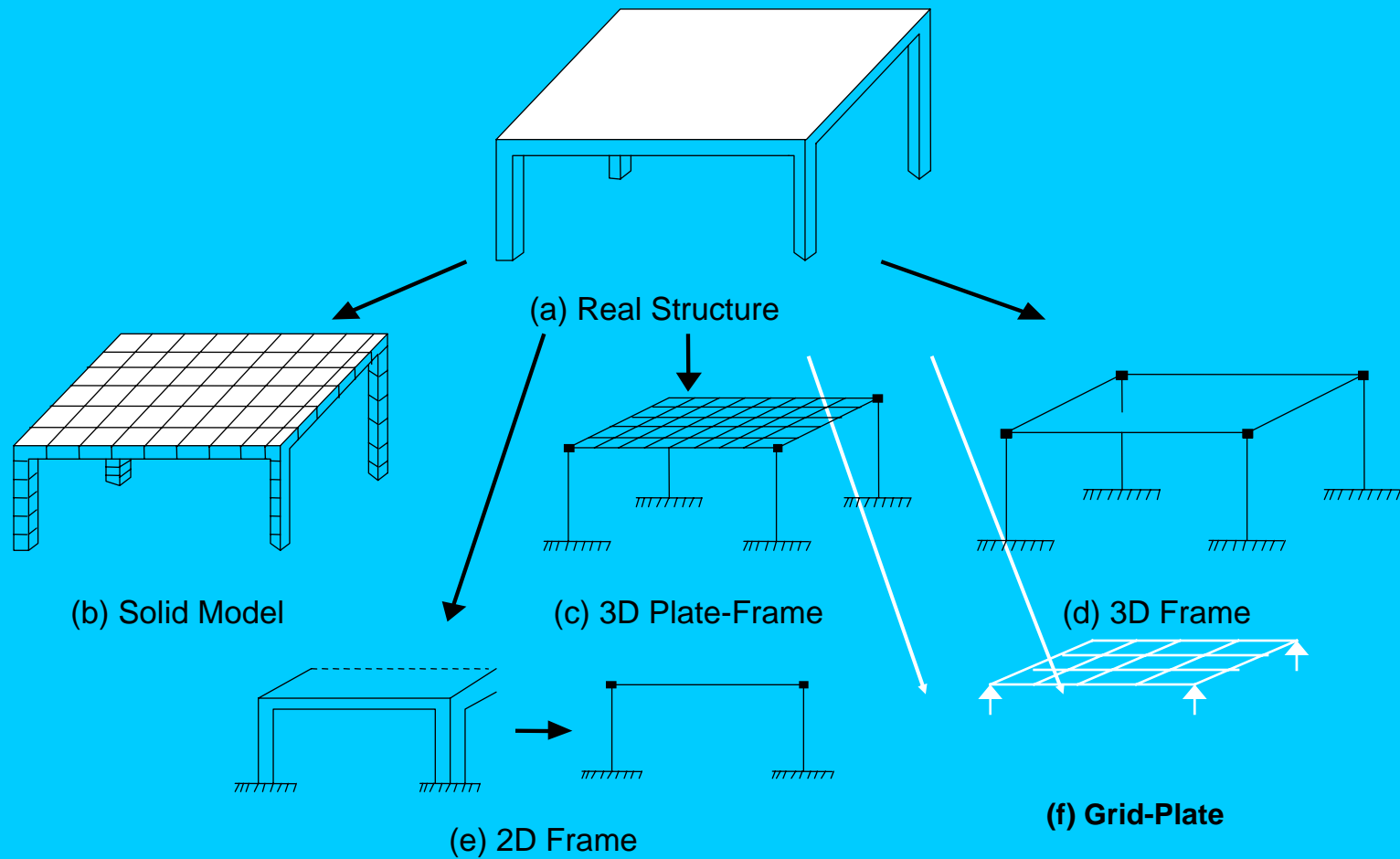
Advantages of Frames:

- ❖ Optimum use of floor space.
- ❖ Easy construction.
- ❖ Rapid construction.
- ❖ Economical for high rise buildings.
- ❖ Erected by steel and/or reinforced concrete.

Disadvantages of Frames:

- ❖ Generally, frames are flexible structures and lateral deflections control the design process for buildings with greater than about 4 stories. The concrete frames are 8 times stiffer than steel frames of the same strength.
- ❖ Span lengths are limited when using normal reinforced concrete (generally less than about 13 m, but up to about 15 m).

Global Modeling of Structural Geometry



Various Ways to Model a Real Structure