

# Willamette Valley Spillway Gates

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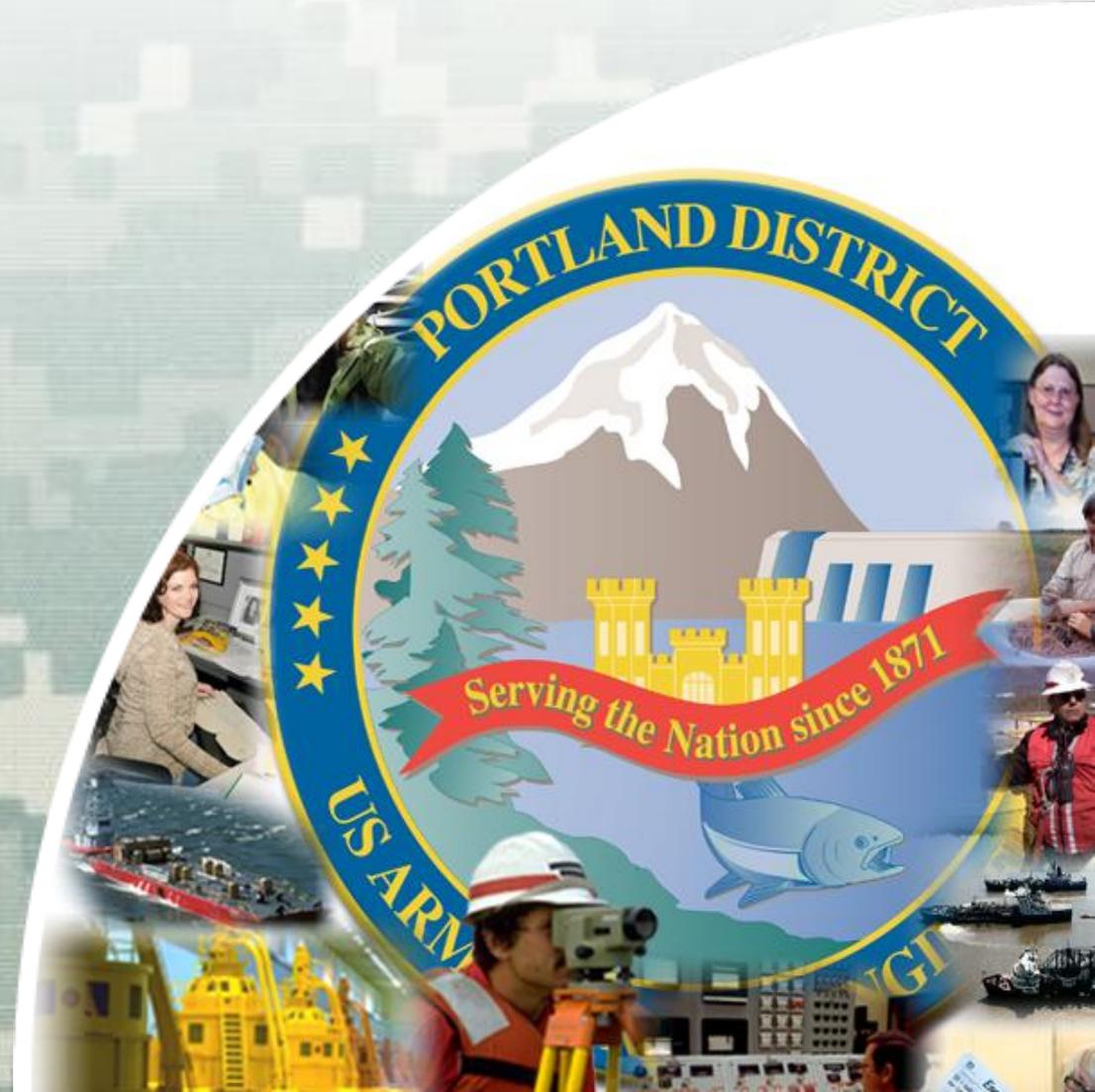
USACE Portland District

25-Sep-2012

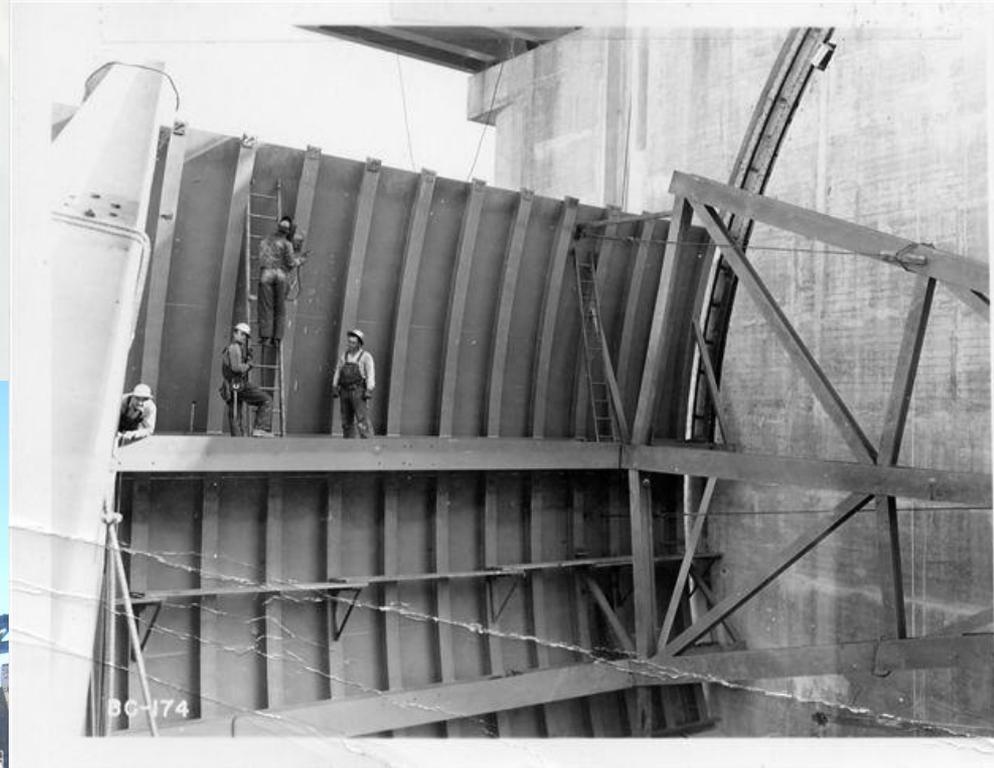


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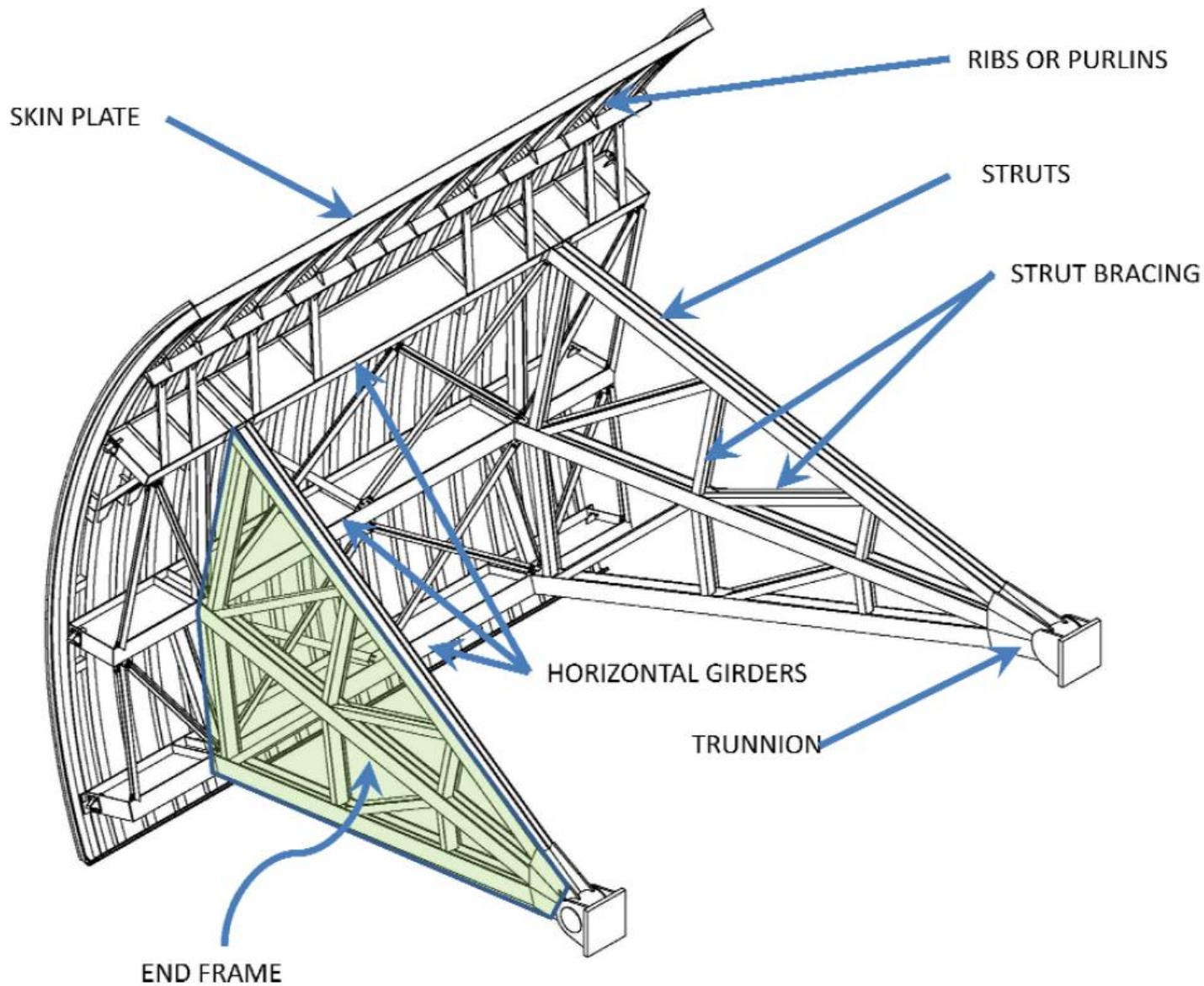


Dexter



Big Cliff





<b>Project</b>	<b>Total Number of Gates</b>	<b>Placed In Service</b>	<b>Design Guidance Used (Assumed)</b>
<b>Willamette Valley Basin Projects</b>			
<i><b>North Santiam Subbasin</b></i>			
Detroit	6	1950	1945
Big Cliff	3	1951	1945
<i><b>South Santiam Subbasin</b></i>			
Green Peter	2	1962	1950
Foster	4	1964	1950
<i><b>McKenzie River Subbasin</b></i>			
Cougar	2	1959	1950
Blue River	2	1965	1950
<i><b>Middle Fork Willamette Subbasin</b></i>			
Hills Creek	3	1957	1950
Lookout Point	5	1951	1945
Dexter	7	1953	1950
Fall Creek	2	1963	1950
<i><b>Coast Fork Willamette and Long Tom Subbasins</b></i>			
Fern Ridge	6	1940	Unknown



# Tainter Gate Operations

- Conservation
  - ▶ Filling season Feb thru May
  - ▶ Release season May thru Oct
- Flood Season.
  - ▶ Nov thru Jan, sometimes in Feb.
- 1990 WRDA – added Environmental Protection.
  - ▶ Spilling for temperature control
  - ▶ Operational changes for fish passage
- Hydropower load balancing due wind power (up to gas cap)
- Change in gate use has increased the need for reliable operation.



# Timeline

- ▶ Lost gate at Folsom led to inspections, assessment tools
- ▶ SPRA, Screening for Portfolio Risk Assessment
- ▶ PFMA, Probable Failure Modes Analysis
- ▶ IRRM's, Interrim Risk Reduction Measures
- ▶ FaultTree program, USACE Risk Mgt Ctr (Elec & Mech reliability assessment)
- ▶ Inspections, surveys, OCA (operational condition assessment), analysis occurring 2006 thru 2010 found issues with some components:
  - Gate arms, Skin plates, Gear boxes worn, Wire ropes worn, Weld flaws, Electrical reliability





Bent strut arm



Crack at Girder/Rib joint

What happens next?

Analysis using numerical modeling.

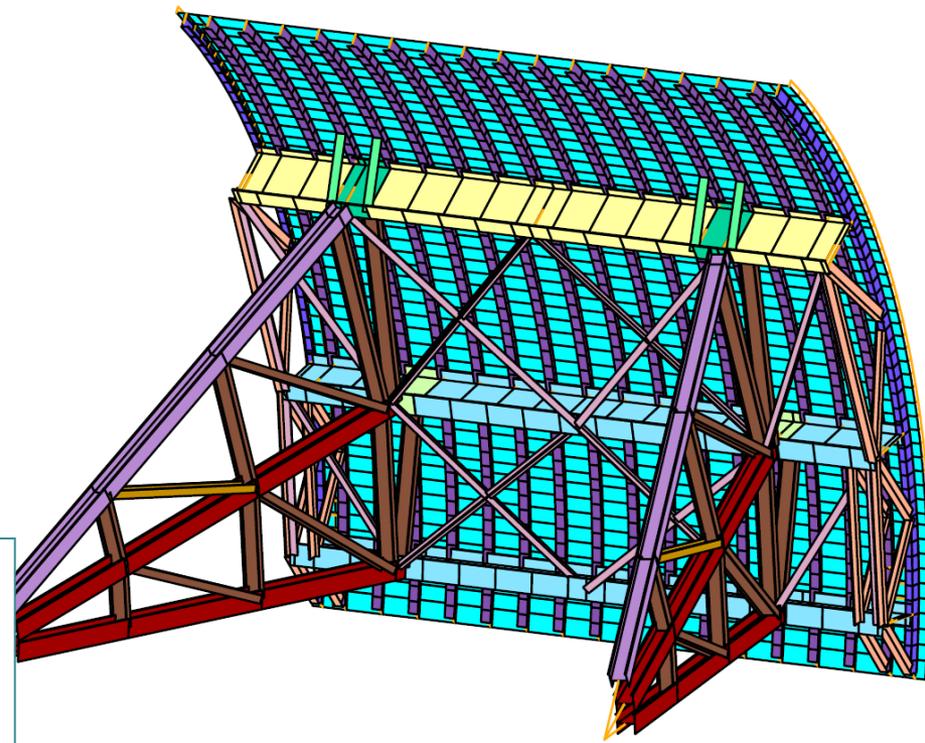
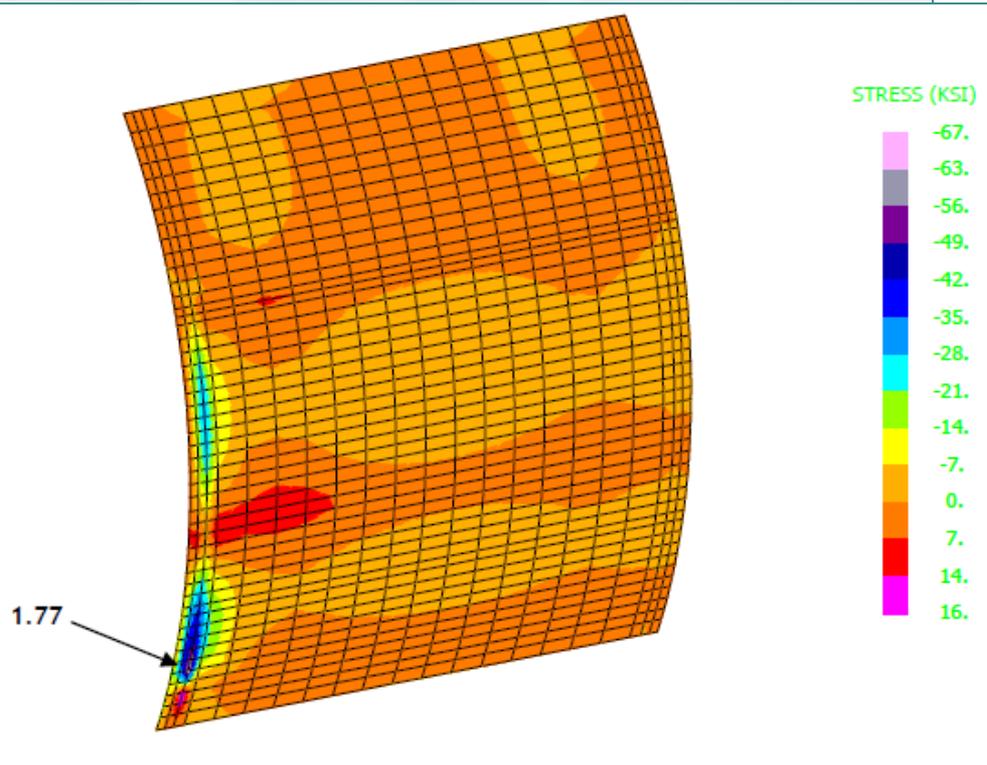
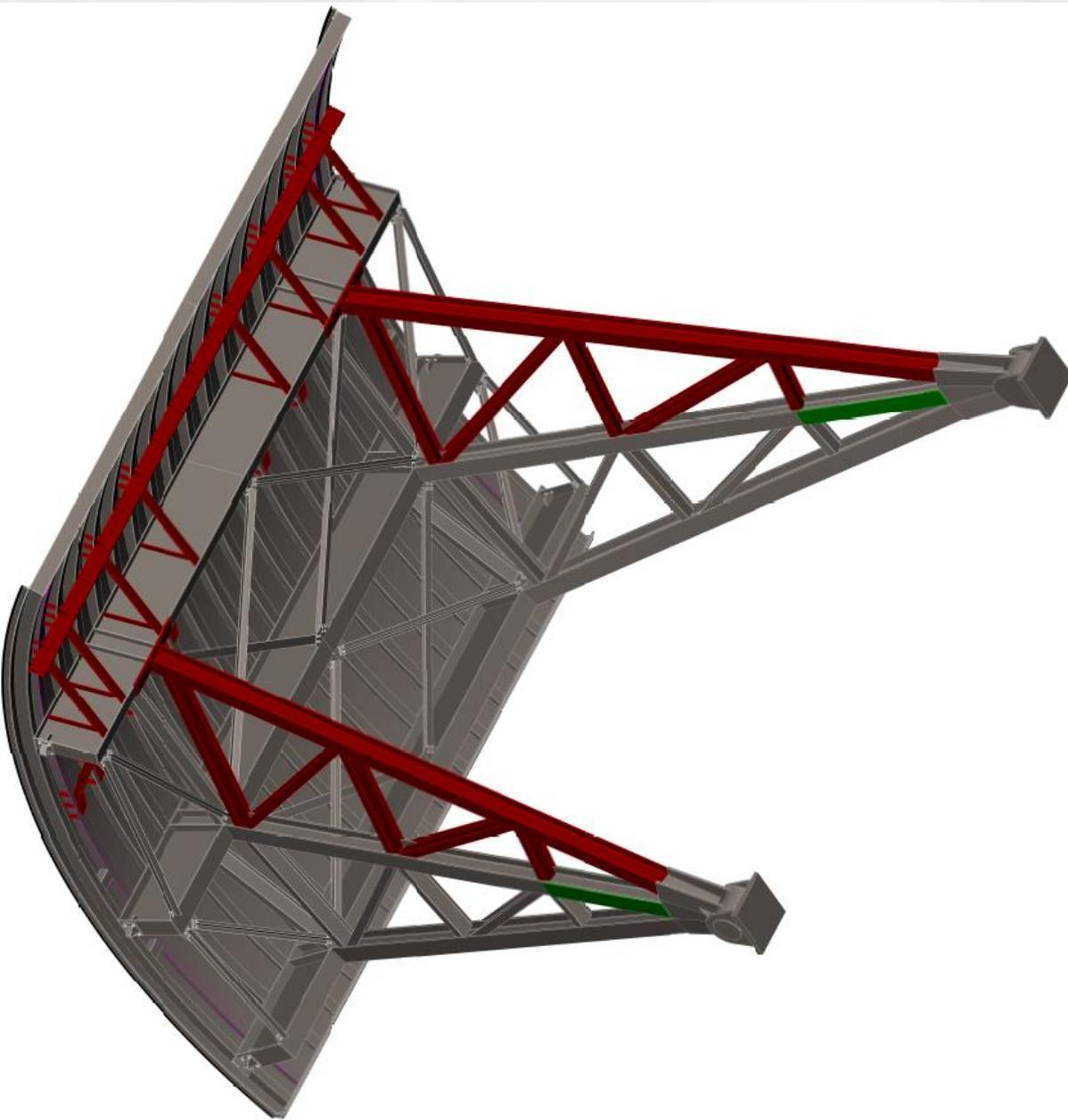


Figure 46: Green Peter Dam radial gate retrofit model





## Foster Gate Modifications

- Strut arms strengthened
- Cantilevered section strengthened.
- Trunnion bearings replaced.

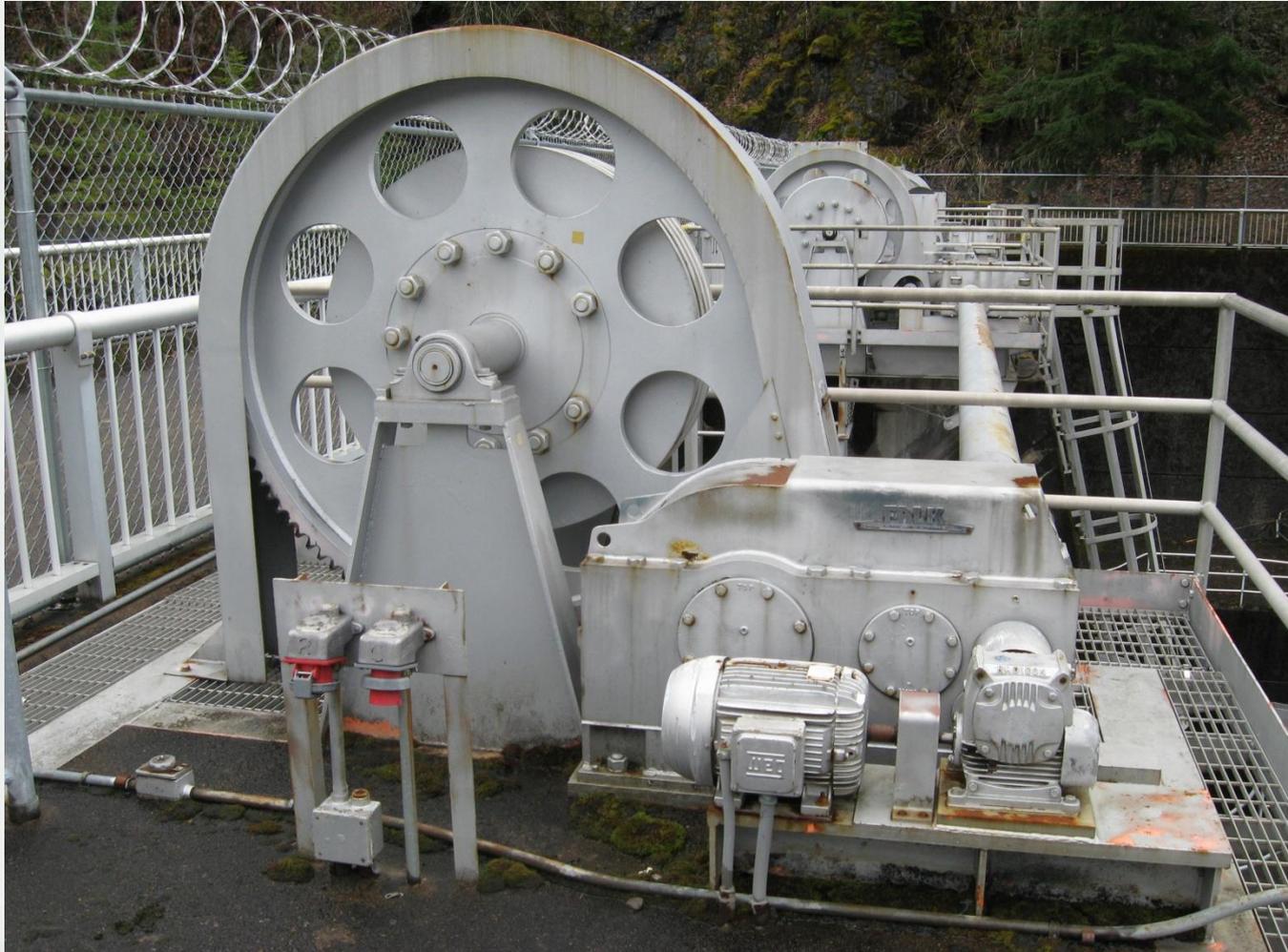


# Tainter Gate Systems Approach

- Reliability Analysis includes Electrical and Mechanical systems in the analysis
- Electrical:
  - ▶ Limit switches, circuit protection, distribution, power supply
- Mechanical:
  - ▶ Wire Ropes, drums, gear boxes, machinery platforms, gate position indication.
- Objective - overall reliability number of  $1 \times 10^{-4}$ 
  - ▶ Product of individual reliability values.



# Mechanical Hoisting Systems



Blue  
River



# Mechanical Hoisting Systems

- Spiral-wrapped drums, A.K.A. stacked-plate drums



Dexter



# Construction work

- Foster – completed
- Dexter – In construction
- Big Cliff – In construction
- Fall Creek – In Design
- Green Peter – In Design
- Scheduled: Detroit, Cougar, Blue River, Hill Creek, Lookout Point and Fern Ridge.
- Policy and Procedures:
  - ▶ NWD Policy on inspection, testing maintenance



# Summary

- Tainter gate reliability is dependent on a program of regular/periodic inspection and evaluation.
- Analysis performed to date has shown potential risks that are being addressed.
- Resources are being applied, and progress is being made with a sense of urgency.
- Reliability involves the entire gate system, not just the tainter structure.
  
- Questions?

