

Displacement-Based Design of Low-Damage Buildings

Description

The objective of the course is to introduce the students to the displacement-based design (DBD) of buildings to achieve low-damage outcomes. A brief overview of historical developments in the field of seismic design, with the evolution of Direct DBD, is provided. Guidance is provided for DBD of single-degree of freedom structures and multi-storey RC wall buildings. The emerging philosophy of low-damage seismic design (LDSD) is then described, with reference to recent developments in New Zealand. Options for undertaking LDSD of cantilever RC wall buildings are then presented, with hybrid rocking RC structures discussed. The seismic design and detailing requirements for non-structural elements within low-damage buildings are emphasized and finally, the design of low-damage base-isolated buildings is introduced. Practice exercises are included within the course to assist with application of the content presented.

Programme

Day 1 – April 20

09:30-12:30 and 14:00-17:00

- Morning Session:** **Historical Development of Seismic Design**
- History of seismic design methods
 - Problems with Force-Based Design
 - Performance Criteria
 - DDBD of SDOF systems
- Afternoon Session:** **DDBD of Cantilever RC wall buildings**
- Extending DDBD to MDOF Systems
 - DDBD of RC wall systems
 - Capacity Design
- **Exercise Lab 1:** DDBD of a multi-storey cantilever wall building

Day 2 – April 21

09:30-12:30 and 14:00-17:00

- Morning Session:** **What is Low-Damage Seismic Design?**
- Observations from recent EQs in New Zealand
 - Low-Damage Seismic Design (LDSD) Performance Objectives
 - Means of Compliance
 - Relating Engineering Design Criteria to Performance
 - Conceptual design strategies for LDSD.
- Afternoon Session:** **LDSD of Cantilever RC wall buildings**
- Traditional or Hybrid RC wall Detailing?
 - Setting Engineering Design Criteria
- **Exercise 2:** LDD of a multi-storey cantilever wall building
- DDBD procedure for Hybrid Rocking Walls
- **Exercise 3:** LDD of a hybrid-rocking cantilever wall building

Day 3 – April 26

09:30-12:30 and 14:00-17:00

Morning Session:

Requirements for Non-Structural Elements

- Historical Performance of Non-Structural Elements (NSEs)
- Seismic Classification of NSEs
- Seismic Demands on NSEs
- Factors Affecting Design Strength Requirements for NSEs

Afternoon Session:

Seismic Detailing of Non-Structural Elements

- Suspended Ceilings
- Pipes and services
- Plasterboard Partition Walls
- Pre-cast Concrete Cladding Panels
- Glass Façade Systems

Day 4 – April 27

09:30-12:30 and 14:00-17:00

Morning Session:

DDBD of base-isolated buildings

- Background and technology
- Critical performance criteria
- DDBD of base-isolated buildings
- Detailing considerations

Afternoon Session:

Exercise 4: DDBD of a base-isolated building