GUROBI OPTIMIZATION | KVÆRNER™

Kvaerner: Scaffolding Design Optimization

Case Study

Learn how the Gurobi Optimizer enables Kvaerner – a leading global provider of engineering, procurement, and construction services for the oil and gas and renewable energy industries – to optimize the process of generating 3D scaffolding models.

The Challenge: Streamlining the Scaffolding Modeling Process

Engineering, procurement, and construction (EPC) companies – who plan and execute complex, large-scale infrastructure projects – operate in a highly competitive and challenging business landscape.

In order to deliver projects of the highest quality – on time and within budget – for customers and to win new contracts, EPC companies must be able to maximize their operational efficiency.

Kvaerner – a leading global provider of EPC services for the oil and gas and renewable energy industries, which specializes in delivering advanced offshore platforms, onshore plants, floating production units (FPSOs), and renewable energy solutions – is constantly looking for opportunities to improve the efficiency of its project planning and execution process.

One technical function that was identified as an area for possible improvement is scaffolding modeling. The process of designing and building a scaffolding model – which is carried out by specialized engineers – is a critical part of Kvaerner's entire project planning and execution framework.

As a typical project requires several hundred tons of scaffolding, having a scaffolding model before construction can significantly reduce construction times and costs. The actual process of creating a scaffolding model, however, can be a complicated and time-consuming endeavor.

Around two years ago, Kvaerner looked at its scaffolding modeling process and saw that there was room for improvement. Kvaerner's digitalization program was enlisted to implement an automated, 3D scaffolding modeling tool to boost the efficiency of the process and the quality of the scaffolding models.

> *"With mathematical optimization, we are able to create better scaffolding models, faster – and this boosts our operational efficiency and ultimately reduces construction times and project costs for our customers.*
>
> Sigmund Mongstad Hope, the Head of Technology & Digitalization at Kvaerner

This automated, 3D scaffolding modeling tool gives scaffolding engineers a detailed drawing showing exactly how the finished scaffolding will look and enables them to precisely calculate:

- The design of the scaffolding,
- The weight of the scaffolding,
- The exact list of parts they will need to build it,
- The amount of time it will take to build it, and
- The amount of time it will take to demolish it after the project is done.

But Kvaerner's Technology & Digitalization team did not merely want to be able to create just any 3D scaffolding model – they wanted to be able to rapidly and automatically generate an optimal one. To achieve this, they decided to use mathematical optimization.

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The Solution: Automated, Optimal Scaffolding Design

A key component of Kvaerner's automated, 3D scaffolding modeling tool is a mathematical optimization application, which is powered by the Gurobi Optimizer.

This application enables Kvaerner's scaffolding engineers to easily and effectively design optimal scaffolding models, which are then used to guide the construction of the actual scaffolding for the offshore platform, onshore process plant, or other structure.

With mathematical optimization, Kvaerner's scaffolding engineers can:

- Use all relevant data on the design, weight, time requirements, and parts requirements of the scaffolding that will be built.
- Specify the volume, type, and location of scaffolding required at each phase of a given project, the locations where workers will need access, and the location of the obstructions where the scaffolding cannot be built.
- Rapidly generate optimal scaffolding models that take into account access points and obstructions.
- Dynamically revise and redesign the scaffolding models as business conditions and requirements change.

This mathematical optimization application – which is embedded in Kvaerner's automated, 3D scaffolding modeling tool – gives the company's scaffolding engineers the capability to automatically generate optimal scaffolding models that improve access and minimize construction times and costs.

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Results: Improved Operational Efficiency and Model Quality

Kvaerner's addition of a mathematical optimization application in the company's automated, 3D scaffolding modeling tool has delivered significant business benefits including:

- **Improved model quality:** With mathematical optimization, Kvaerner can design optimal scaffolding models that maximize access, minimize obstructions, and take into account changing project requirements and timelines.
- **Reduced construction times and costs:** Having an optimal scaffolding model enables Kvaerner to ultimately reduce the construction times of the scaffolding – and minimize the number of man-hours required to complete projects.
- **Better capacity utilization:** By using mathematical optimization to rapidly and automatically generate optimal scaffolding models, Kvaerner's engineers are able to decrease the amount of time they spend on 3D scaffolding modeling, and increase the amount of time they devote to high-value tasks such as scenario analysis and quality assurance.
- **Improved operational efficiency:** With mathematical optimization, Kvaerner can improve the efficiency of its workforce as it can increase the amount of scaffolding modeled without any increase in the resources allocated towards performing that task.

Sigmund Mongstad Hope, the Head of Technology & Digitalization at Kvaerner, said: "With the implementation of the mathematical optimization application in our automated 3D scaffolding modeling tool, we have been able to dramatically improve the quality of our 3D scaffolding designs and expand our capacity to model scaffolding. With mathematical optimization, we are able to create better scaffolding models, faster – and this boosts our operational efficiency and ultimately reduces construction times and project costs for our customers."

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Why Gurobi?

After a thorough selection process during which Kvaerner's Technology & Digitalization team tested various commercial mathematical optimization solvers, the Gurobi Optimizer emerged as the solver of choice. The reason for the selection of the Gurobi Optimizer is simple: Speed.

"With the addition of the mathematical optimization application – powered by the Gurobi Optimizer – to our automated 3D scaffolding design tool, we have been able to significantly improve the efficiency and effectiveness of our scaffolding modeling process," Mongstad Hope added.

> *Speed was the primary factor in our decision to choose the Gurobi Optimizer over the competition. It is critical that our engineers have a tool that can rapidly generate optimal 3D scaffolding models – and the Gurobi Optimizer far outperformed the other commercial solvers in terms of speed.*

Sigmund Mongstad Hope, the Head of Technology & Digitalization at Kvaerner