
Seismic Design of Concrete Bridges in California (IDM-30)

Course Outline

Day 1: Seismic Design of the Bent (Column/Cap)

08:00 AM *Session #1: Introduction*

- 1.1. Classroom Logistics
- 1.2. Goal of Course
- 1.3. Course Overview
- 1.4. Seismic Design Criteria Overview (SDC 1.0)
- 1.5. Bridge Performance – 2014 Napa Earthquake
- 1.6. Improving Seismic Resiliency
- 1.7. Key References

Session #2: General Design Requirements (SDC 3.0, 7.1)

- 2.1. Earthquake Resisting Elements
- 2.2. Seismic Design Hazard
- 2.3. Material Properties
- 2.4. Effective Section Properties
- 2.5. Global Displacement Criteria
- 2.6. Load and Resistance Factors
- 2.7. Balance Stiffness and Frame Geometry (SDC 7.1)

09:40 AM Break

10:00 AM *Session #3: Seismic Analysis / Deformation Demands (SDC 4.0)*

- 3.1. Background – Seismic Demand
- 3.2. Seismic Deformation Analysis Methods
- 3.3. Structural Modelling
- 3.4. Deformation Demands
- 3.5. Two Span Bridge Example

Session #4: Deformation Capacity (SDC 5.0)

- 4.1. Inelastic Static Analysis (ISA)
- 4.2. Local Displacement Capacity
- 4.3. Global Displacement Capacity

12:00 PM: Lunch



1:00 PM *Session #5: Seismic Critical Member Design*

- 5.1. Sizing of columns and bent caps
- 5.2. Column reinforcement requirements
- 5.3. Axial load limits on columns
- 5.4. Balanced stiffness
- 5.5. Balanced frame geometry
- 5.6. Local displacement capacity
- 5.7. Local displacement ductility
- 5.8. Displacement ductility demand
- 5.9. Global displacement capacity
- 5.10. P-Delta effects
- 5.11. Minimum flexural capacity
- 5.12. Column shear design
- 5.13. Column key design

3:10 pm: Afternoon Break

3:30 PM *Session #6: Capacity Protected Member Design*

- 6.1. General
- 6.2. Flexural Capacity of Bent Cap
- 6.3. Shear Capacity of Bent Cap
- 6.4. Superstructure and Bent Cap Seismic Capacity
- 6.5. Type II Shaft Transverse Reinforcement
- 6.6. Bent Cap Design Example
- 6.7. Class Example

5:00 pm: Adjourn

Day 2: Seismic Design of the Superstructure

8:00 AM *Session #7: Superstructure Seismic Strength*

- 7.1. Background
- 7.2. Superstructure Seismic Demands
- 7.3. Superstructure Section Capacity (SDC 7.2)
- 7.4. Example Problem

Session #8: Joint Shear Design

- 8.1. Joint proportioning
- 8.2. Types of joints
- 8.3. Joint shear reinforcement
- 8.4. Bridge example



9:40 AM: Morning Break

10:00 AM *Session #9: Abutments (SDC 6.3)*

- 9.1. Supporting Research
- 9.2. Seismic Design Criteria
- 9.3. Example Problem
- 9.4. Interactive Class Problem

Session #10: Recent / On-Going Research

- 10.1. Slab Bridges
- 10.2. Probabilistic Seismic Design Methods
- 10.3. Recovery Columns
- 10.4. Liquefaction

12:00 PM Lunch

1:00 PM *Session #11: Design of Slab Bridges*

- 11.1. Background
- 11.2. Modifications due to Recent Research
- 11.3. Seismic Design Requirements
- 11.4. Interactive Class Design Problem

Session #12: Course Evaluations and Certificates

- 12.1. Course Evaluations
- 12.2. Certificates of Attendance

5:00 PM Adjourn