

Belt #1 Repairs

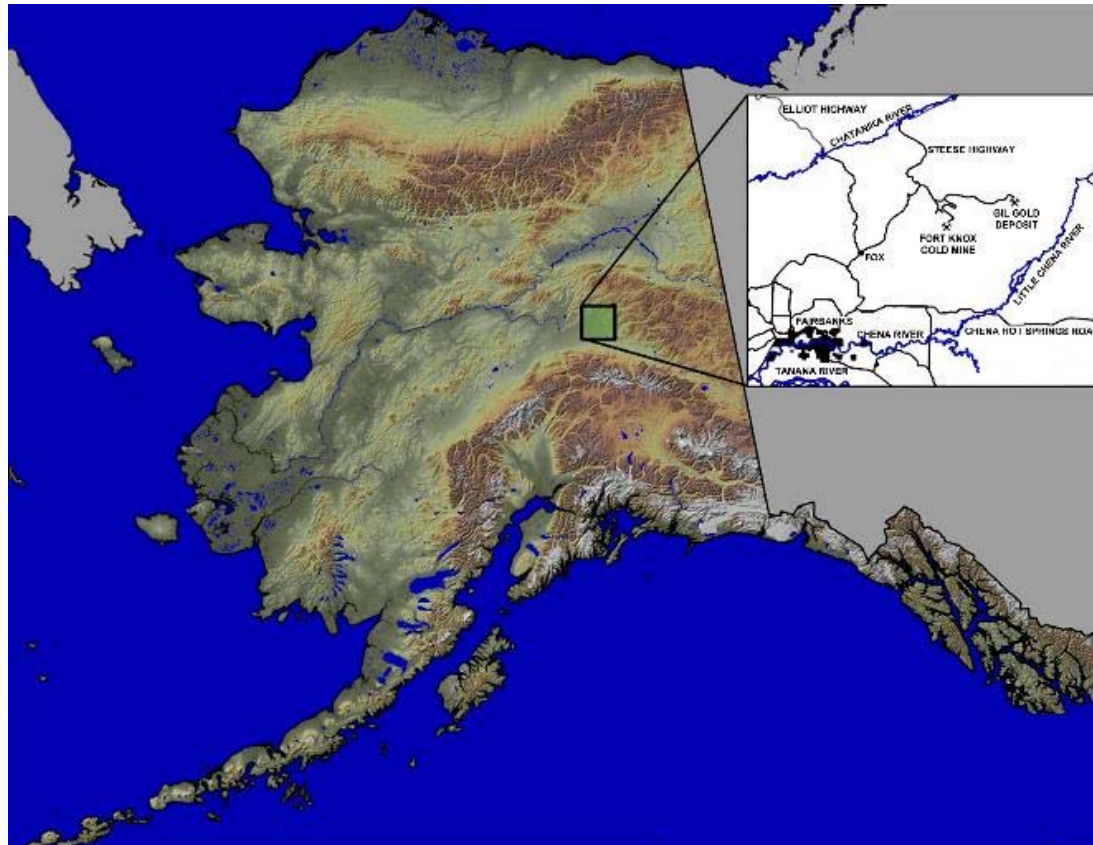
Fort Knox Mine – Alaska



KINROSS

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Mine Location



Ft. Knox Facts

- 20 Years in Operation
- 400,000 oz./year (1100 oz./day)
 - \$1.4 million/day
- 7,000,000 oz.s in 2016
- 0.4 g/ton Ore Quality
- 70,000 ton/ day Ore Processing
- Multiple Means of Ore Processing
 - Low Grade – Heap Leach
 - High Grade - Mill



Conveyor Plan



Conveyor Elevation



Conveyor Alignment



Initial Site Observation – 08/2013



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Support Design Considerations

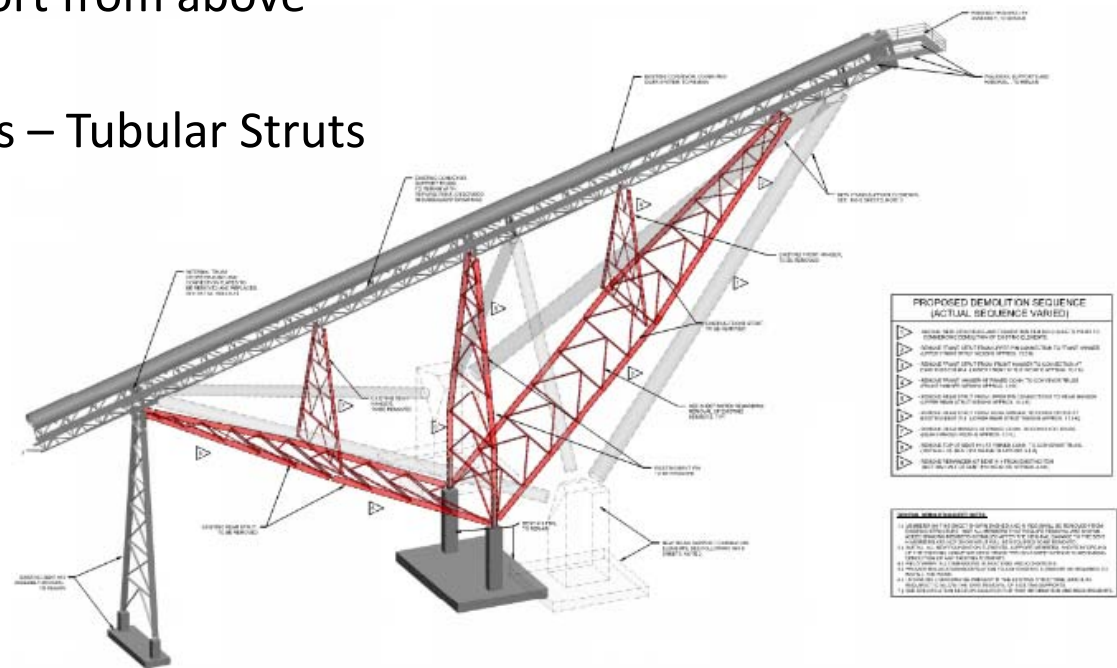
- Downtime
- Ease of installation
- Functionality
- Downtime
- Cost
- Toughness
- DOWNTIME



Big Picture...

- Support Configuration

- Replace Truss and Supports with similar design
- Build next to and over – Support from above
- Bury the whole thing
- Add new Supports Below Truss – Tubular Struts



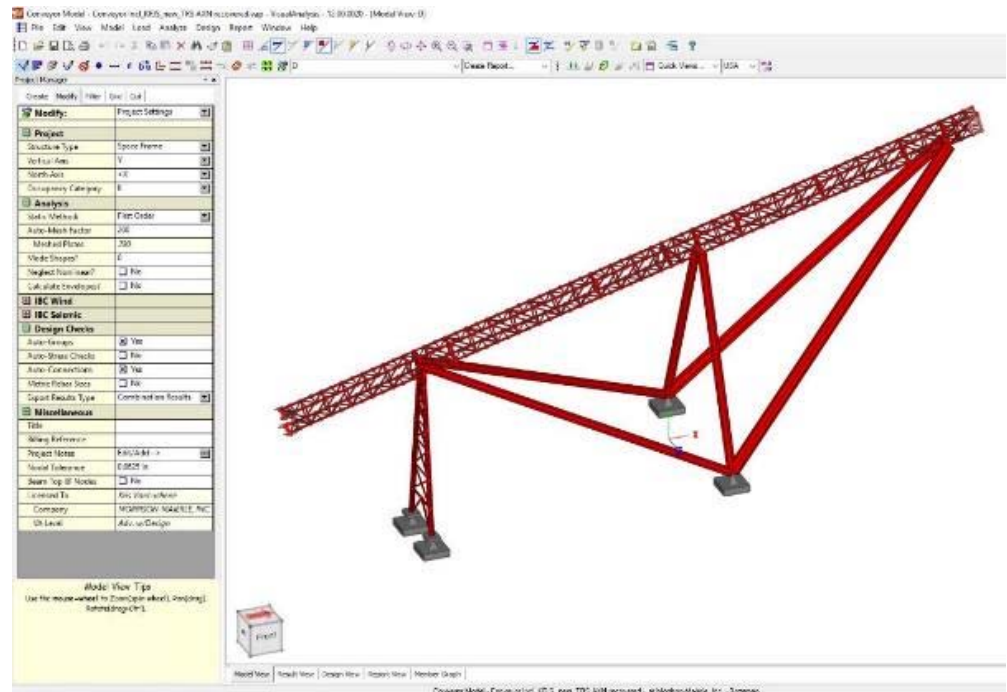
The Details...

- Unique Loading Concerns
- Truss Reinforcing for New Support Points
- Complicated Geometry
- Truss Misalignment
- Load Transfer – Existing to New
- Downtime
 - Existing Truss to Remain in Place
 - Installation around Existing
 - Few New Elements
 - Maximum Field Adjustment
- Avoid Future “D-10” Earthquakes



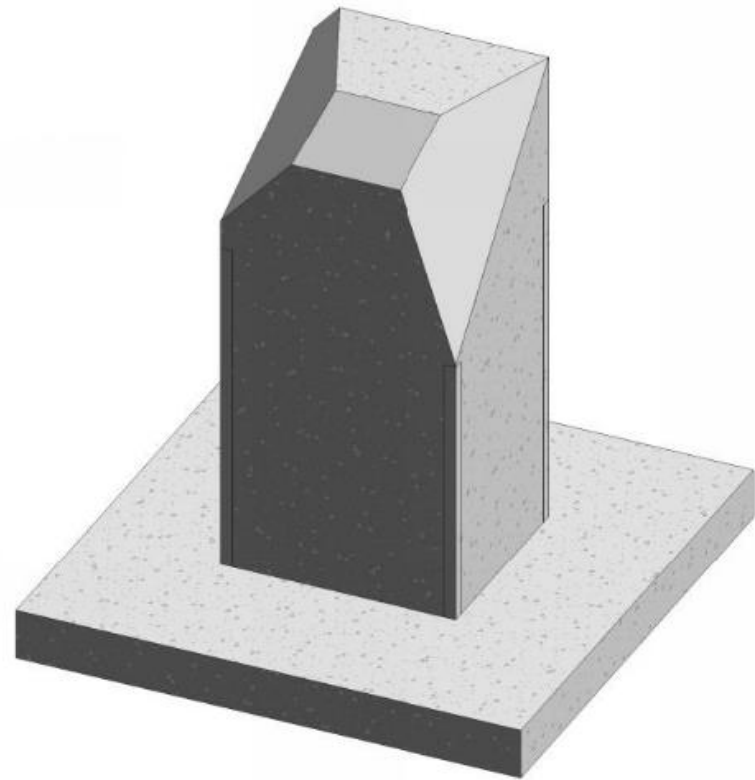
Design

- 20.5 k Head Pulley and Enclosure
- Belt Tension Loading (up to 200 k)
- Long. Support of System Back to Drive Tower
- 1'-6" Misalignment at Head Pulley
- Pattern Loading of Conveyed Material
- 209 Load Cases



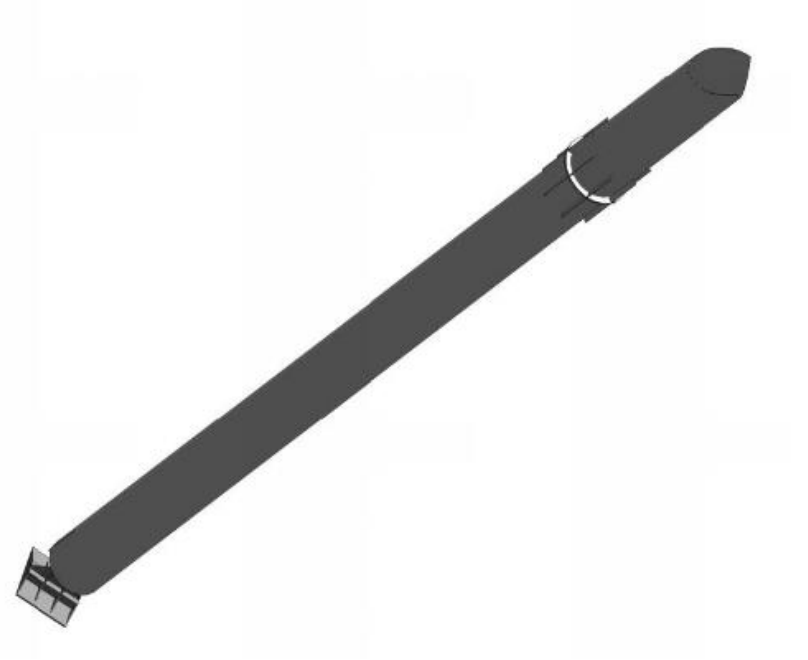
Foundations

- 30' x 30' x 3' Spread Footings
- 14' x 12' x 29' Tall Piers
 - Geometry set by connecting supports.
- Rock / Eqpt. Protection
 - Large Size
 - Additional Clear
 - Additional Tie Reinforcement
 - Protection Plates
 - Cast In Angles

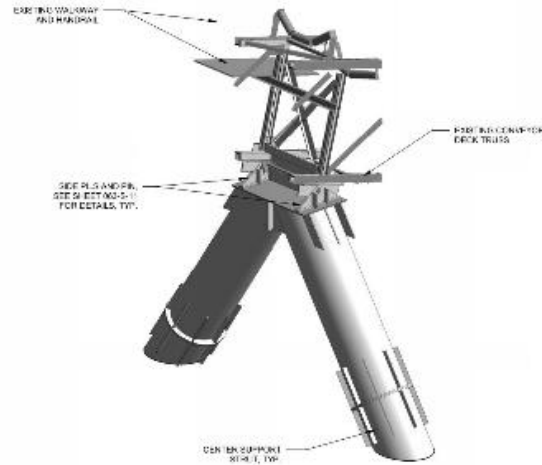
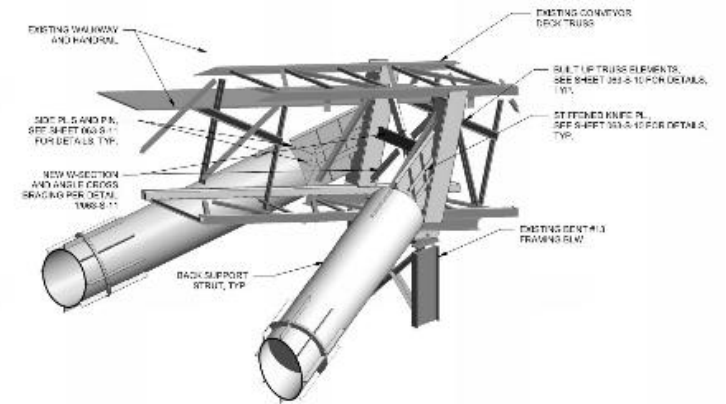
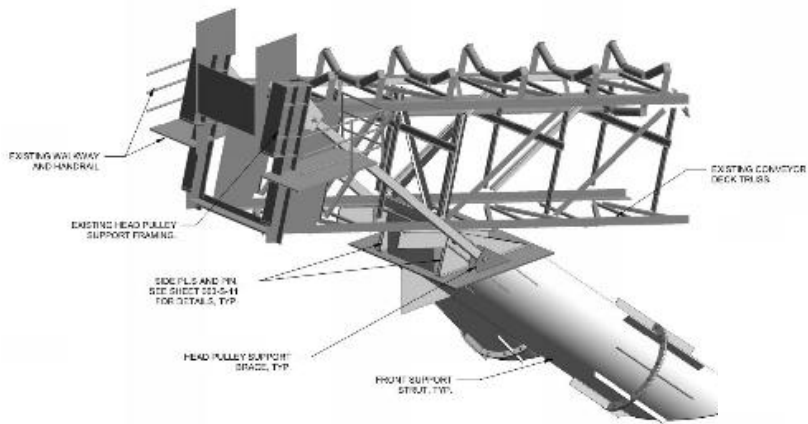


Struts

- Middle and Rear Struts – 42” Dia. Tubes
 - Up to 130 ft. Long
- Front Struts – 60” Dia. Tubes
 - Around 145 ft. Long
- Pinned Base and Flanged, Bolted Top

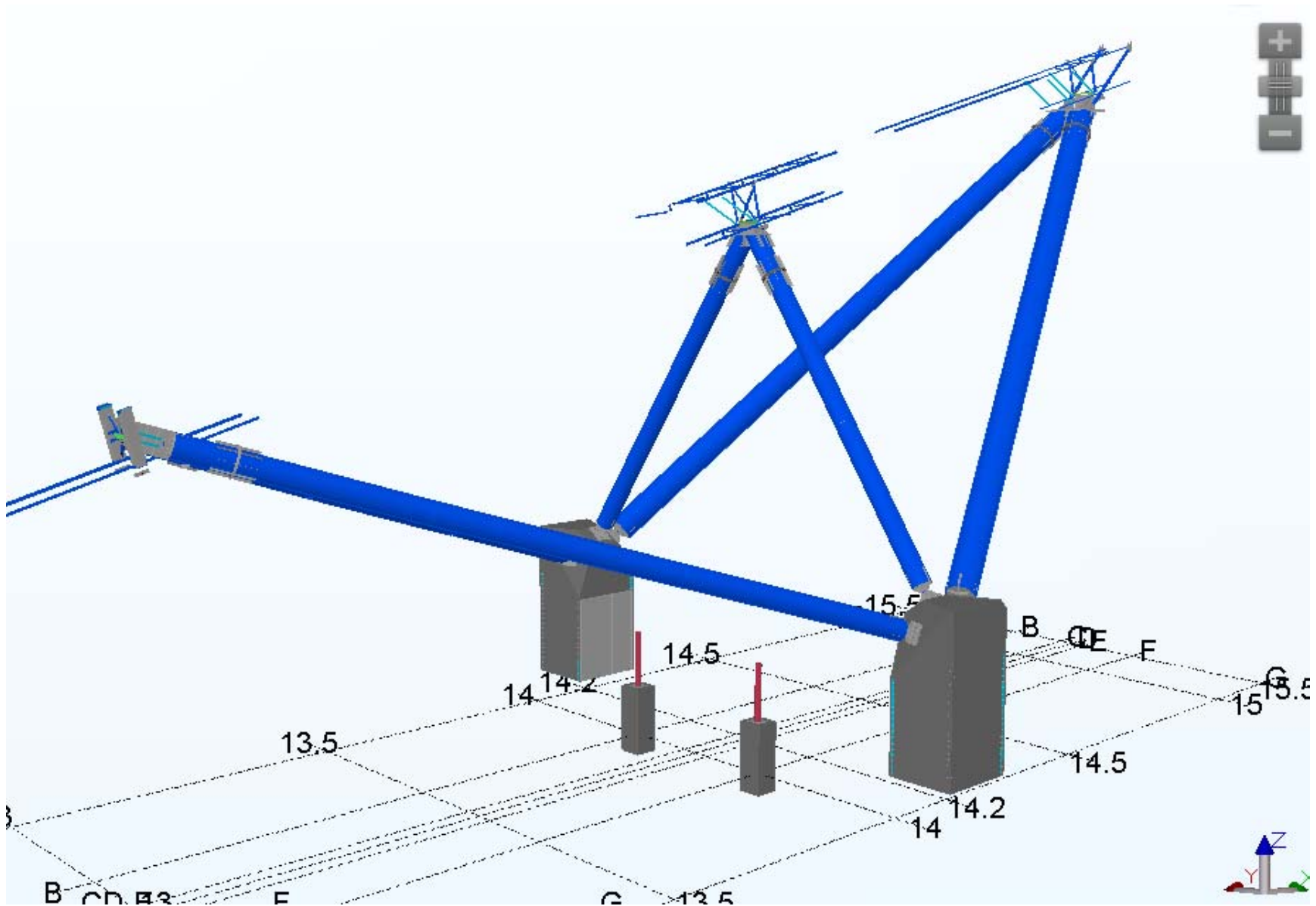


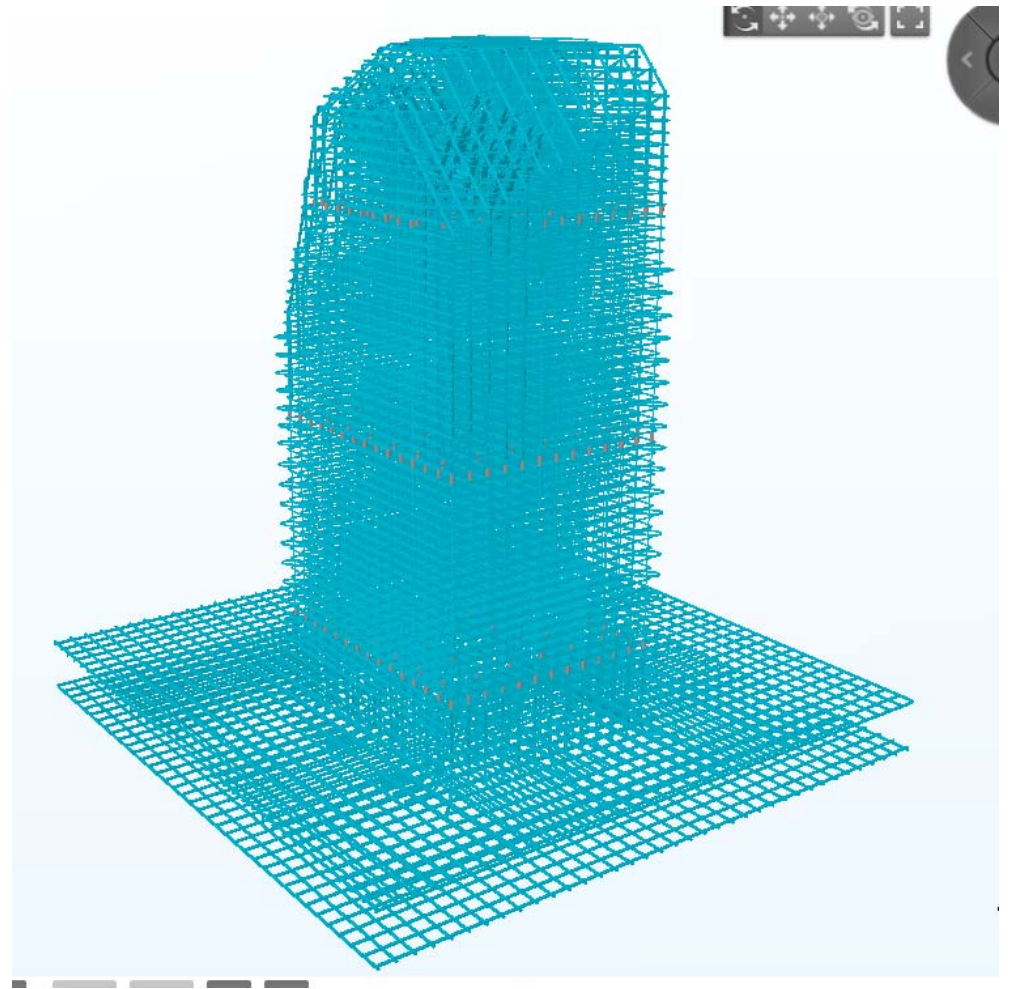
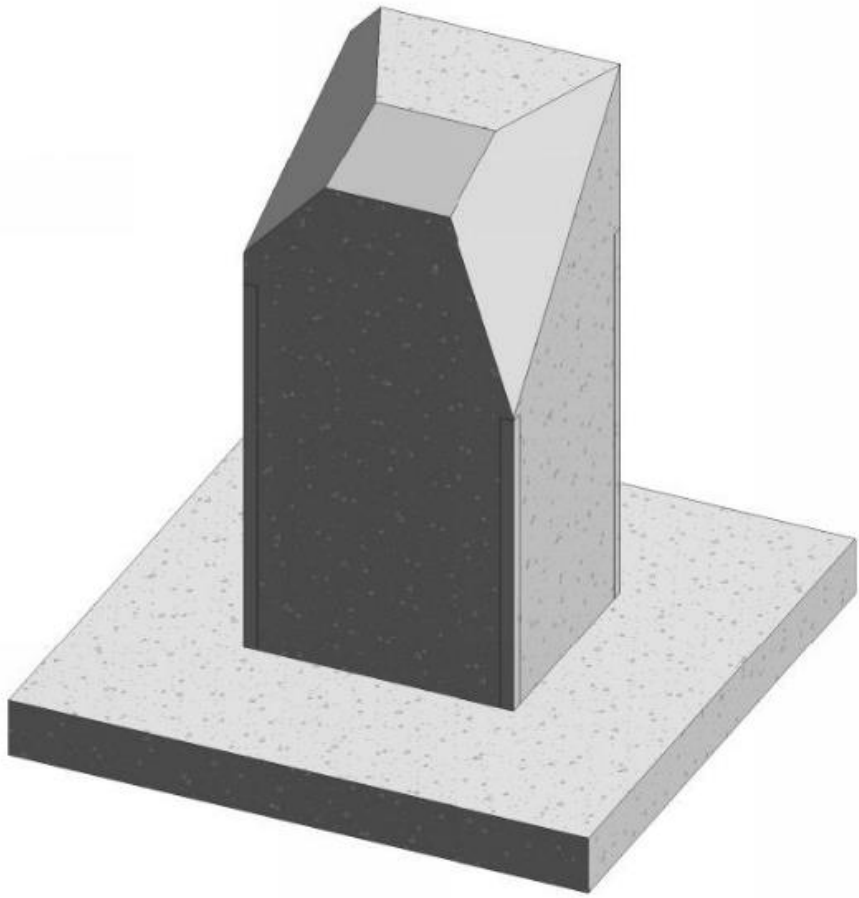
Strut to Truss Connections

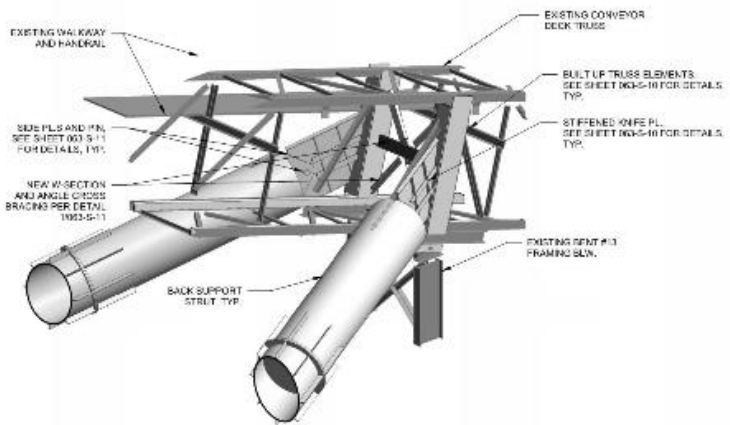
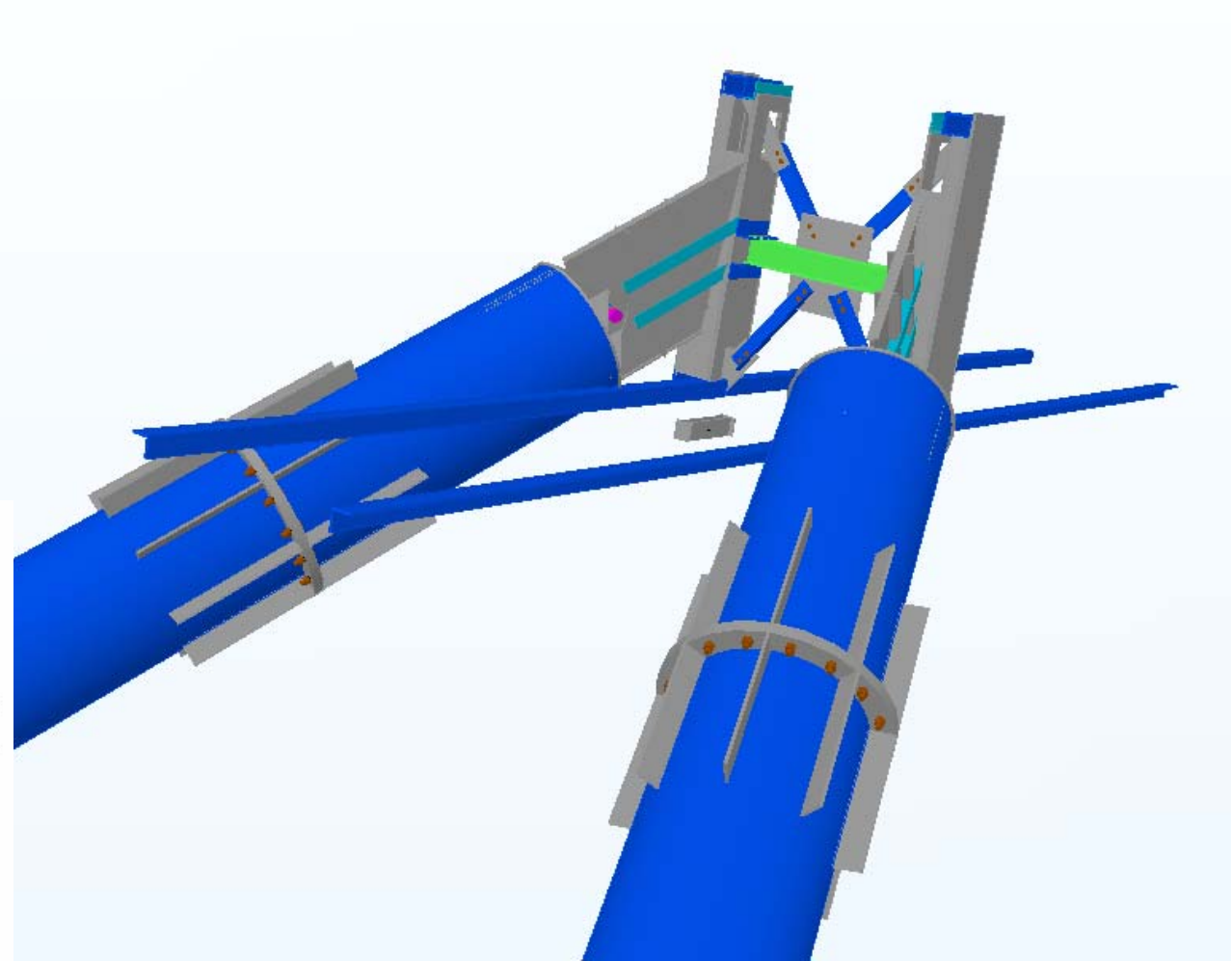


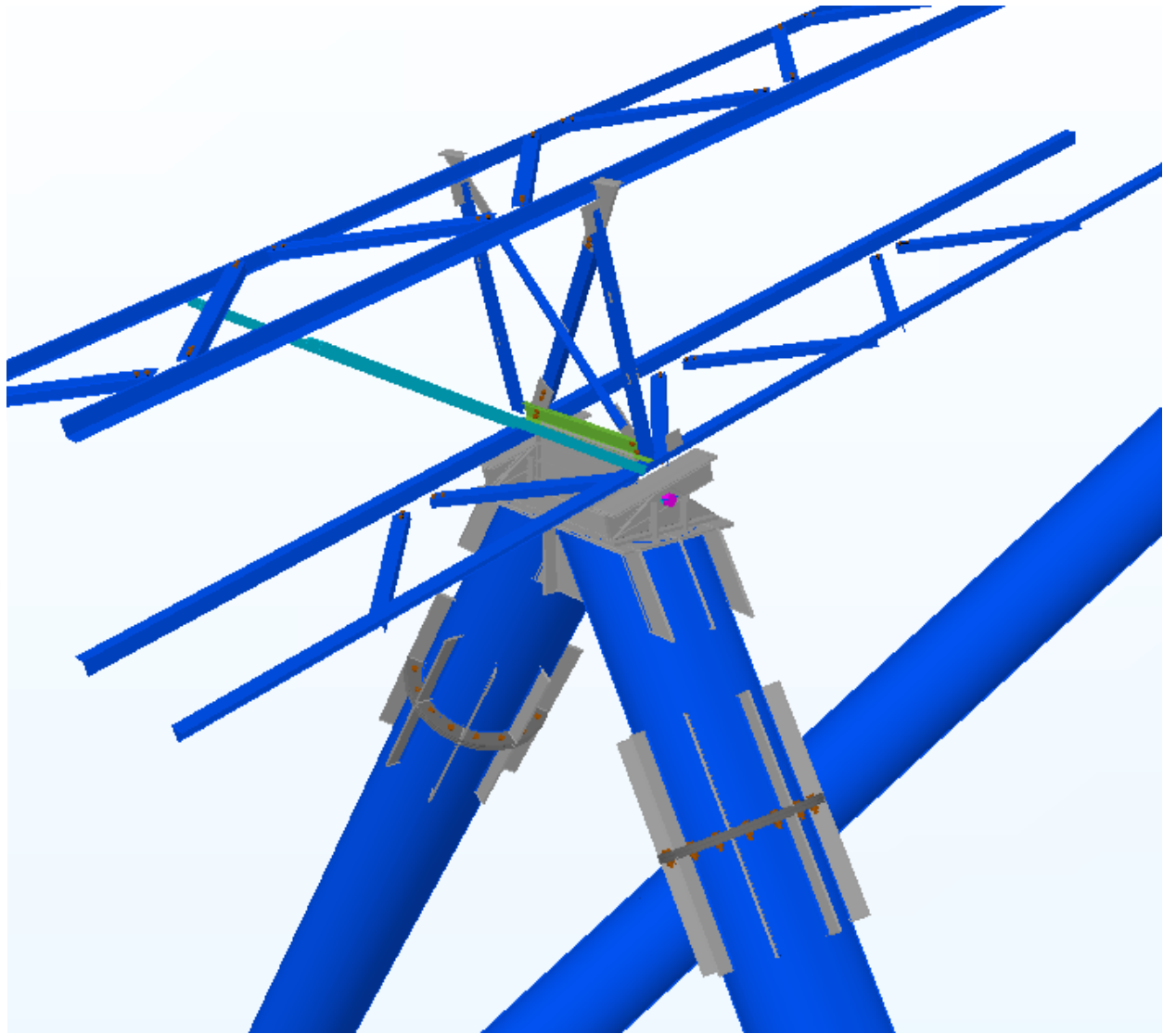
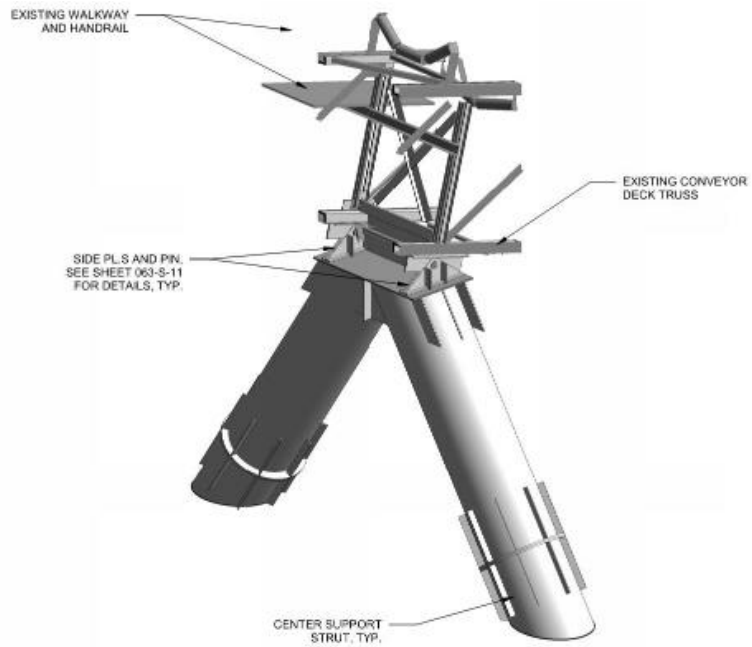
Construction!!!

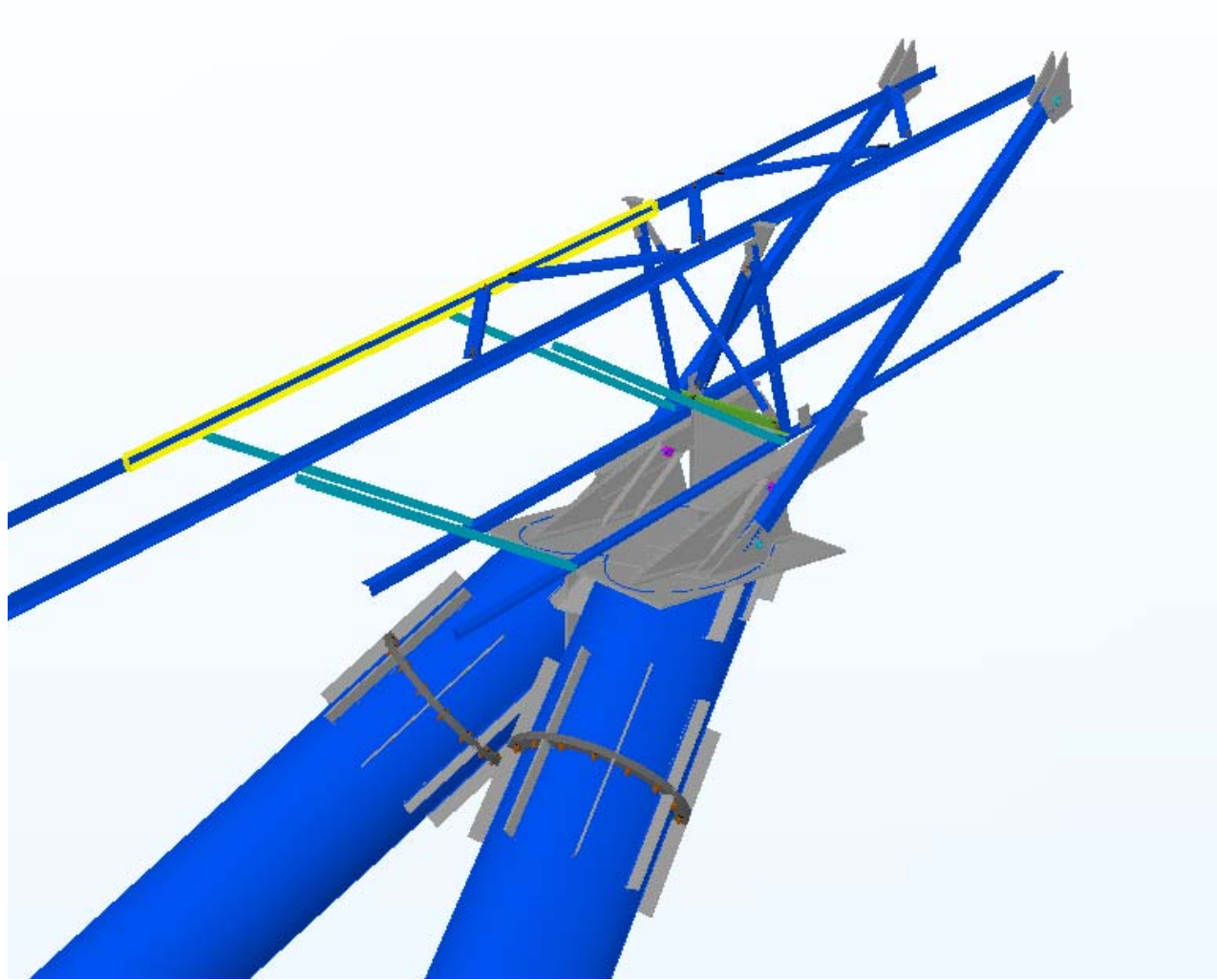
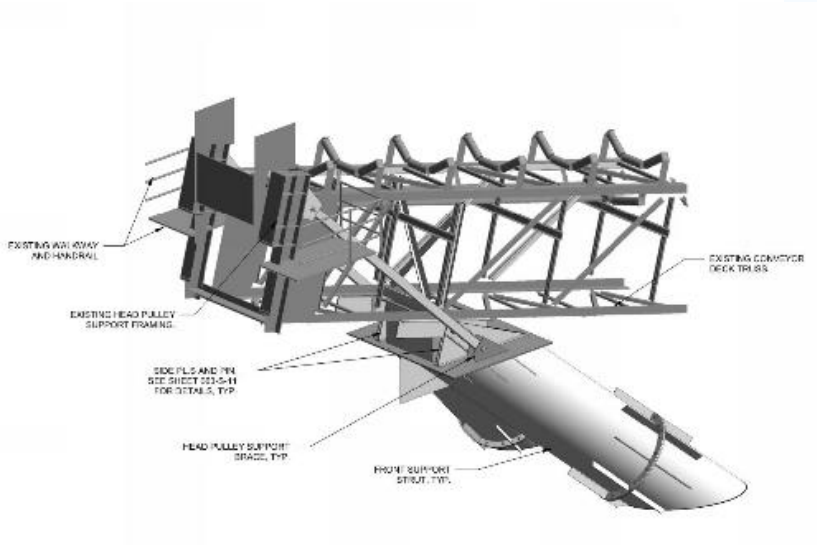
- Contractor Selection (2 bidders)
- Schedule
 - Complete during 2014 construction season (June – September)
 - ~ 2 months foundations, ~ 2 months steel
 - \$\$\$\$ - 2 conveyor shutdowns (3-day – truss reinforcement, 10-day – support structure installation)
- Observation/Inspection
 - Continuous MMI presence (minimize risk)
- Shop Drawings – Tekla BIMsight
 - More of a verification than a review (minimize risk)











Foundations



Foundations



Foundations

- Mass concreting
 - Initially intended to cool internal temp.
 - In the end, raised external temp. and monitored ΔT



Foundations



Conveyor Shutdown 1 (3-days)

- 12hr day shifts
- Truss cleaning
- Truss reinforcement
- Bolt and conn. insp.



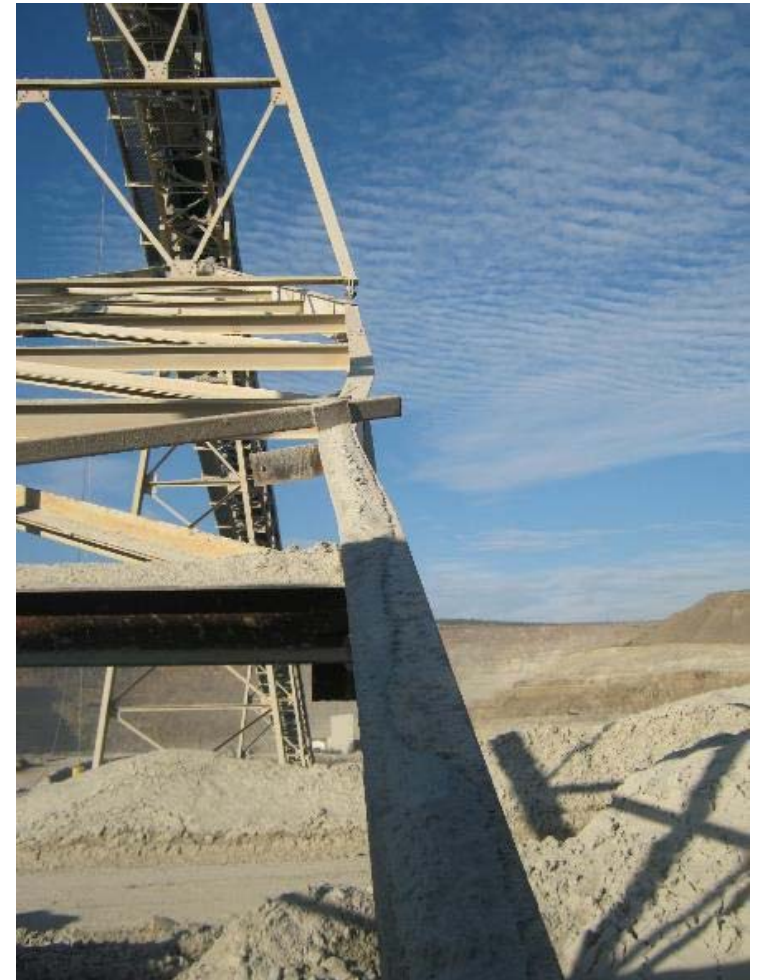
The Big Shutdown (10 days)

- 2 – 12hr shifts
- 3 MMI personnel (2-Engineers, 1-RPR)
 - On the fly means and methods analysis
 - Concurrent mine maintenance work
- 2 CWIs



Post Down Capacity

- Additional weight added to structure
- Structurally deficient supports not repaired
- Complete structural analysis not possible
 - Members out of alignment
 - Unidentified supports
 - Deficient welds



Post Down Capacity

- Use Historical Loading Data to Limit future Loads
- Ft. Knox provided info. on past snow loading
 - Observed Snow Depths
- Morrison Maierle Researched Past Wind Loading
 - Historical Data from nearby weather stations
- Produced Tonnage Matrix

Operating Tonnage During Wind and Snow Events (Tons / Hour):

		Gust Wind Speed (MPH)					
		0	5	10	15	20	30
Snow Depth (In.)	0	3000	3000	2783	2379	1469	Cannot Run
	2	3000	3000	2422	2018	1122	Cannot Run
	4	2608	2579	2076	1657	761	Cannot Run
	8	1738	1710	1353	949	39	Cannot Run
	12	869	841	577	204	Cannot Run	Cannot Run

A New Team

- 2 additional shutdowns
 - Apr. & Sept. 2015
- Day Shifts
- 1 – MMI Engineer

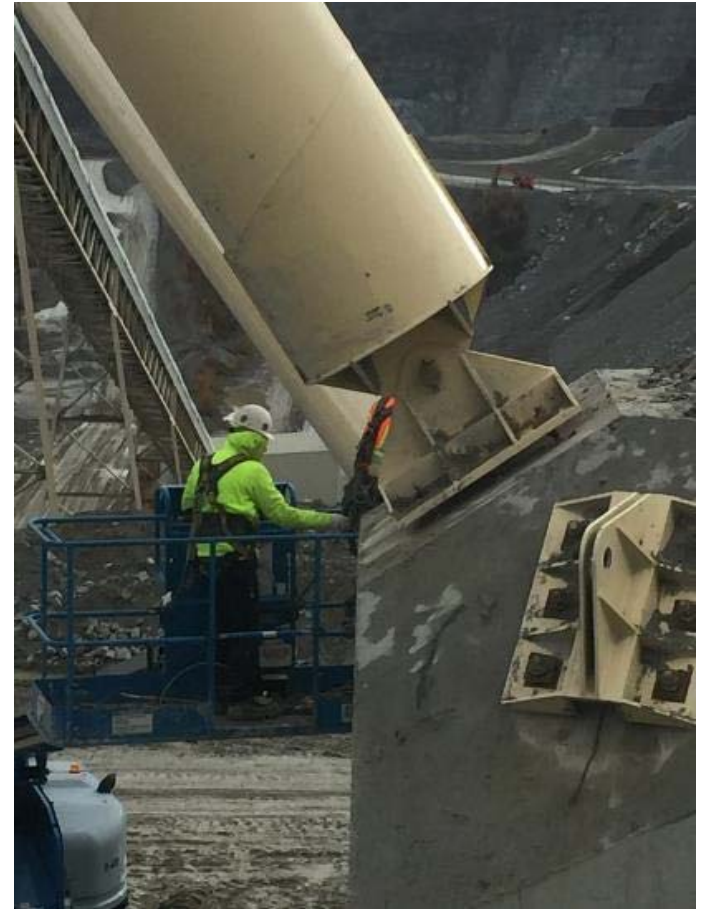


Fit-up – Apr. 2015



Construction Team Coordination

- Erection Sequencing
 - Head Pulley Removal
- Pre-Loading New Structure
 - Minimize “Unsprung” Forces in Existing Members
 - Enerpac Jacks Below Strut Base Plates
 - Pre-Determined Jacking Forces



Final Installation – Sept. 2015



Final Installation – Sept. 2015



Final Installation – Sept. 2015



Final Installation – Sept. 2015



Completion!



Questions?

