Industrial Solutions

Mine Planning

Optimizing your Mining Operations.
thyssenkrupp’s Mine Planning Department offers a number of services for mining and material-handling projects – from pit to port. Mine Planning started off as a support group to perform projects, prepare requirement specifications for equipment design and system operating principles, and evaluate the feasibility of systems. Nowadays, Mine Planning offers consulting services for multiple topics throughout the mine planning cycle, as well as carrying out feasibility studies or supporting such studies. We utilize a variety of externally and in-house developed solutions for tasks ranging from soil and rock testing to mine design, equipment dimensioning, mine scheduling and delivery of cost estimates, financial modeling, and sensitivity or risk analysis.

Our mine planners work directly with the customer’s project team to ensure close cooperation and maximize success. Engaging thyssenkrupp for mine planning tasks brings the services of skilled plant engineers and highly experienced mining professionals into projects. We are especially strong in fields where continuous mining equipment is in use. Thanks to thyssenkrupp Mining Technologies’ extensive project experience we have access to a large database of equipment designs and mining concepts. This enables us to estimate prices quickly and evaluate the applicability of integrated mining system concepts.

Detailed equipment specifications can be developed to a stage that allows immediate tendering and supply of the equipment specified. Our service portfolio also covers supplying continuous mining equipment as a partner for EP or EPC contract models and performing all the project management tasks related to the engineering, supply, delivery, installation, and commissioning of the equipment.

We advise our customers throughout the mine planning process.
Mine planning services – for your benefit

Every project is unique and requires a different level of detail that mainly depends on the work already done. For that reason, each study follows a general methodology, or parts of it, as a standalone to enable a trade-off through comparing discontinuous truck and shovel systems with various continuous mining systems.

Requirement assessment
Every study requires a kick-off meeting, either remotely or at the project site, in order to base the project on sound foundations. The aim of the meeting is to collect and verify basic data, and confirm the scope of work and KPIs to be generated. If data is unavailable, equipment-specific material tests will be performed using hardness and abrasiveness evaluation techniques developed in-house.

System concept development
The concept development phase investigates the general possibilities to operate a continuous mining system. Continuous systems use conveyors as the main means of transport. The use of such systems can lead to trucks being partially or entirely substituted. The main conveying systems available are in-pit overland conveyors, cross-pit conveying systems, mobile bridges/grasshopper conveyors, high-angle conveyors, and ex-pit.

Optimization
As continuous mining systems are less flexible, the mine design must be tailored to the requirements of the system. This means that an appropriate and proven methodology for truck and shovel mining is inappropriate for continuous mining systems. To overcome this challenge we established close working relationships with our customers and developed our own methodologies for planning continuous mining systems.

Equipment selection and dimensioning
As optimal equipment selection is essential for efficient mining, we have developed an integrated toolkit for equipment selection and dimensioning to deliver the best possible system. Additionally, based on our expertise in plant engineering and mine planning, thyssenkrupp can optimize the dimensioning of equipment by tailoring the design of available equipment to specific mining conditions and customer needs.

Financial modeling
A techno-economic evaluation summarizes every study and relevant KPIs are evaluated. However, the system evaluation inevitably comes down to CAPEX and OPEX estimates by means of one of several discounted-cash-flow methods. Sensitivity analyses are carried out as costs are likely to be estimates and the sensitivity of the system to individual variables affects the accuracy of these estimates and hence the overall result.

Mine scheduling
To some extent, continuous systems follow different constraints than discontinuous systems. For this reason and depending on the overall mine design, a modified mine schedule has to be developed.
After thyssenkrupp completed a feasibility study for a metal mine, the outcome was an optimized mining system employing different types of equipment, including a bucket wheel excavator, a semi-mobile and fully mobile crushing plant, as well as trucks and shovels for ore and waste transport to the crushers. The new mining system substantially reduced mining costs and increased project NPV by more than 20%.

**Case study**

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**Overburden system**

(above the ore horizon)

The first 120 m are excavated by a bucket wheel excavator (BWE) and a fully mobile crushing plant. As a standalone machine, the BWE does not require any additional equipment for excavation and loading. The mobile crusher requires a shovel. The overburden is divided into eight benches, each 15 m high. Every bench covers 30 m.

**Waste system**

(mainly inside the ore horizon)

All waste material below the overburden (or pre-stripe) is covered by the semi mobile IPCC system. The crushing plants are installed very close to the active faces so that truck shuttle distances are minimized and costs reduced. Additionally, the crushing plants can be relocated as the mine develops to depth.

**Dumping system**

The extraction systems are connected with the dumping system by a series of bench and ramp conveyors. A large spreader operates on the dump and is connected to a shiftable dump conveyor to dump all mined overburden and waste material.