King County

Meadowbrook Bridge Rehabilitation

Technical Session Agenda

Introduction & Program Design (Jessy Jose, King County)

a. Project Location & Bridge Background
b. Structural and Functional Deficiencies
c. Project Planning and Evaluation
d. Bridge Rehabilitation Goals

Rehabilitation Design & Construction (Ken Wilson, ISE)

a. Design Development General Requirements
b. Structural Component Details
c. Construction Sequence
d. Construction Photos
e. Conclusion

Q&A

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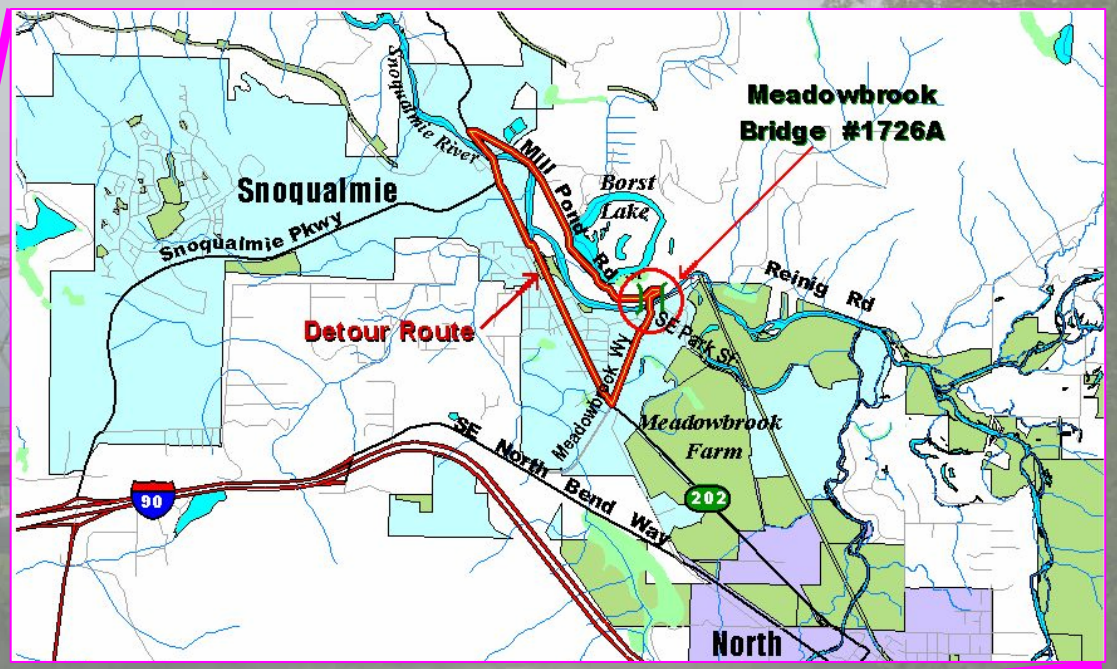
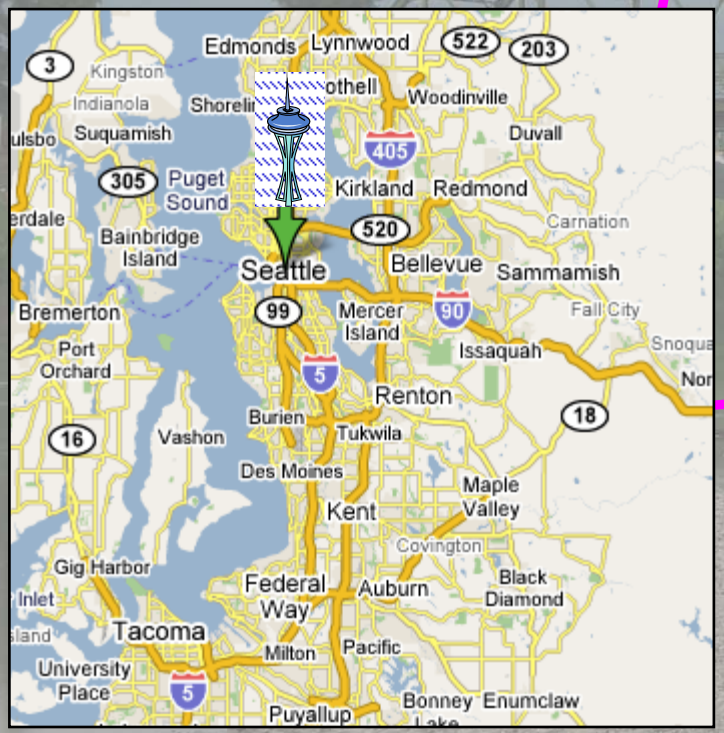
Introduction	Design Development	Construction	Conclusion





- Located in East King County
- 1,900 ADT

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Meadowbrook Bridge looking North

- Built in 1921
- Posted for load limit due to structural deficiencies (16 Ton)
- Narrow bridge width (18’-6”).
- Substandard vertical alignment with limited sight distance
- Posted Vertical clearance only 14’
- Very Low sufficiency rating (4.27/SD)

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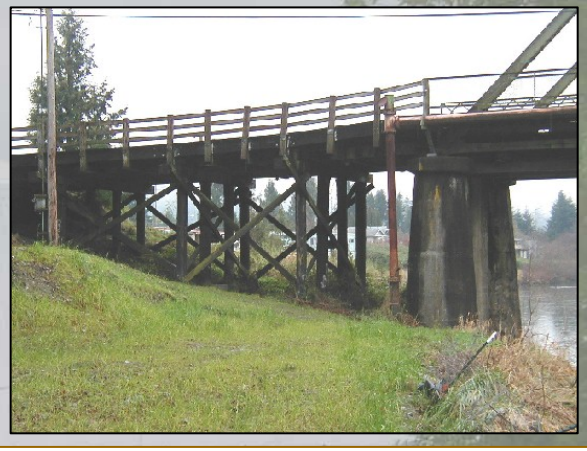
Meadowbrook Bridge looking West- Down stream



Timber Approach

- 9 approach timber trestle spans
- 220’ truss main span
- 6” of flood clearance above 100 year flood elevation

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King County Historic Landmark – 1921 opening ceremony

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LOOKING NORTH

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LOOKING WEST- Poor sight distance
and substandard horizontal curve

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Corroded Lateral Support

Asphalt Deck Deterioration

Corroded Sidewalk Support

Approach cracks

Structural Deficiencies

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Weak Substandard Bridge Rails

Poor Drainage Details/Bottom Cord Corrosion

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Damaged top lateral due to high load hit – 14’ Vertical clearance

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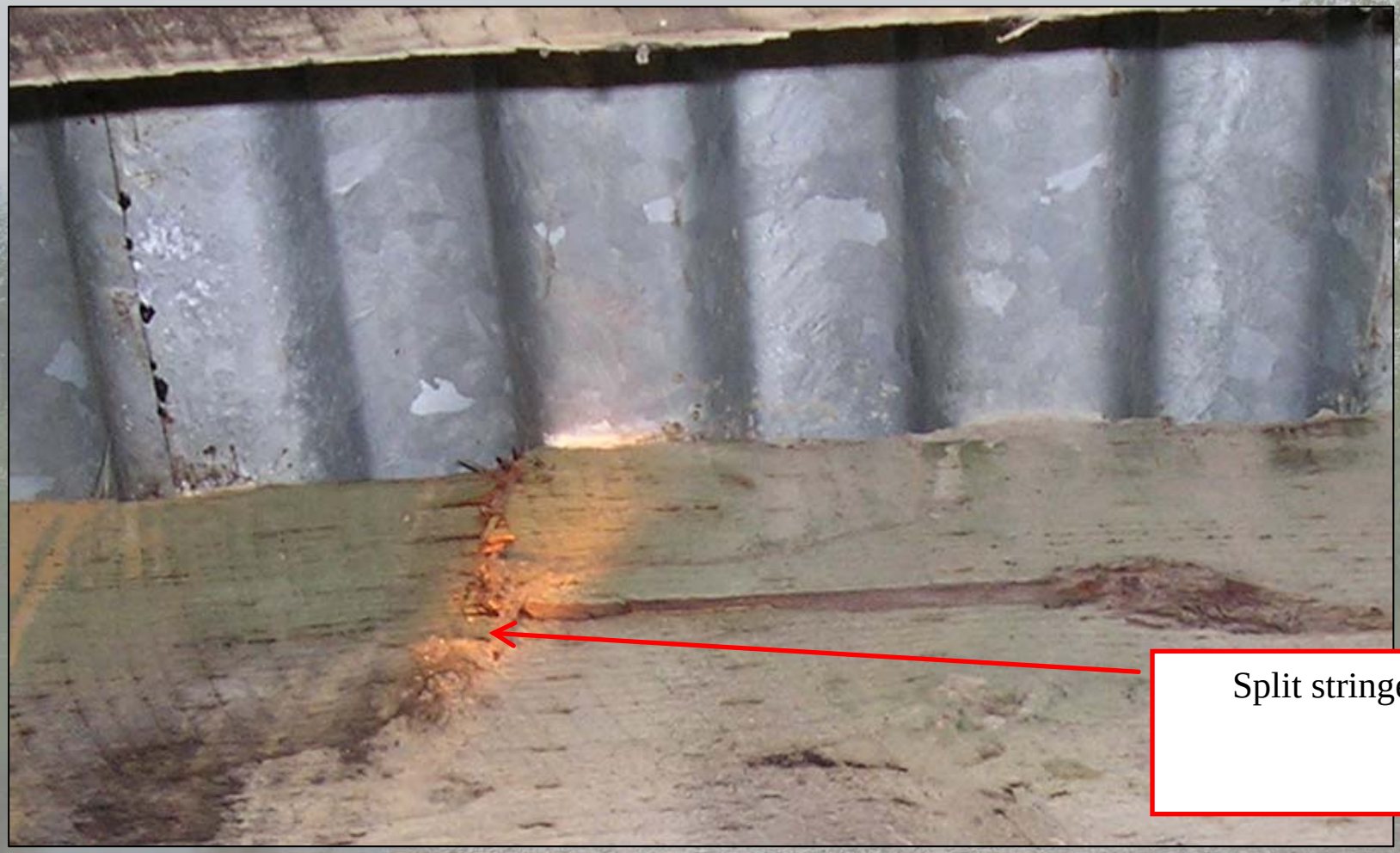

Main Span Timber Stringers

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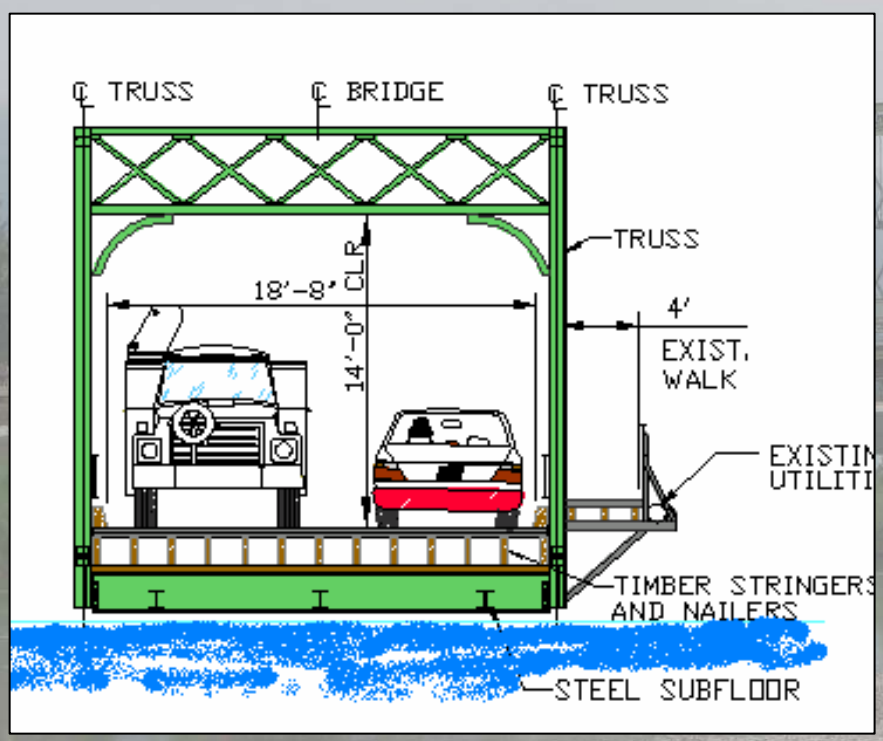
Summary of Deficiencies



- Low SR and SD
- Seismically Vulnerable- Liquefiable soil
- Load Limited
- Narrow Travel Way Width
- Substandard/Deteriorated Rails
- Low Flood Clearance
- Poor Sight distance

Added Constraint:

- Historical - King County Landmark

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Introduction	Design Development	Construction	Conclusion

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Project Development

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Federal Grant Applications

Replacement Project 1994

Identified Deficiencies
- Low SR and SD
- Seismic Vulnerability
- Load Limited
- Narrow Travel Way Width
- Substandard/Deteriorated Rails
- Low flood clearance

Evaluated Alternatives

Replacement

Rehabilitation

Repair

Held
3 public meetings

Rehab Design
2002-2004

Construction
2005

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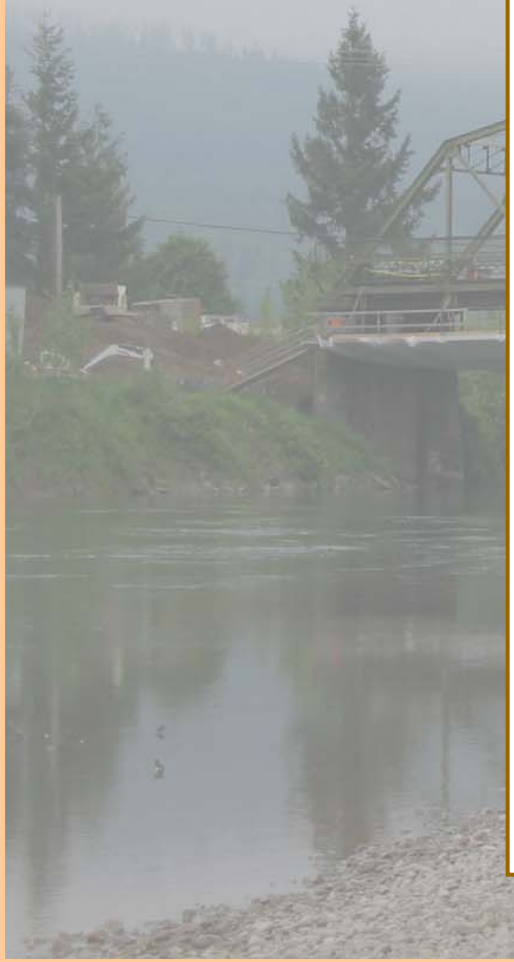

Project Goals

- Improve Traffic Safety
  - Lane & shoulder width as well as sight distance
  - Upgrade rail capacity and transitions to current standards
- Reduce frequent maintenance needs
  - Aging structure and paint system
- Remove bridge load posting
  - Provide adequate capacity for all legal truck loads
- Eliminate Structural Deficiencies
  - Timber Approach Capacity
  - Main Span Stringers
  - Steel Truss and Floorbeam Capacity
  - Bridge rail capacity and configuration deficiency
- Seismically retrofit the bridge
  - Reduce foundation demands and mitigate liquefiable soil
- Preserve King County Landmark
  - Retain the existing truss in current vehicular bridge usage

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Rehabilitation Design & Construction

a. Design Development
b. Structural Details
c. Construction Sequence & Photos
d. Conclusions

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Design Requirements

1. Eliminate Structural Deficiency
2. Seismically retrofit the bridge
3. Replace the bridge rail
4. Improve traffic safety for lane widths and sight distance
5. Improve flood clearance
6. Bring vertical clearance to standard
7. Improve frequent maintenance Demands
8. Preserve King County Landmark

Design Solutions

1a. Replace timber approach spans
1b. Reduce main truss demand (one lane bridge)
1c. Replace truss deck with light weight system
1d. Strengthen floorbeams through composite action

2a. Improve liquefiable soils
2b. Isolate/minimize truss substructure response

3a. Replace/add bridge rails and missing transitions

4a. Add roadway shoulders and increase lane widths
4b. Convert truss to one lane with signal actuation
4c. Added stop bars and "Rest-in-Red" signaling to slow traffic and improving sight distance

5a. Reducing truss deck thickness and raised bridge

6a. Thinner replacement deck improved clearance

7a. Replace the aging deck and timber trestles
7b. Remove the existing lead paint and repaint
7c. Collect truss drainage and provide treatment

8a. Retain the existing truss for vehicular usage
8b. Actions per Certificate of Appropriateness

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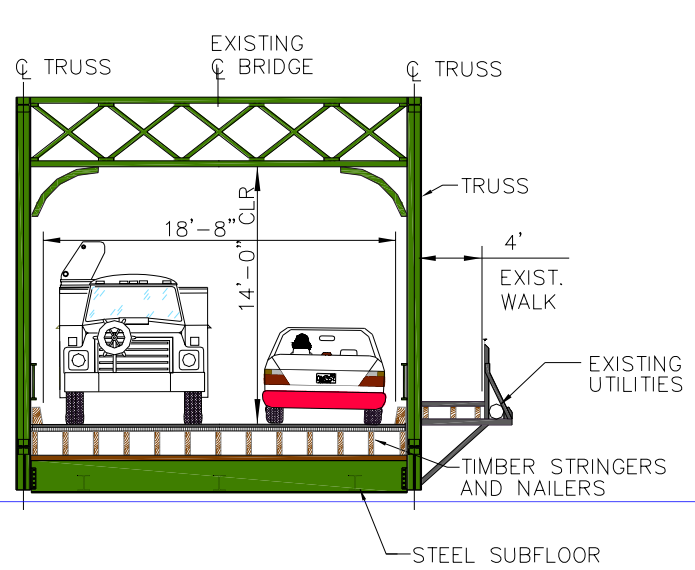
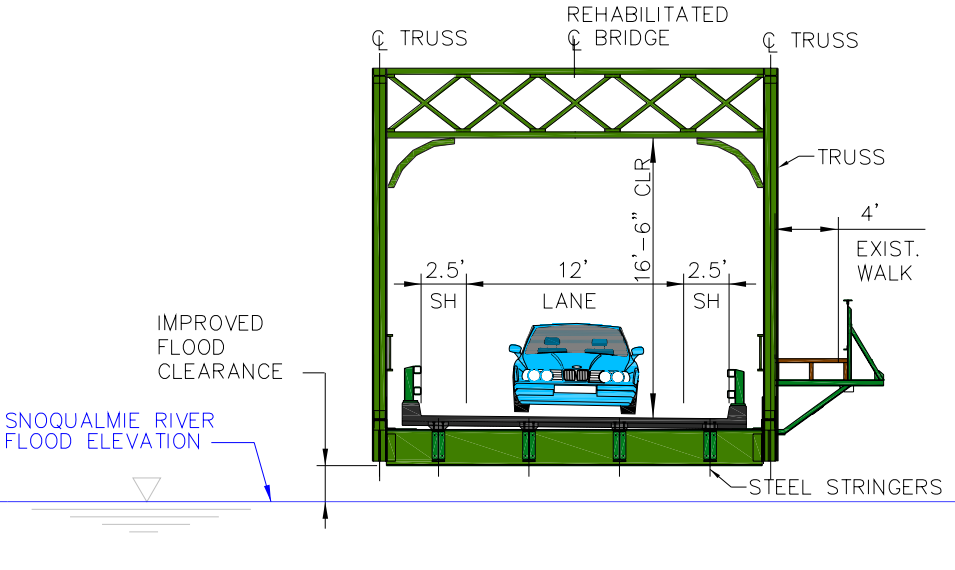
Rehabilitation Comparison





EXISTING BRIDGE SECTION

REHABILITATED BRIDGE SECTION

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One Lane Traffic Configuration

Current ADT :1900

20 year forecasted ADT :4500

Analysis: 15.1 sec delay during peak

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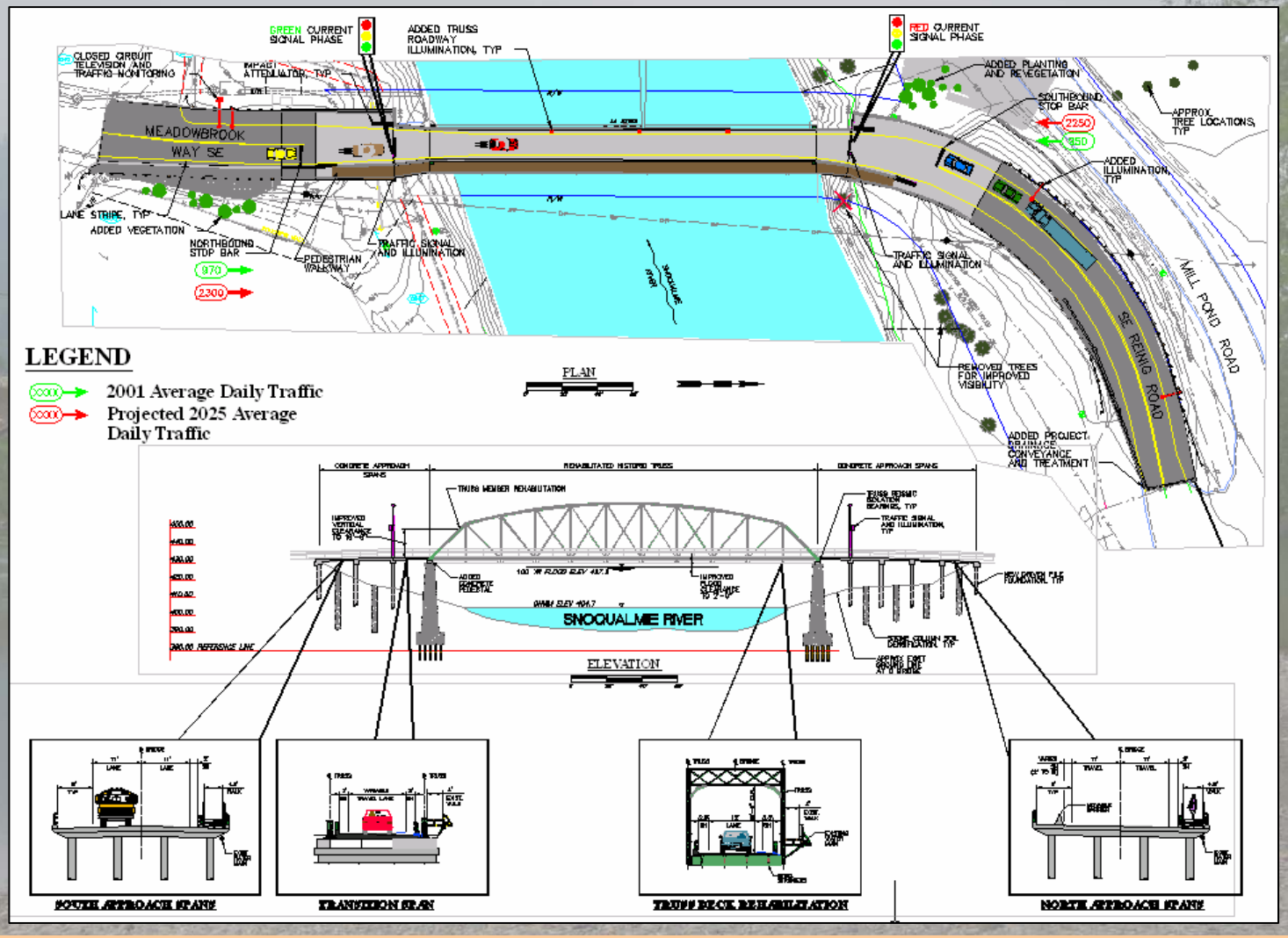
Final Design Configuration



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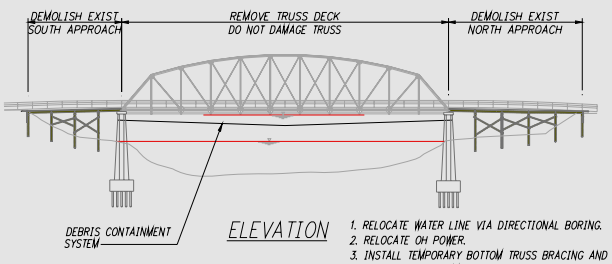
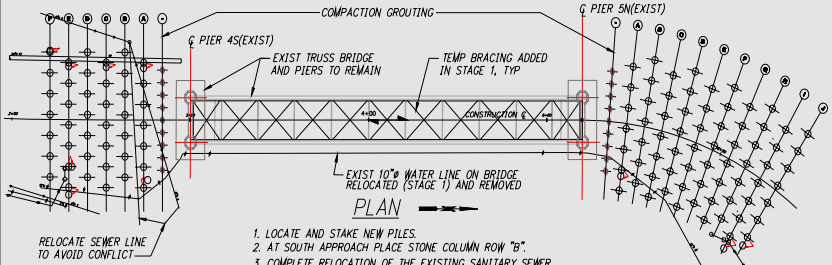
Introduction | Design Development | Construction | Conclusion

STAGE 1
(REMOVE APPROACH TRESTLES AND TRUSS DECK)



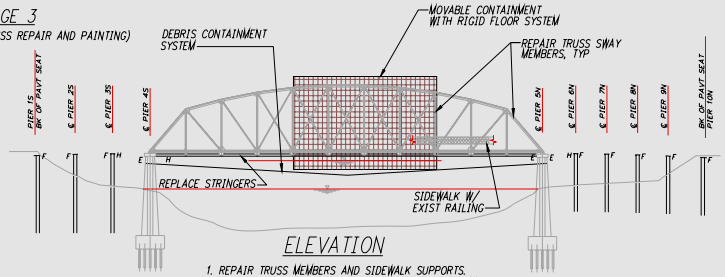
1. RELOCATE WATER LINE VIA DIRECTIONAL BORING.
2. RELOCATE OH POWER.
3. INSTALL TEMPORARY BOTTOM TRUSS BRACING AND DEBRIS CONTAINMENT SYSTEM.
4. CLOSE BRIDGE. REMOVE EXISTING TRUSS DECK SYSTEM.
5. DEMOLISH BOTH THE NORTH AND SOUTH APPROACH TIMBER TRESTLES.
6. BEGIN RELOCATION OF SANITARY SEWER BELOW SOUTH APPROACH.

STAGE 2
(SOIL DENSIFICATION AND PILE DRIVING)



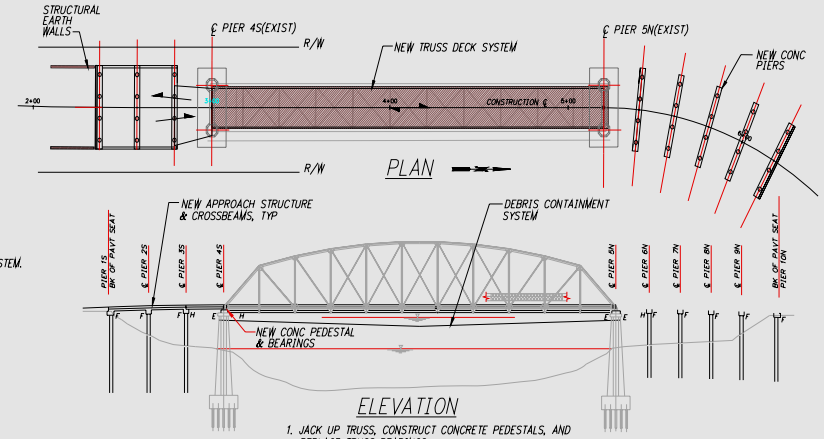
1. LOCATE AND STAKE NEW PILES.
2. AT SOUTH APPROACH PLACE STONE COLUMN ROW "B".
3. COMPLETE RELOCATION OF THE EXISTING SANITARY SEWER.
4. INSTALL COMPACTION GROUT COLUMNS TO PROTECT THE EXISTING MAIN TRUSS PIERS.
5. PLACE STONE COLUMN ROW "A" AND CONTINUE STONE COLUMN PLACEMENT WORKING AWAY FROM THE RIVER.
6. PLACE NORTH APPROACH COMPACTION GROUTING THEN STONE COLUMNS BEGINING AT THE RIVER AND WORKING AWAY.
7. DRIVE PILING.

STAGE 3
(TRUSS REPAIR AND PAINTING)



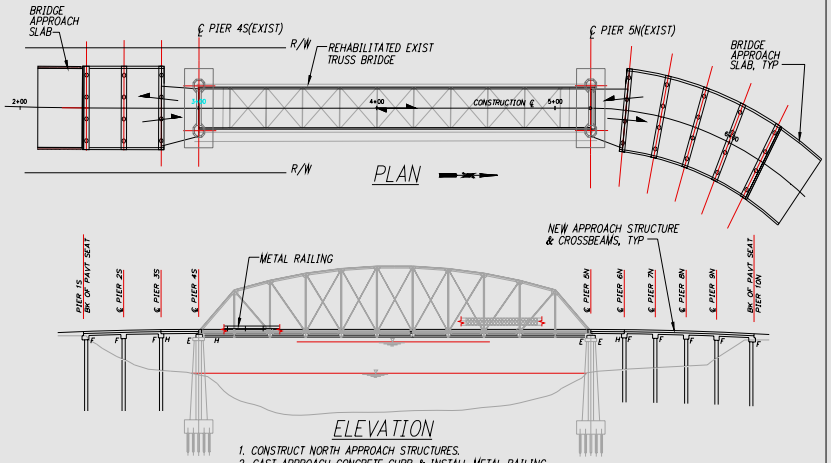
1. REPAIR TRUSS MEMBERS AND SIDEWALK SUPPORTS.
2. INSTALL NEW STEEL STRINGERS BETWEEN FLOORBEAMS.
3. SET UP NEGATIVE PRESURE CONTAINMENT SYSTEM (4 PANEL MAX AT A TIME), PREPARE SURFACES, AND PAINT THE BRIDGE.
4. MOVE NEGATIVE PRESURE CONTAINMENT & CONTINUE OPERATION.
5. FORM SOUTH APPROACH STRUCTURES.

STAGE 4
(JACK TRUSS, REPLACE BEARINGS, AND CONSTRUCT DECK SYSTEM)



1. JACK UP TRUSS, CONSTRUCT CONCRETE PEDESTALS, AND REPLACE TRUSS BEARINGS.
2. CONSTRUCT SOUTH APPROACH STRUCTURES.
3. INSTALL TRUSS DECK SYSTEM AND CURBS.
4. RECONSTRUCT TIMBER SIDEWALK DECKING AND RAMPS.
5. PLACE STRUCTURAL EARTH WALLS.

STAGE 5
(COMPLETE APPROACH SPANS AND ROADWAY)



1. CONSTRUCT NORTH APPROACH STRUCTURES.
2. CAST APPROACH CONCRETE CURB & INSTALL METAL RAILING.
3. CONSTRUCT DRAINAGE STRUCTURES AND STORM WATER WETLAND.
4. CONSTRUCT APPROACH SLABS AND APPROACH ROADWAY.
5. INSTALL APPROACH RAILS AND TERMINALS.
6. INSTALL TRAFFIC SIGNALS, PERMANENT SIGNS, AND ILLUMINATION.
7. COMPLETE PAINT LINES AND OPEN BRIDGE TO TRAFFIC.
8. FINISH LANDSCAPING, PLANTING, AND REMOVE TESC.

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Water Line Directional Boring Relocation

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Installing Temporary Work Platforms

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Demolition Work

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Heat Straightening Truss Repairs

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Grout Compaction Soil Densification

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Stone Column Soil Densification & Monitoring

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Painting Work

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Approach Pile Driving

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Approach Work

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Truss Deck Replacement Work

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Truss Lifting/Bearing Work

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Exodermic Truss Deck Replacement

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Signal Installation

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Bridge Rail Installation

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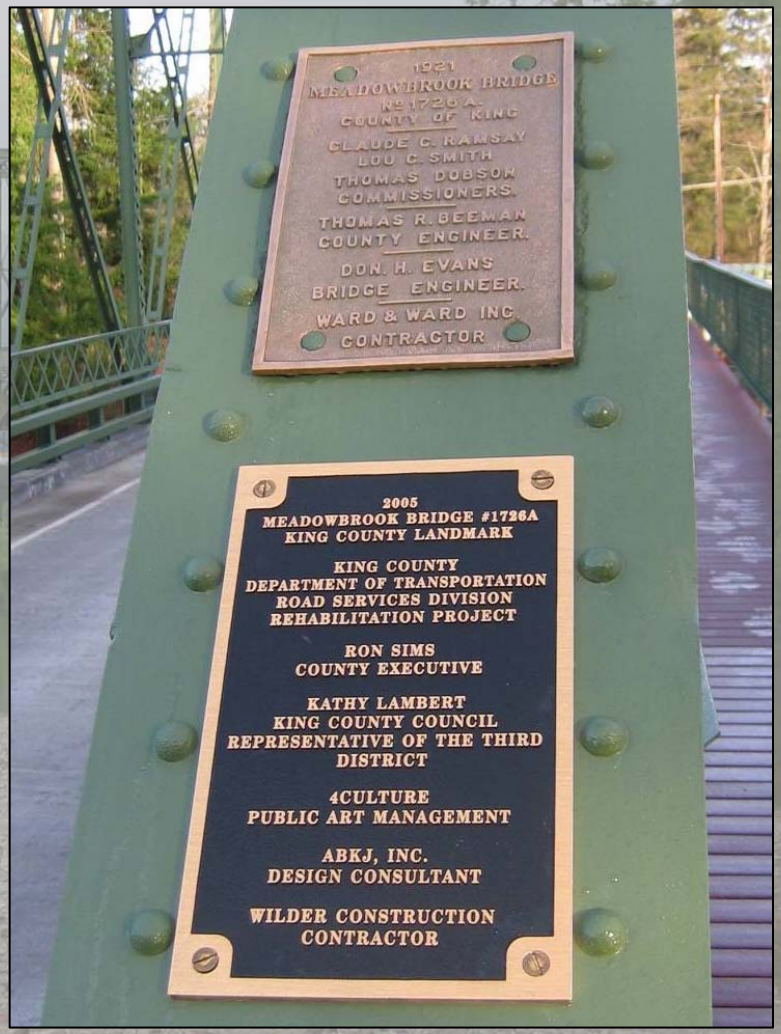

Construction Cost

- $4,152,000

Construction Duration

- 7 1/2 months

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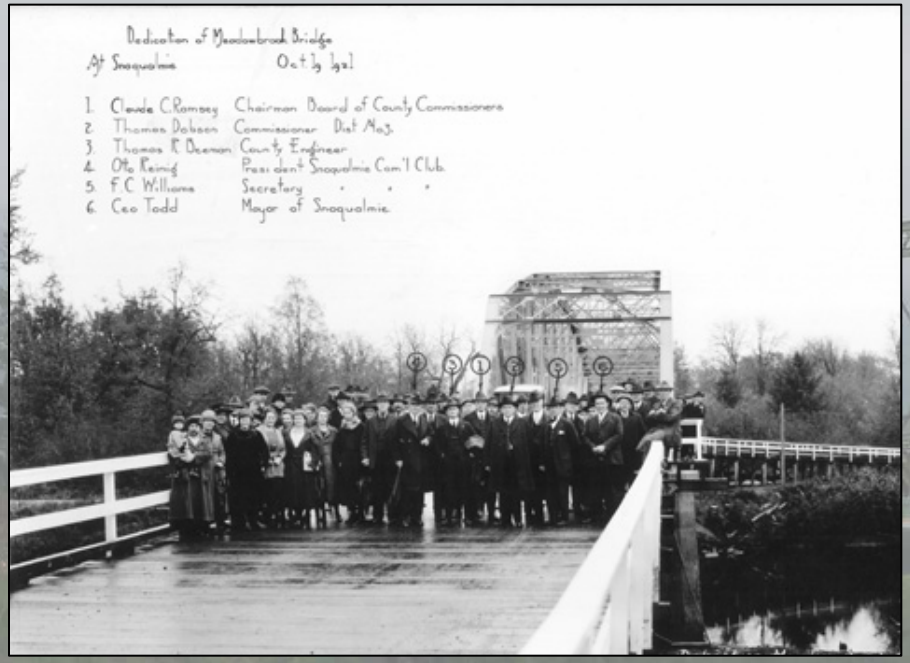

Before

After

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Before

After

Meadowbrook Bridge Rehabilitation

Before

After

Meadowbrook Bridge Rehabilitation

Before

After

Meadowbrook Bridge Rehabilitation

Introduction	Design Development	Construction	Conclusion

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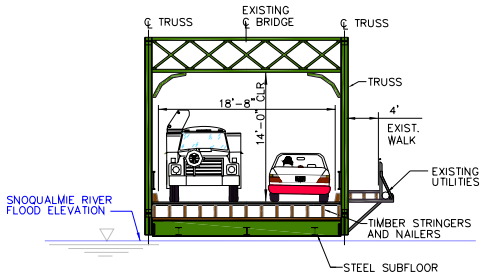
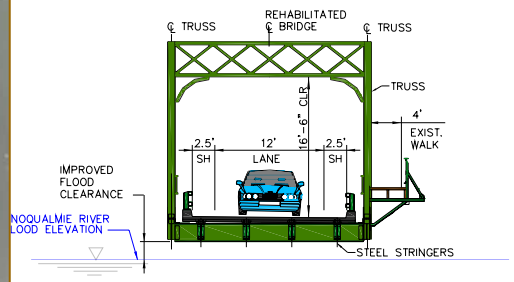
Conclusion

- ✓ Complied with COA from King County Landmark
- ✓ Cost Effective Relative to Replacement Bridge Costs
- ✓ Prolonged Structure's Useful Life
- ✓ Enhanced Public Safety and Welfare
- ✓ Environmental Benefits and Historic Compatibility



EXISTING BRIDGE SECTION



REHABILITATED BRIDGE SECTION

	Original Bridge	Rehabilitated Bridge
Lane Width	9 feet	12 feet
Vertical Clearance	14 feet (as posted)	16 feet 6 inches
Legal Load	16 Tons	25 Tons
Flood Clearance	~6 inches	~2 feet
Maintenance	High	Low
Traffic and Pedestrian Rails	Not to Standard	Meets Standards
Seismic Safety	Vulnerable	Upgraded
Water Quality	No Treatment	Full Treatment

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Acknowledgements

Owner/Client: **KING COUNTY**

Bridge & Structures
- Jim Markus, Managing Engineer
- Stephen Jiang, Structural Engineer
- **Jessy Jose**, P.E, Project Manager

Construction
- Bob Lee, Supervisor
- Kino Gomez, Resident Engr.
- Casey Hayes, Inspector

Contractor: Wilder Construction
- Phil Bogardus, PM
- Vance Aeschleman, Superint.

Consultant:

ABKJ, Inc.
- Pong Jongjitirat, PIC
- Jim Morris, Engineer

Ken Wilson P.E, S.E, Project Engr./Manager, Currently with Integrity Structural Engineering, PLLC

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Q & A