Performance-Based Plastic Design (PBPD)/Pushover Analysis of High-Rise Buildings

Category: Technology Development and Application

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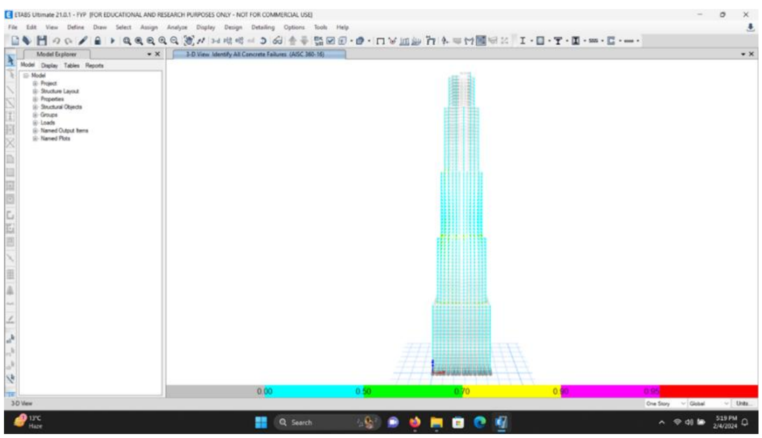
Summary: This project investigates the application of Performance-Based Plastic Design (PBPD) and Pushover Analysis (PA) in high-rise buildings, focusing on enhancing the structural resilience of tall buildings in Pakistan. The study addresses the seismic vulnerabilities and dynamic load challenges unique to Pakistan's geological conditions, aiming to develop optimized design strategies that ensure safety and performance. Utilizing ETABS for pushover analysis and PBPD, the research examines critical steps, including data collection, material property assignment, load distribution, and nonlinear analysis. Collaboration with local engineers and adherence to seismic standards are emphasized. The study's outcomes contribute to the structural engineering field by advancing practical, region-specific design solutions that enhance high-rise building resilience under extreme loading conditions.



Objectives: The objectives focus on enhancing high-rise building safety and efficiency in seismic-prone regions of Pakistan. The first aims to create a region-specific design framework incorporating Performance-Based Plastic Design, soil-structure interactions, and advanced pushover analysis to address local seismic and climatic challenges. The second integrates advanced simulations with real-time structural health monitoring to optimize design, enable adaptive maintenance, and ensure resilience through data-driven insights.

Key Achievements: The project successfully utilized Performance-Based Plastic Design (PBPD) and Pushover Analysis (PA) to enhance the structural resilience of high-rise buildings in Pakistan, addressing regional seismic and dynamic load challenges. Through ETABS-based nonlinear analysis and collaboration with local engineers, it developed optimized, region-specific design strategies aligned with local seismic standards to improve safety and performance under extreme loading conditions.

Implementation Challenges: Implementing this approach faced several challenges, including the availability and accuracy of seismic data specific to Pakistan's diverse geological conditions, which could impact analysis results.

Proposed Solutions: To address the challenge of limited or inaccurate seismic data in Pakistan, collaboration with local institutions and government agencies helped access or gather new data.

Impacts: The project has had a multifaceted impact. Students gained practical skills and technical expertise through hands-on experience with ETABS and advanced analysis techniques, enhancing their career readiness and satisfaction. Professors benefited from enriched teaching methods and expanded research opportunities, while the university administration recognized the program as a step toward innovation and sustainability, strengthening its reputation. The industry responded positively, aligning the program's focus on high-rise buildings with technological advancements in Pakistan. Citizens appreciated the improved safety and resilience of structures, and the government supported the initiative for its potential to enhance infrastructure resilience in earthquake-prone areas, despite challenges in aligning with existing codes and promoting widespread adoption.