Reconstruction Challenges of a Nationally Historic Arch Bridge in San Diego

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Western Bridge Engineers' Seminar

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Outline

- Project Timeline and Designation
- Original Condition (Seismic/Service/Condition)
- Proposed Retrofit Alternative
- Construction requirements
- Construction sequence and challenges

Location

Georgia Street Bridge Location

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Georgia Street Timeline

- Built in 1914 in San Diego, CA
- Two 640-Foot Long Anchor Block Retaining Walls
- 3-Hinge Concrete Arch Bridge
- Many Past Repairs Since 1947

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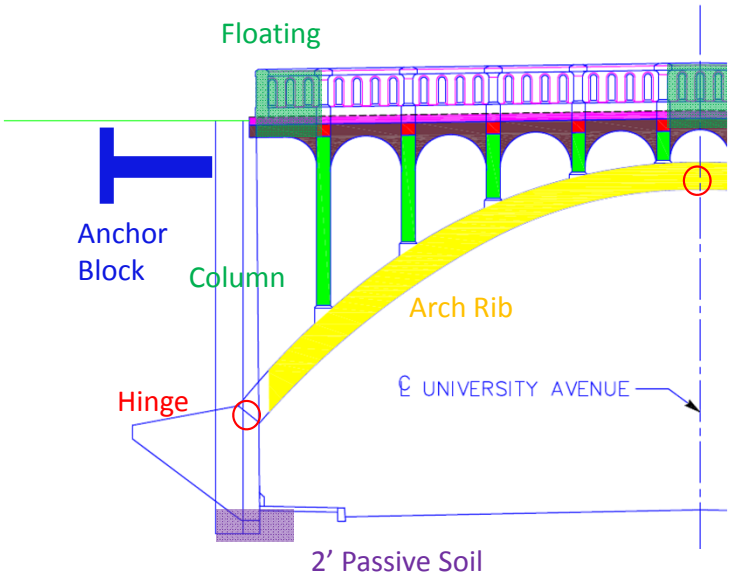
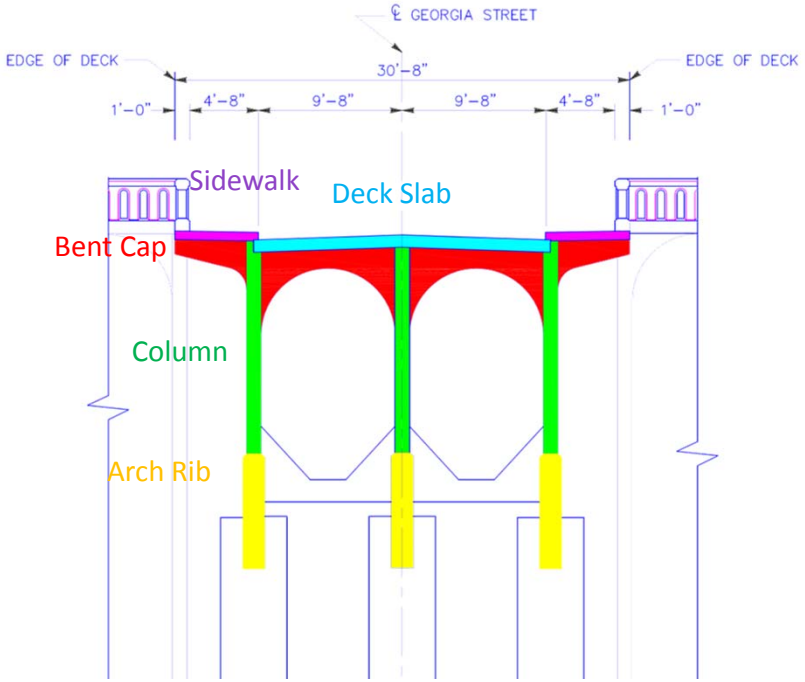
- Many Past Repairs Since 1947
- 1994 City of San Diego Designated Bridge and Walls Historic
- 1999 Placed on Historic Register
- 2002 Vulnerability Study to Replace by Others
- 2009 Begin New Retrofit/Replace Studies
- 2012 Caltrans Approved Rehabilitation/Retrofit
- 2016 Construction Began

Bridge Components

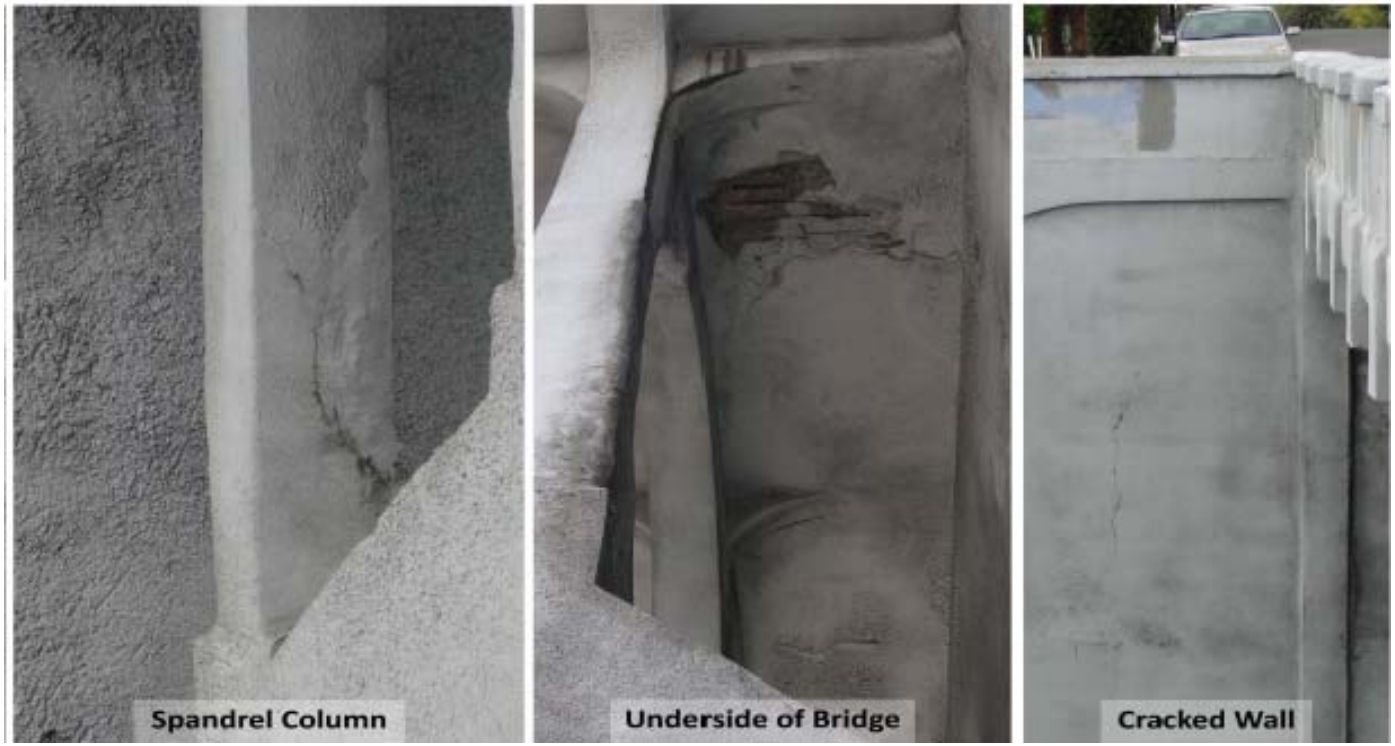


Half Elevation



Typical Section

Visual Inspection



Existing Condition

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Existing Condition

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Existing Condition

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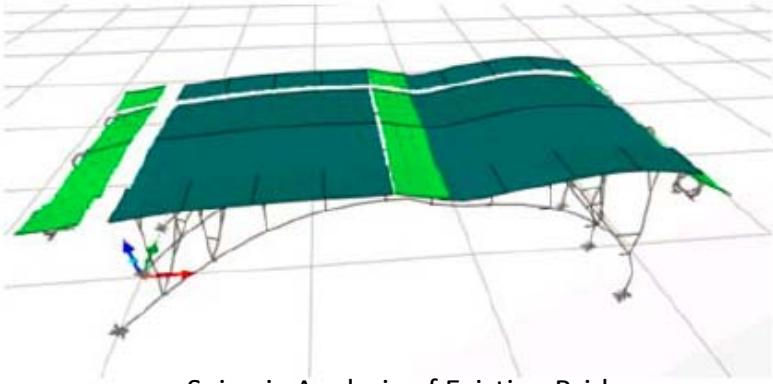
Seismic Vulnerabilities

- Global Analysis
  - Floating slabs need to be continuous
  - Abutment restraint will lower superstructure demand
  - Ensure stability of hinges (axial and bending)



Seismic Analysis of Existing Bridge

- Component Analysis
  - Spandrel columns have insufficient shear capacity
  - Center spandrels have very high shear
  - Arch-ribs insufficient shear/torsion steel
  - Abutment and retaining walls need strengthening

Functional Deficiencies

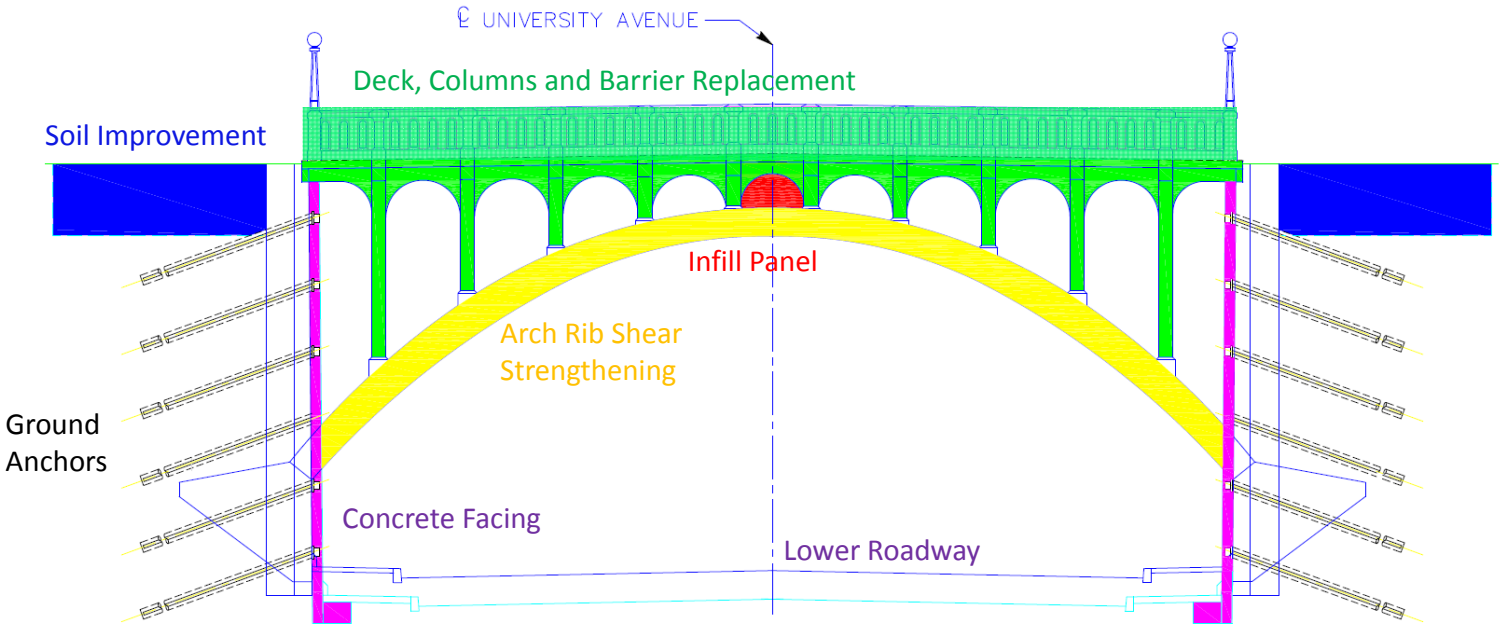
- Barrier rails not sufficient
- No sidewalk ADA ramps
- Asphalt paving at sidewalk elevation
- Substandard vertical and horizontal clearance
- Bridge width is substandard
- Bridge does not support modern live loads

Historic Preservation

- Community Meetings
  - SOHO, North Park Planning Committee, Uptown Planners

- NEPA CE – CEQA IS/MND Finding of no Adverse Effect with Standard Conditions – Rehabilitation
  - Arch ribs to remain
  - Historic corner lighting
  - Wall facing
  - Barrier rails
  - Shear panel design
  - Geometry, texture, color to match as-built
  - Replace sidewalks (historic scoring)
  - Remove street lighting

Retrofit Strategy (preferred)



Bridge Elevation

Construction

- Winning Bid
  - Reyes Construction, Inc.
  - $8.3M in June 2016 with NTP in June 2016

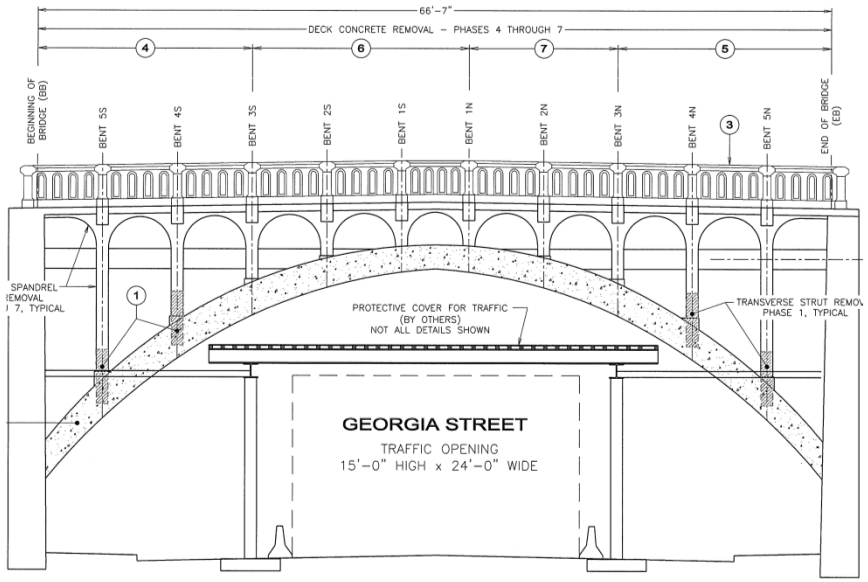
- Bid Volatility
  - Range = 75% of winning bid

- Construction Schedule – Summer 2016-Fall 2017

- Construction Team
  - Contractor: Reyes Construction, Inc.
  - Resident Engineer: City of San Diego
  - RE Support: T.Y. Lin International Group

Construction Requirements

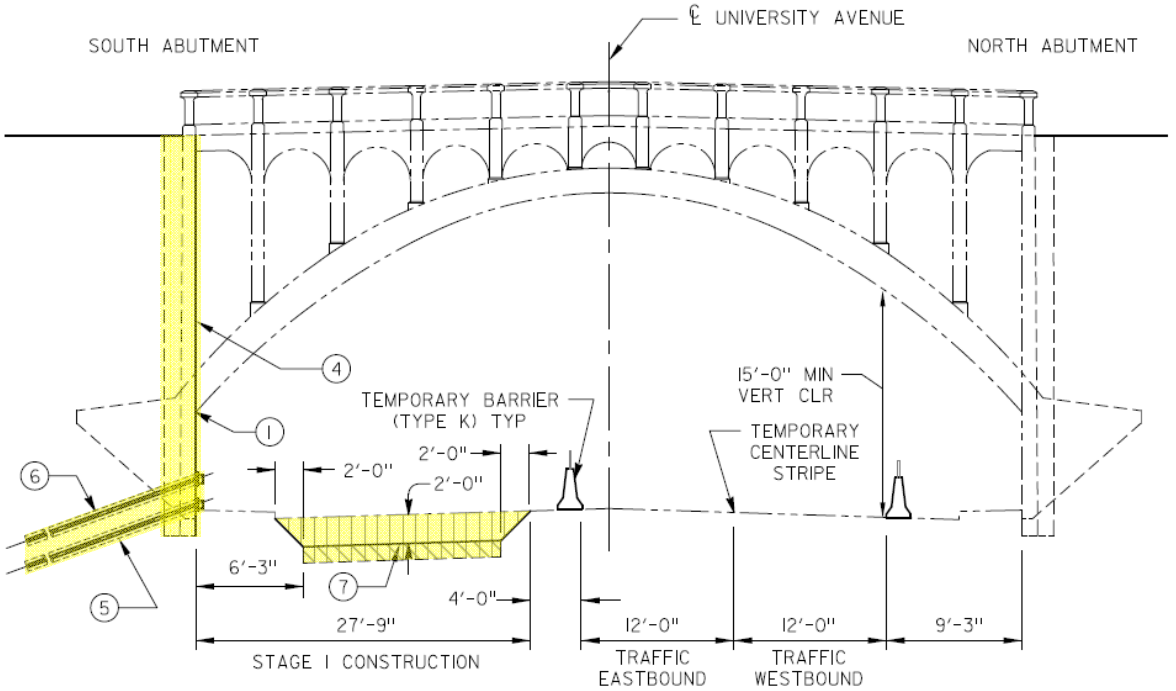
- Prevent any damage to arch ribs
- Protect public in project area
- Maintain two lanes of traffic
- Ensure stability during all stages



Construction Phasing

- Stage 1-3
  - Stabilize Walls
  - Partially Stabilize Abutments
  - Lower University Avenue

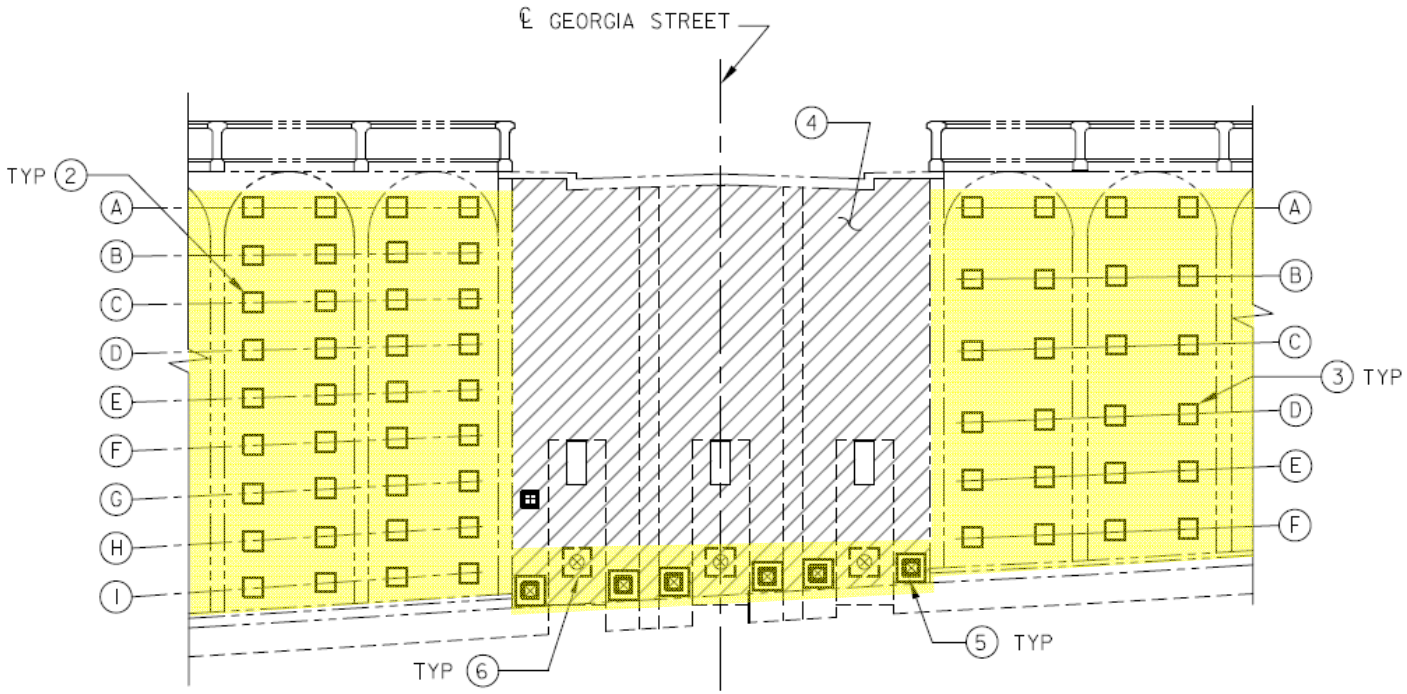
Proposed Staging- Stages 1-3



STAGE 1
BRIDGE ELEVATION

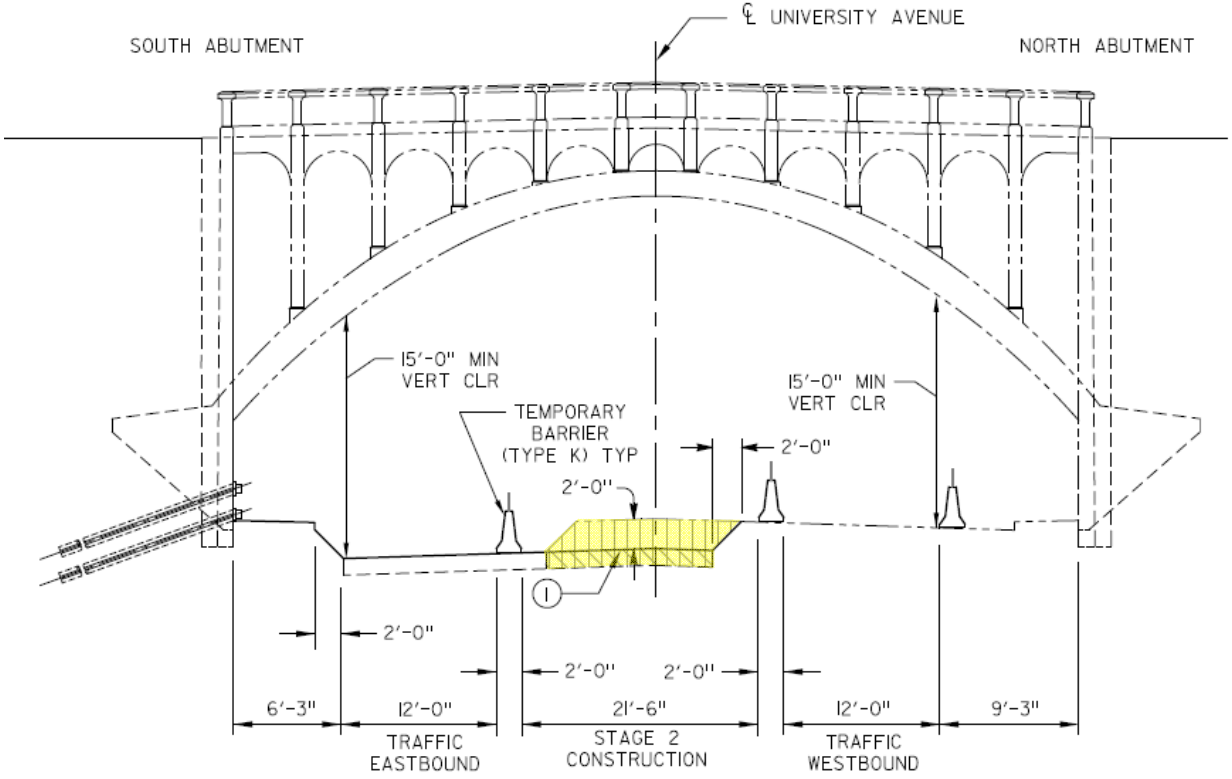
NOT TO SCALE

Proposed Staging- Stages 1-3



STAGE 1
SOUTH ABUTMENT ELEVATION

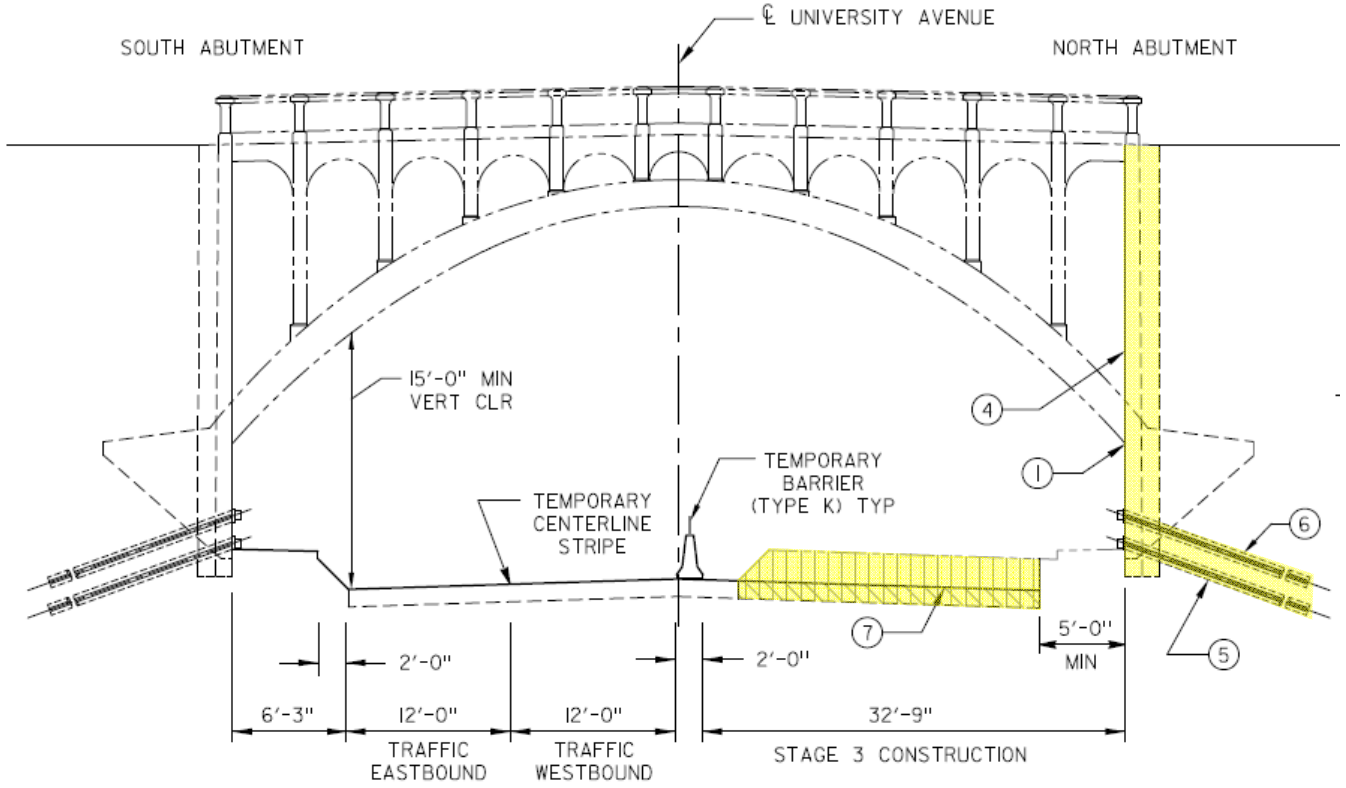
Proposed Staging- Stages 1-3



STAGE 2
BRIDGE ELEVATION

NOT TO SCALE

Proposed Staging- Stages 1-3

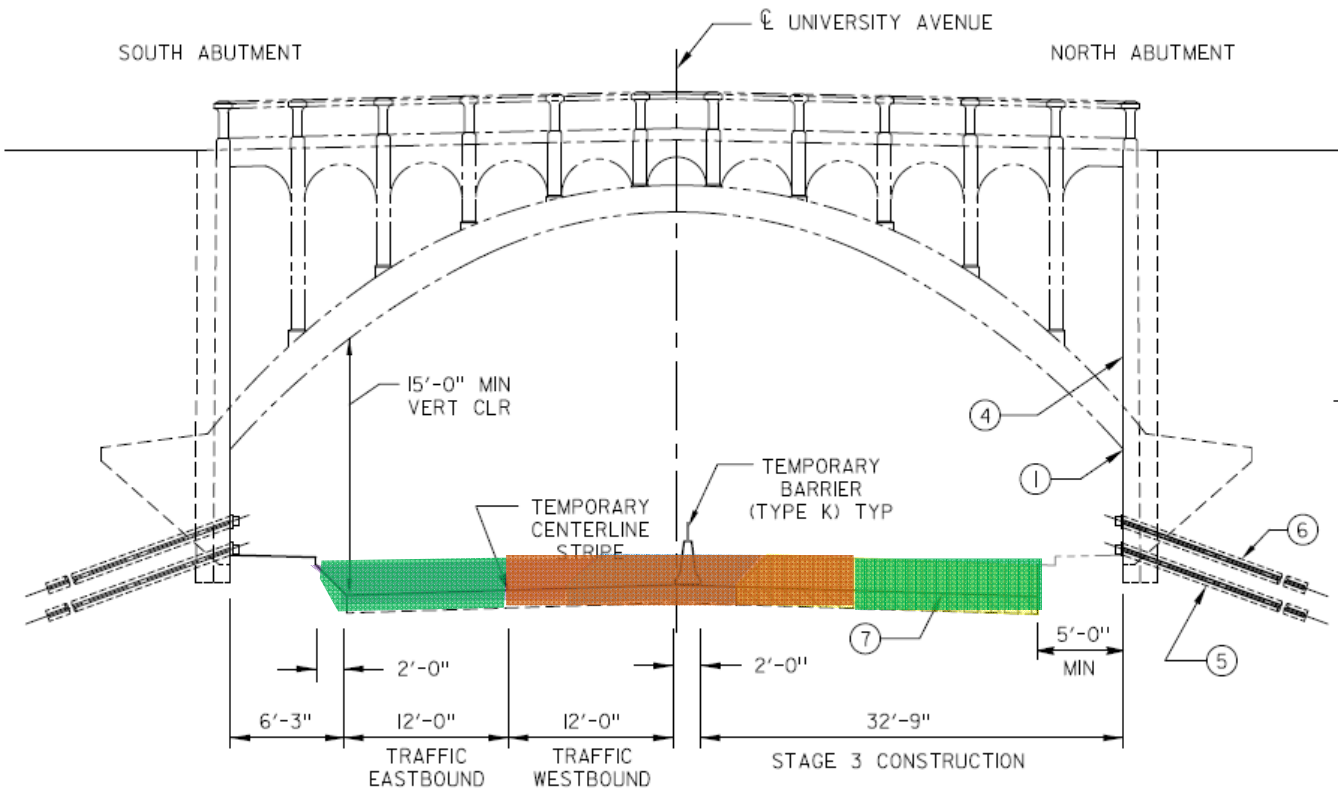


STAGE 3
BRIDGE ELEVATION

NOT TO SCALE

Challenges/ Issues/ Modifications- Stages 1-3

Lowering Roadway in Two Stages



Challenges/ Issues/ Modifications- Stages 1-3

Soil Nail Installation Using Temporary Steel Casing

Challenges/ Issues/ Modifications- Stages 1-3

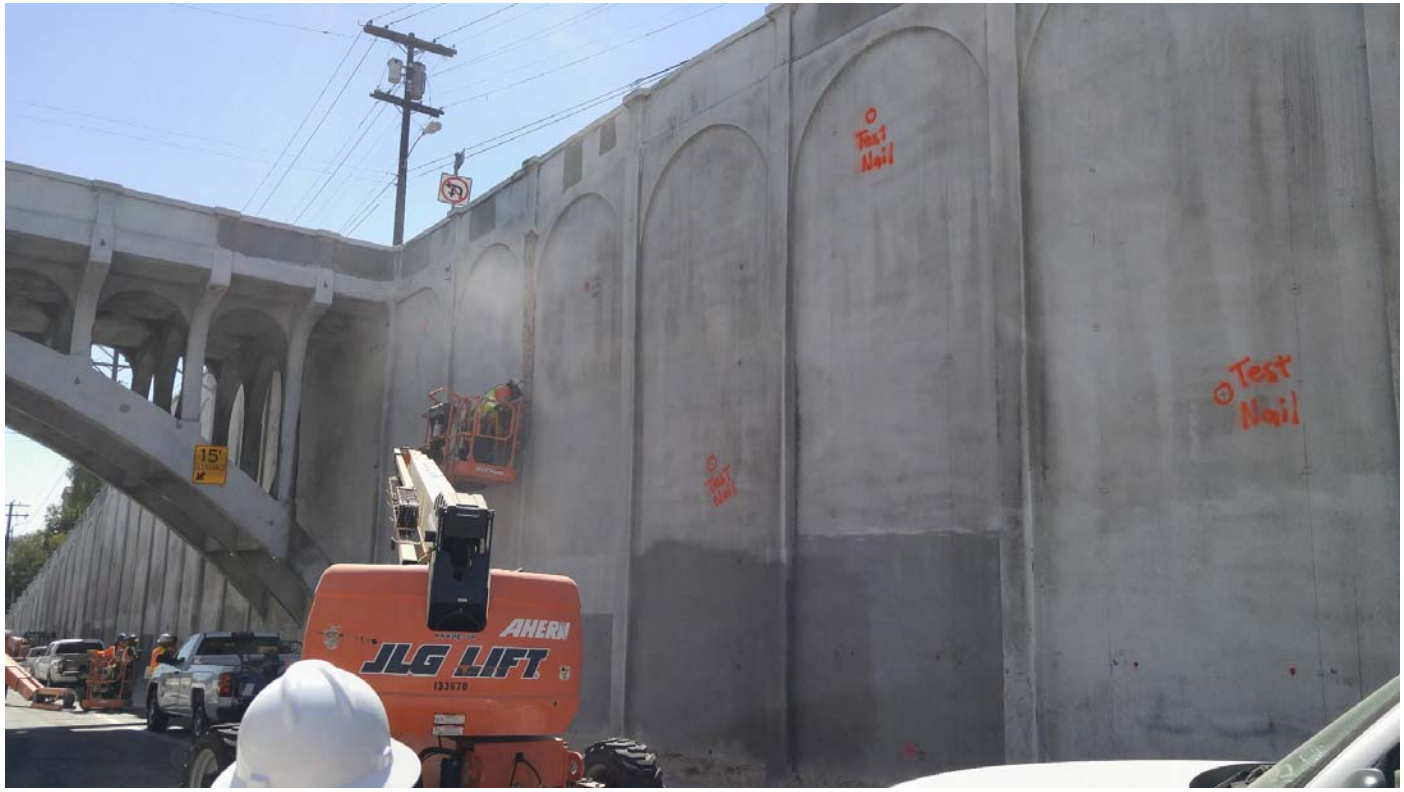
Reinforce and Shotcrete Wall Unsound Concrete

Challenges/ Issues/ Modifications- Stages 1-3

Existing Wall Curved Alignment

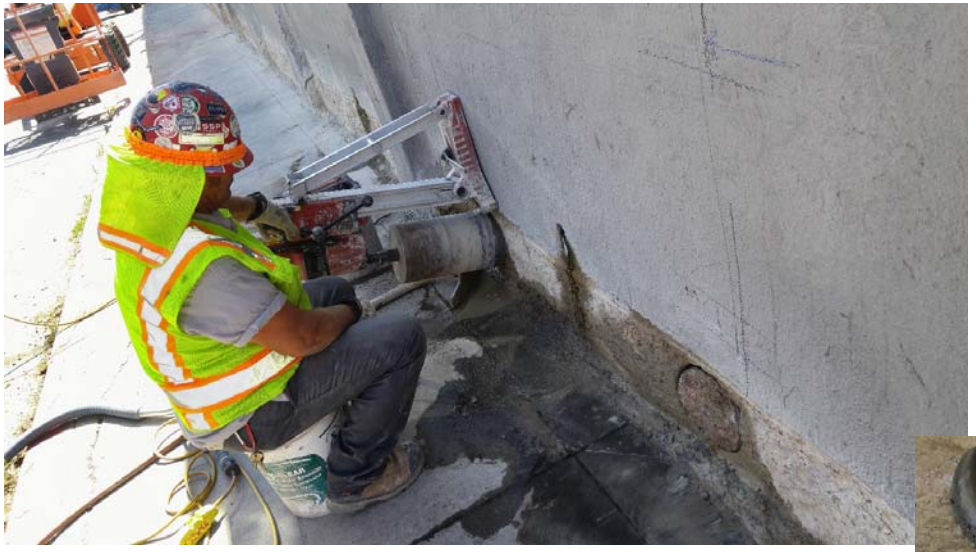
Challenges/ Issues/ Modifications- Stages 1-3

Collaboration with Contractor/CM



Construction Photos- Stages 1-3

Coring Abutment and Retaining Walls



Construction Photos- Stages 1-3

Drilling into Backfill and Formation

Construction Photos- Stages 1-3

Soil Nail Installation

Construction Photos- Stages 1-3

Soil Nails Installation Completed

Construction Photos- Stages 1-3

Ground Anchor Installation

Construction Photos- Stages 1-3

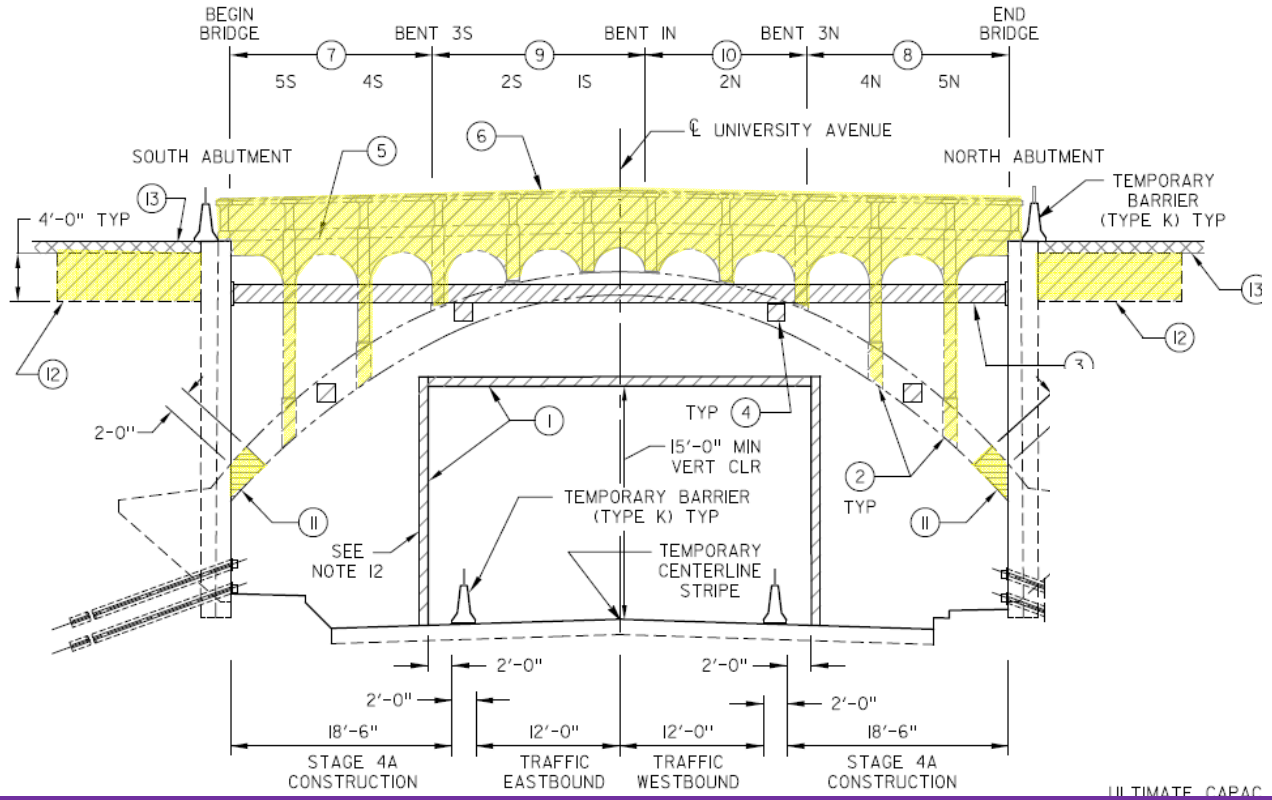
Abutment New Facing Construction

Construction Photos- Stages 1-3

Roadway Lowering

Proposed Staging- Stage 4A

Bridge Demolition

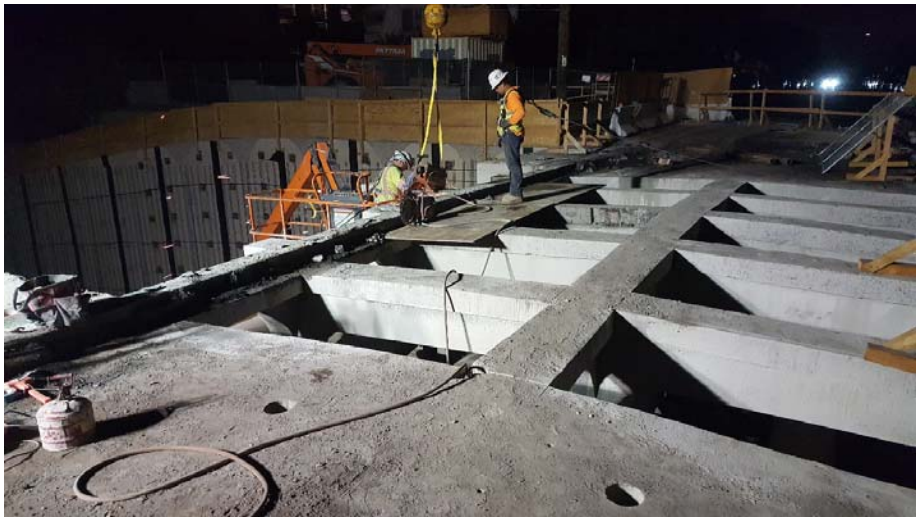


Construction Photos- Stage 4A

Traffic Protective Cover

Construction Photos- Stage 4A

Bridge Demolition



Construction Photos- Stage 4A

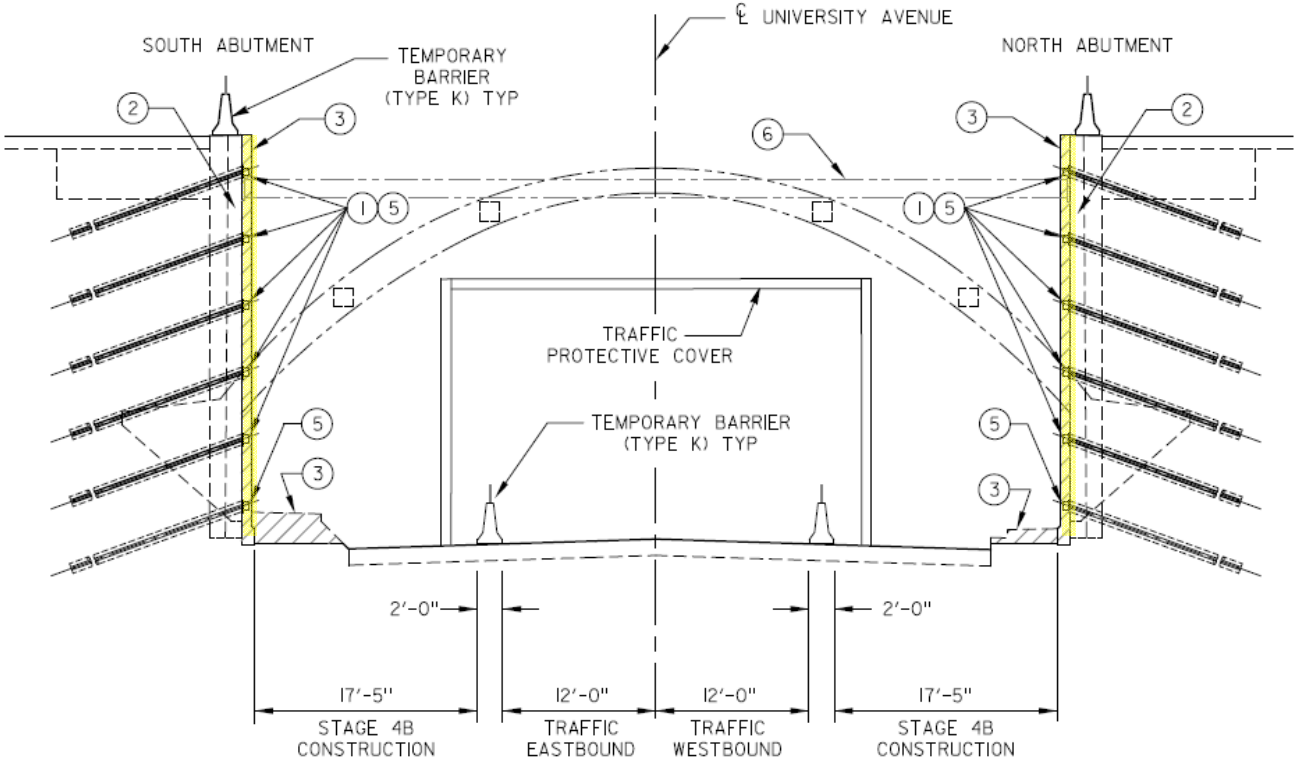
Soil Improvement

Construction Photos- Stage 4A

Installation of Remaining Ground Anchors

Proposed Staging- Stage 4B

New Facing Construction



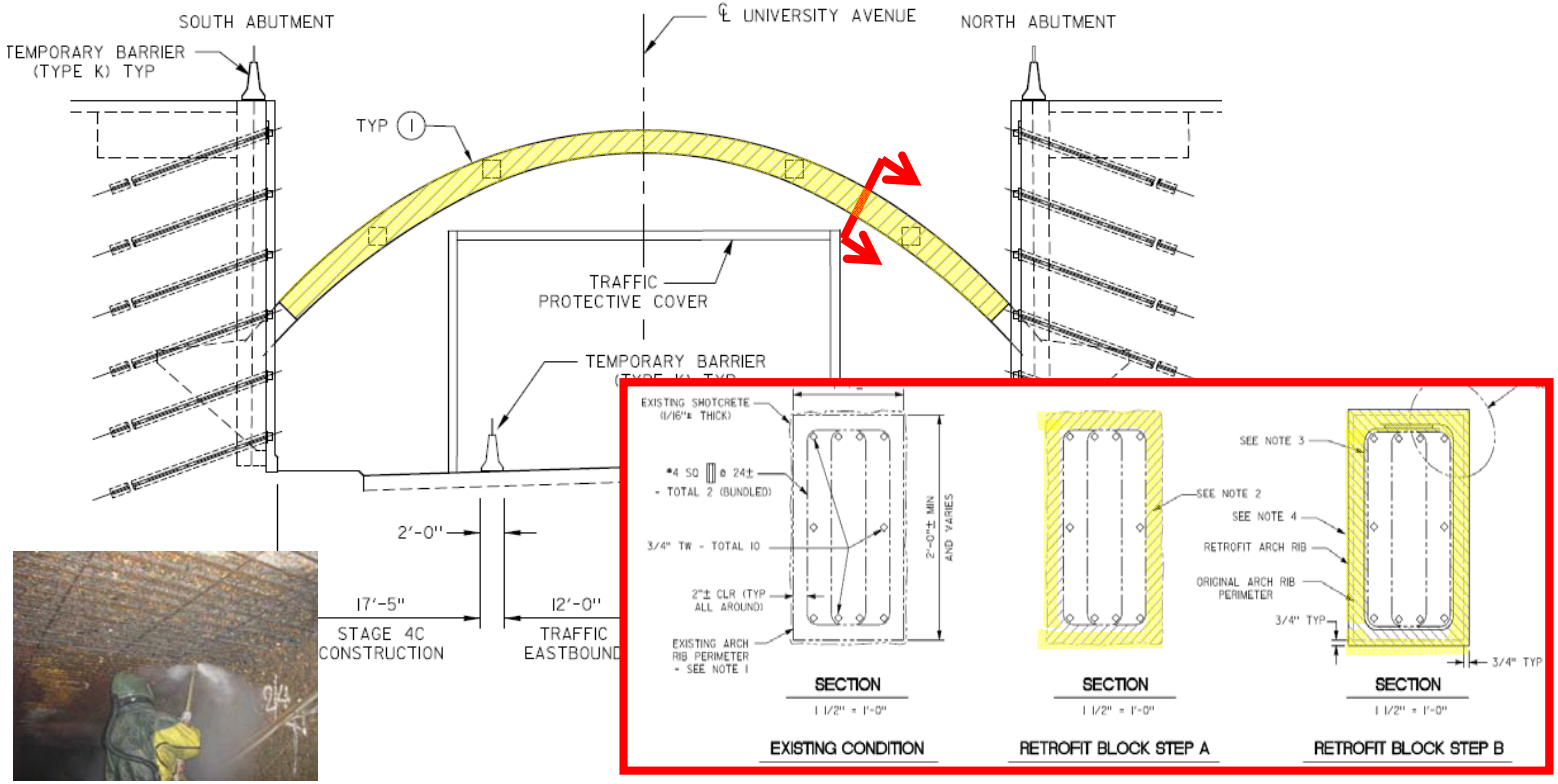
Retrofit/Rehabilitation/Reconstruction

Proposed Staging- Stage 4B

New Facing Construction

Proposed Staging- Stage 4C

Arch Rib Retrofit



Challenges/ Issues/ Modifications- Stages 4C

Hydrodemolition- Alternative Means and Method

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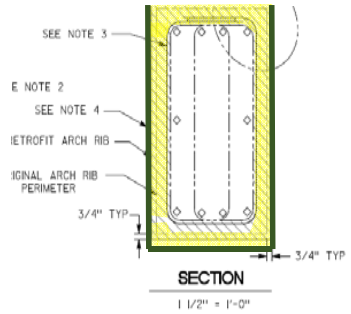
Hydrodemolition- Alternative Means and Method

Challenges/ Issues/ Modifications- Stages 4C

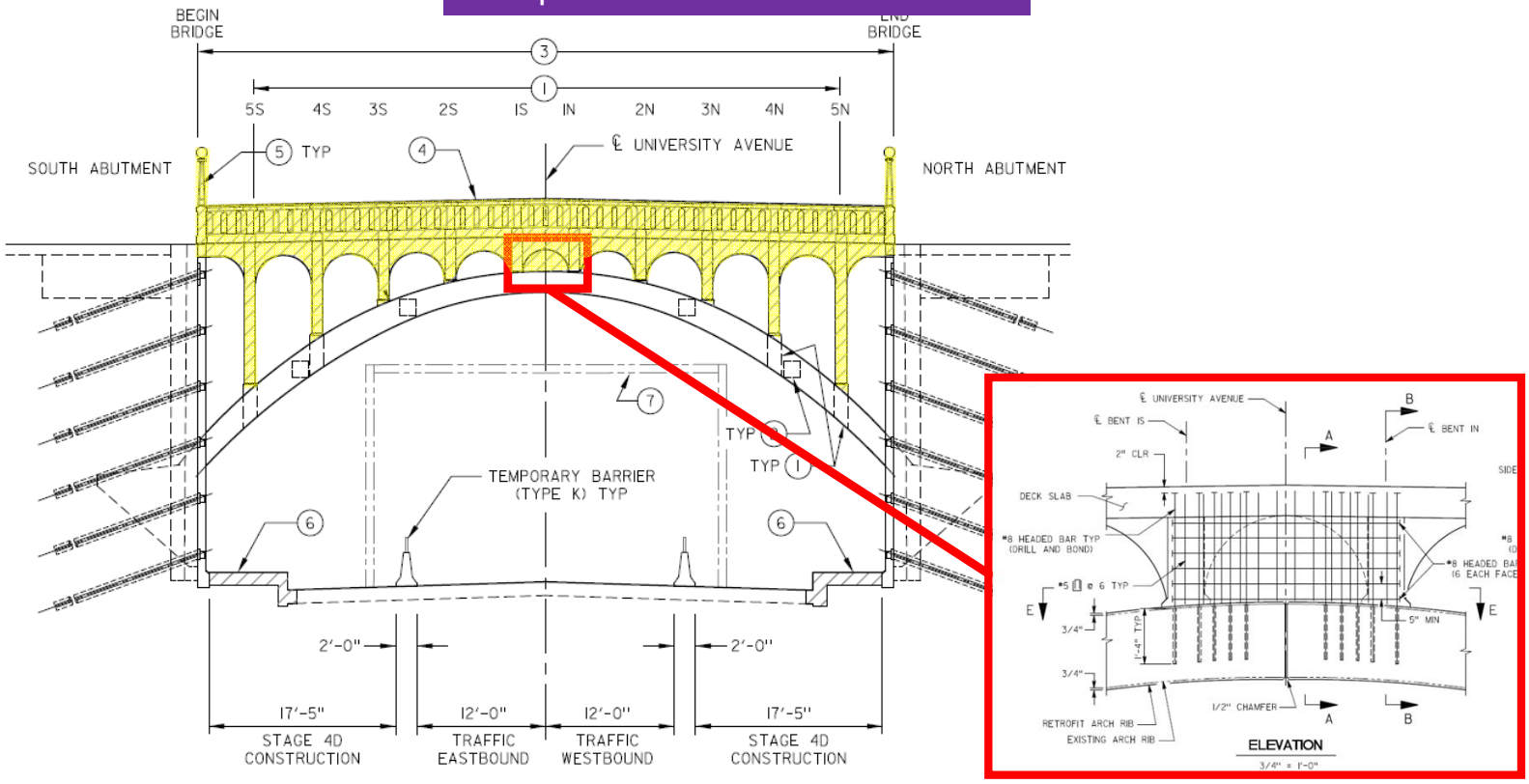
Arch Rib Fiber Reinforced Self-Consolidating Concrete



Arch Rib Mock-ups

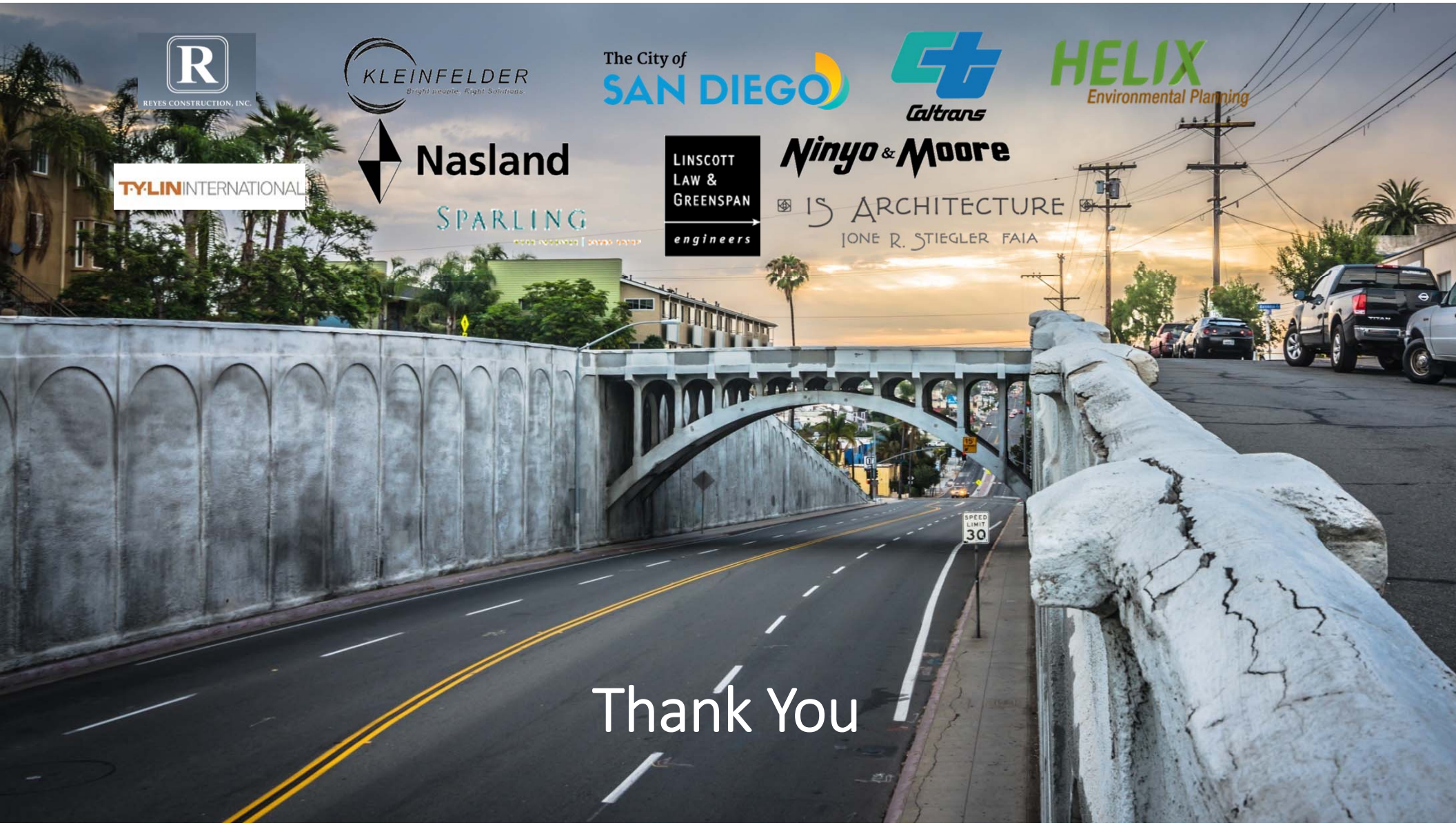
Proposed Staging- Stage 4D

Superstructure Reconstruction



Lessons Learned

- Community Engagement for Env. & Design
- Pricing and Schedule Contingencies
- Construction Considerations for Reconstruction
- Contractor/CM/Design Interaction
- Historic Resource will be preserved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Caltrans
HELIX
Environmental Planning
Nasland
TY·LIN INTERNATIONAL
SPARLING
LINSCOTT
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Thank You