

2009 Western Bridge Engineers' Seminar

FREMONT BRIDGE

In-Depth Inspection of the World's 2nd Longest Steel Tied-Arch Bridge

Portland, Oregon

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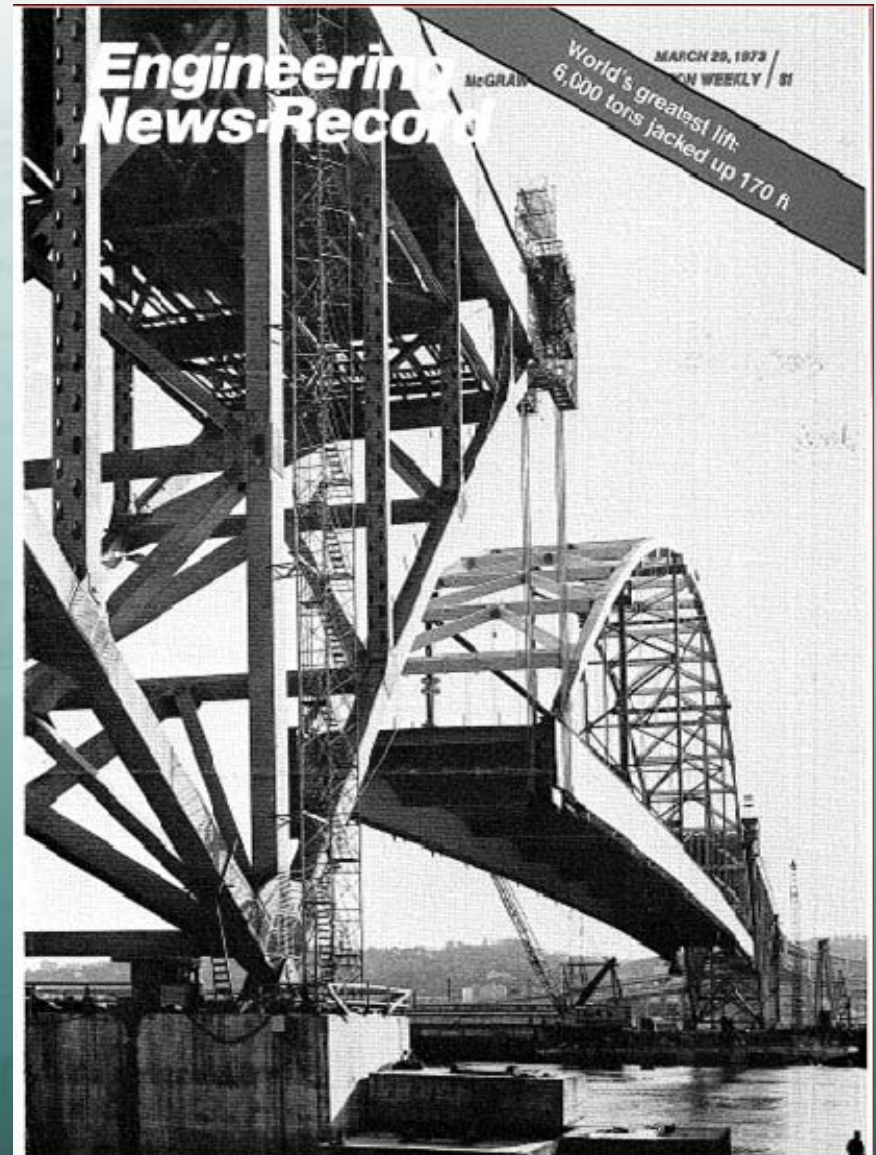


Agenda

- **Background**
- **Bridge Characteristics**
- **Site Conditions**
- **Access Techniques/ Phasing**
- **Inspection Findings**
- **ODOT Contracting of Major Bridges**

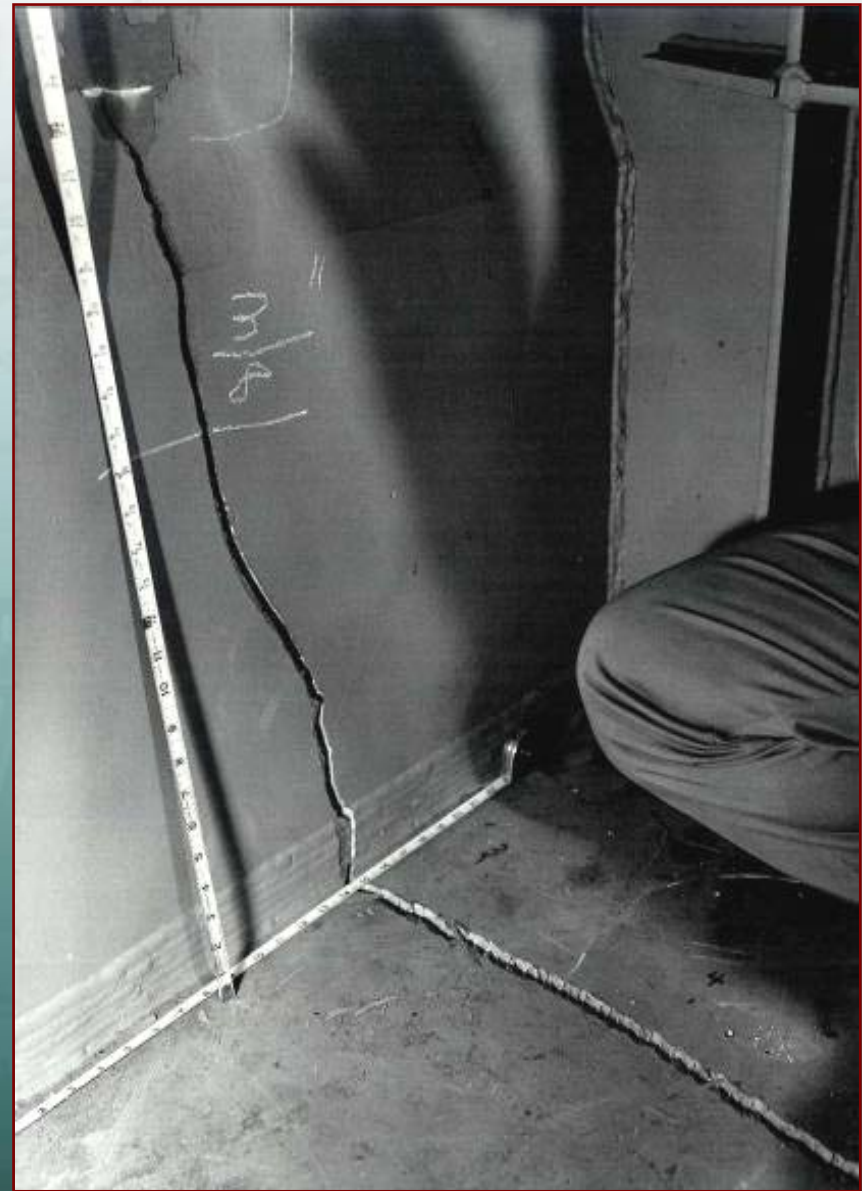
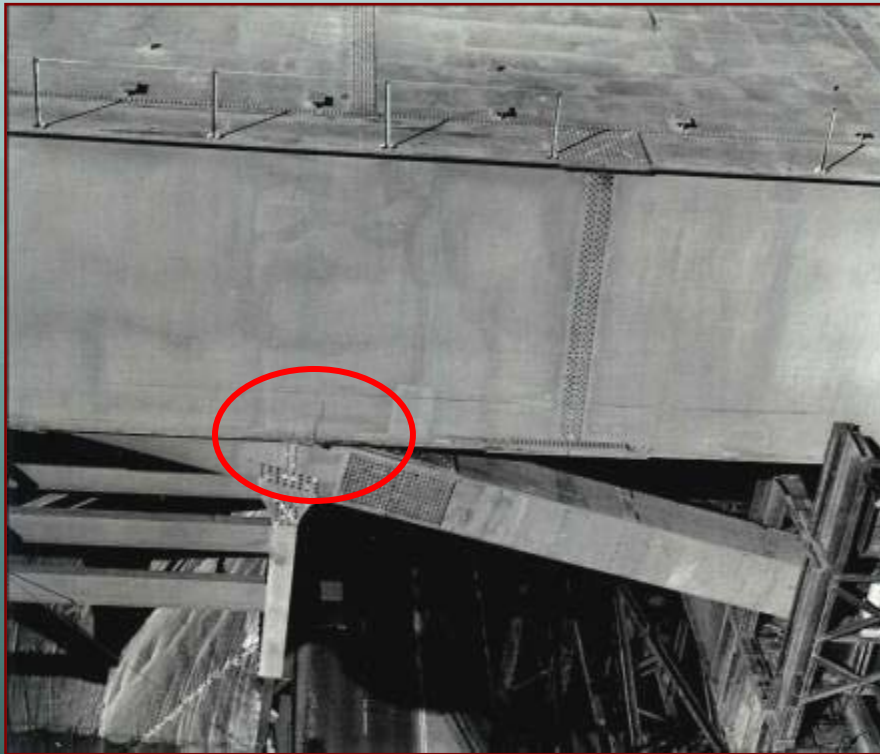
Background

- **Constructed 1971 – 1973**
- **Record-setting lift**
 - Longest: 902-ft through-arch section
 - Heaviest: 6,000 tons
 - Highest: 170-ft vertical lift



Background

- **Cracked tie girder causes 2-year delay**

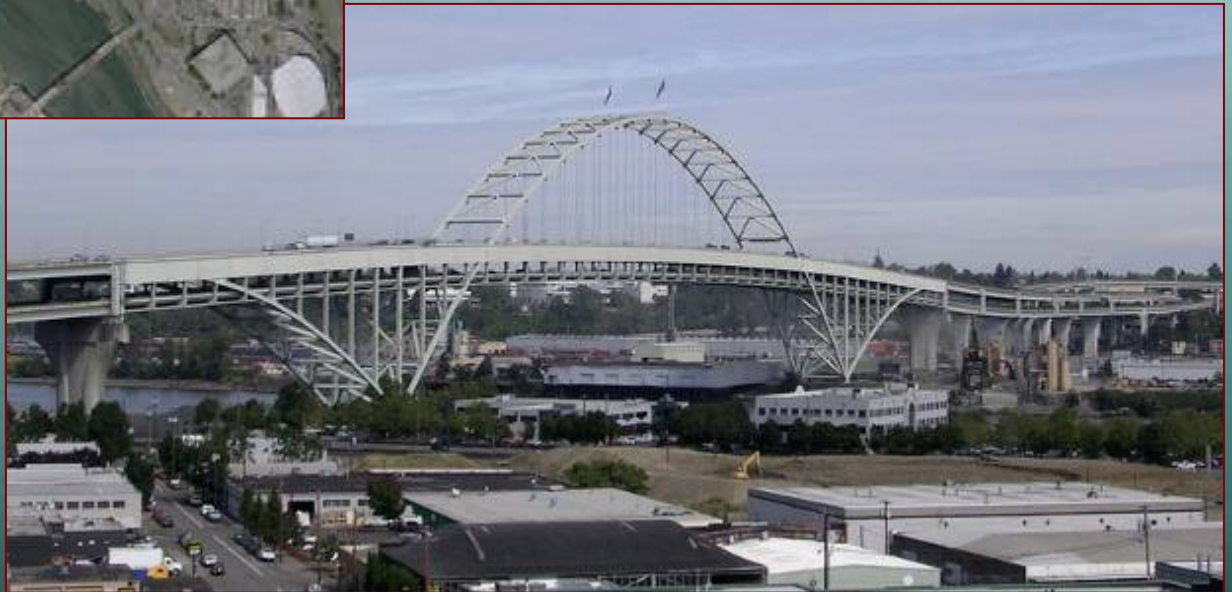


Fremont Bridge Characteristics



- I-405, I-5, and US30
- 3-span double-deck steel tied-arch (2,154 ft.)
- 1,255-ft main span

- 175-ft navigation clearance
- 385-ft. to arch



Fremont Bridge Characteristics

- **4' x 4' 105 ksi steel arch (ASTM A514)**
- **18' x 4' hybrid steel tie girders (ASTM A36, A441, A588)**



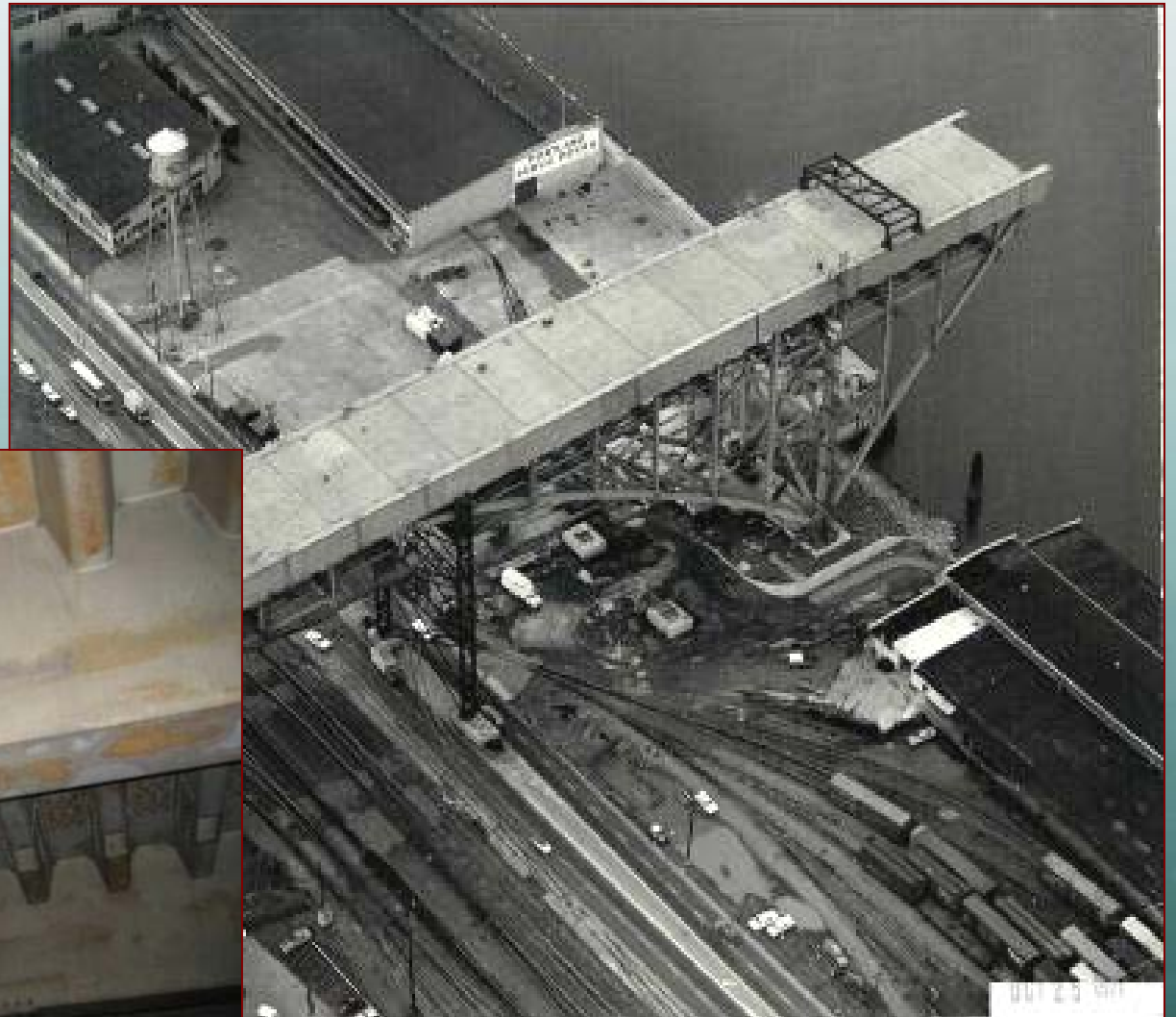
Fremont Bridge Characteristics

- **4' x 16"** spandrel columns
- **4- 2 5/16"** dia. suspender strands



Fremont Bridge Characteristics

**Continuous
steel orthotropic
upper deck**



Fremont Bridge Characteristics

**Stringer-floor
beam system
with CIP lower
deck**



Site Conditions

- **113,400 ADT, 11% trucks (I-405)**
- **Lane Closures (night only)**
 - 8 p.m. to 5 a.m.
- **Shoulder Closures (permitted)**
 - 9 a.m. to 3 p.m.
- **High winds for daytime work**



Site Conditions

- **Pre-job Site Visit – 8/13/08** facilitated by Region 1 Inspection Team (Bob Schmidt and Stan Gamolo)
- **Permitted full rigging and access walk-thru**



Access Techniques

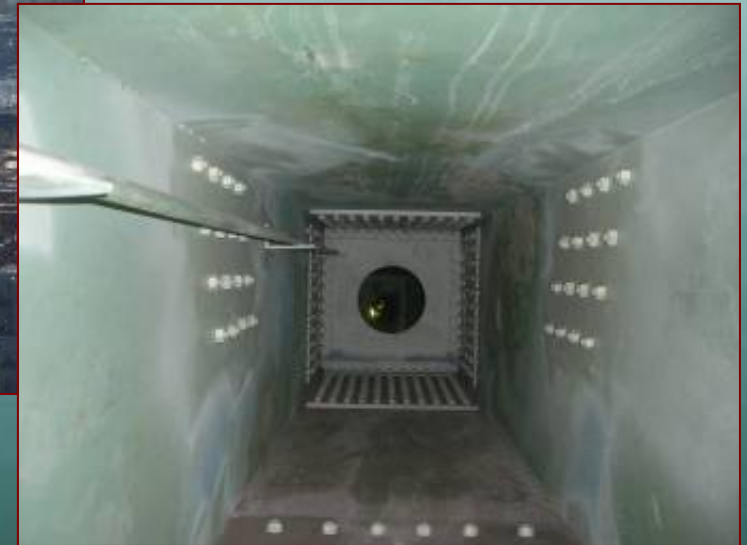
- **ODOT 50-ft. snooper truck**
- **38-ft. bucket truck**



Access Techniques



**Industrial
rope-access
techniques**



Confined-space entry

Phase I – Deck Arch



Phase I – Deck Arch



Phase I – Deck Arch



Phase I – Deck Arch



Phase II – Through Arch



Phase II – Through Arch



Phase II – Through Arch



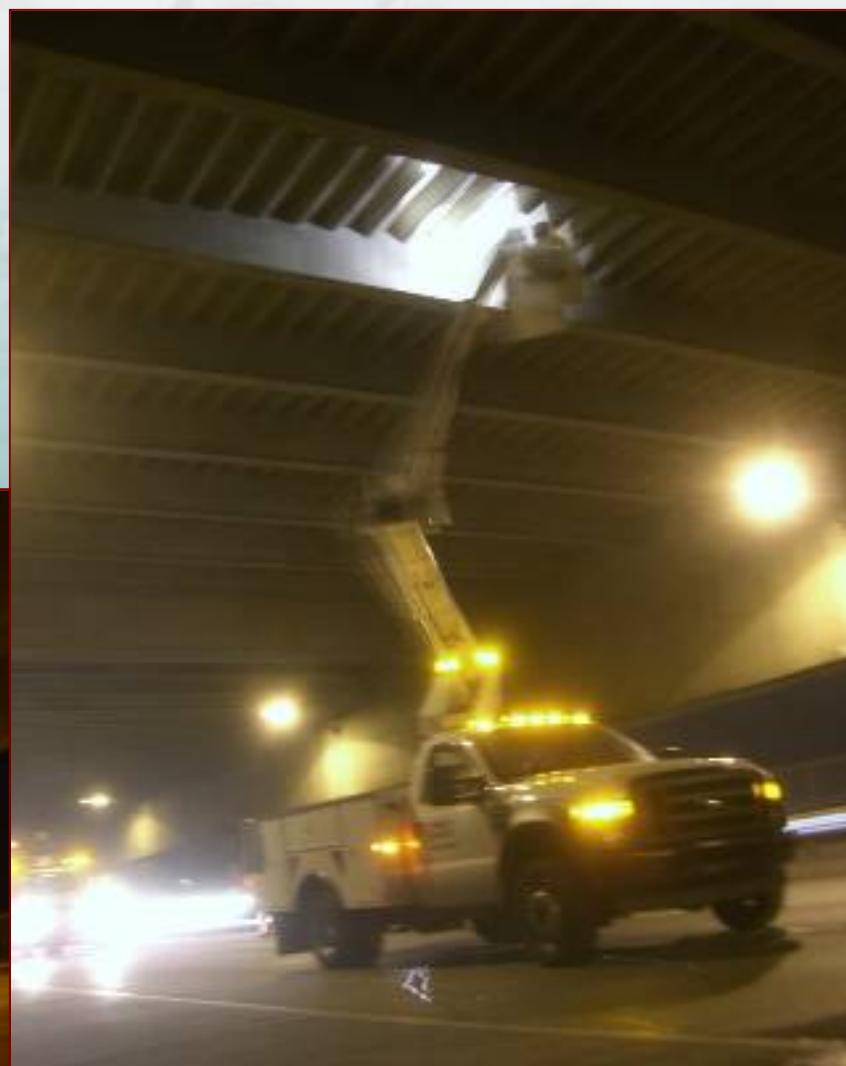
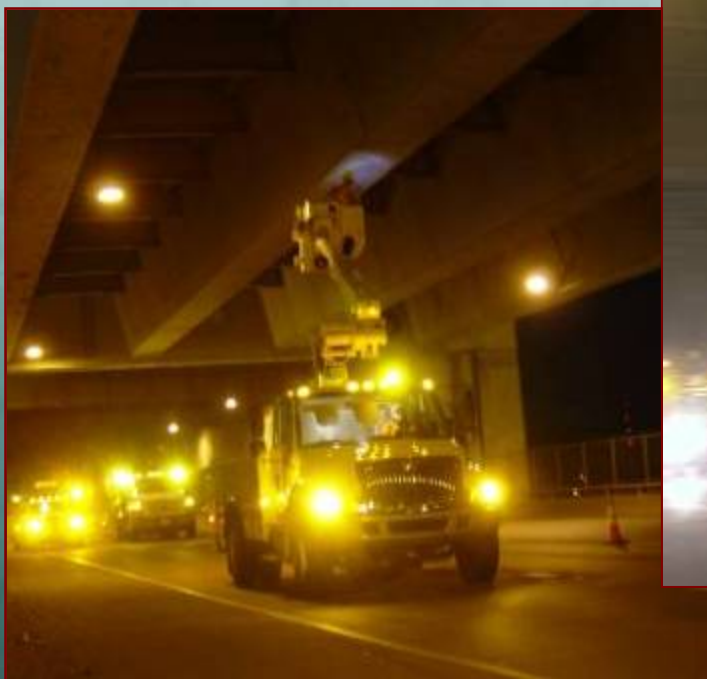
Phase II – Through Arch



Phase II – Through Arch



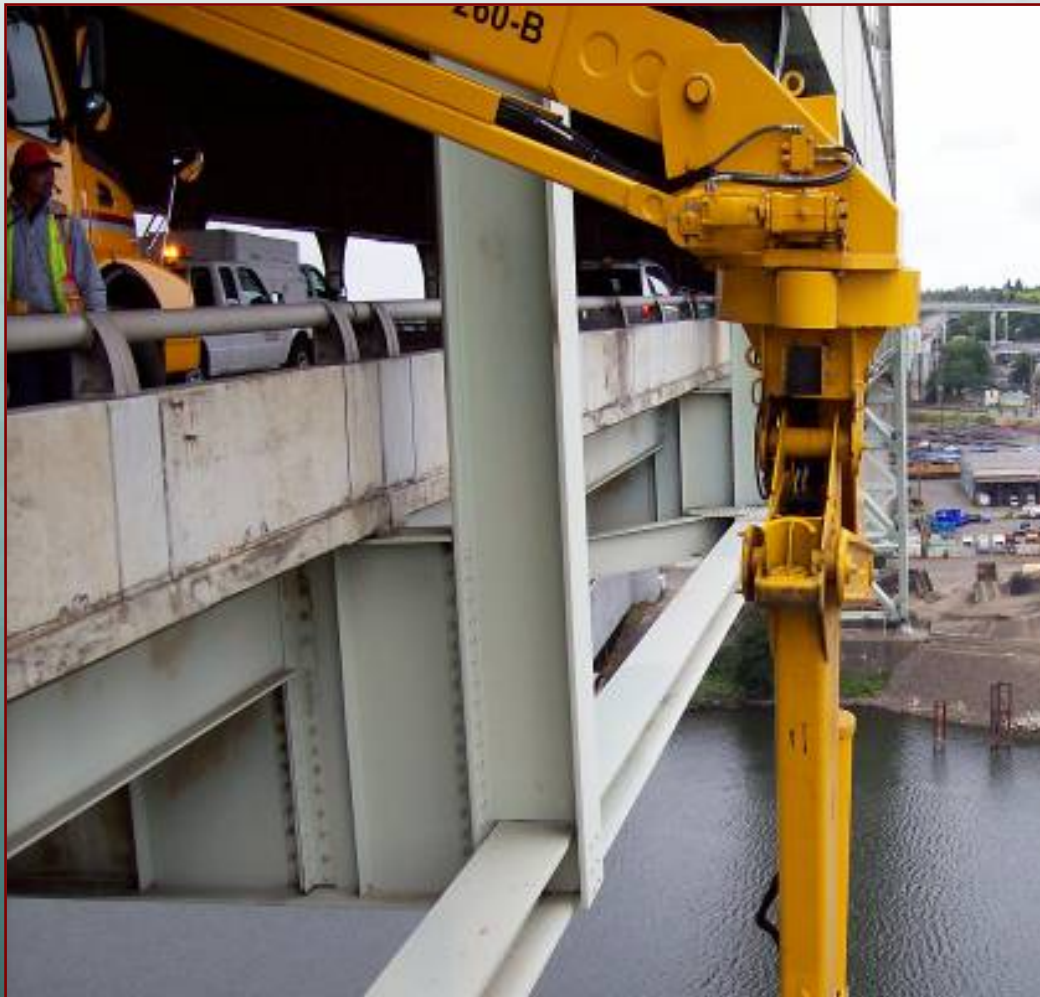
Phase III – Deck Floor Systems



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Phase III – Deck Floor Systems



Phase III – Deck Floor Systems



Phase IV – Deck/Tie Girder Exterior



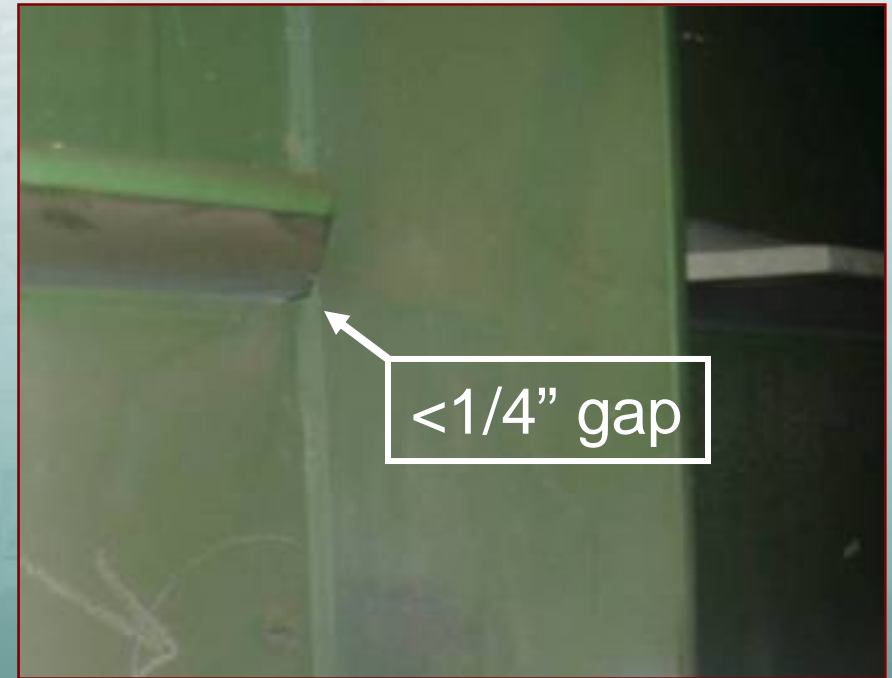
Phase IV – 2 Days



Typical Fatigue Prone and Intersecting Weld Details

- **Fracture critical members**

- Tie girders
- Floor beams*



- Intersecting welds and intermittent piggy back welds are common on tie girder interior

Typical Fatigue Prone, Intersecting Welds and Fracture Critical Details

Tack welded splice plates, fill plates, and gusset plates



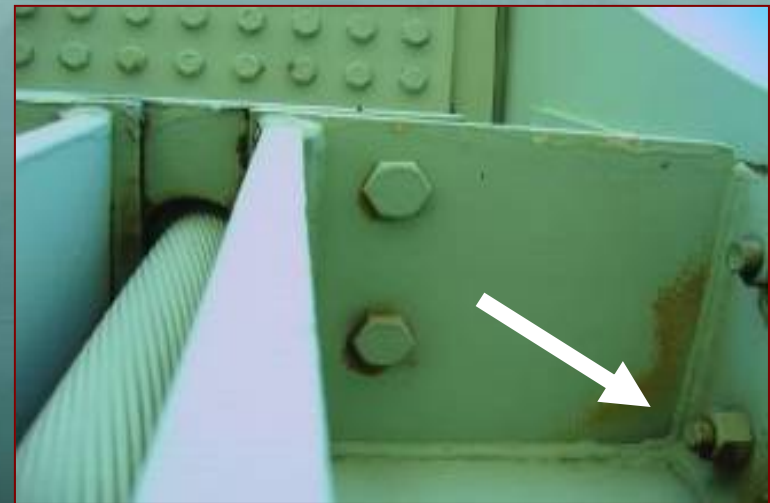
Typical Fatigue Prone, Intersecting Welds and Fracture Critical Details

Fragmented tie girder splice plates



Typical Fatigue Prone, Intersecting Welds and Fracture Critical Details

**Intersecting “Hoan-style”welds
in upper suspender assemblies
and bolted wind chord connections**



Non-destructive testing techniques

- **Magnetic particle**
- **Dye penetrant**
- **Ultrasonic depth meter**



ODOT Contracting of Major Bridge Inspections

- **ODOT's Major Bridge Inspection Program**
 - From 1996 to present
 - Nearly 40 major bridge inspections performed by consultants in 2006-2009
 - Limited in-house inspection staff
 - Consultants are an “extension” of ODOT Inspection Staff
 - Emergency repairs/problems averted by major bridge inspection program

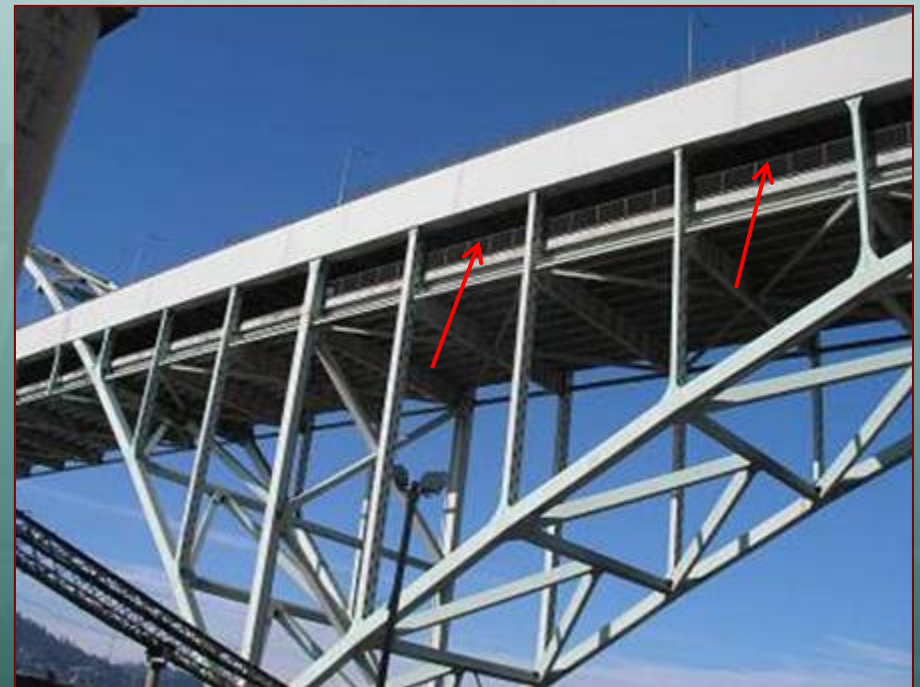
ODOT Contracting of Major Bridge Inspections

- **Collaborative approach to bridge inspection**

- Case study: Willamette River (Fremont) Bridge
 - In-depth fracture critical and fatigue prone inspections
 - Problems found in 1996
 - ODOT Fremont Bridge inspection history
 - Overall cooperation between ODOT and Consultant during inspections

ODOT Contracting of Major Bridge Inspections

- **Collaborative approach to bridge inspection**
 - Case Study: Willamette River (Fremont) Bridge
 - Access methods for lower deck



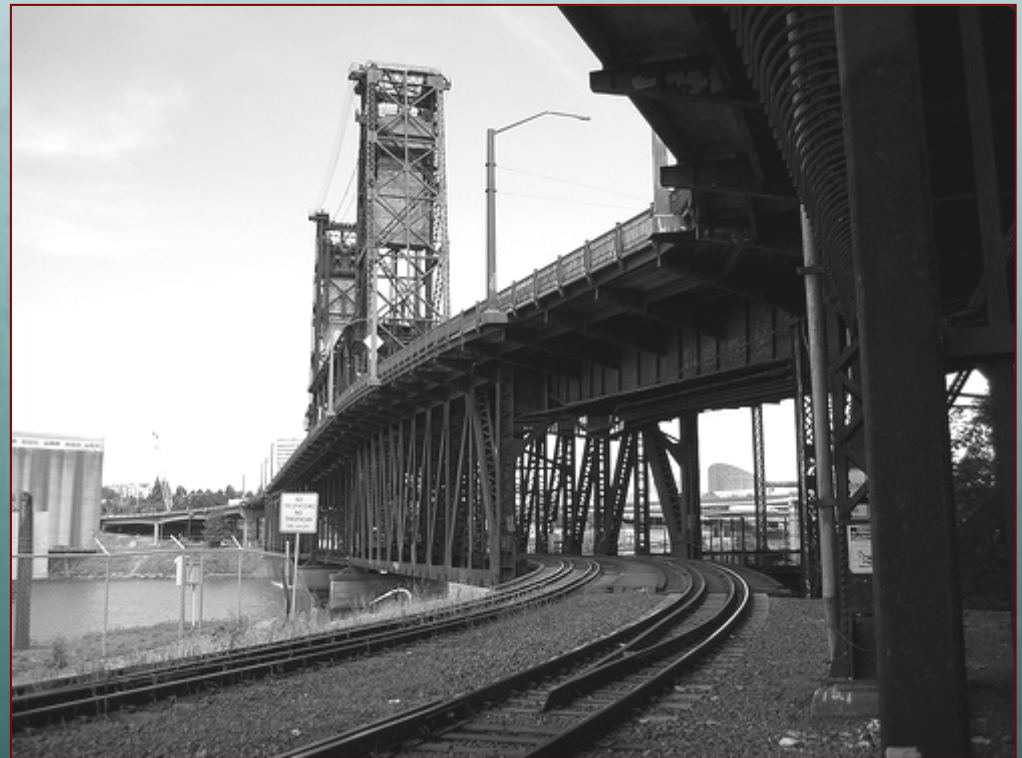
ODOT Contracting of Major Bridge Inspections

- **Collaborative approach to bridge inspection**
 - Case Study: Willamette River (Fremont) Bridge
 - Access methods for lower deck
 - Access for future inspections



ODOT Contracting of Major Bridge Inspections

- **Collaborative approach to bridge inspection**
 - Case Study: Steel Bridge
- 1910 twin deck vertical lift truss carrying freight, light rail, vehicular, pedestrian
- First-ever in-depth and fracture critical inspection effort
- **Multi-agency coordination:**
 - ODOT
 - UPRR (bridge owner)
 - TriMet
 - USCG
 - City of Portland
 - Port of Portland



Open For Questions...

