Lifting a Steel Pan Roof

Presented by: **Warren L. Hall**

A. R. Watson, Inc.

Tank

- 100 ft diameter by 48 ft high cone roof tank
- Service: Crude Oil
- Tank removed from service for cleaning and inspection

Situation

- Contractor found roof was on low legs with less than 3 ft of clearance
- Excessive sludge also present in the tank
- Two door sheets were cut into the tank shell for access to the roof.
- Contractor attempted to jack the roof
  - Due to roof flexibility, the process would be very slow
  - Prolonged exposure of workers to sludge

Plan

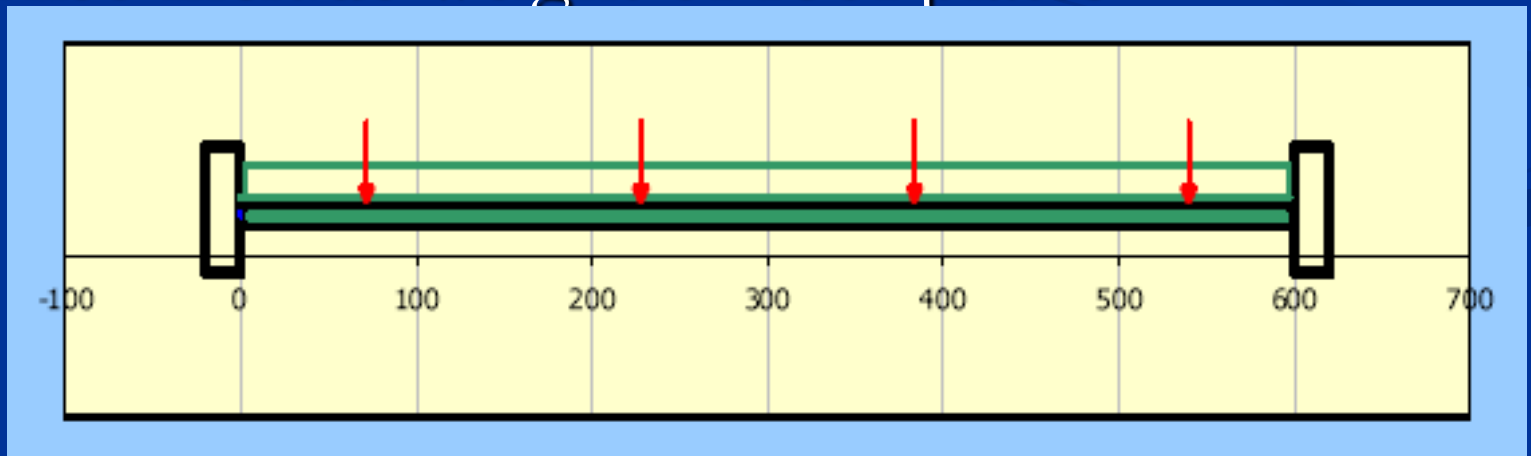
- A. R. Watson was contacted to assist the contractor in a plan to move forward.
- Watson considered many options and ultimately decided to lift the roof using a cable system suspended from the tank fixed roof
- The floating roof is a 100 ft diameter steel pan roof
  - Weight – approximately 60,000 lbs
  - 48 legs arranged in 4 radial rows

Engineering

- The roof was designed to support a load of 25 psf
- The IFR has a weight of approximately 10 psf
- Run a cable from each leg to the roof where it will then be run to a series of come-along to lift the roof

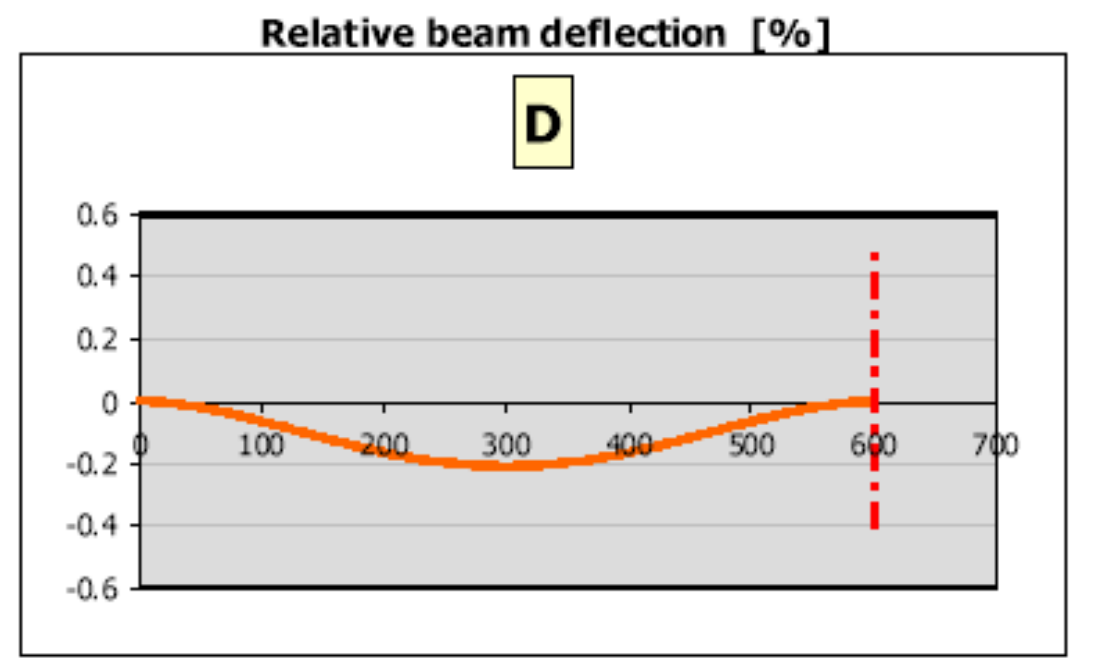
Engineering

- Rafters are W12 x 16 I-Breams 50 ft long – only a center column.
- The rafters and structure was analyzed assuming loads are point loads along each rafter corresponding to leg location.
- Also include weight of roof plates



Engineering

- Found maximum deflection of a rafter was 0.207%



Cables

- ½” galvanized steel
- Working load of 6,000 lbs
- ½” Thimble
- 3 cable clamps with a torque of 68 ft-lbs

Execution

- Cable locations were identified on the roof.
- Pipes located such that the cable loads were distributed over two to three rafters for additional safety.

Execution

- Cables run to the shell and attached to a come-along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Execution

- Once cabling completed – the roof was leveled

And The Roof Lifted

06/20/2007


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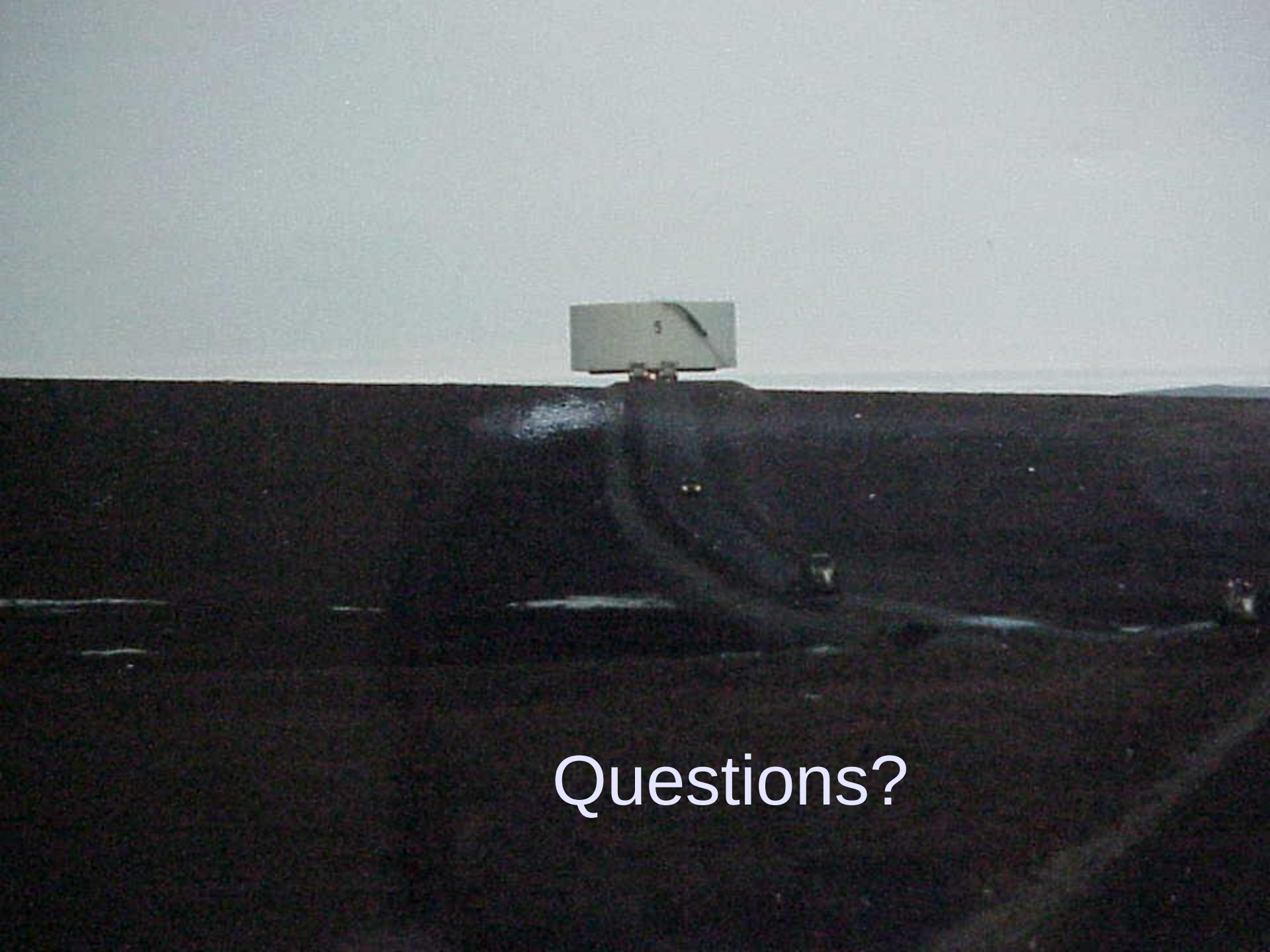
Conclusions

- Roof was lifted in 2 hours after cabling completed.
- The cable lift system was successful for this type of floating roof.
- Cable support of a steel floating roof is not practical as most of the roof strength is required to support the floating roof and little left for other loads.


Questions?