

EARTHQUAKE RESISTANT STRUCTURES

- ▶ Innovations and techniques in seismic designs
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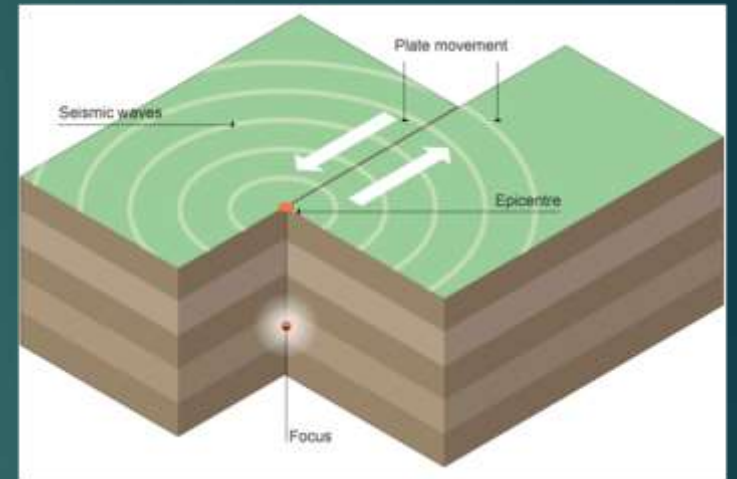
INTRODUCTION

Designing buildings that can withstand earthquakes is important to keep people safe and reduce damage when an earthquake happens. Earthquakes can cause buildings to collapse, leading to injuries, deaths, and huge costs to repair the damage. By using special techniques and materials, engineers can make structures stronger and more flexible, so they can survive earthquakes better. This helps protect lives, save money, and ensure that important services continue to work during and after an earthquake.



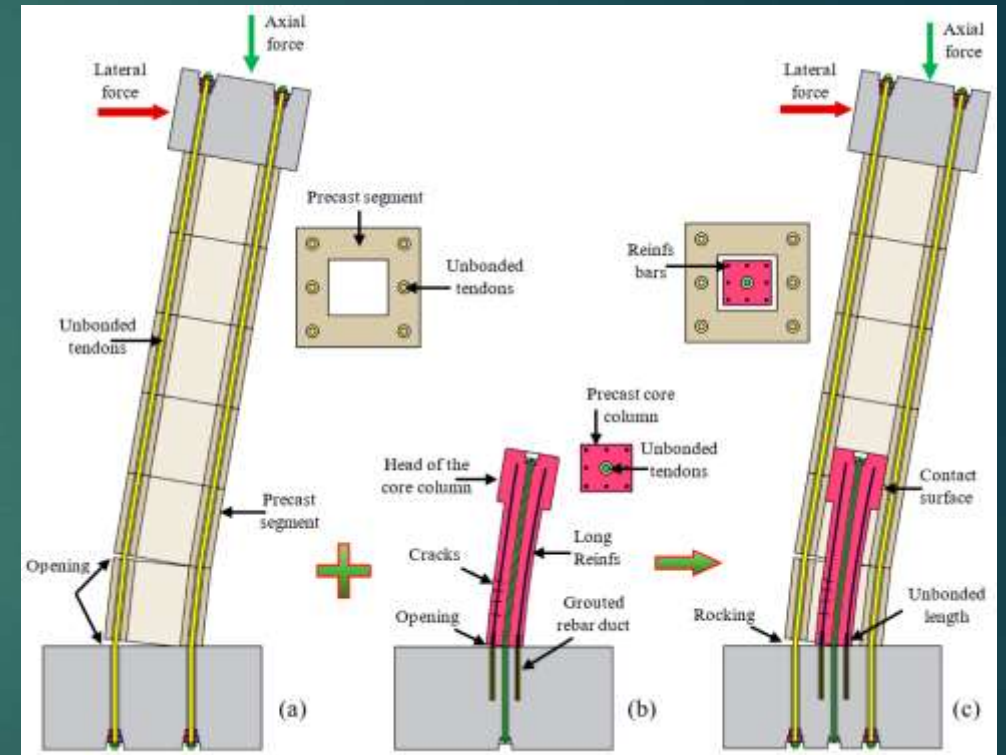
UNDERSTANDING EARTHQUAKE

- ▶ Earthquakes are sudden, shaking movements of the ground caused by the shifting of Earth's tectonic plates. These plates are large sections of Earth's crust that move slowly over time. When they grind against each other or collide, the stress builds up until it is released as an earthquake.
- ▶ When an earthquake occurs, the ground shakes, which can cause buildings and other structures to move.
- ▶ If these structures aren't designed to handle this shaking, they can crack, collapse, or suffer severe damage. This can lead to injuries, deaths, and significant property loss. Designing earthquake-resistant buildings helps minimize this damage and keeps people safer.



PRINCIPLE OF EARTHQUAKE RESISTANT DESIGN

- Flexibility: Buildings need to be flexible so they can bend and sway during an earthquake without breaking. This helps them absorb and spread out the energy from the shaking.
- Energy Dissipation: Structures should have features that absorb and reduce the energy from an earthquake. This can include special materials or devices like dampers that act like shock absorbers in a car, making the shaking less intense.
- Redundancy: Buildings should have multiple support systems so if one part fails, others can still hold up the structure. This ensures that even if one part of the building is damaged, the whole building won't collapse.



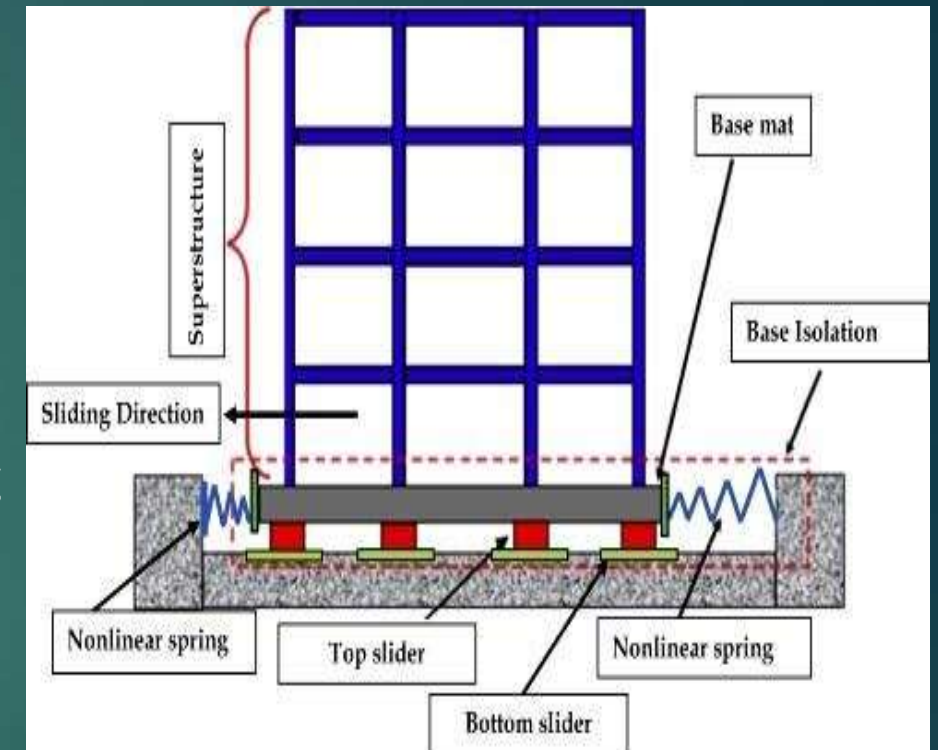
MATERIALS USED

- ▶ Reinforced Concrete: Concrete that has steel bars or mesh inside it. The steel makes the concrete stronger and more flexible, helping buildings withstand the shaking.
- ▶ Steel: Steel is strong and flexible, making it an ideal material for earthquake resistant structures. It can bend without breaking, which helps buildings absorb and dissipate the energy from an earthquake.
- ▶ Base Isolators: Devices placed under buildings that act like large shock absorbers. They allow the building to move independently from the ground, reducing the amount of shaking the structure feels during an earthquake.



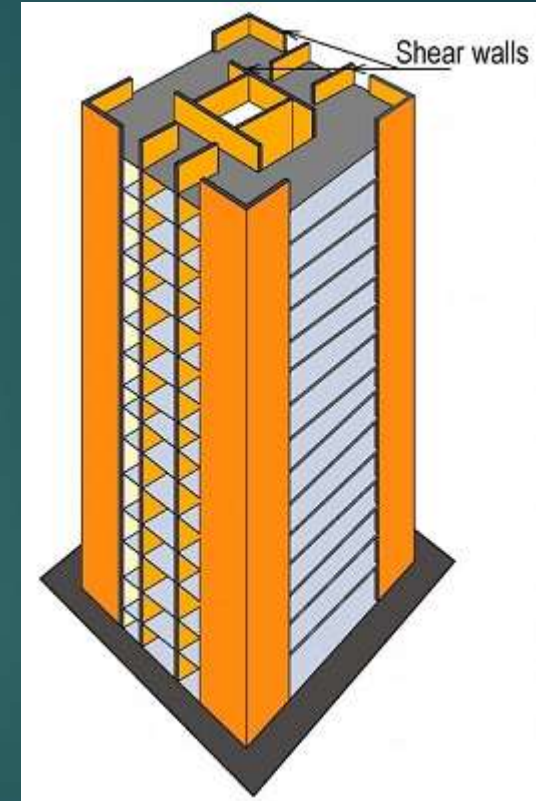
BASE ISOLATION SYSTEMS

- ▶ Base isolators are devices installed between a building and its foundation. They act like large shock absorbers, allowing the building to move independently of the ground. When an earthquake occurs, the ground shakes, but the base isolators absorb and reduce this movement. This means the building experiences less shaking, which reduces the risk of damage.
- ▶ Effectiveness: Base isolators are very effective in protecting buildings during earthquakes. By reducing the amount of shaking that reaches the building, they help prevent structural damage and keep the building's occupants safe. This technology is widely used in important structures like hospitals, bridges, and emergency response centers, ensuring they remain functional after an earthquake.



SHEAR WALLS

- Shear Walls: Shear walls are vertical walls, typically made of reinforced concrete or steel, designed to resist sideways forces from wind and earthquakes. These walls provide crucial strength and stiffness to a building, preventing excessive swaying and potential collapse during an earthquake. By taking on the horizontal forces, shear walls help maintain the building's shape and integrity.



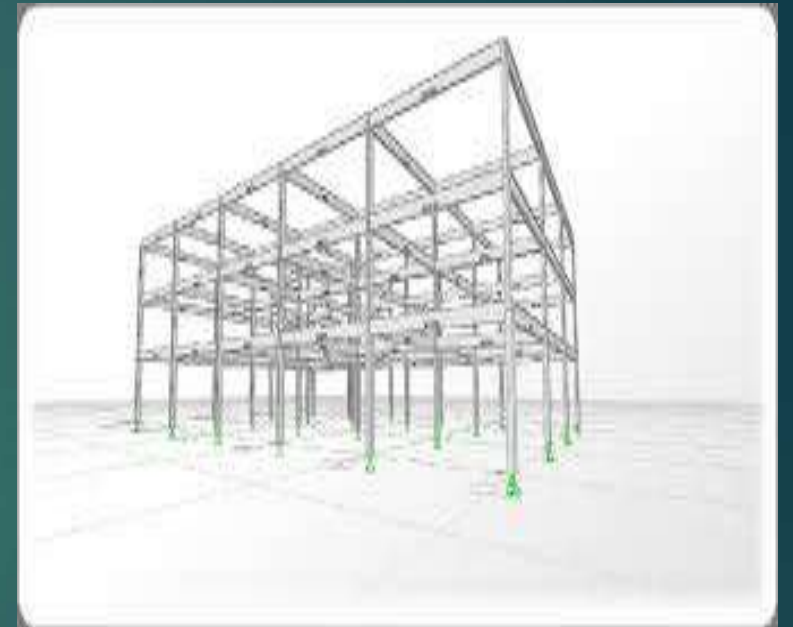
CROSS BRACING

- ▶ Cross-bracing involves placing diagonal braces, often made of steel, across sections of a building's frame. These braces form an “X” shape and help stabilize the structure by distributing the forces from an earthquake throughout the frame. Cross-bracing reduces the strain on individual parts of the building, enhancing overall stability and preventing severe damage during seismic events.



MOMENT RESISTING FRAMES

- ▶ Moment-resisting frames are structural systems designed to withstand earthquakes by allowing certain parts of a building to bend without breaking. These frames consist of beams and columns connected rigidly at the joints, enabling the structure to absorb and dissipate seismic energy through bending and flexing.
- ▶ Role in Seismic Resistance: The main role of moment-resisting frames in seismic resistance is to provide flexibility and strength. When an earthquake strikes, the rigid connections in the frame allow the building to sway and deform without collapsing..



CHALLENGES AND FUTURE DIRECTIONS

- ▶ Retrofitting Older Buildings: Many older structures were not built to withstand seismic activity and require costly and complex upgrades to meet modern standards.
- ▶ Cost Constraints: Designing and constructing earthquake-resistant buildings can be expensive, making it difficult for some regions and communities to afford these measures.
- ▶ Predicting Earthquake Impact: Accurately predicting the behavior of buildings during an earthquake is challenging due to the variability in earthquake characteristics and building responses.
- ▶ Balancing Flexibility and Strength: Achieving the right balance between flexibility and strength in materials and design is complex, requiring sophisticated engineering and materials.

THANKING YOU