

To Engineer is Human



Mills Dam #2 - Tainter Gate Leakage

Mills Tainter Gate Embedded Bottom Sill



The concrete around the embedded bottom sill plate has eroded away to the extent that water is going through the monolith joint.

Mills Tainter Gate Leakage



Mills Tainter gates leak, have vibration issues and have ogee concrete erosion.

Mills Tainter Gates - Repairs



Embedded Sill Repairs

Mills Tainter Gate Repairs



Pipe Kicker Repairs

Mills Knife Edge Repair



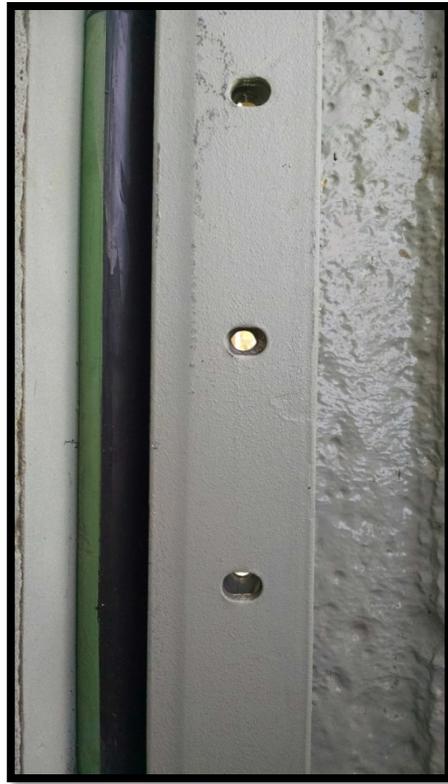
It was assumed that the knife edge and the embedded metal was causing the leaks.

Mills Tainter Gate



Steel Fabrication Repairs and Painting

Mills Tainter Gate Side Seals



New Side Seal Angles, J-bulb Seals and
Clamp Bars

Mills Tainter Gate Painting



Painting the bottom of the Tainter gate

After the Repairs



The gate still leaked

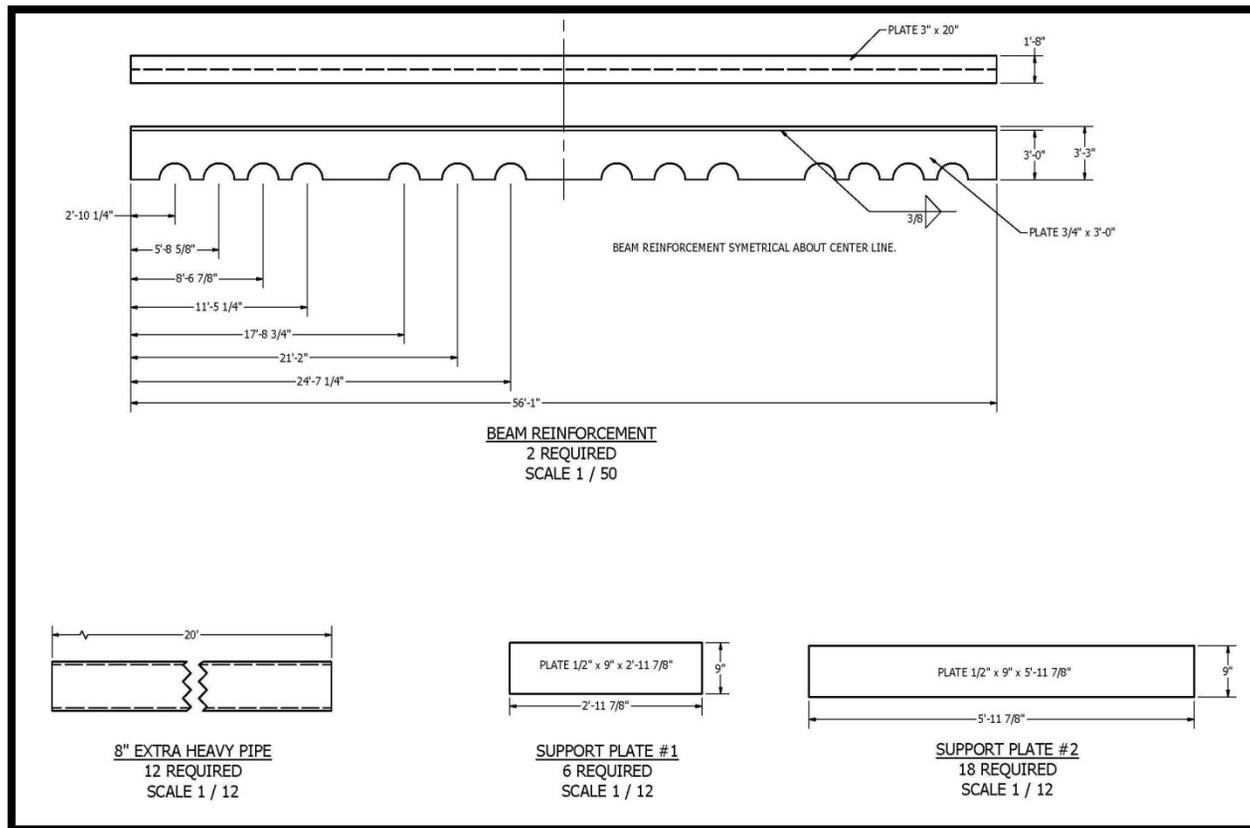
Deflection Calculations

- After the field worked very hard to machine the knife edge to within 0.020" by grinding and feeler gauges. We checked the bottom girder beam deflection calculations.
- The beam deflection calculations indicated that the beam was deflecting approximately $5/8$ " to $3/4$ ".

Deflection Measurements

- Our Survey Crew was asked to measure the bottom girder and bottom seal deflection with reflectors.
- The results showed that the bottom girder measured $5/8$ " horizontally and $3/8$ " vertically.
- The results also showed that the seal deflected $7/8$ " horizontally and $3/16$ " vertically.

Repair Plan

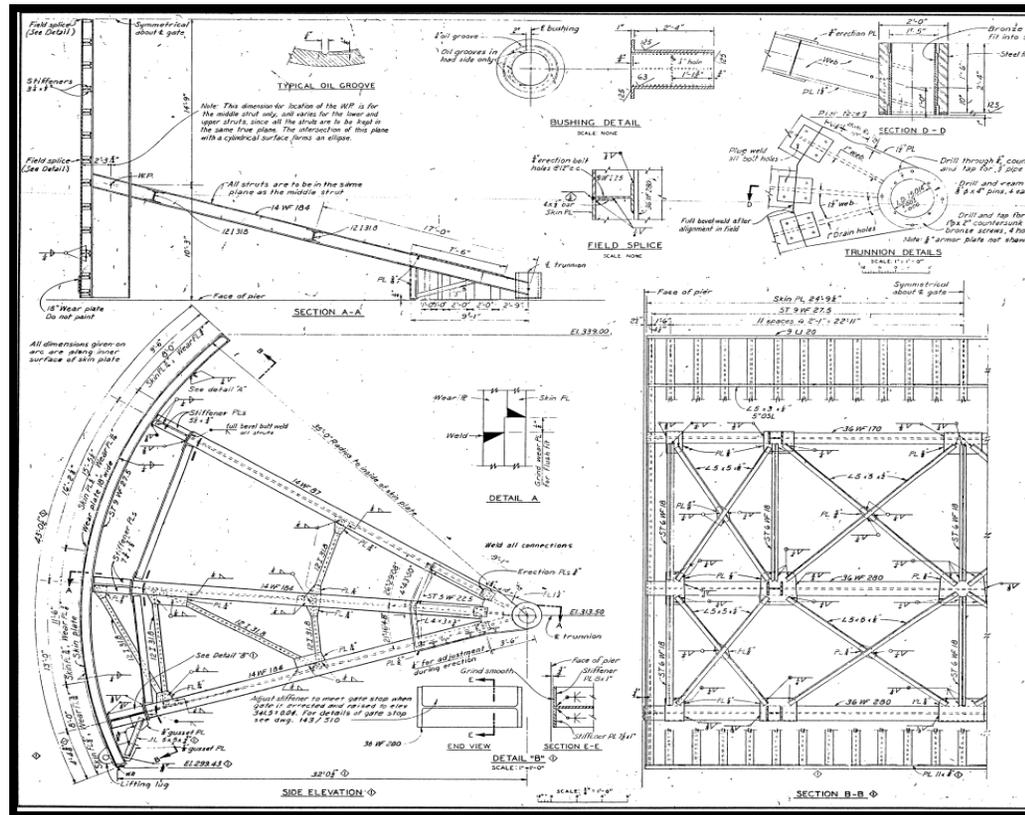


Beam reinforcing with a large WT
additional bracing of the bottom girder

Design Guidance

- ETL 1110-2-584 recommends that the trunnion be placed at an approximate height of $1/3$ of the gate. This will make the bottom girder almost level, which will allow the deflection to be perpendicular to the flow which will not create leakage. But this can put the trunnion under water which will increase the trunnion friction due to sand infiltration into the trunnion bushing.

Dardanelle Tainter Gates

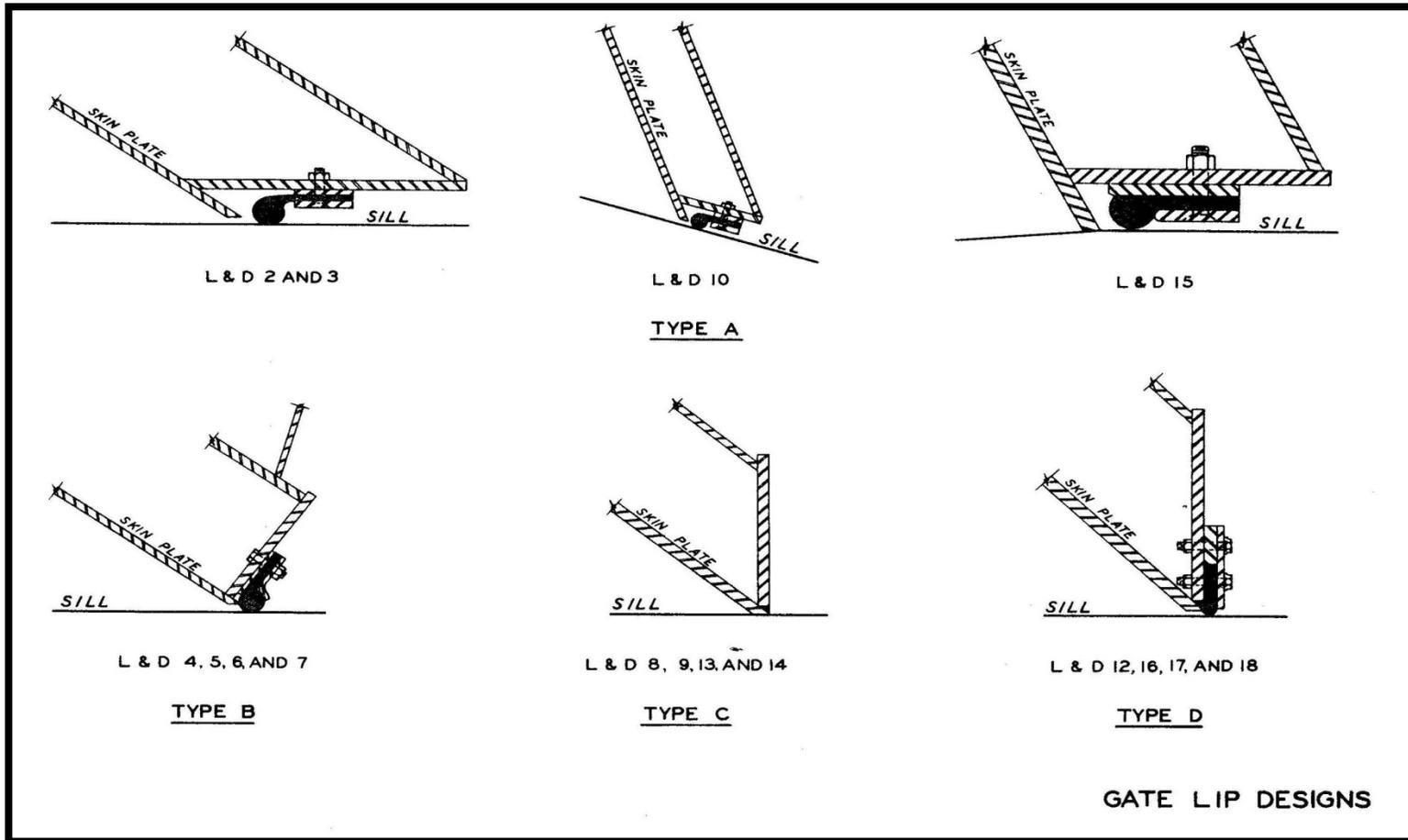


The trunnions are at the 1/3 height and the strut arms are angled in 10' to reduce the span.

Spillway Gate Vibration on the Arkansas River

- In 1971 the US Waterways Experiment Station conducted a vibration study to try to stop the tainter gate vibration along the Arkansas River.
- ASCE – American Society of Civil Engineers provided another publication.
- They concluded that the vibration was caused by the bottom rubber seal and the lip configuration.

Contingency Plan



Tainter Gate Lip Designs