Seismic Analysis of Example Bridge 2: Consultant Report

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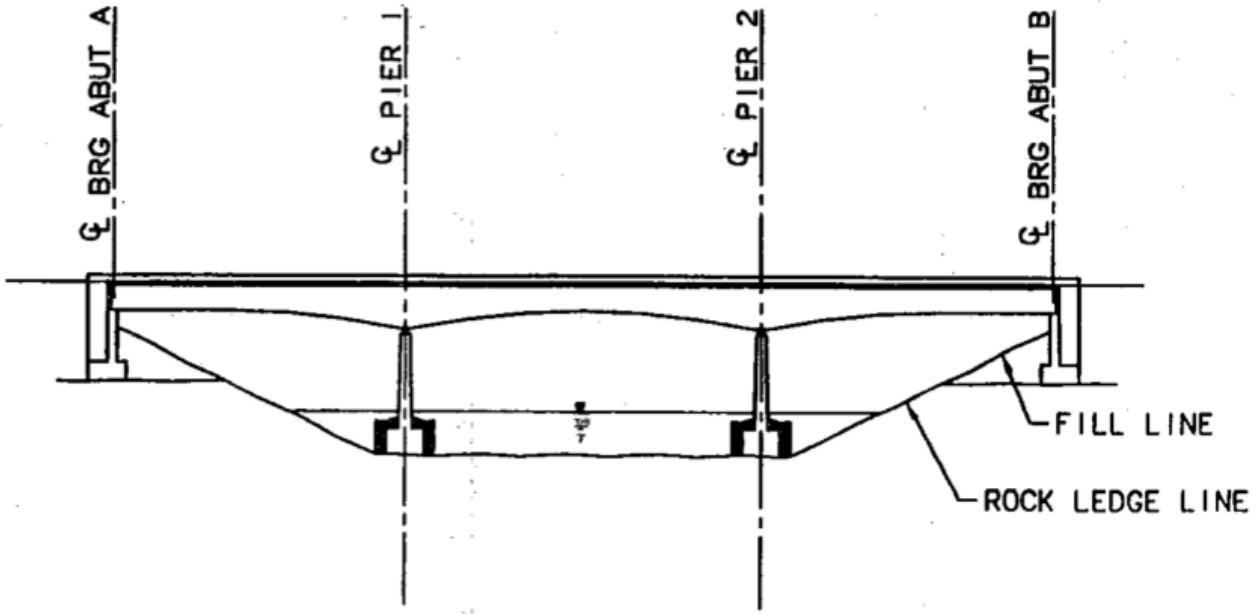
Outline

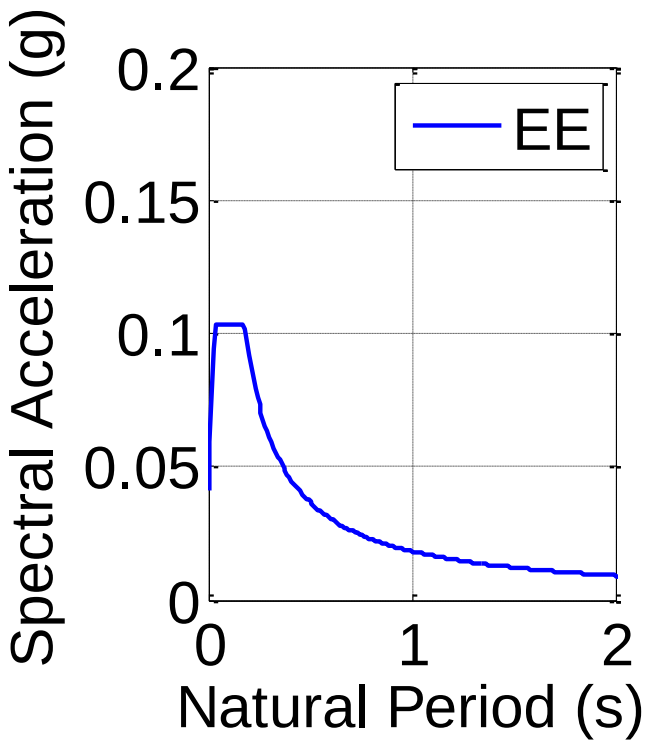
- Basic features of bridge
- Analysis assumptions
- Comparison of results
- Summary

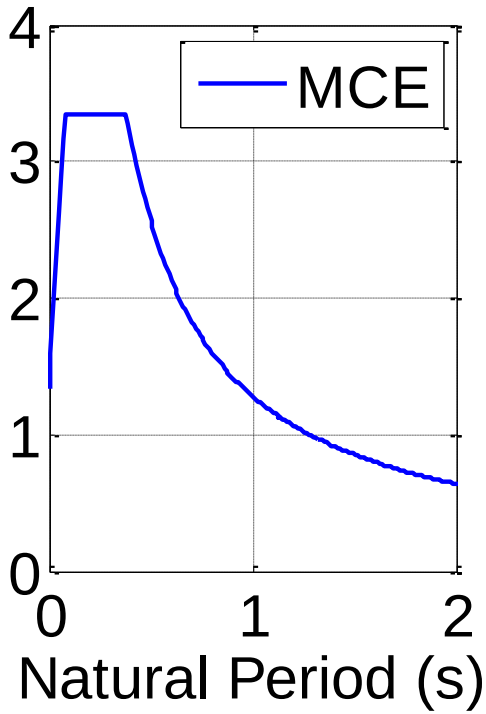
Basic Features of Bridge

- Geometrical features
  - Three spans (124ft - 152ft - 124ft)
  - 25° skew at piers and abutments
- Site class B
- Location: New Madrid (MO)



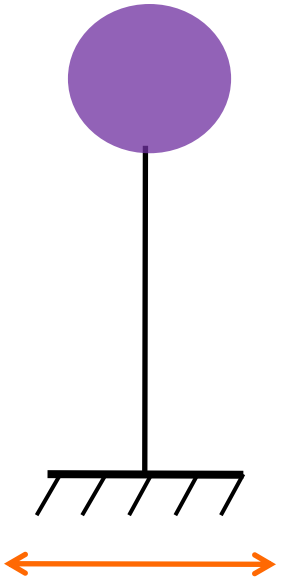
Seismic Hazard





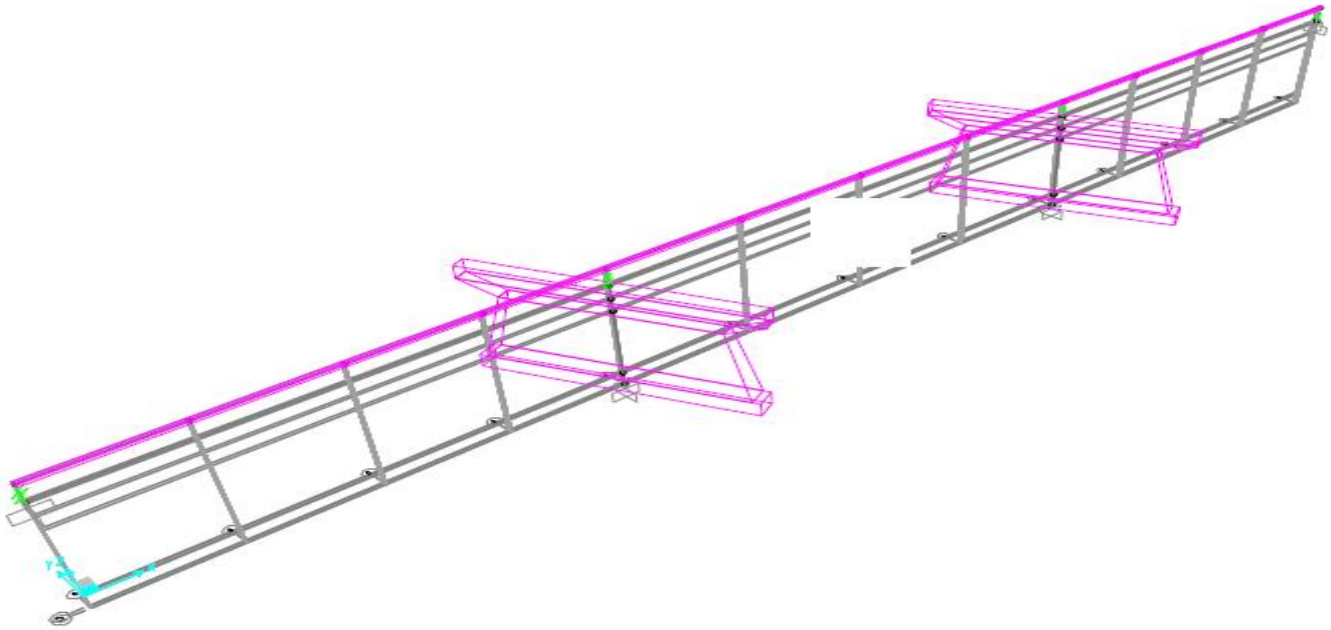
Analysis Assumptions

- SDOF Analysis
  - Mass
    - Superstructure
    - Substructure
  - Stiffness
    - Weak and strong directions of pier
    - Elasto-plastic behavior
  - Yield strength
    - Based on pushover analysis
  - Damping
    - 2% of critical



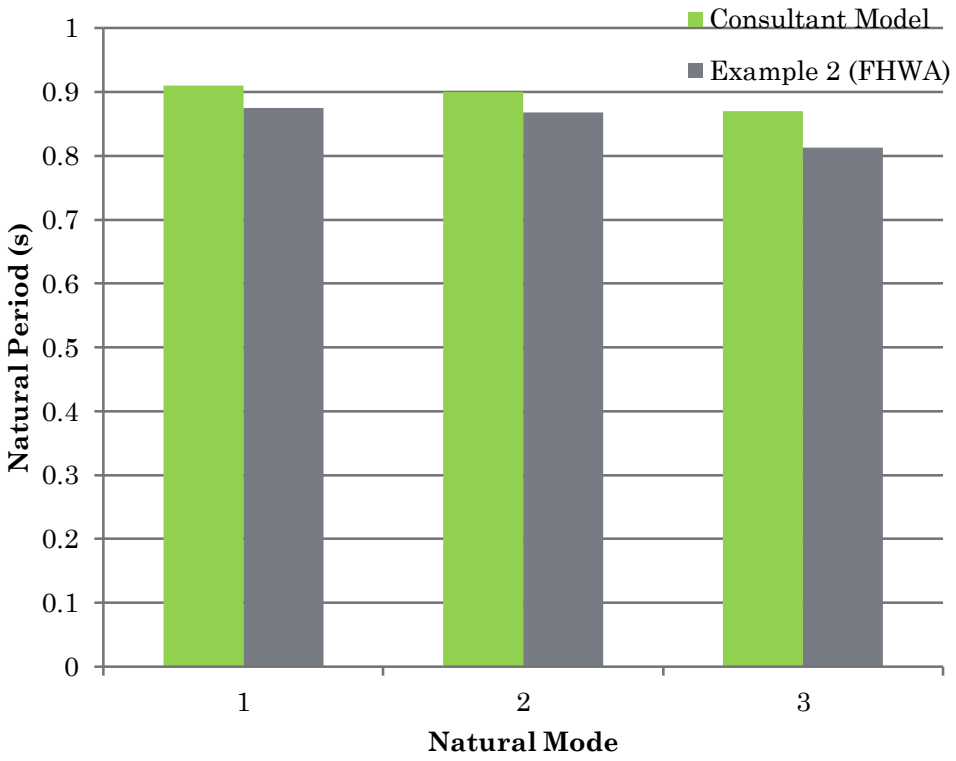
Analysis Assumptions…

- Assumptions for spine model
  - 2% damping in all modes
  - Infinite deformation capacity for bearings
  - Other parameters same as in Example 2 bridge



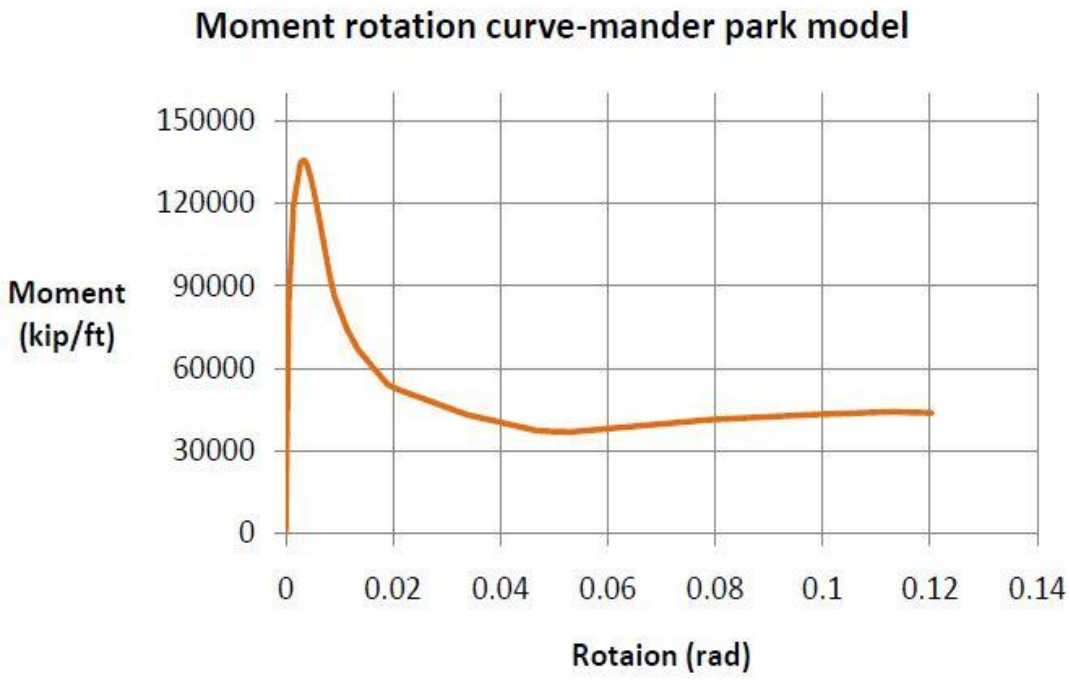
Natural Period

- Consultant model vs. FHWA model



Analysis Results

- Pushover Analysis



Analysis Results

- Comparison of strength using hand calculations
  - Axial load ≈ 2% of capacity
  - Limiting moment capacity for a beam

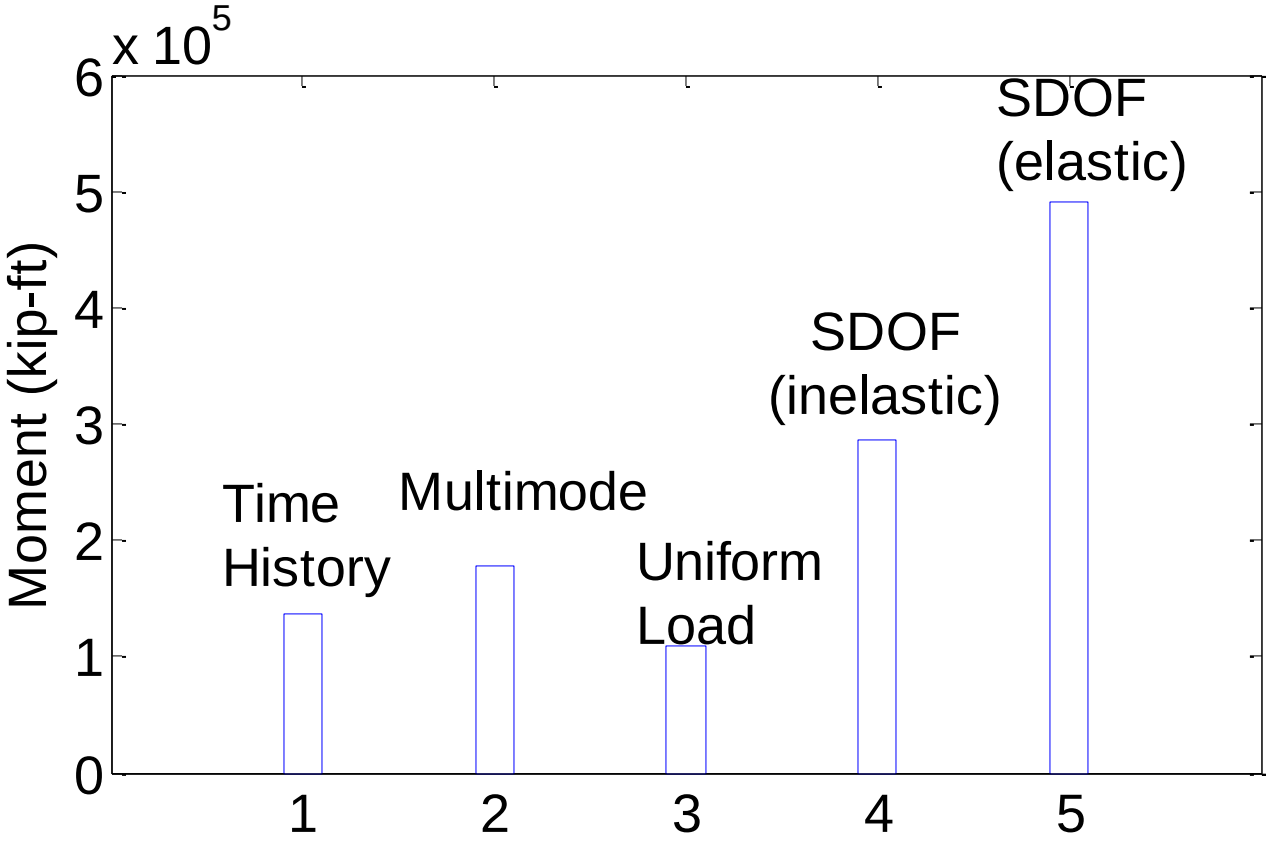
$$\frac{M_{u,\lim}}{f_{ck} \times bd^2} = 0.362 \frac{x_{u,\max}}{d} \left(1 - 0.416 \frac{x_{u,\max}}{d} \right)$$

  - $M_{u,lim}$ = 400000 kip-ft ($x_{u,lim}/d$=0.3)
  - $M_{u,lim}$ = 117000 kip-ft ($x_{u,lim}/d$=0.5)

  - Used capacity in analysis ≈ 130000 kip

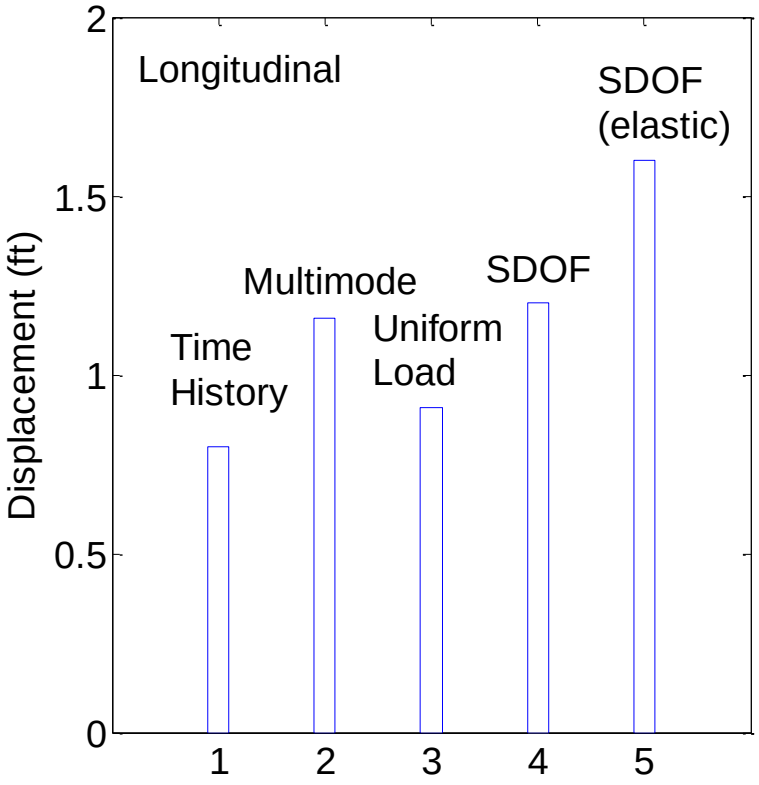
Analysis Results

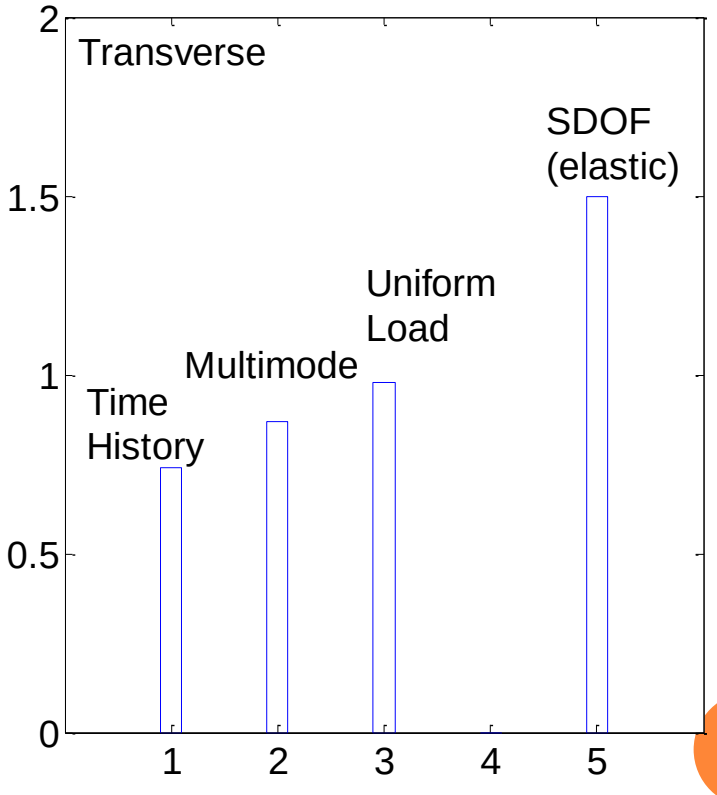
- Moment in weak direction of column



Analysis Results

- Displacement at midspan





Analysis Results…

- Capacity Spectrum Analysis

Type of Load Distribution	Plastic Deformation Capacity ($\theta_P H$) (inch)	P-Δ Capacity (inch)	Operational Performance Capacity Requirement (inch)	Life Safety Performance Capacity Requirement (inch)
Triangular	15.85	169.9	10.7	4.18
Parabolic	12.96	151.2	11.46	4.47

Conclusions

- Bridge may remain operational during MCE
- Certainly functional during EE

Thank You