THE ULTIMATE STRATEGIC MINE PLANNING CHECKLIST

A SIMPLE GUIDE TO THE 8 ESSENTIAL STEPS IN THE MINE PLANNING PROCESS

A BETTER WAY TO APPROACH MINE PLANNING

Developing a solid mine plan is key to the long-term success of a mining project. However it can be challenging to account for all the parameters that may affect a project throughout the life-of-mine and get every department on the same page. This is where the game-changing **3D**EXPERIENCE Platform from Dassault Systemes can make a huge impact.

A process flow checklist is a critical mine planning tool to help design a project that provides sustained value throughout the life-of-mine.

It's an effective way for in-house mine planners and external consultants to collate all the parameters that will be used in the mine planning process to perform a complete analysis of the mining value chain. It communicates the process and expectations to the different departments that contribute to it and ensures the process is rigorous and thorough, accounting for all possible factors that make or break a project.

By committing to the parameters and getting departments to sign off on them before starting work, mine planners can validate crucial information and set the project up for success right from the beginning.

It also helps your project meet the investment and sustainability criteria and reduces the risk of a negative return on investment. Above all, it demonstrates to investors that your operation is mature and ESG compliant and that you are dedicated to delivering value with a clearly defined strategic plan.

Combining this helpful mine planning checklist with Dassault Systèmes' Strategic Mine Planning can help mine planners uncovers the real lifetime economic potential of their mine by simulating thousands of operational scenarios, modeling sensitivity to changes in parameters, and creating a strategic plan.

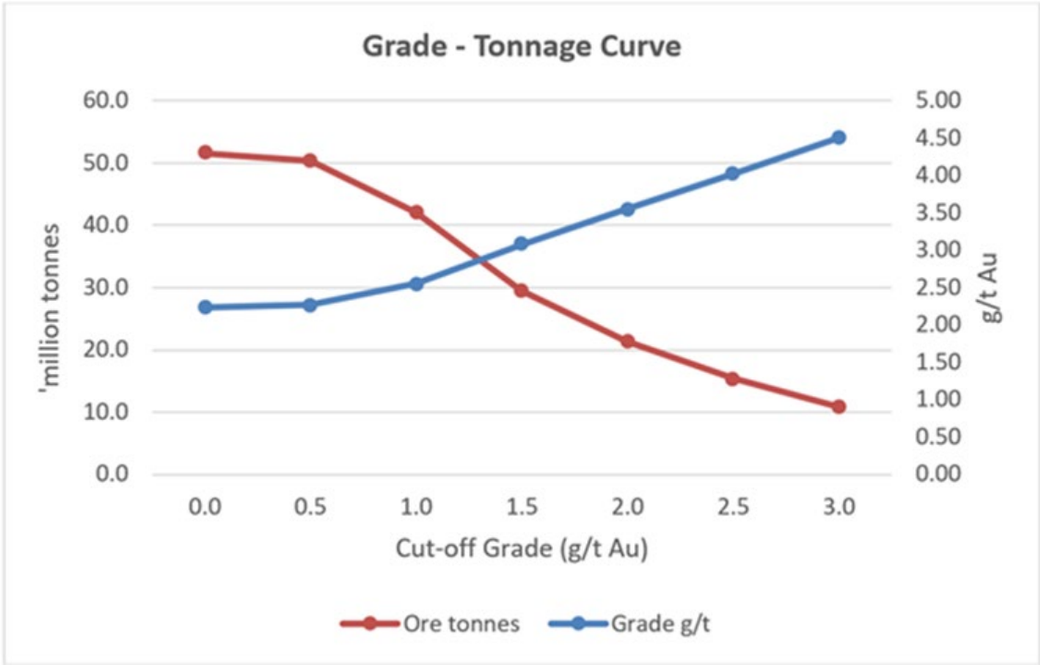
THE MINE PLANNING CHECKLIST

- [x] Review Mineral Resource Model
- [ ] Optimization Block Model Generation
- [ ] Optimization Process and Ultimate Pit Selection
- [ ] Final Pit Design
- [ ] Mining Sequence Definition
- [ ] Pushback Pit Designs
- [ ] Production Scheduling
- [ ] Economic Evaluation

1 Review Mineral Resource Model

The first stage of the planning process involves advanced analytics of the published resource model produced by the geology department. Automated processes and AI are used to generate a wide range of statistics and create grade tonnage curves for material reconciliation.

Outcome: A thorough understanding of the content and structure of the mineral resource model as well as the generation of information for later reconciliation.



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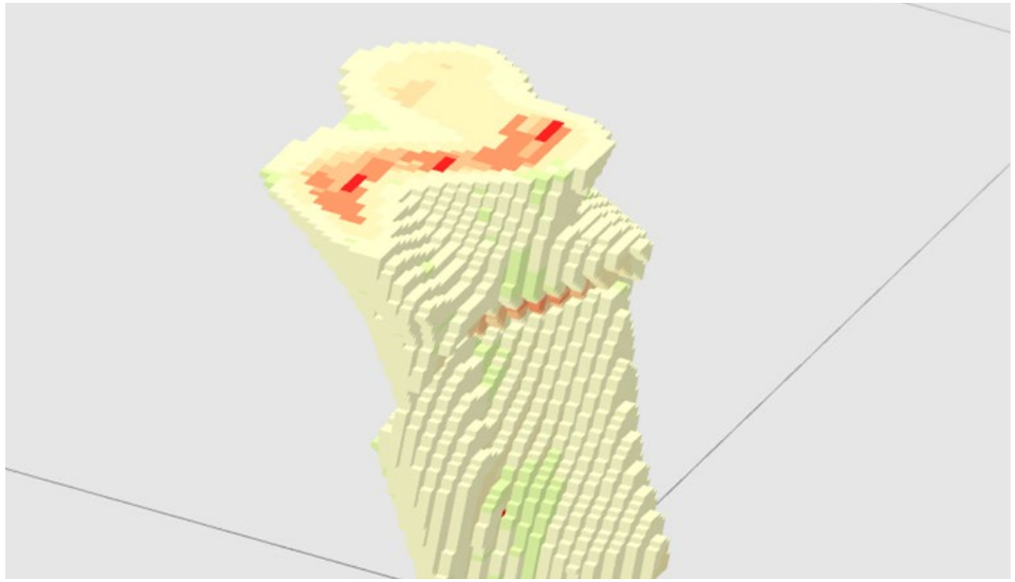
2 Optimization Block Model Generation

The next step is to generate the mining model from the resource block model by calculating the optimization attributes (e.g., mining cost adjustment factor, processing cost adjustment factor, geotechnical regions, mining dilution, mining recovery, process recovery, etc.). At this stage, mine planners also re-block the block model published by the geologists to the nominated Selective Mining Unit (SMU) parent block size and reconcile it with resource model grade tonnage curves. Traditionally a time consuming stage of the planning process which is also accelerated using automated processes on a central data platform.

Outcome: Generation of the optimization block model containing all the attributes used in the optimization process.



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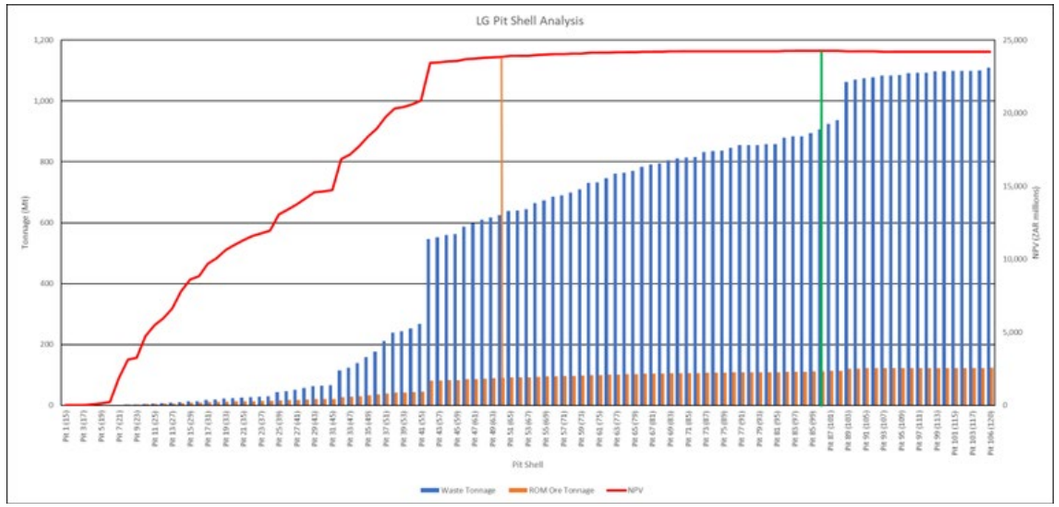
3 Optimization Process and Ultimate Pit Selection

The third stage of the planning cycle involves the optimization process to generate a series of pit shells and analytics of the associated material properties. The optimization will quickly generate a range of outputs including NPV, an incremental stripping ratio, and unit costs as well as sensitivity analysis not only based on mining costs, product price but also associated CO2 emissions as required.

Outcome: Multiple revenue factor pit shells and statistical analysis of content presented in tabulation and graphical formats allow the selection of the ultimate pit shell based on relevant criteria.



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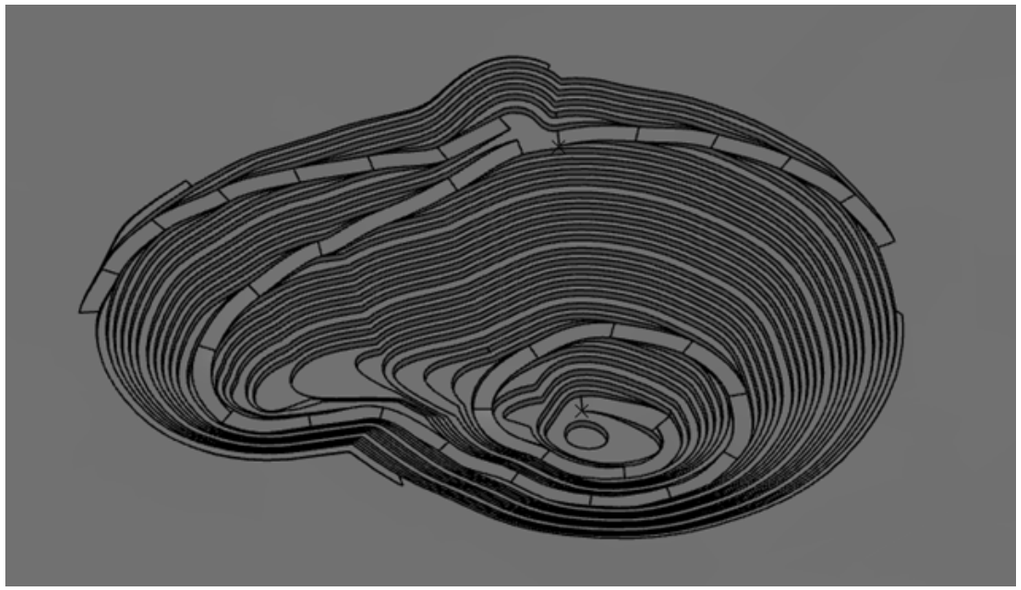
4 Final Pit Design

Once the final pit shell is generated the mine design itself can be created incorporating mine design criteria (e.g., face angles, berm widths, haul road width and inclination, slope configuration, etc.) and applying practical operational engineering constraints

Outcome: Final pit design detailing pit integrated with topography, including waste dumps and stockpiles in the form of wireframe surfaces.

The Strategic Mine Design solution employs parametric design techniques, which allow rapid design of multiple options to generate the best pit design possible.



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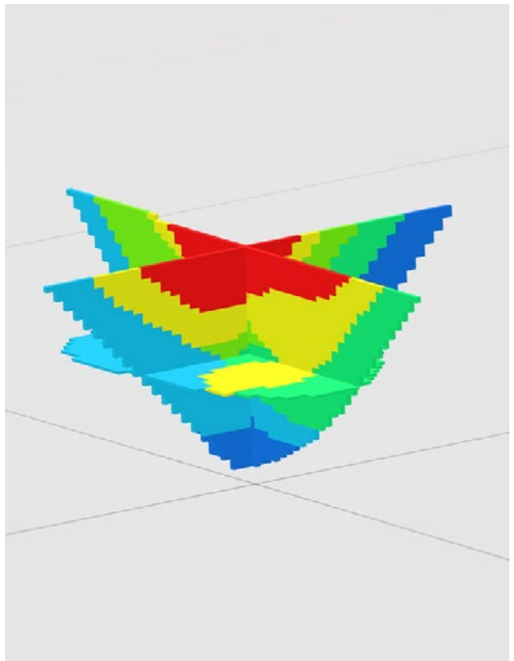
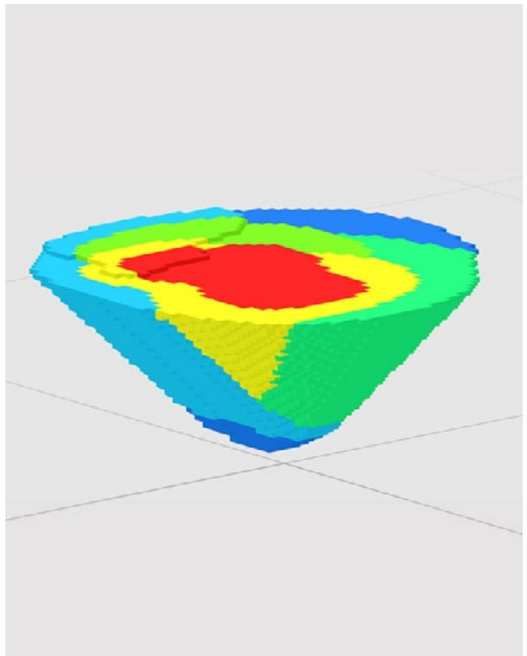
5 Mining Sequence Definition

Based on the information generated previously the mining pushback sequence can be created. At this step, the ultimate pit can be constrained within the final pit design and pushback requirements (e.g., size, number, start position, mining direction, etc.), as well as practical operational constraints can be applied while maximizing value.

Outcome: A series of pushback pit shells describing the mining sequence to be used in the scheduling process.





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6 Mining Sequence Definition

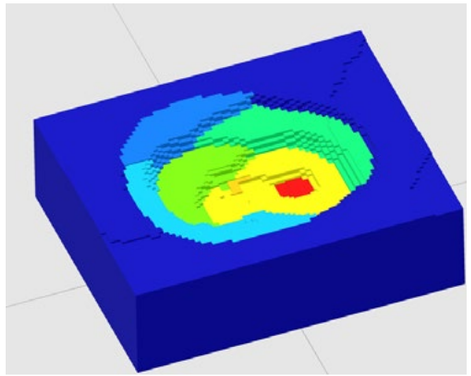
Next, it is possible to generate pushback pit designs whilst incorporating mine design criteria (e.g., face angles, berm widths, haul road width and inclination, slope configuration, etc.) and applying practical operational engineering concepts. Again this is achieved using the parametric design features of the **3D**EXPERIENCE Platform

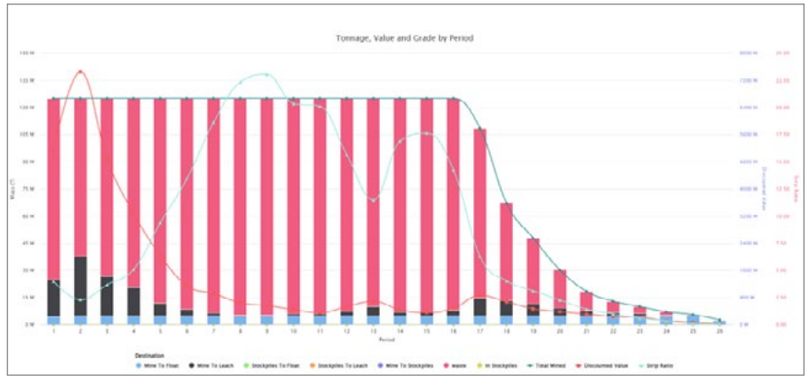
Outcome: A series of detailed pushback pit designs describing the mining sequence to be used in the scheduling process.

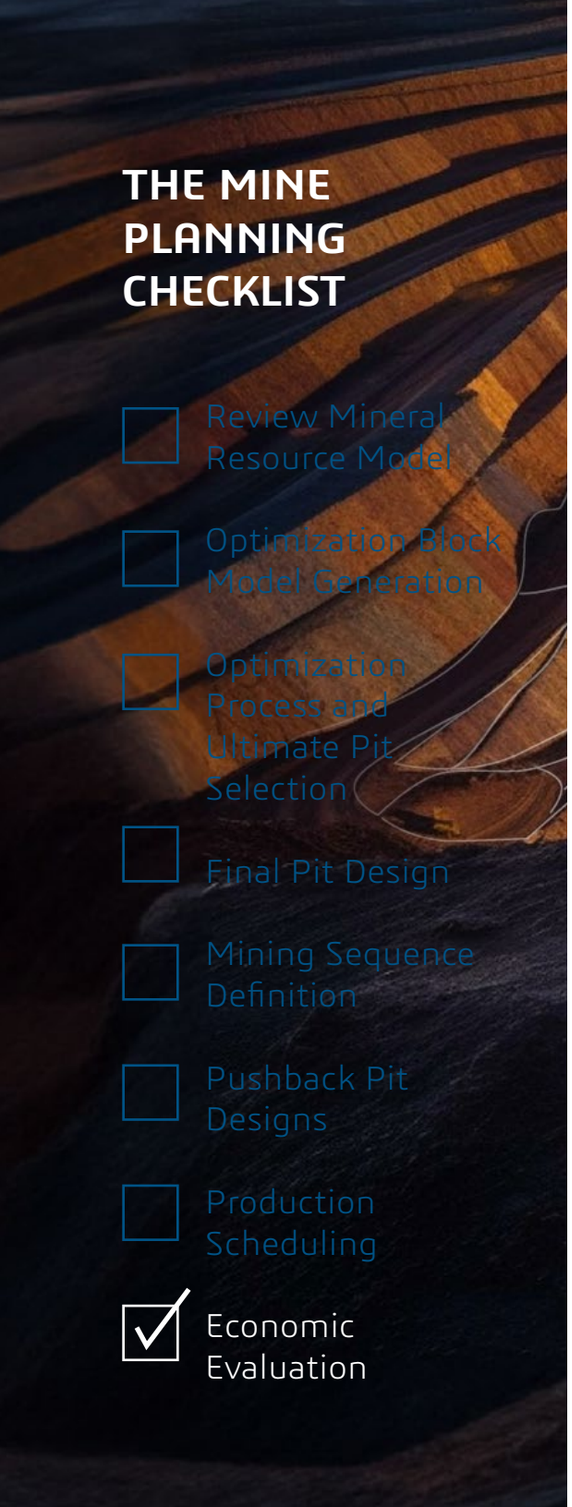
7 Production Scheduling

Once you have your interim pit designs, you can develop your practical mining schedule, ensuring you incorporate your mine design criteria (e.g., equipment capacities, leads and lags, drop-down rate, etc.) and apply practical operational engineering concepts. Equally, the schedule can be linked to upstream or downstream components of the value chain to provide the most efficient and sustainable schedule to be executed.

Outcome: A strategic mining schedule presented in tabulation, graphical, and geospatial formats.







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8 Economic Evaluation

Finally, a detailed financial model is generated based on the production schedule to evaluate the financial viability of the strategic schedule for investment decisions and options analysis, and perform operational and financial risk analysis using stochastic and probabilistic analysis techniques.

Outcome: A detailed financial model and statistical analysis presented in tabulation and graphical formats.

PAIRING MINE PLANNING WITH PARAMETRIC MODELING

To develop a truly optimal mine plan, mine planners can combine this comprehensive checklist with a powerful digital tool like Strategic Mine Planning and Design from Dassault Systèmes. This planning software leverages parametric modeling to create digital models based on sophisticated algorithms and automated processes embedded in the **3D**EXPERIENCE Platform.

By following this comprehensive process checklist and harnessing the potential of Strategic Mine Planning and Design, mine planners can help speed up the planning process, de-risk their projects, and realize a more achievable return on investment and a more sustainable operating model.

CASE STUDY: GREENFIELD COPPER & GOLD PROJECT

CHALLENGE

For a project composed of three mines sharing a process:

- Determine the optimal reserves, design-friendly phases
- Find the best scale of production at each mine, the optimal pre-stripping investment, and the best plant location
- Maximize the NPV of the strategic plan for the whole complex

RESULTS

- Found the best phases and scales of production, considered all CAPEX and OPEX options as well as pre-stripping
- Determined the best plant location
- Achieved a 42% increase in NPV over the base case
- Analyzed 75,000 simulations over five weeks

CASE STUDY: BROWNFIELD IRON ORE PROJECT

CHALLENGE

- Optimize the planning of a complex of two mines, sharing a process, constrained by concentrate transport
- Optimize and simplify phase design
- Evaluate the impact of increased production in different market conditions
- Resolve production interruptions in the plan

RESULTS

- Optimized reserves, improved phasing, reduced costs
- Optimized sequence of two pits
- Reduced SR | **Mine 1:** -16% SR | **Mine 2:** -20% SR
- Increased cash flow | **Mine 1:** +42% ($85M) | **Mine 2:** +29% ($146M)
- Increased NPV: $231M0

LOOKING FOR SUPPORT TO ACCOMPLISH MORE AT YOUR MINE SITE?

Dassault Systèmes offers outcome-based services that provide quick access to results without investing in software.

We take on the heavy lifting of building and delivering workflows, scenarios, and the structure of the mine plan while you maintain ownership over the results. This keeps your team focused on other core business operations, allows you to validate the concept before deciding to scale, and shortens the time to project completion.

LEARN MORE HERE

Discover the power of Strategic Mine Planning and Design or our outcome-based services. Contact us today at GEOVIA.Info@3ds.com to discuss your project.

Our **3D**EXPERIENCE® platform powers our brand applications, serving 12 industries, and provides a rich portfolio of industry solution experiences.

Dassault Systèmes, the **3D**EXPERIENCE Company, is a catalyst for human progress. We provide business and people with collaborative virtual environments to imagine sustainable innovations. By creating virtual twin experiences of the real world with our **3D**EXPERIENCE platform and applications, our customers can redefine the creation, production and life-cycle-management processes of their offer and thus have a meaningful impact to make the world more sustainable. The beauty of the Experience Economy is that it is a human-centered economy for the benefit of all –consumers, patients and citizens.

Dassault Systèmes brings value to more than 300,000 customers of all sizes, in all industries, in more than 150 countries. For more information, visit **www.3ds.com**.

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