Burnside Bridge
Counterweight Trunnion Replacement

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Burnside Bridge Specifics

- Historic Bascule Bridge in Portland, Oregon
- Original Construction 1926, owned and operated by Multnomah County
- Bascule Span designed by Strauss Engineering of Chicago, IL
- Joseph Strauss patented a hinged under deck counterweight- allows counterweight to articulate (rotate) as span opens
- 213 feet channel
- 252 ft. Double Leaf Bascule (trunnion – trunnion)
- Carries 5 lanes of traffic and 2 sidewalks
- One of the heaviest bascule bridges in the U.S.
  - Dead Load of one Counterweight approximately 3.7 million pounds
  - Each leaf approx. 5 million pounds
Articulated Counterweight

- Joseph Strauss – Patented Articulated Counterweight Design
- Cwt supported by pin and hanger assembly from truss allows cwt to articulate as leaf rotates open
- Link Arm ensures hanger plates remain vertical and steady the counterweight through travel
- Smaller Bascule Pier Cwt Pit – construction cost savings
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Cross Section through the cwt trunnion bearing
- 36” diameter Hub – fixed to two webs of bascule truss and bushed with a bronze sleeve
- 25.5” dia. Trunnion – rotating within bronze sleeve bushing
- 13 ¼” diameter pin – connection trunnion to hanger plate
- 2 inch diameter rods to tie the assembly together

Concerns During 2004 Inspection
- Added motor draw at East Leaf
- Grease grooves clogged
- 2 inch diameter rods sheared
- Borescope showed cracked bushing
- Cracked concrete around hanger plates
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Hanger Plates Concerns

- Cwt Trunnion design has history of bending fatigue failure due to rotation lag
- Coupled with corrosion susceptibility
- Fatigue failure would be catastrophic
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Jacking Frame Design

- Eight (4 per side)-3 inch diameter rods supports counterweight
- CWT load is transferred from cwt trunnion to jacking frame grillage
- Grillage on top of truss Keeps bascule span balanced
- Lowers counterweight approximately 4 feet to allow access to cwt bearings
- Design stabilizes the bascule leaf and counterweight as well
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Jacking Frame

Jacking Frame Above Truss

Jacking Frame Below Ctwt.
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Jacking Monitoring Devices
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Removal—
Bushing had multiple cracks
Trunnion had clogged grooves and corrosion
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Removal of Hub
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Truss Preparation

Line Boring setup for web pair
Inboard web bore smaller than outboard bore to allow a stepped hub
Provides interference fit of both webs with new hub
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Hub Installation
Dry ice used to shrink hub diameter for final interference fit
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Hub Bolt holes drilled in place
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Trunnion Installation
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Hangers positioned in line with the trunnion bore
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Line Boring for Pin
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Pin Installation
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Contractor

Advanced American Divers (Constructors)

Contract Cost $7,324,440

Jacking System, Shoring and Bearings Cost $745,000

29 day closure of East Leaf to complete work

Worked 7 days a week, 24 hours a day