Prepared for

Yolo County

Rumsey Town Hall

July 21, 2014

Public Information Meeting

Rumsey Bridge Project

QUINCY ENGINEERING

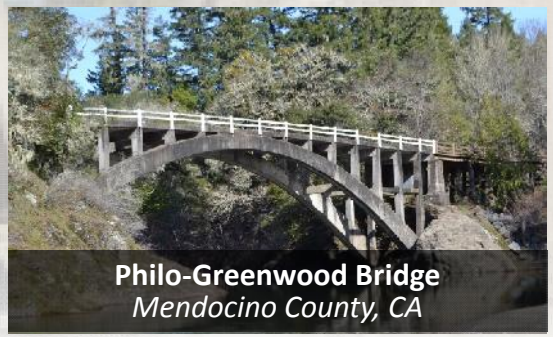
Firm Introduction

- Quincy Engineering since 1992
- We specialize in:
  - Bridge design
  - Roadway design
  - Construction management
- Our key clients include:
  - Cities
  - Counties
  - Regional Transportation Councils, Associations, and Agencies
  - Private Developers
  - Caltrans
  - ODOT

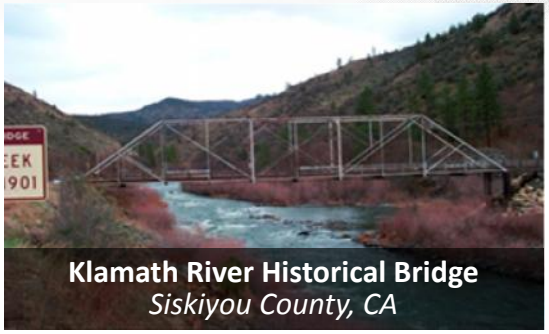
Quincy Engineering Staff's Past Experience

Foresthill Bridge
Placer County, CA

Oakdale Road Bridge
Merced County, CA



Philo-Greenwood Bridge
Mendocino County, CA



Klamath River Historical Bridge
Siskiyou County, CA

Donner Summit Bridge
Nevada County, CA

Diesloehorst Bridge
Redding, CA

Winston Bridge
Winston, OR

Project Key Staff

Steve Mellon, PE – Project Manager

Areas of Expertise:
- ✓ *CT Seismic committee*
- ✓ *Construction Management*
- ✓ *Earthquake Engineering*

Key Qualifications:
- ✓ *BS, Civil Engineering, UC Davis, 1978*
- ✓ *35 Years of Experience*
- ✓ *CA PE / NV PE*

Mr. Mellon's Project Experience:

Donner Summit Bridge
Nevada County, CA

Diesloehorst Bridge
Redding, CA

Tisdale Bypass Bridge
Sutter County, CA

Oakdale Road Bridge
Merced County, CA

Project Key Staff

Jeff Olson, PE – Project Engineer

Areas of Expertise:
- ✓ *Arch Bridge Design*
- ✓ *Caltrans Seismic Specialist*
- ✓ *Historic Bridges*

Key Qualifications:
- ✓ *BS, Civil Engineering, UC Davis, 1983*
- ✓ *30 Years of Experience*
- ✓ *CA PE / OR PE / WA PE*

Mr. Olson's Project Experience:

- Winston Bridge Seismic Retrofit
  - Historic Steel Arch, Built in 1934
- Barton Bridge Rehabilitation
  - Historic Steel Truss Bridge, Built in 1937
- Bull Run River Bridge Seismic Retrofit
  - Historic Steel Truss Bridge, Built in 1889
- Dodge Park Bridge Life Expectancy Analysis
  - Historic Steel Truss Bridge, Built in 1889

Project Key Staff

Jason Chou, PE – Lead Designer

Areas of Expertise:
- ✓ *Seismic Analysis*
- ✓ *Structural Analysis*
- ✓ *Bridge Retrofits*

Key Qualifications:
- ✓ *MS, Civil & Env. Engineering, UC Davis, 2007*
- ✓ *BS, Civil Engineering, UC Davis, 2006*
- ✓ *7 Years of Experience / CA PE / OR PE*

Foresthill Bridge

Mr. Chou's Project Experience:

- Foresthill Bridge, Placer County, CA
  - Steel Truss Seismic Retrofit, Built in 1971
- Klamath River Bridge, Siskiyou County, CA
  - Historic Bridge Replacement in kind, Built in 1901
- Guy West Bridge, City of Sacramento, CA
  - Suspension Bridge Rehabilitation, Built in 1968
- Ogden Siphon, City of Sacramento, CA
  - Suspension Bridge Retrofit, Built in 1937

Klamath River Bridge

Guy West Bridge

Ogden Siphon Bridge

Project Description

- Assess Existing Bridge
- Develop Rehabilitation and Replacement Alternatives

Feasibility Study Objectives

STEP 1

Existing Bridge Assessment

STEP 2

Retrofit & Replacement Alternatives

STEP 3

Public Feedback

Caltrans Consultation

Environmental Review

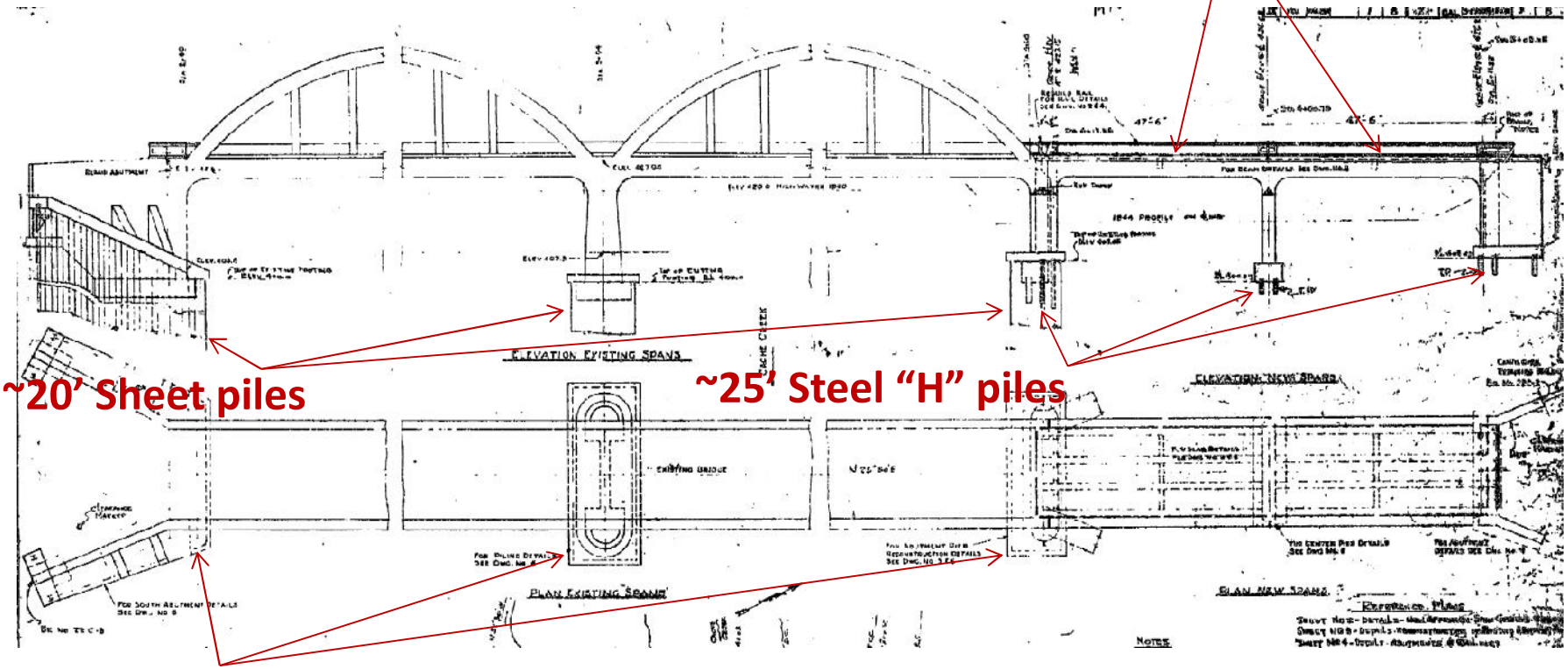
STEP 4

Bridge Type Selection

Existing Bridge

Built in 1930	Concrete Arch
Lengthened in 1949	T-Girder
Overall Length	311 Feet

CIP “T” Girders



~20’ Sheet piles

~25’ Steel “H” piles

~20’ Sheet piles

108 feet span arches

47.5 feet span T-girders

Existing Bridge Vulnerabilities

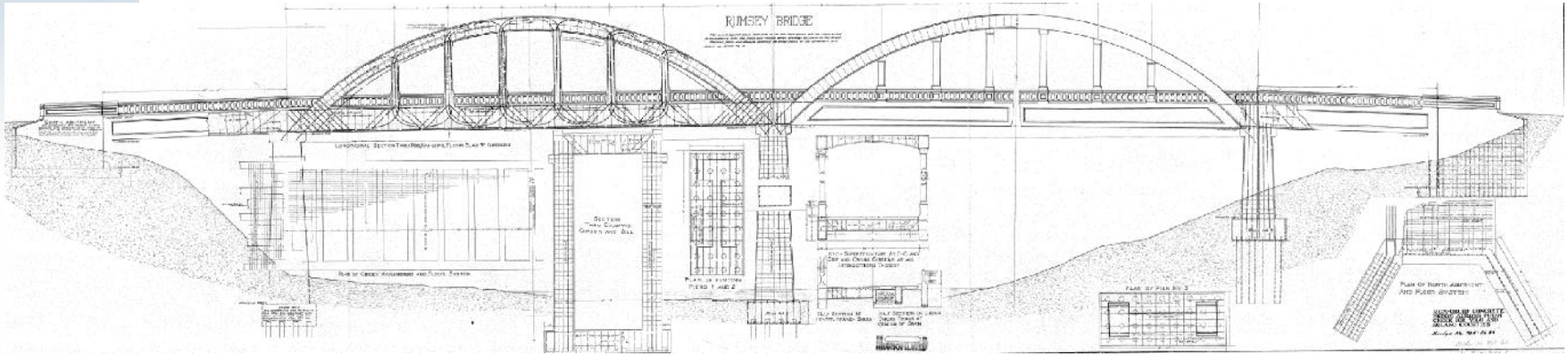
- Hydraulic
- Age/Condition
- Seismic

Alternatives Analysis

- Retaining Existing Bridge
  - Scour Countermeasures
  - Rehabilitation
  - Seismic Retrofit
- Construct New Bridge
  - Close and Retain Existing Bridge
- Construct New Bridge
  - Remove Existing Bridge

Existing Bridge

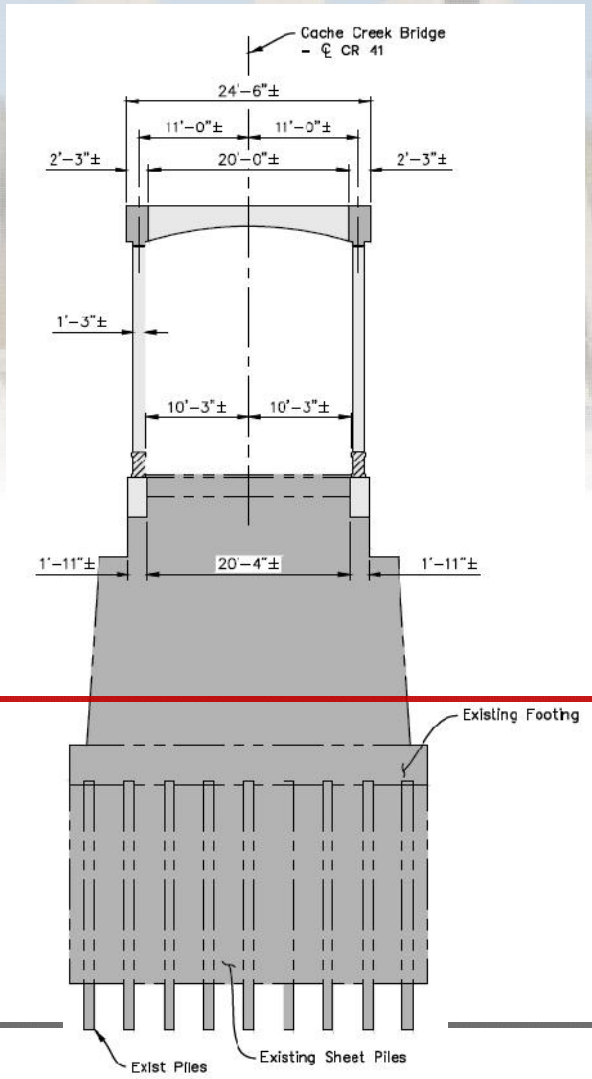
- Available Information
  - As-built Design Plans
  - Historic Photos
  - Caltrans Inspection Reports



Concrete Arch Spans Built in 1930

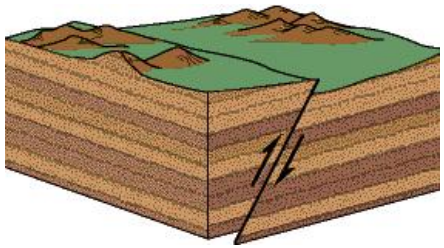
Hydraulic Vulnerability

Hydraulic Vulnerability



Age/Condition

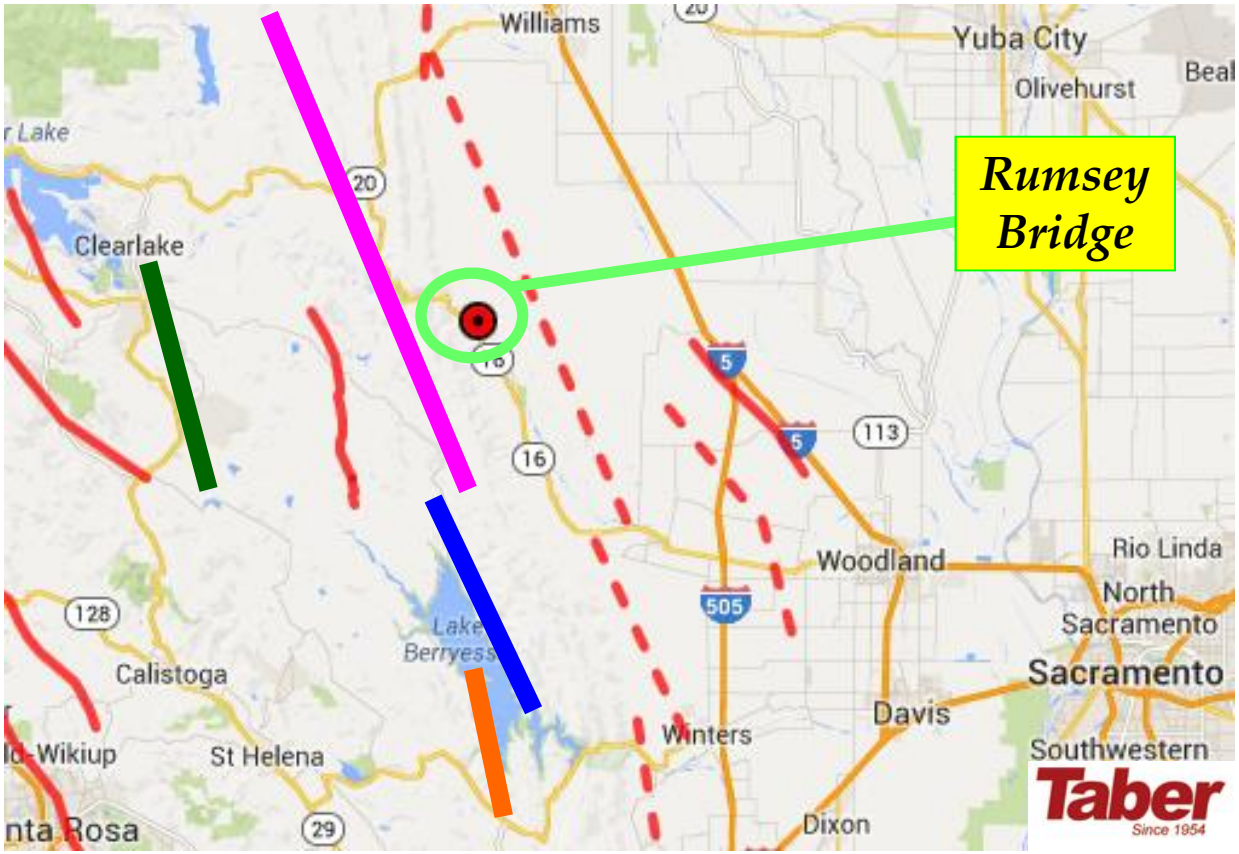
Seismology



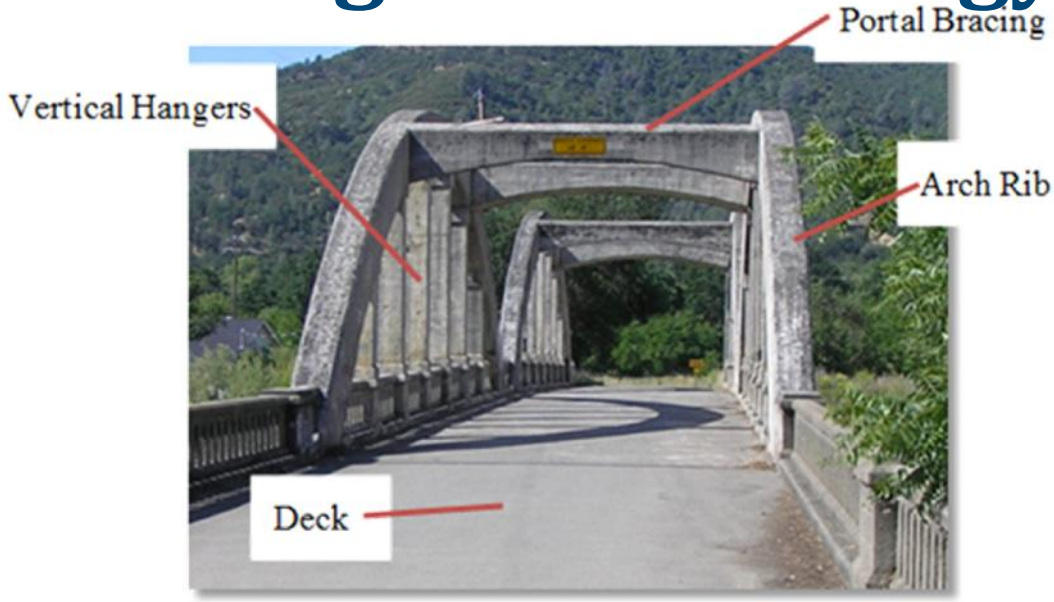
- 1,000 year return period = 5% probability in a 50-year
- Maximum Magnitude = 7.0 ⌋ 1994 Northridge Earthquake

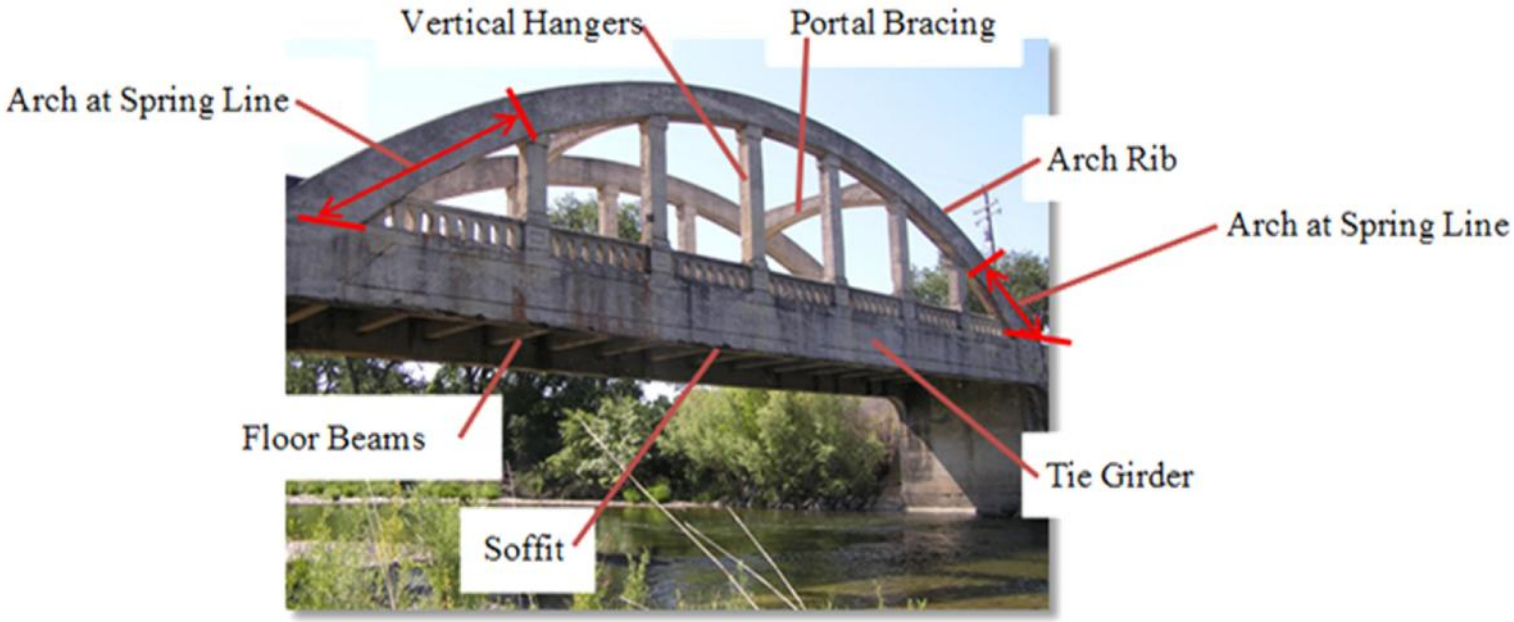
Faults

Pink	= Mysterious Ridge
Green	= Berryessa
Blue	= Dunnigan Hills
Orange	= Trout Creek
Red	= Additional Faults



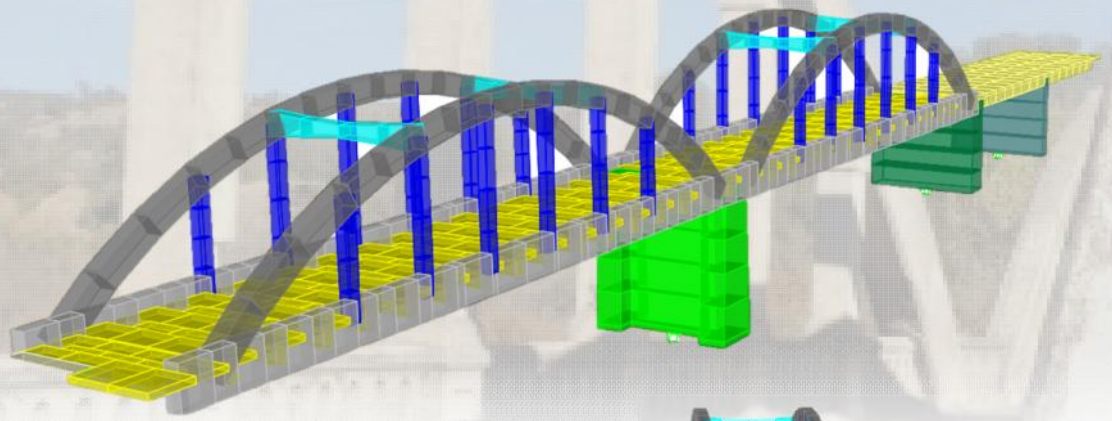
Bridge Terminology

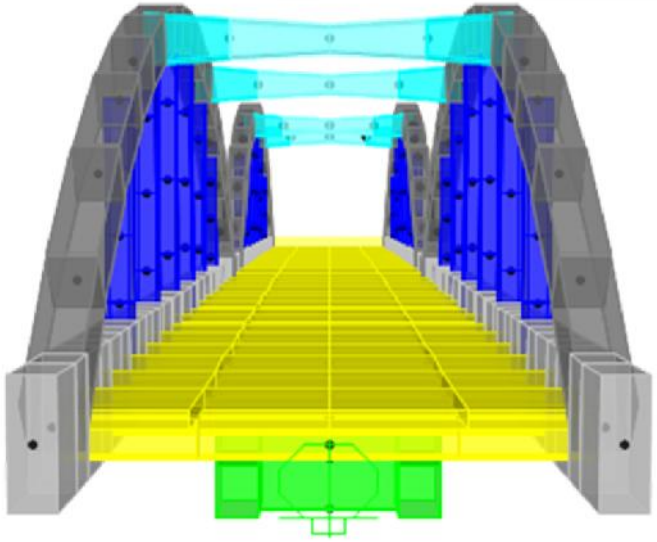


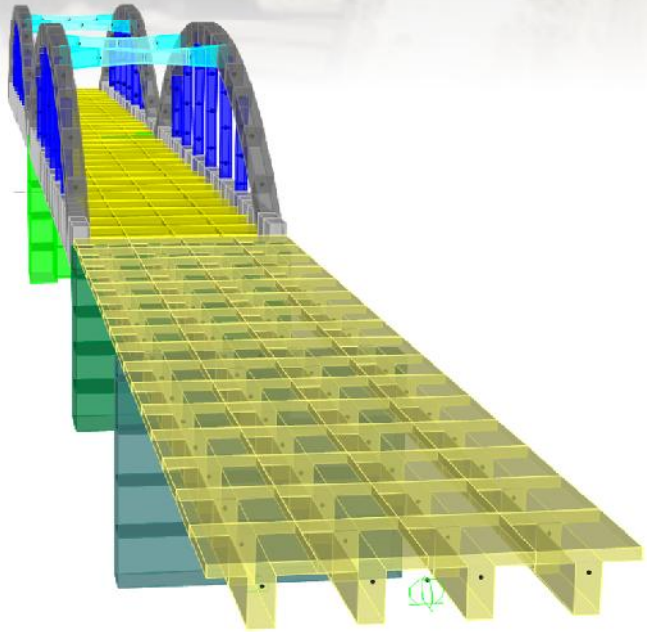


Seismic Analysis Model

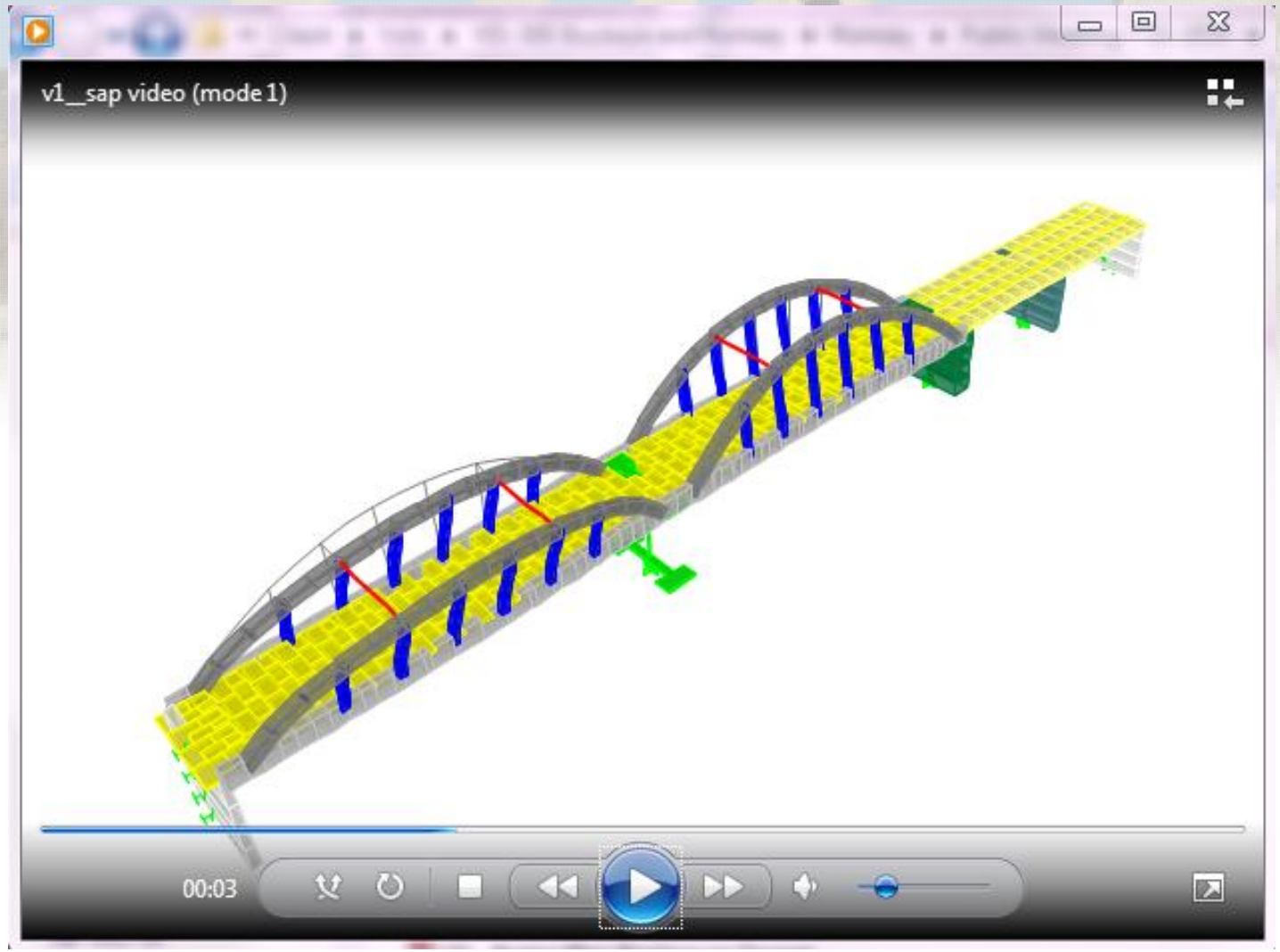
Seismic Analysis Model



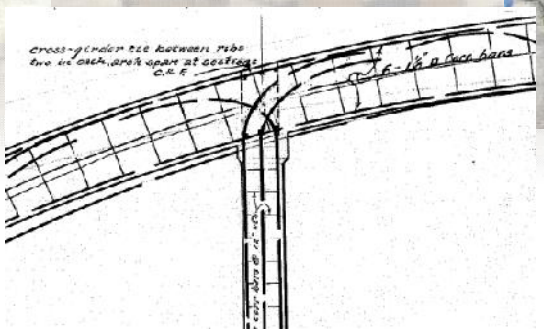


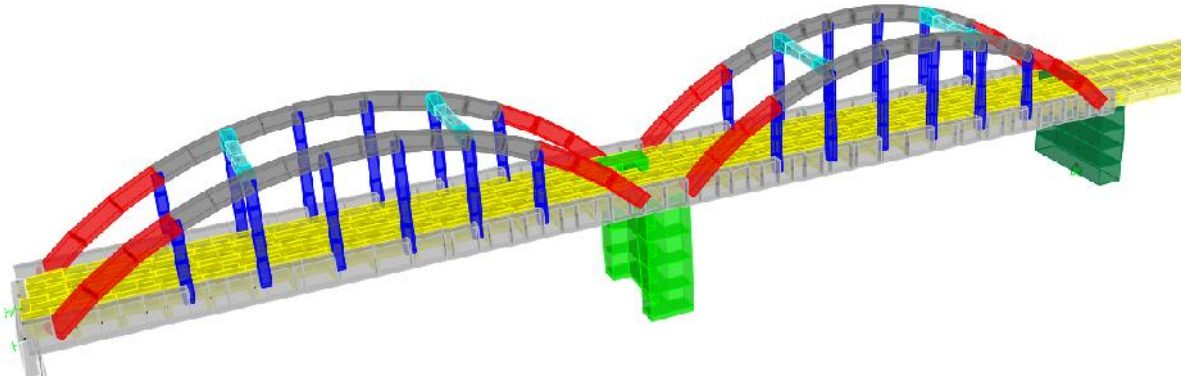


Seismic Analysis Model

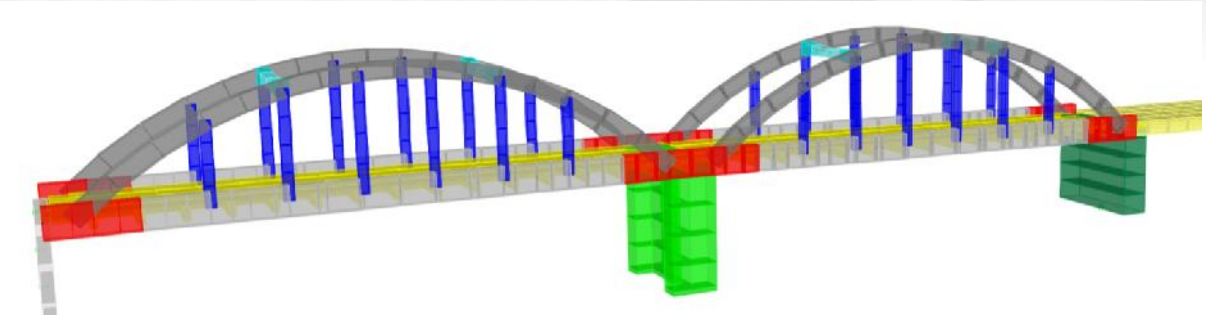


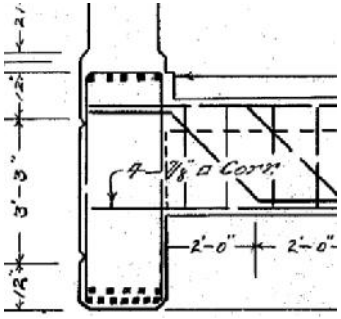
Vulnerabilities: *Arch Rib*



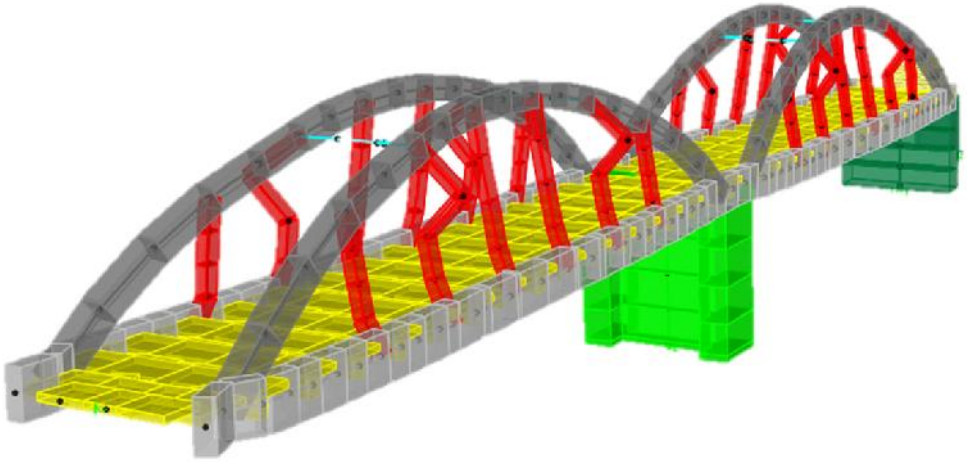


Vulnerabilities: *Tie Girders*

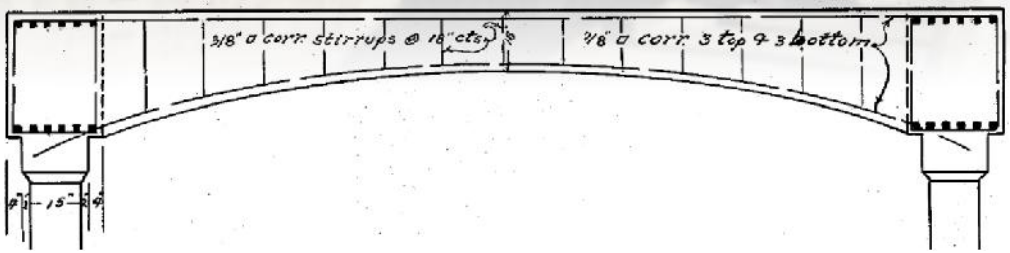


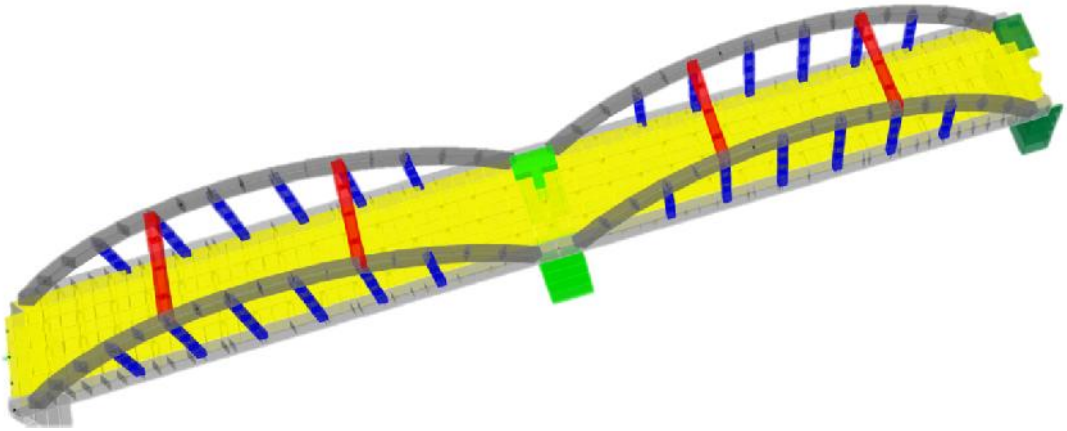


Vulnerabilities: *Vertical Hanger*



Vulnerabilities: *Portal Bracing*

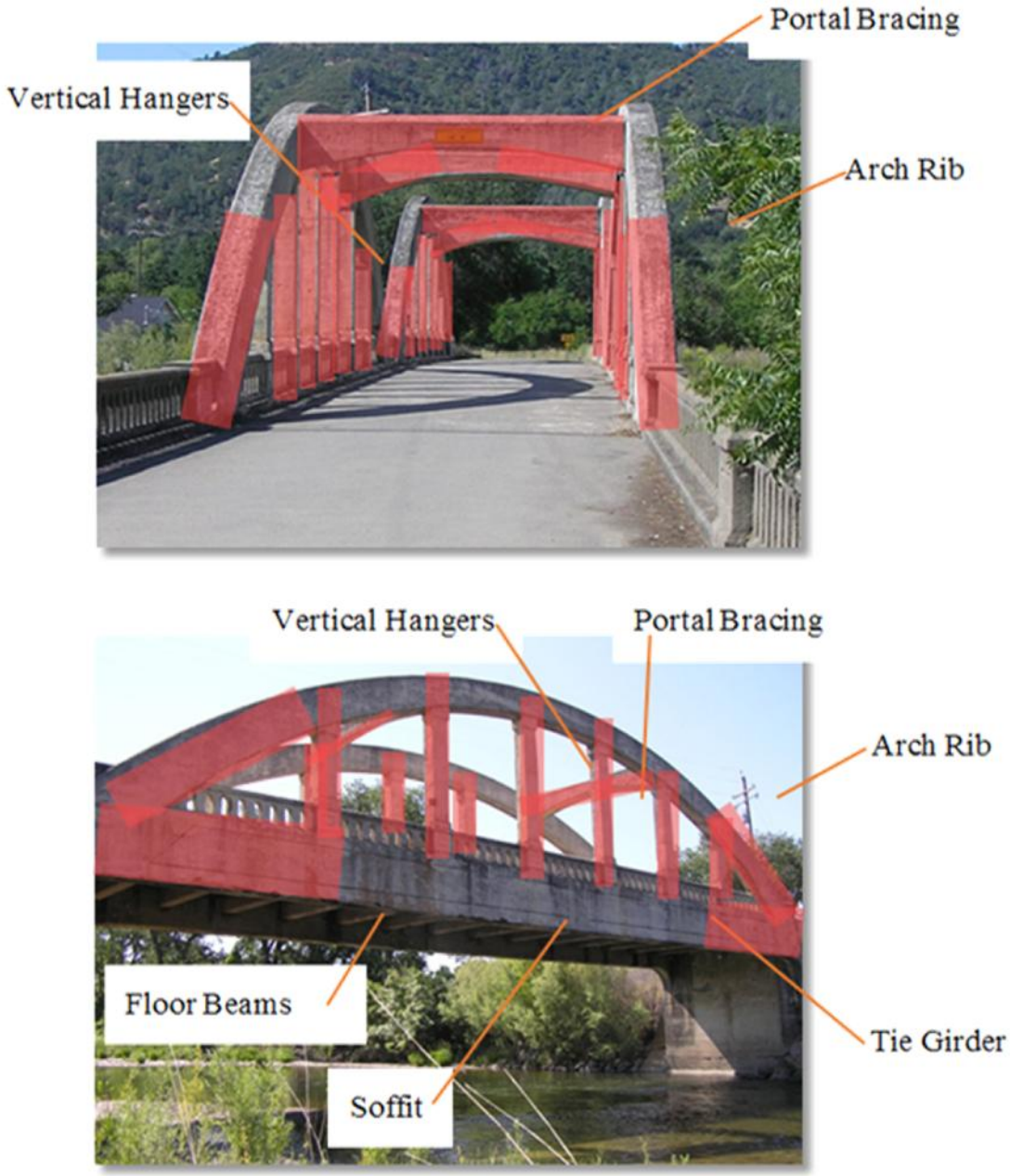




Additional Seismic Vulnerabilities

- Pier & Abutment Foundations

Seismic Vulnerabilities



Rehabilitation & Retrofit Measures

A. **Cast-In-Drilled-Hole & Footing Build-out at Piers**

B. **Cast-In-Drilled-Hole behind Abutment**

C. **Fiber-Wrap Vertical Hangers**

D. **Refinish Deck**

E. **Fiber-Wrap Arch Rib from Spring Line to first vertical hanger**

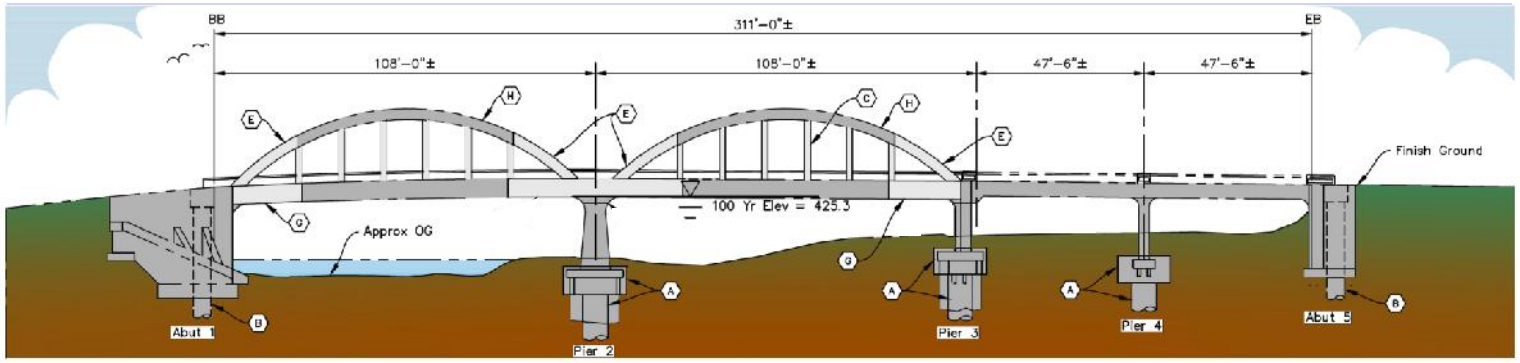
F. **Reconstruct Wingwall**

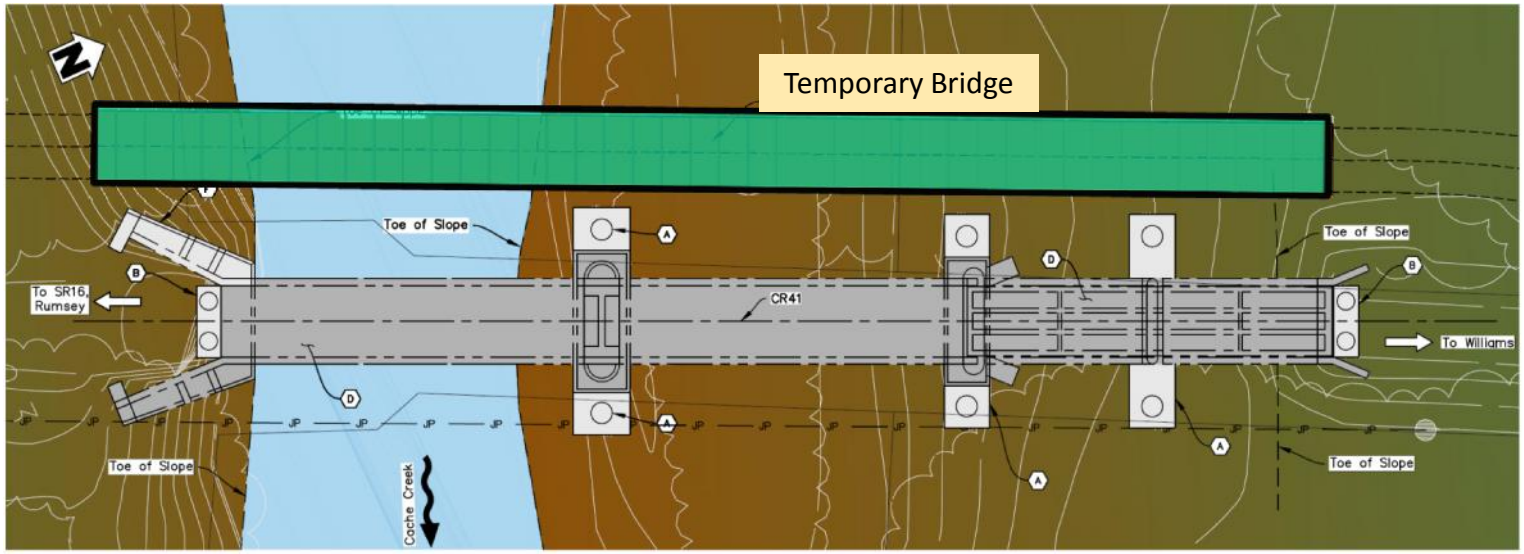
G. **Bolster Exterior Tie Girders**

H. **Patch spalled or delaminated concrete**

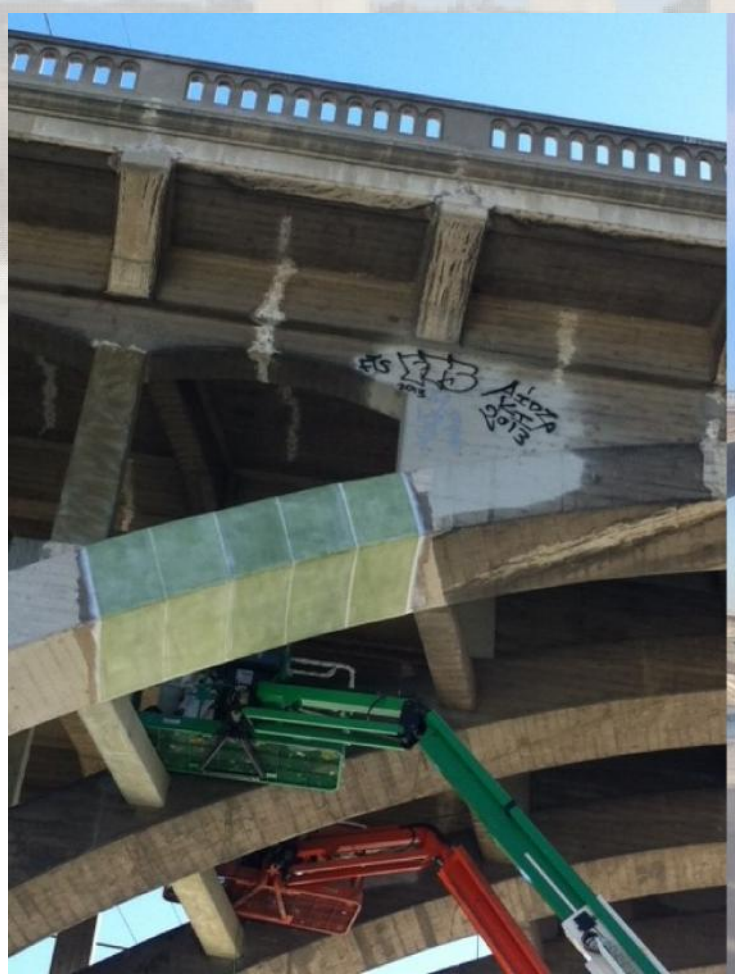
I. **Rebuild Concrete railing**

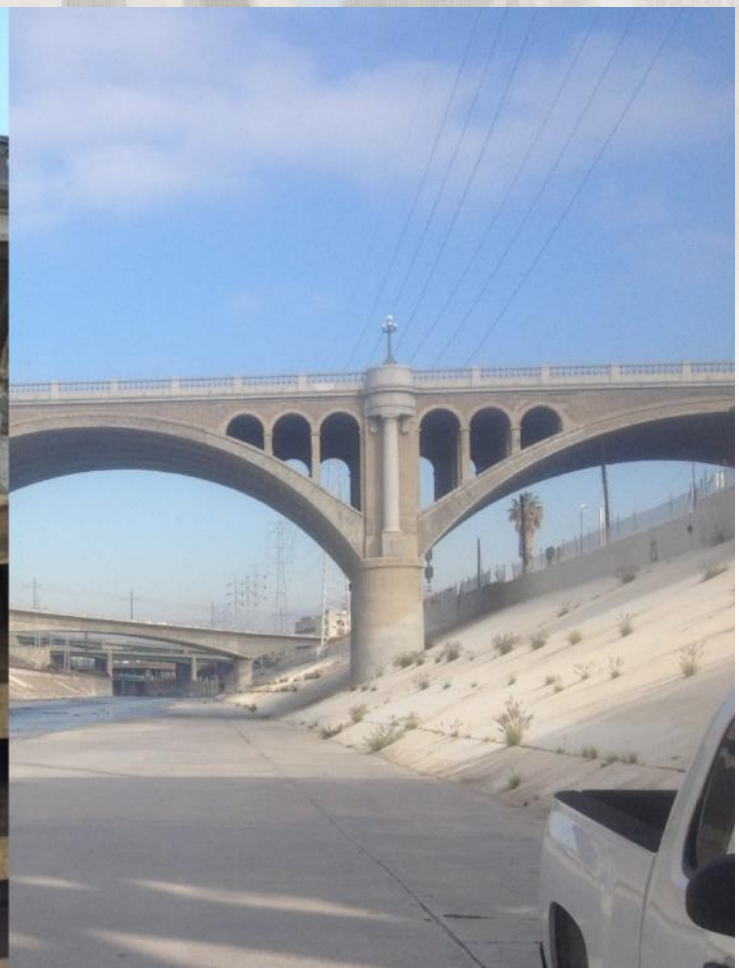
J. **Portal Bracing Fiber-Wrap**





FRP Example:
CA North Spring St. Viaduct

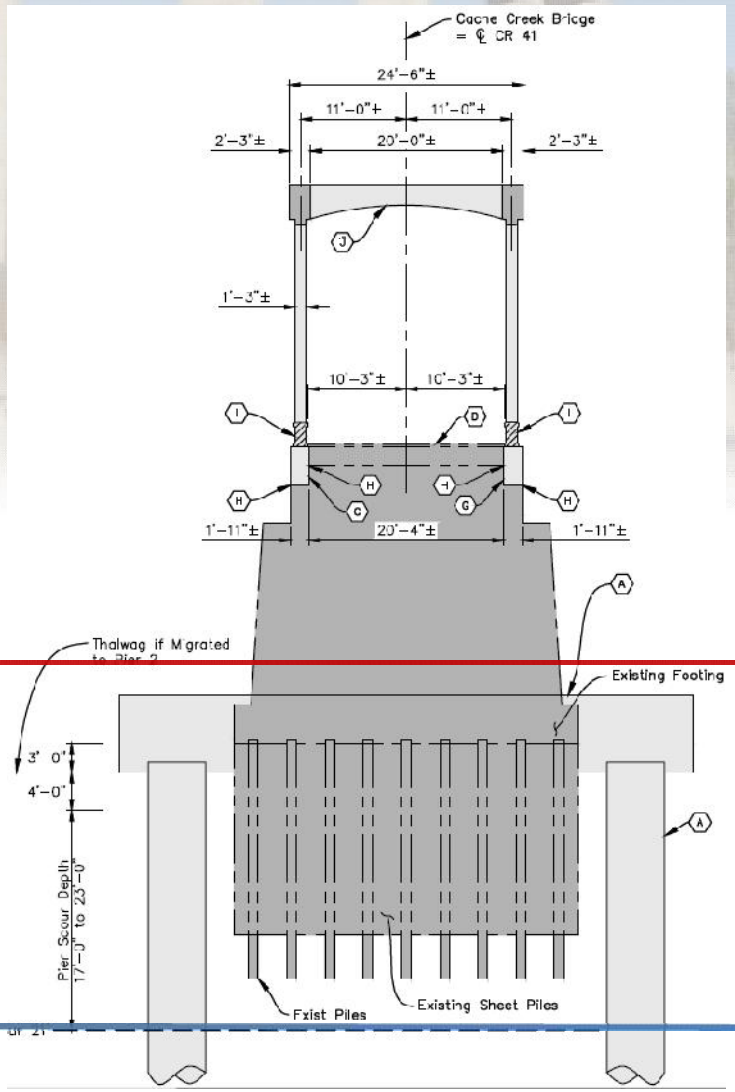




FRP Example:
NY White Plains Viaduct Arch

FYFE
Tyfo FIBRWRAP Systems

Foundation Retrofit



Existing Ground

Scour Elevation

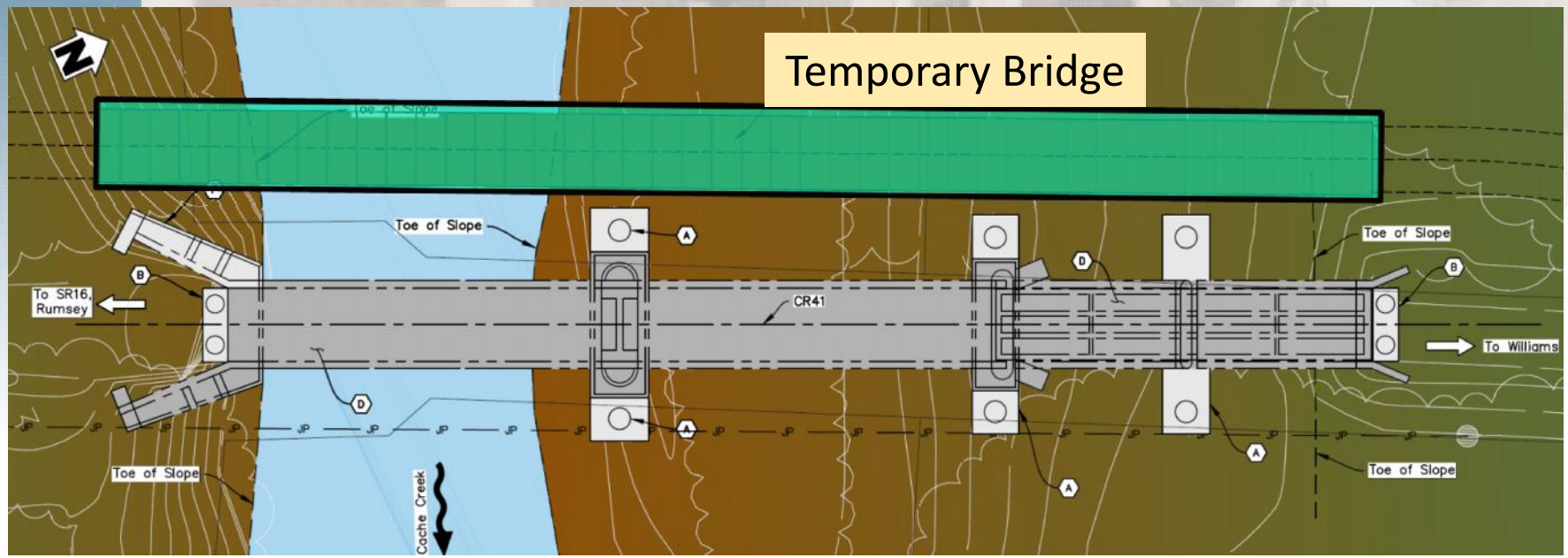
Fiber Wrap (FRP)

Maintenance, Appearance, & Risks

- Susceptible to UV rays, repainted regularly
- Rounded element corners for FRP
- FRP covers architectural details
- Susceptible to damage caused by vehicular impact
- Construction cost predictability
- Uncertainty of rehabilitation limits

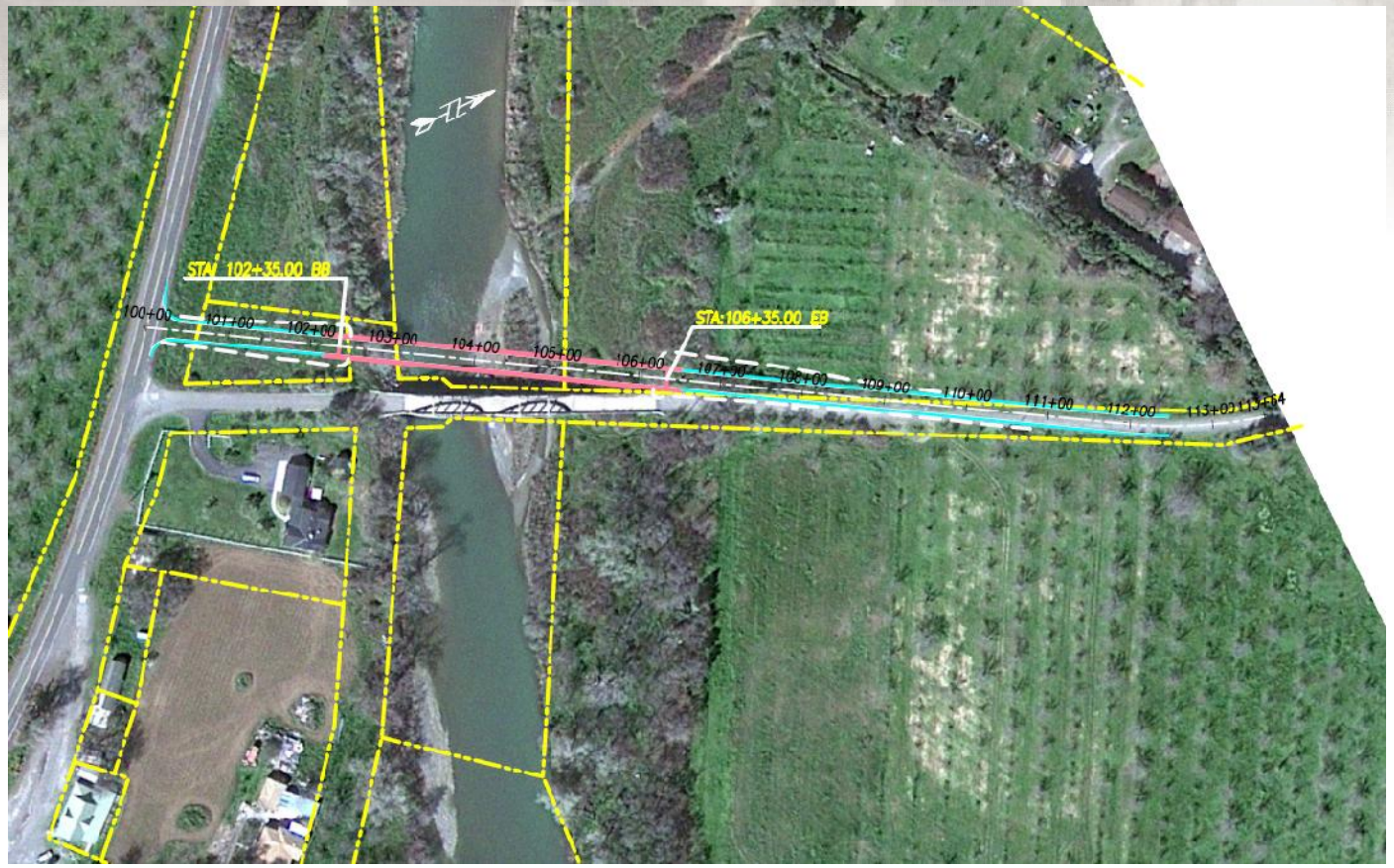
Accessibility During Construction

- Temporary bridge required



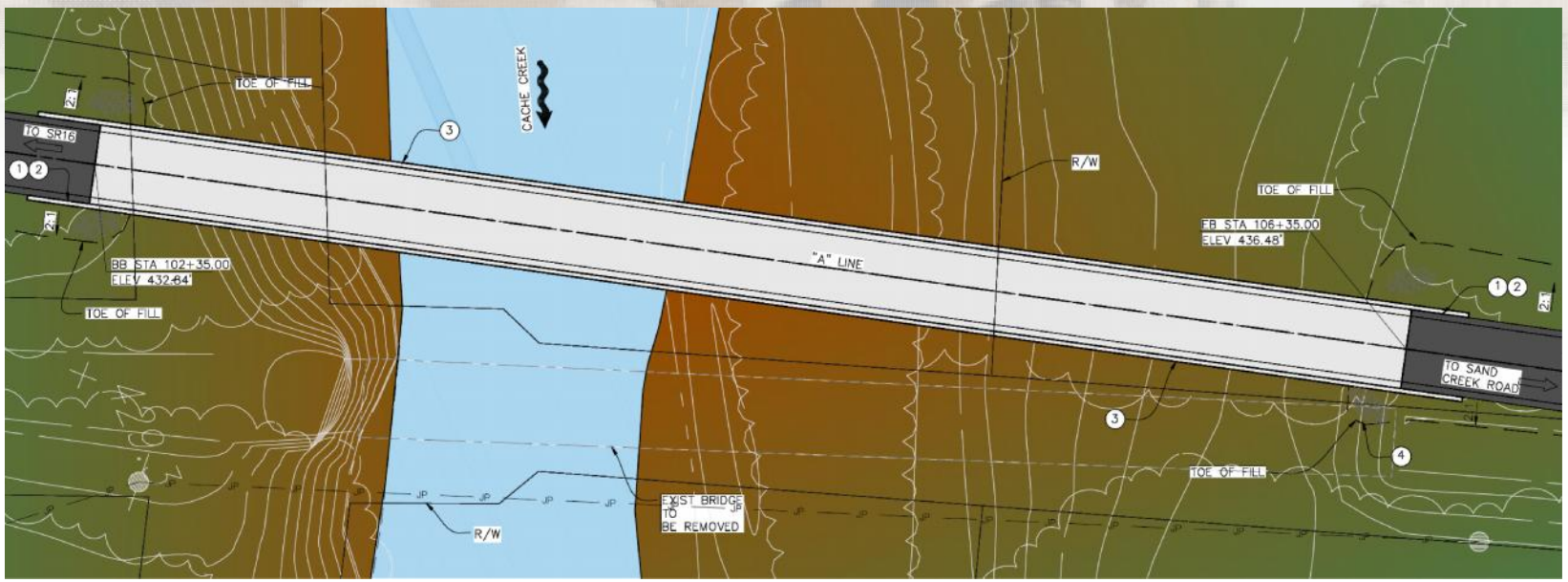
Bridge Replacement Alternatives

- Roadway Realignment Upstream
- Downstream Alignment (Rejected)
- Existing Alignment (Rejected)



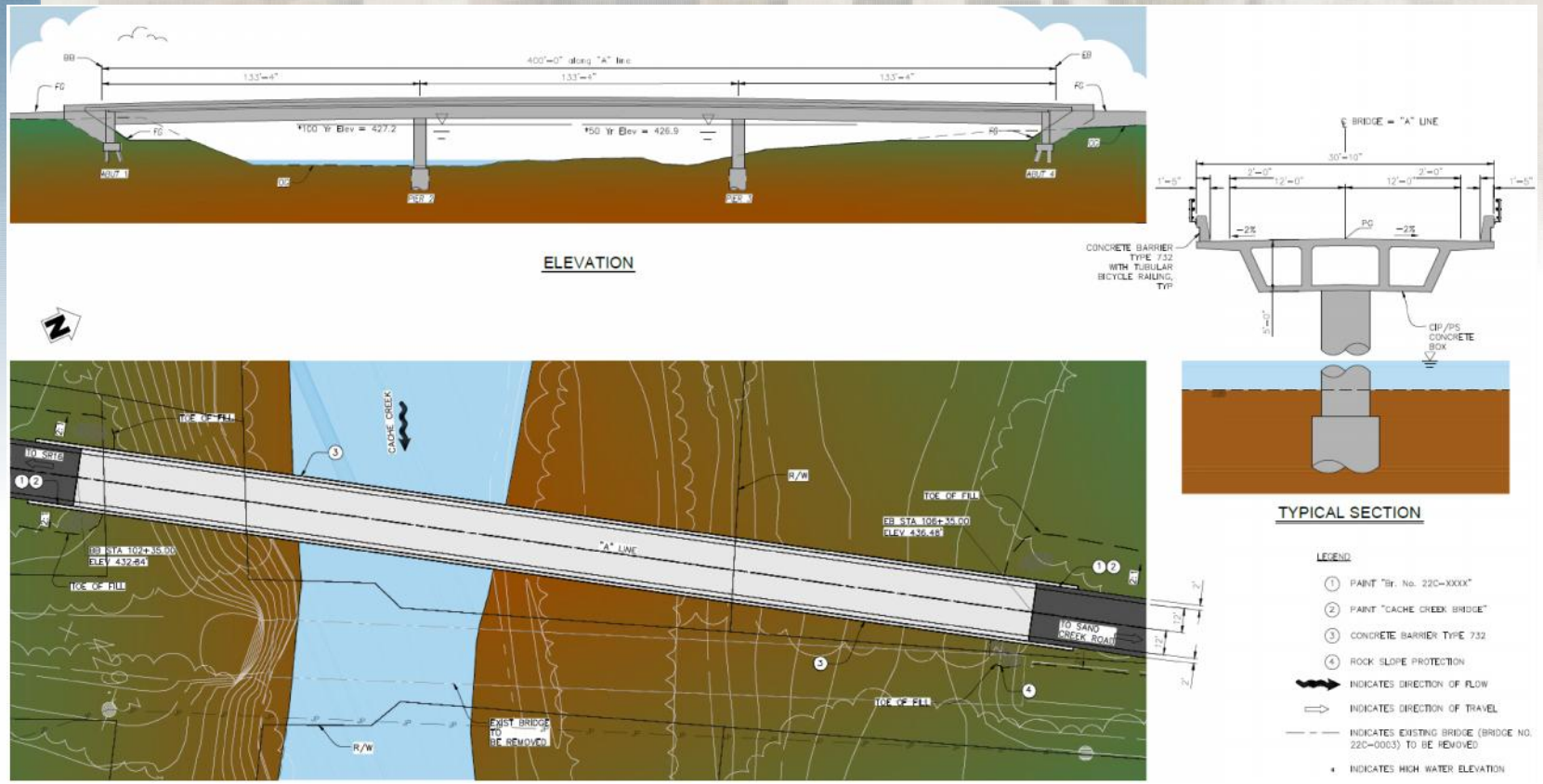
Bridge Replacement Alternatives

- Improved Intersection Geometry at SR16
- Improve Hydraulic Capacity with Raised Profile
- Relocate South Abutment to Reduce Scour Threat



Bridge Replacement Alternatives

- CIP Concrete Box Girders = Most Cost-Effective Bridge



Alternatives Comparison

Alternative 1 – Retrofit & Rehab Existing Bridge

Estimated Cost: **$10,800,000**

Advantages:

- Provides safe river crossing
- Preserves historical significance and aesthetics of original Rumsey Bridge
- Lowest permanent Right-of-Way impact

Disadvantages:

- Extensive retrofit ➔ high cost
- Lower life expectancy
- Higher maintenance cost
- Greater impact on traffic during construction
- Does not address hydraulic conveyance problem
- Continued substandard lane width

Cost Break Down

Alternative 1 – Retrofit & Rehab Existing Bridge

Major cost components:

- $4M Scour Countermeasures
- $1M Fiber Wrap (Seismic Retrofit)
- $0.7M Deck & Concrete Rehabilitation
- $0.3M Bridge Rail Upgrade
- $2M Temporary Detour/Bridge
- $0.8M Mobilization
- $2M Contingencies

- $10.8M Total Cost

Alternatives Comparison

Alternative 2 – Conventional Concrete Box Girder Bridge, Close and Retain Existing Bridge

Estimated Cost: **$3,900,000**

Advantages:

- Provides new safe river crossing
- Provides a long-term, low-maintenance structure
- Preserves historical significance and aesthetics of existing bridge
- Lowest construction cost

Disadvantages:

- Existing bridge still vulnerable to seismic & hydraulic events
- Does not improve the overall hydraulic capacity at the site
- Public safety at risk if existing bridge collapses while in use
- No funding mechanism for future maintenance or removal after collapse of existing bridge
- Greater Right-of-Way and environmental impacts

Alternatives Comparison

Alternative 3 – Conventional Concrete Box Girder Bridge, Remove Existing Bridge

Estimated Cost: **$4,500,000**

Advantages:

- Provides safe river crossing
- Provides a long-term, low-maintenance structure
- Improves hydraulic capacity by raising the profile and reducing the supports in the creek

Disadvantages:

- Loss to the local community who value existing bridge aesthetics
- Greater Right-of-Way and environmental impacts

What's Next

Questions & Answers