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Methodology for risk analysis in the design phase of high-rise buildings

Bakhtyar Saleh Ahmmad

PhD student, Óbuda University, Doctoral School on Safety and Security Sciences, Hungary, Budapest

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Methodology for risk analysis

- **Introduction**
- **Risks in Structural Design**

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Building height from 25 m is called high tall building since change according to the place

Introduction

- The methodology for risk analysis in the design phase of high-rise buildings is a systematic approach for identifying, evaluating, and addressing potential risks and challenges associated with the design of tall structures, with the goal of ensuring safety, feasibility, and project success.
- High-rise buildings are remarkable symbols of modern urban architecture and engineering prowess. However, the design and construction of these structures present complex challenges, particularly in ensuring their structural integrity and safety.

Risks in Structural Design

- High-rise buildings have become an integral part of urban landscapes worldwide, representing architectural marvels and symbols of modernity. However, behind the aesthetic appeal lies a complex world of structural engineering, where the design and construction of high-rise buildings involve significant challenges and risks.
- Engage experienced structural engineers to design a robust and resilient structure capable of withstanding various loads, including wind, seismic, and live loads.

1- Foundation Challenges: (Soil Structure Interaction)

- High-rise buildings are enormous structures, and their weight and loads must be effectively transferred to the ground. Ensuring a stable foundation is a crucial part of the structural design process.
- Risks include inadequate soil (soil bearing capacity), which could lead to settlement or tilting of the building. Engineers use geotechnical studies and deep foundation techniques like piles or caissons to mitigate these risks.

DID YOU KNOW?

"LEANING TOWER OF PISA" is a structural failure that resulted from lack of soil knowledge!!

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2- Structural Integrity

- . the structural integrity of reinforced concrete plays a critical role in ensuring the safety and stability of buildings and infrastructure. Here are some key factors that can compromise the(**load-bearing capacity)** of reinforced concrete structures
- Design Flaws:
- Material Quality:
- Construction Errors:
- Corrosion of Reinforcement:
- Overloading:

Compression failure due to low bearing capacity of concrete

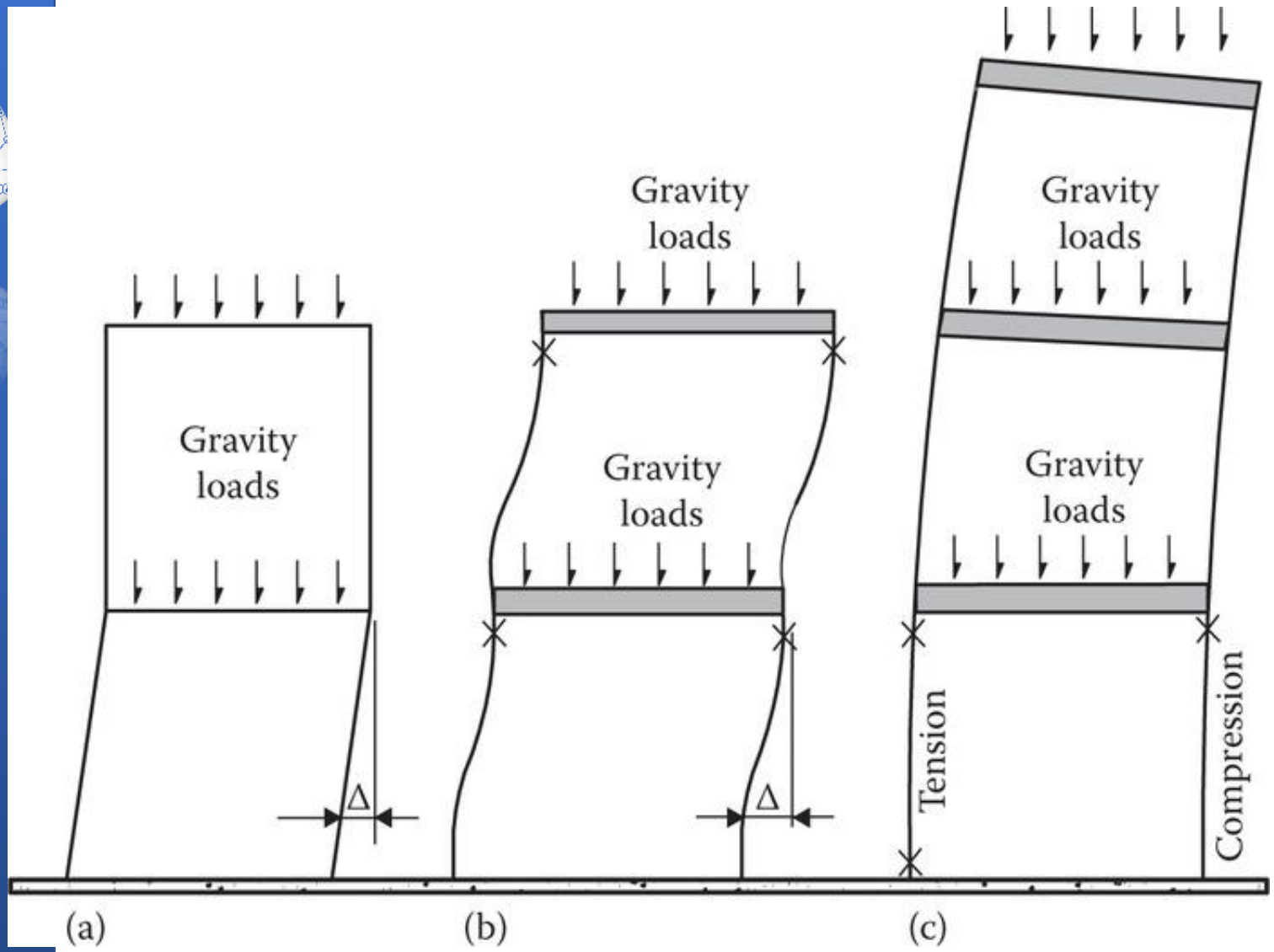
3- Earthquakes and wind:

- High-rise buildings are susceptible to seismic forces, which can cause structural damage and even collapse if the design does not account for earthquake resistance
- high-rise buildings are particularly vulnerable to seismic forces, and designing them to resist earthquakes is of paramount importance. Earthquakes subject structures to horizontal ground motions, and these forces can induce significant stress and deformations in buildings. Here are some key considerations for designing high-rise buildings to resist seismic forces:

key considerations for designing high-rise buildings to resist seismic forces:

- Seismic Design Codes:
- Base Isolation:
- Damping Systems:
- Reinforced Concrete Design:
- Shear Walls and Bracing:
- Foundation Design:
- Dynamic Analysis:
- Site-Specific Considerations:
- Regular Inspections and Maintenance:
- Emergency Preparedness:

Structure during earthquake



Collapse patterns: (a) inadequate shear strength, (b) inadequate beam/column strength, and (c) tension compression failure due to overturning.

collapsed Earthquake, 1999.
Taipei county

4- Material Properties:

- Reinforced concrete is a primary material in high-rise construction. Its quality and properties are critical to the building's structural integrity. Poor concrete quality or workmanship can lead to structural defects, weakening the building over time. **(High strength concrete)** and Strict quality control, material testing are essential to mitigate these risks.

5- Fire Resistance:

- Reinforced concrete has good fire-resistant properties, but improper design can expose buildings to fire-related risks, such as structural weakening and thermal stress
- Reinforced concrete does have inherent fire-resistant properties compared to some other building materials, but it's important to note that improper design and construction can still expose buildings to fire-related risks. While concrete itself is non-combustible and can withstand high temperatures, the steel reinforcement within the concrete can be vulnerable to fire. Here are some key considerations related to fire and reinforced concrete:

key considerations related to fire and reinforced concrete:

- Fire-Resistant Properties of Concrete:
- Vulnerability of Steel Reinforcement:
- Concrete Cover and Fire Protection:
- Thermal Stress and Spalling:
- Proper Design and Fire-Resistant Measures:
- Fireproofing of Steel Components:
- Fire Testing and Modeling:
- Emergency Response and Evacuation Planning:

The building of China Telecom in Changsha has gone up in flames 2022

Results/Conclusion

- the methodology for risk analysis in the design phase of high-rise buildings is a comprehensive approach that prioritizes safety and resilience.
- Beginning with a Preliminary Hazard Analysis, the process includes risk identification, Failure Mode and Effects Analysis (FMEA), and performance-based design to address various hazards such as earthquakes, fires, and structural failures.
- Fire Safety Engineering and geotechnical analysis further contribute to building safety.

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Thank you for the kind attention!