

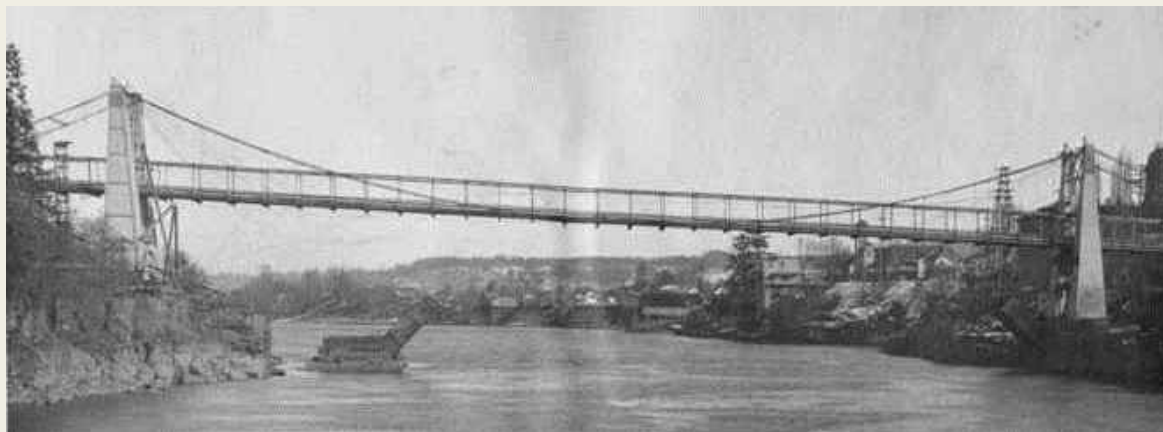
# Oregon City Arch

## Rehabilitation



Presented by **Jason Kelly, PE &**  
**Eric E. Bonn, PE**

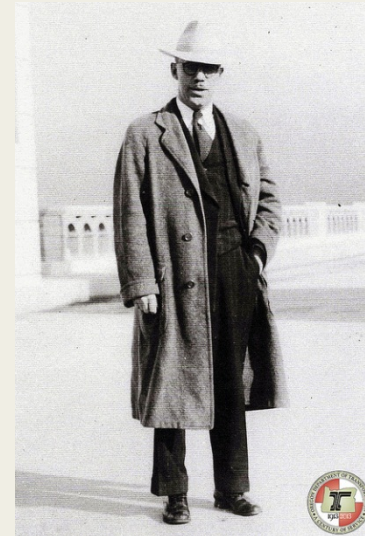
# Background - 1920 Site



- Timber suspension span built in 1888
- River depth is 100' of swift current
- Willamette River prone to flooding with heavy river traffic
- Adjacent paper mills

# Background - Design

- Design By Conde B. McCullough, “Oregon’s Master Bridge Builder”
- Main span: 350’ steel partial through arch
- Approach spans: 500’ cast-in-place deck girder
- Gunite coating of steel members for protection
- Bridge listed on the National Register as a historic structure





# Background - Construction





# Background - Rehabilitation

- 2008 Bridge identified for rehabilitation



# Discussion Topics

- Preconstruction Evaluation
  - Access
  - Safety
  - Tools & Procedures
  - Steel Arches Condition Assessment
  - Arch Chambers and Slabs Assessment
- Construction
  - Shotcrete Replacement
  - Arch Rib Plating
  - Stealth Rail
  - Stringer Replacement
  - Hanger Rods
  - Sewer Line Supports



# Access



- Towers, accessing the Arch Rib hatches.
- Q-Deck, accessing the Chambers and floor system.
- Wildish access by Barge and Temporary Platforms.



# Safety

## ■ Permit Confined Space

- Entrapment Hazard
- Insufficient O<sub>2</sub>, <19.5%
- Lead hazard, >200mg/m<sup>3</sup>
  - PEL is 50mg/m<sup>3</sup>
  - Action Level 30mg/m<sup>3</sup>



## ■ Controls

- Training
  - Confined Space
  - Respiratory Protection w/fit test
  - Lead Awareness
- Engineering
  - Ventilation
- TVF&R and CFD#1



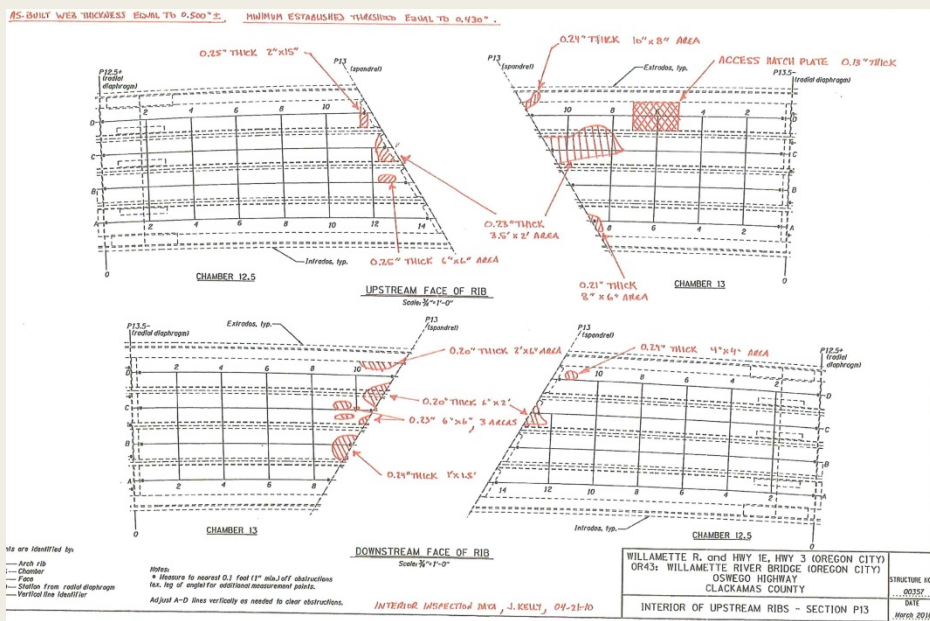
# Tools & Procedures for Steel Assessment

- Ultrasonic Depth Gage
  - 37DL Plus Corrosion Thickness Gage
  - Displays Thickness of Coating
  - Measure Points or lines
  - File Based Datalogger
- Measurement Frequency
- Coding Notation: U035U080C
- Thresholds & QC



# Findings – Steel Arch Ribs

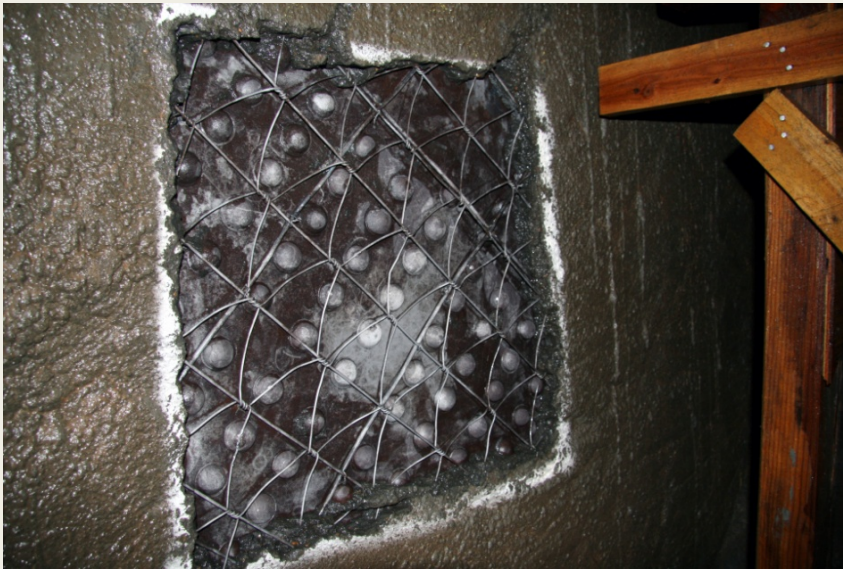
- Arch Ribs in Fair Condition
  - P13 Upstream Webs Poor.
  - Isolated areas on top flanges.





# Findings – Arch Rib Plugs & Foundation

- Plug Connection at Base Good.
- No damage found at Foundation.



# Findings – Arch Chamber Web Slabs

- Delamination Survey
  - Hammer sounding
  - Rotatory percussion for overhead areas



# Shotcrete Removal and Replacement

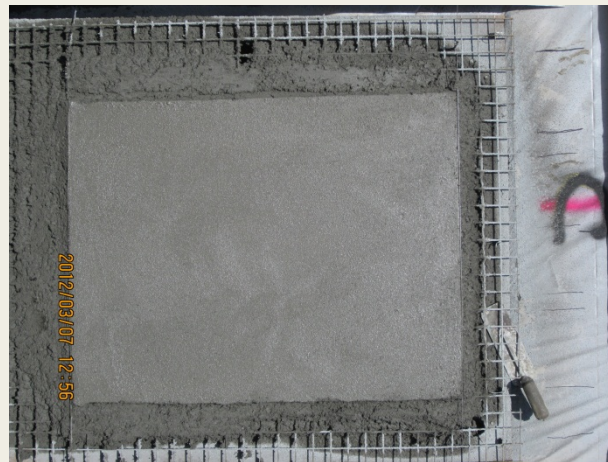
- Problems to Overcome
  - Bond Strength
  - Cracking
  - Permeability





# Shotcrete Removal and Replacement

- Final Solution
  - Lower Strength
    - Original >8,000 PSI
    - Final <6,000 PSI
  - Fiber Additive
  - Sand Blast Prep



# Arch Rib Plating



- Bottom Plate Corrosion
  - Criteria
  - Survey Extent
  - Note Interference
  - Design Repair



# Arch Rib Plating



- Typical corrosion damage



# Arch Rib Plating



- Interference – Strake Tab, Floorbeam

# Arch Rib Plating

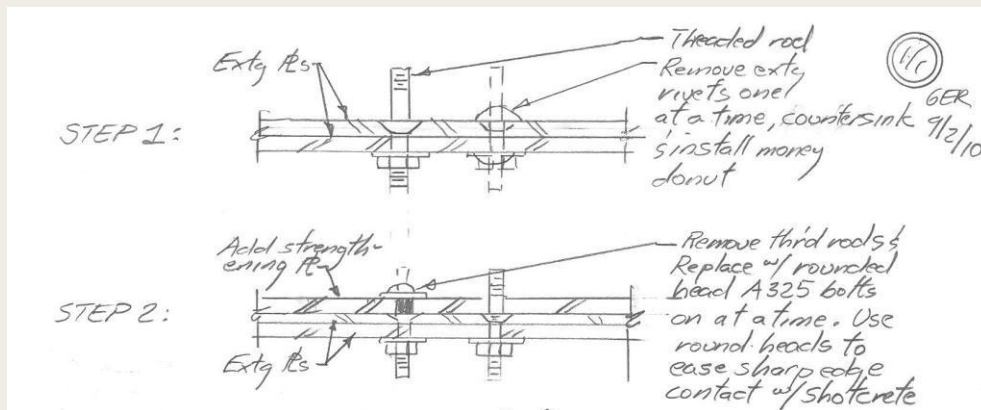


- Preparation – rivets and "bondo"



# Arch Rib Plating

- Flush mounted nuts, “Monkey Donut”
  - Allows for removal of rivets and flush mounting reinforcement plates



Patent Pending



# Arch Rib Plating



- Creating template – first plate installed

# Arch Rib Plating



- Coring out the rivets



# Arch Rib Plating



- Monkey donuts and side cover plate



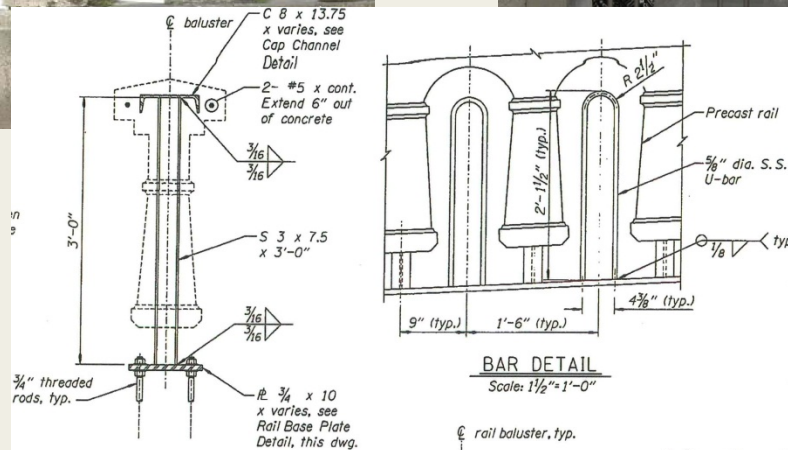
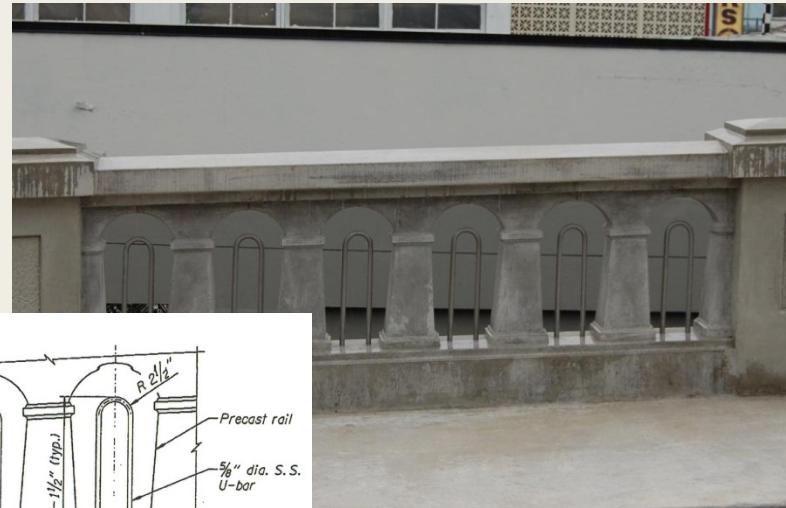
# Arch Rib Plating



- Completed repair

# “Stealth” Rail

- Upgrading for both vehicular and pedestrian traffic while maintaining the historic look.





# “Stealth” Rail



- Flush cutting rail at top of sidewalk



# “Stealth” Rail



- Sidewalk removal
  - Approach spans
  - Improved connection

# “Stealth” Rail



- Forming
- Sidewalk poured



# “Stealth” Rail



- Completed rail



# Stringer Replacement

- Existing stringer ends completely corroded at joints, relocated exteriors and repaired others with fish plates.



# Stringer Replacement



- Existing damage – This stringer replaced



# Stringer Replacement



- Repair preparation



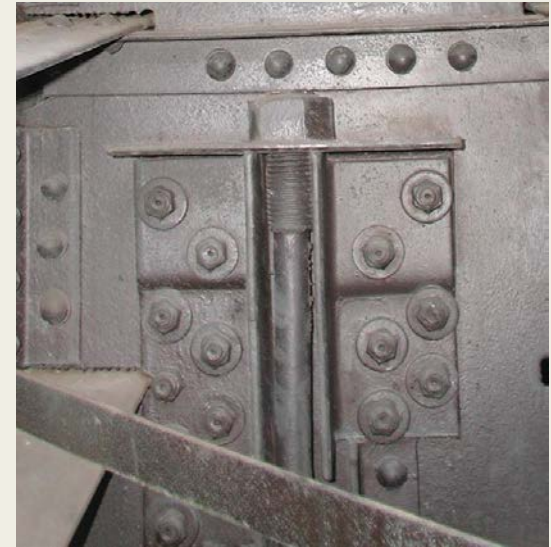
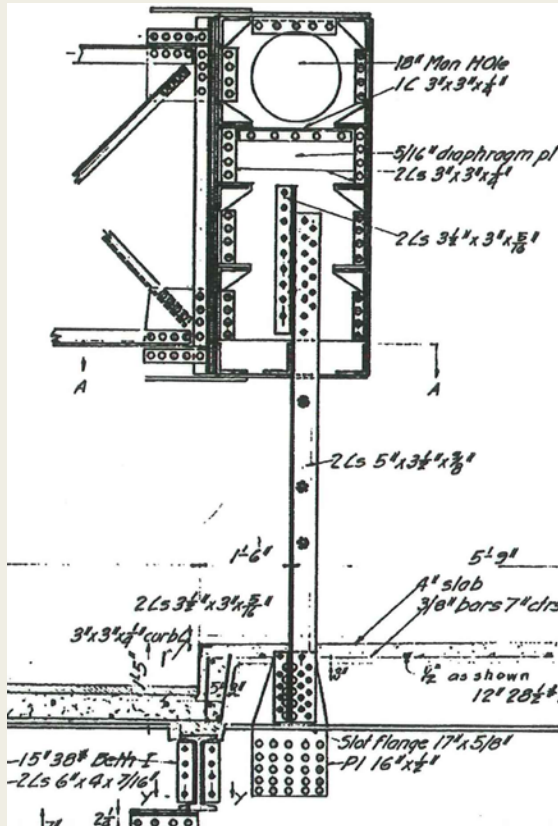
# Stringer Replacement



- Completed repair

# Floor Beam Hangers

- Load Limiting Bridge Member
- Additional Support Rods





# Floor Beam Hangers



- Plate repair



# Floor Beam Hangers

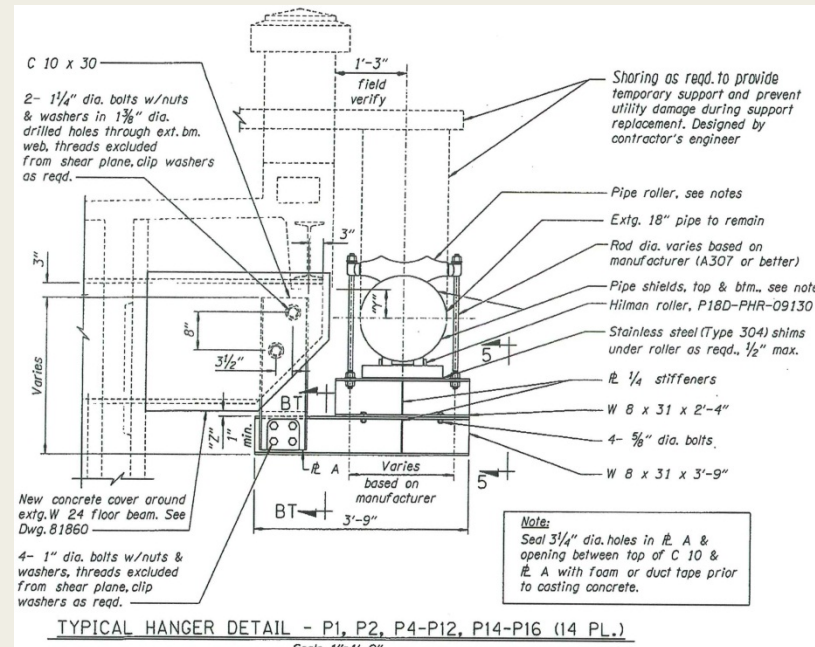


- Concrete form and pour



# Sewer Line

- 18-inch sanitary sewer line
- Maintain operation at all times
- Heavily deteriorated supports



# Sewer Line



- Existing hangers and concrete damage



# Sewer Line



- Concrete removal and new bracket

# Sewer Line



- Virtually completed replacement



# Conclusion

- Historic Rehabilitation are complex, risky bridge projects, but you can reduce the risk by:
  - Comprehensive condition evaluation prior to construction.
  - Appropriate contingency for unforeseen and foreseen issues.
  - Experienced design, management team
  - Qualified Contractor
- Thanks: Wildish, ODOT CE, Eric Bonn (OBEC EOR), Pacific Precast, Chris Leedham (ODOT)
- Questions?

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