LAUREL STREET OVERCROSSING
RETROFIT AND REHABILITATION
AGENDA

• History and Layout
• Seismic Demand and Retrofitting
• Rehabilitation and Bridge Inspection
• Project Award
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SOUTH ELEVATION
VIEW FROM SR-163
BRIDGE DECK K
TYPICAL PIER

- Cast-in-Place Reinforced Concrete
- Twin Cell Superstructure
- Transverse T-Beams and Deck Between Cells
- Numerous Internal Diaphragms
- Twisted Square Reinforcing Bars
- Khan Reinforcing Bars

Khan Bar
INTERIOR PIER DETAILS
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SEISMIC DEMAND

- Modified SDC ARS Curve for soil profile D
- $M = 7.25 \pm 0.25$
- Peak Rock Acceleration = $\pm 0.7g$
- Modified for Near Source Effects
- Period = 1.0 sec
Laurel Street Overcrossing
Transverse Time History Accelerations

-0.8 -0.6 -0.4 -0.2 0 0.2 0.4 0.6 0.8

Ground Acceleration (g)

Time (sec)

Pier 1
Pier 2
Pier 3
Pier 4
Pier 5
Pier 6
Pier 7
Pier 8

Courtesy of David Evans & Associates
SEISMIC VULNERABILITIES

- Tall piers lack displacement capacity
- All the piers fail in shear

RETROFIT STRATEGY

- Internal retrofitting
- Shear walls with vertical post-tensioning
- Close joints between piers
- Post-tension superstructure
PIER VERTICAL POST-TENSIONING
CLOSE SUPERSTRUCTURE JOINTS
POST-TENSIONING END DIAPHRAGMS
LONGITUDINAL POST-TENSIONING
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REHABILITATION

- Retrofit strategy requires intact cross sections
- Remove and repair unsound concrete
- Clean and replace corroded reinforcing bars
- Exterior rehabilitation must be colored and textured to match existing concrete
STRUCTURAL INSPECTION

- Recommendation from VE analysis
- Determine the types and locations of repair
- Limited inspection access
- Manlift, snooper truck & scaffolding
INSPECTION ACCESS
INSPECTION EQUIPMENT
STRUCTURAL INSPECTION

- Surface mapping
- Rock pockets
- Spalling
- Settled aggregate
- Efflorescence through joints
- Aided in cost & quantity estimating
UNSOUND CONCRETE
TESTING PERFORMED

• Non Destructive Testing
  – Visual Inspection
  – Rebound Hammer
  – Ground Penetrating Radar

• Destructive Testing
  – 100 Concrete Core Samples
  – Compression Strength
  – Petrographic
  – Concrete Chemical
  – Rebar Tensile Strength
ELECTRICAL AND ACCESSIBILITY INSPECTION

- High voltage distribution line on catwalk
- Electrical transformers in abutments
- Exposed wiring inside and outside bridge
- No interior lighting
EXPOSED WIRING
ELECTRICAL AND ACCESSIBILITY INSPECTION

• Wood catwalk is deteriorated, no railings
• Some piers inaccessible
• Eroded interior abutment slopes
• Broken drain pipes
• Doors need replacement
DIFFICULT INSPECTION ACCESS
ELECTRICAL AND ACCESSIBILITY IMPROVEMENTS

- Remove catwalk and wood debris
- Remove transformers and high voltage lines
- New electrical system and interior lighting
ELECTRICAL AND ACCESSIBILITY IMPROVEMENTS

- Install Cal/OSHA compliant ladders and catwalks
- Doors in all piers
- Grade abutment slopes
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PROJECT AWARD

- Bridge remain open during construction
- A+B contract construction and time
- Top 3 bids within 2% of each other
- Low bid $16,550,000
- Duration 200 working days
- Completed before 2015 Centennial Celebration
ACKNOWLEDGMENTS

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- UCSD (Peer Review)
- David Evans & Associates (Finite Element Modeling)
- Atkins (Preliminary Design)
- Ninyo & Moore (Inspection & Testing)
- McLean & Schultz (Independent Check)
Questions?