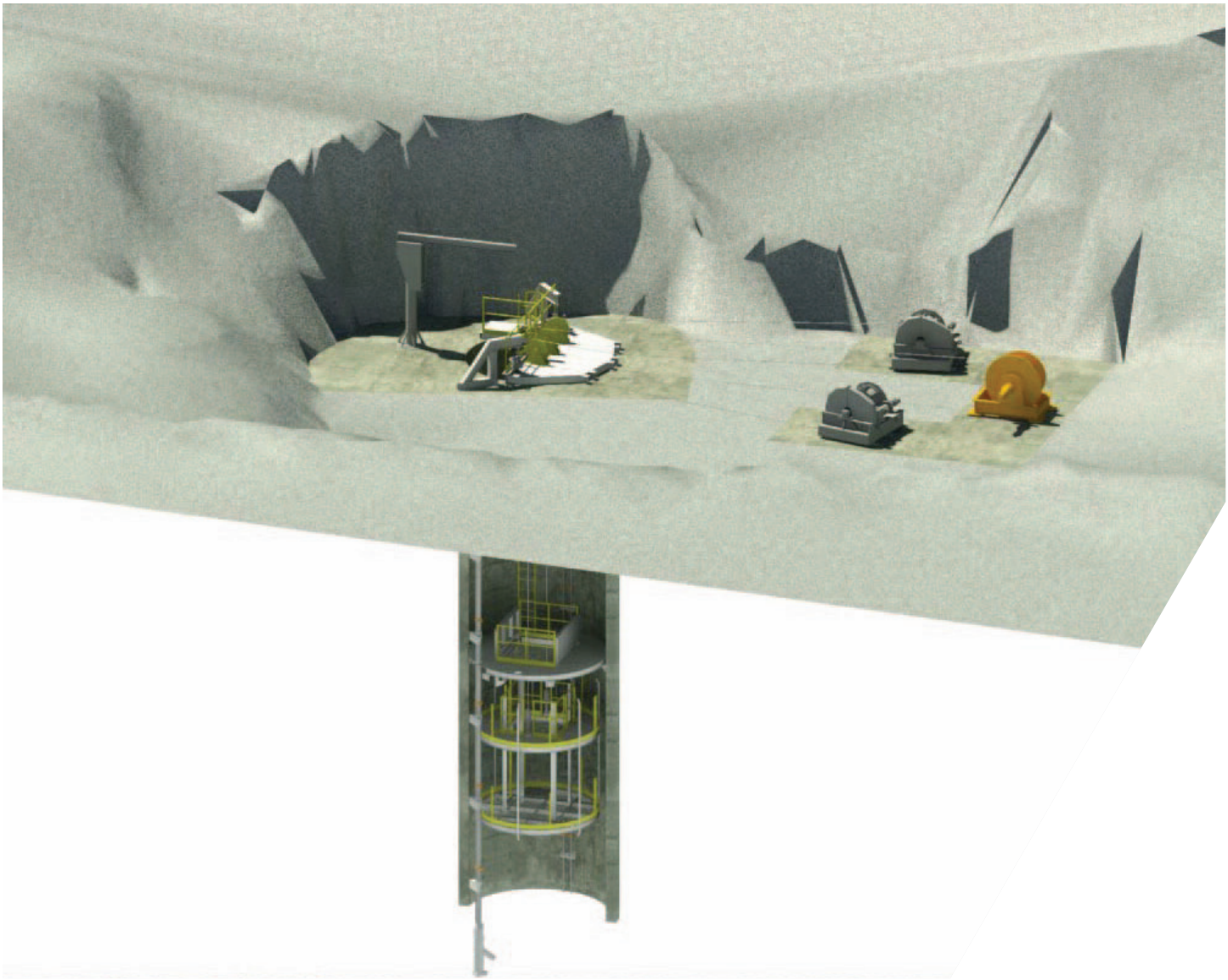
CUSTOMER STORY



DESIGNING SAFE MINING STRUCTURES

ALTAIR S-FRAME HELPS SIMULATE MINING GALLOWAYS FOR COMPLEX LOADING

About the Customer

Dymaco, a professional engineering and consulting firm in Thunder Bay, Canada, provides engineering services to clients engaged in resource-based industrial and commercial projects across Canada and around the world. Their extensive experience in heavy industries such as mining, fixed plant operations, material handling, process infrastructure, power generation, and the pulp and paper sector helps them deliver structural engineering solutions for diverse projects at various stages of development.

> Without Altair S-FRAME, it would have been impossible to design this structure due to the complex load path the Galloway was subject to.
>
> Dylan Gerow,
> Principal, DYMACO

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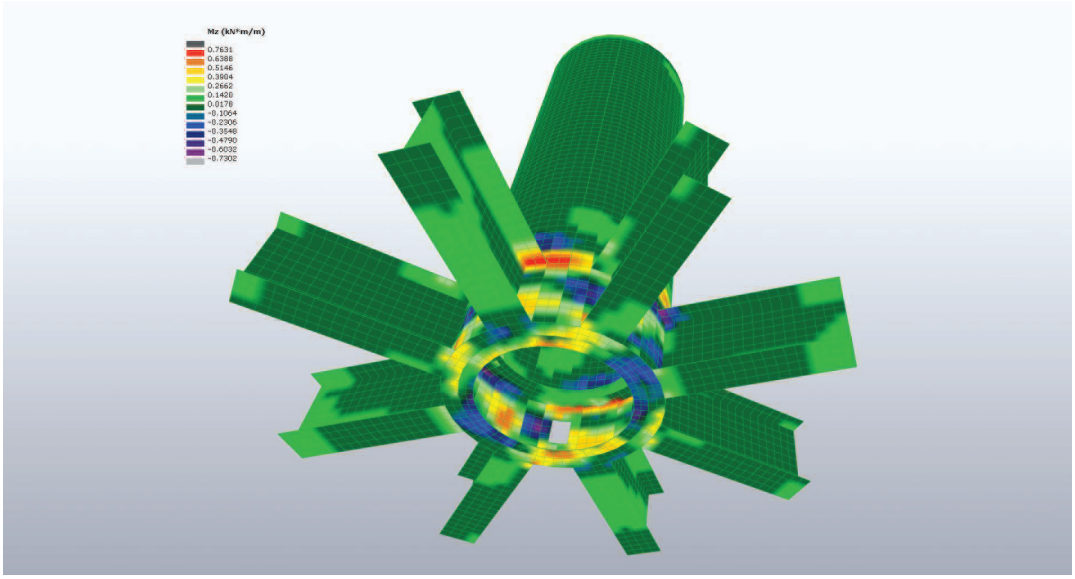

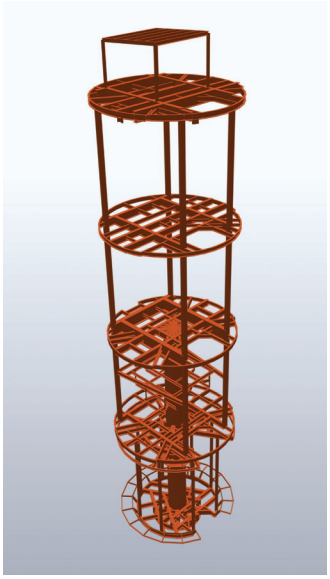

LEFT: Analysis of cantilevered beams and stiffeners on bottom ring to prevent plastic deformation of the central pipe.
RIGHT: Raise and Slash Sinking Galloway model.

Their Challenge

The Galloway is an 80-foot-tall, 94-ton structure suspended inside a mineshaft that moves vertically to provide a stable environment for miners to complete shaft sinking. It also supports the mine shaft's concrete lining and drilling/blasting operations.

The preselected hoists and wire ropes used to suspend the Galloway within the mineshaft governed the Galloway's maximum allowable weight. This weight requirement presented challenges for addressing the high load factors specified by the Australian design code and providing the client's requested functionality. The rotating bottom deck housed three large articulating drills, which caused eccentric loading on the system and large torsional loads on the Galloway's center pipe. This center pipe supported the Galloway's bottom deck and allowed people and equipment access through large openings. Alongside the considerable articulating drill forces, Dymaco needed to consider the loads induced by the concrete hoppers, concrete distribution hoses, shotcrete hopper, shotcrete sprayer, hydraulic and pneumatic cylinders, and jacks.

Our Solution

Dymaco used Altair® S-FRAME® for the structural analysis and Altair® S-STEEL™ for their steel design, adhering to Australian steel section standards and incorporating load factors based on Australian mining codes. Multiple analysis models were required to evaluate the system as a whole and to examine connections, lifting lugs, stiffeners, and more. In particular, Dymaco needed to calculate stiffener sizes and locations in the central pipe's openings and the lower deck's steel supporting ring to prevent plastic deformation.

S-FRAME's flexible meshing capabilities helped produce the necessary finite element analysis (FEA) models to simulate the load paths and evaluate the Galloway's stresses and forces. S-FRAME automatically transforms 1D members and their loads into 3D meshed shell element models with equivalent loads applied to quickly generate models that demand a detailed FEA analysis. S-STEEL enabled a seamless, iterative analysis and steel design workflow for the design optimization. Dymaco's engineering expertise, coupled with S-FRAME's flexibility, empowered the engineers to account for complex loading conditions in-house without external technical support.

Results

S-FRAME and S-STEEL provided the tools needed to model and analyze the Galloway structure subject to eccentric loading, torsion, vibration, and gravity loads. The S-FRAME structural models, developed with Dymaco's engineering expertise, made it possible to simulate the applied loads and complex load paths exerted on the central supporting access pipe, which was suspended from the third deck, guided on the fourth, and subject to torsion and lateral loads at the Galloway bottom deck.

To learn more, please visit **altair.com/s-frame**