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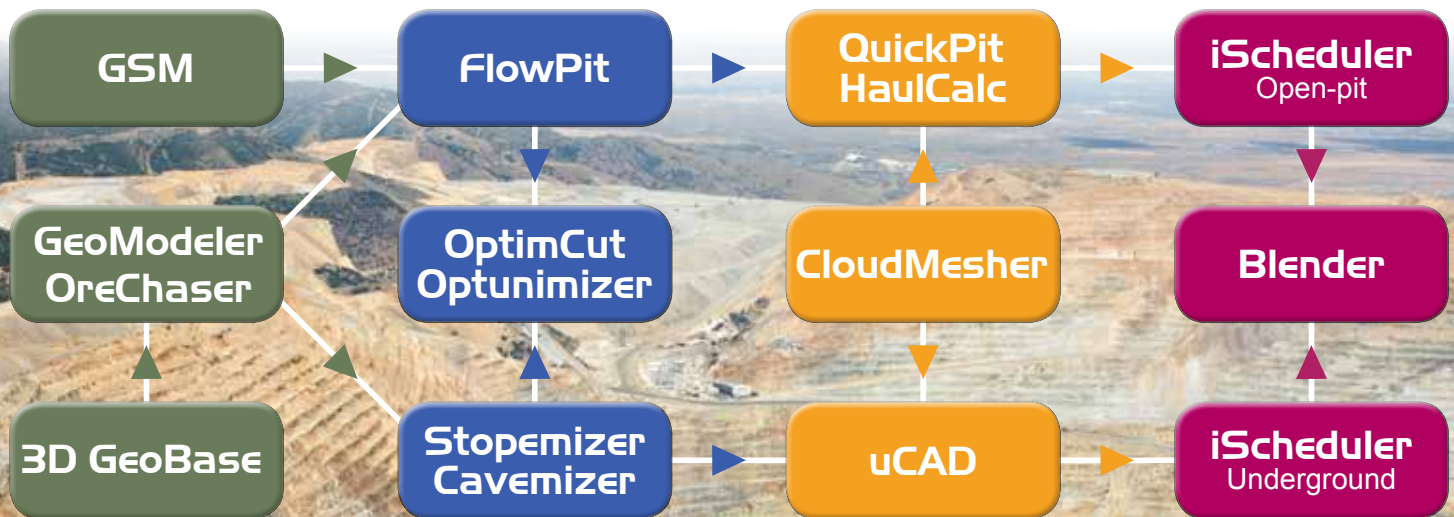
**Powerful 3D Modelling and Optimization**  
Integrated Solution from Exploration to Sequencing  
**Efficiency Productivity Profitability**



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Based in Ottawa, Canada, **ThreeDify Inc.** offers innovative mining software solutions to help our clients increase resource recovery and reduce mining costs. Our products are built on advanced modelling and optimization technologies, plus modern computing techniques to handle, with speed and accuracy, large and complex deposits which impose computational challenges to conventional General Mining Packages (GMPs). Our solution is scalable, cost effective, and easy-to-use and it has good compatibility with different file formats of third party GMPs.

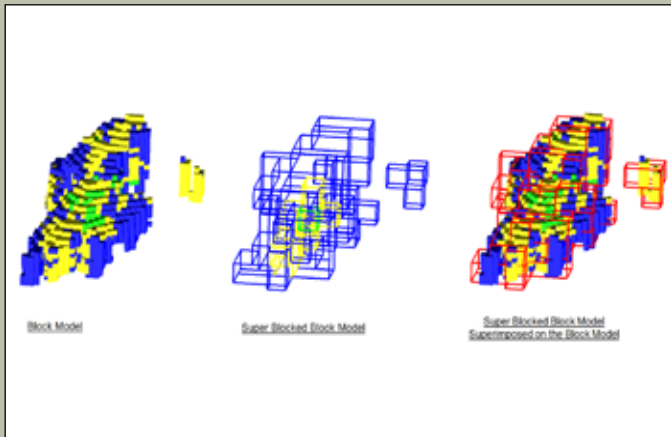
**ThreeDify GeoMine** is an integrated mining software suite that consists of twelve (12) independently licensed modules. GeoMine features an advanced block modeller (**GeoModeler**), a scalable pit optimizer (**FlowPit**) and rapid pit designer (**QuickPit**), a powerful stope optimizer (**Stopemizer**) an automatic cave designer (**Cavemizer**) and a specialized underground mine designer (**uCAD**), a unique open-pit to underground transition optimizer (**Optunimizer**), a cut-off grade optimizer (**OptimCut**), a Life-Of-Mine and production scheduler for both open-pit and underground mines (**iScheduler**), as well as the **GSM** module, a set of modelling, optimization and parametric pit design tools for stratified deposits.



Our mission is to empower you with the competitive edge to maximize your project's economic potential



**GeoMine Foundation:** GeoMine is a fully integrated mining software suite for geological modelling, mine planning and design as well as scheduling for both open pit and underground mines. **Foundation** module provides a unified workspace and CAD tools that are common to all other modules in GeoMine, and helps project data flows seamlessly among all modules. No more import and export between disjoint applications each addressing a specific stage of the complex mine planning process.



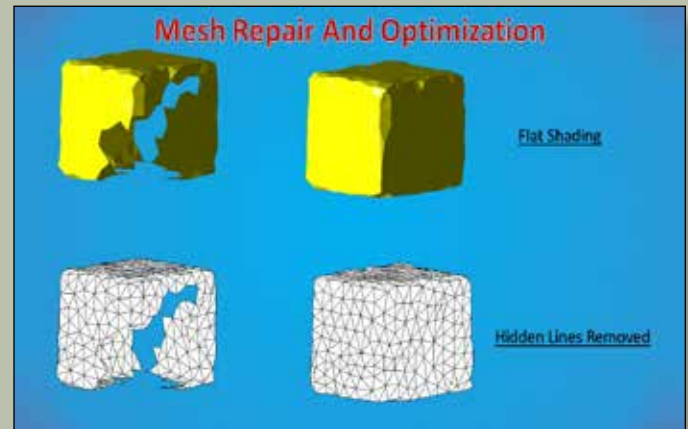
- Command stack: supports both sticky and non-sticky commands with unlimited undo/redo history.
- Essential CAD tools: polyline/polygon and surface/solid creation and editing tools; view manipulation, measurement and dimensioning tools.
- Topographical mesh and contour generation, Boolean operations on meshes and polygons, mesh cutting, repairing and shape optimization.
- Block Model manipulation tools: colour-coding by attributes, Boolean operations, model extraction and expansion; built-in model statistics reporting; defines and assigns your own attributes to block models; creates custom reports on block models with user-defined formulae.
- Creates and edits axis-aligned, non-axis aligned or scaled cross sections.
- Model Universe and Coordinate Systems: manually or automatically defines block model universe orientation from an existing block model CSV file; define the Mine Coordinate System (NEZ) for modelling.
- File import /export: includes generic 3D file importer; imports 3rd party sub-blocked block models; super-blocks your block models; supports over 40 GIS vector formats and over 70 GIS raster formats; imports/exports DXF, Block Model CSV file / or Microsoft Access database format.

### Key Benefits:

**Unified Workspace:** All modules in GeoMine work coherently and seamlessly within the single integrated workspace, eliminating the needs for incremental import/export steps, thereby significantly increasing productivity.

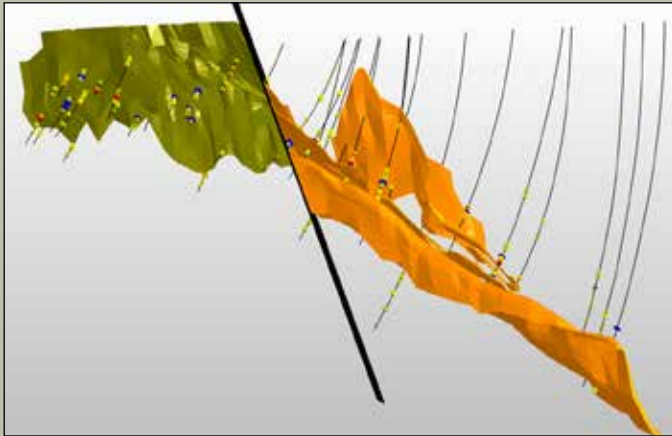
**Easy to use:** Fully event-driven non-blocking interface helps improve efficiency.

**Versatile:** Includes a slew of advanced CAD tools.





**GeoMine GeoModeler** module is a high performance geological modelling and resource estimation tool for large and complex deposits. It offers 3D block modelling and 2D Gridded Seam Modelling (GSM), geostatistical analysis and interactive 3D visualization. Its state-of-the-art surface based **Dynamic Anisotropy (DA)** Interpolation system helps geologists improve accuracy and reduce uncertainty of their resource estimates. Also included is a fast and easy-to-use **RBF** based implicit modelling, as well as a resource classification and custom reporting module for public reporting.



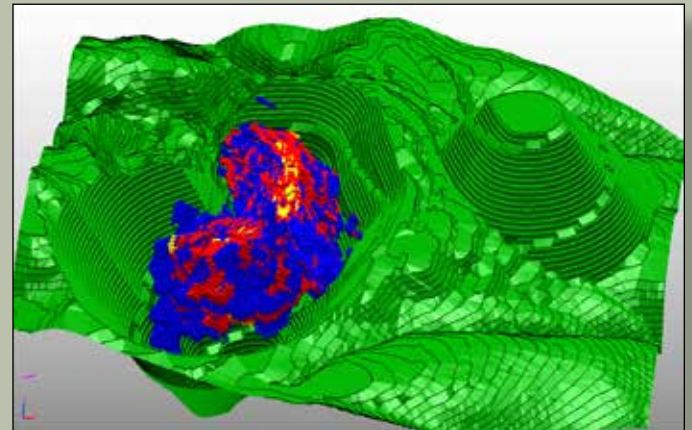
### Key Benefits:

**Accurate:** Surface-based Dynamic Anisotropic Interpolation technology avoids the common pitfall of over-smoothing in resource estimation.

**Powerful:** Models large and complex deposits using either high-resolution block models with optional sub-blocking or gridded seam models.

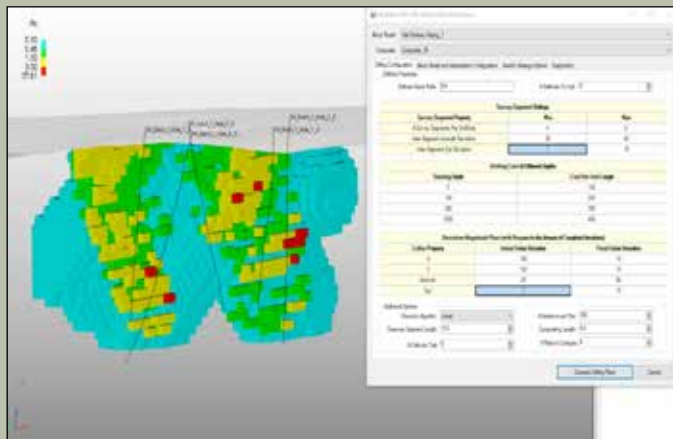
**Flexible:** Includes all common surface, solid and block model manipulation tools in the Foundation module, as well as a block model reconciliation tool.

- Desurveys, color-codes and annotates drillholes by categorical or continuous of attributes.
- Creates full or filtered composites.
- Models massive, disseminated or seam-type deposits with non-axis aligned Mine North and optional sub-blocks with user-defined attributes.
- Interpolates block model grades with high performance inverse distance power and Kriging methods with or without geological domains.
- Uses DA surfaces to precisely control search directions to follow mineralization. Includes a state-of-the-art automatic DA surface generation tool.
- 3D Anisotropic RBF based Implicit Modeling with Real-Time Shells allows the user to automatically create wireframes and DA surfaces.
- Validates block models using histogram comparison plots, Q-Q & P-P plots and swath plots.
- Classifies estimated blocks into measured, indicated and inferred categories for public reporting.
- Creates GSMs to model seam type deposits such as coals or phosphates.
- Converts GSMs to block models for Lerchs & Grossmann pit optimization for deeply inclined multi-seam.





**GeoMine OreChaser** (OreChaser, aka DPO) is an infill drilling plan optimizer. OreChaser allows the drill planner to determine the optimum number, positions and lengths of additional drill holes required to maximize the resource uplift for a given drill budget spend. OreChaser features a proprietary 3D Genetic Algorithm with the choice of two search strategies: RocDP (Randomized Ore Chasing Drilling Plane) strategy and (FRD) Fully Random Drilling strategy, both with the objective of minimizing Kriging variances.



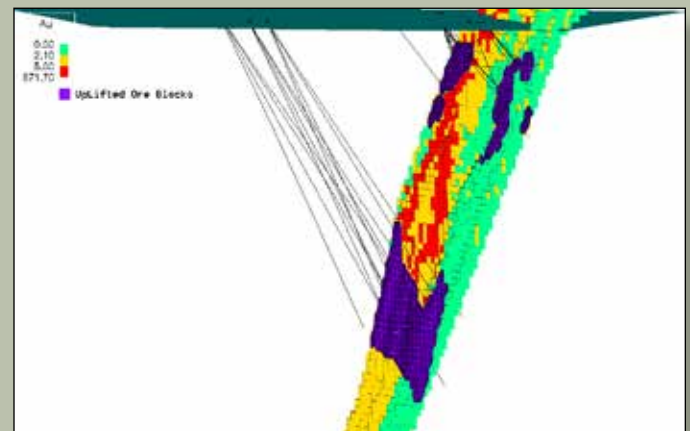
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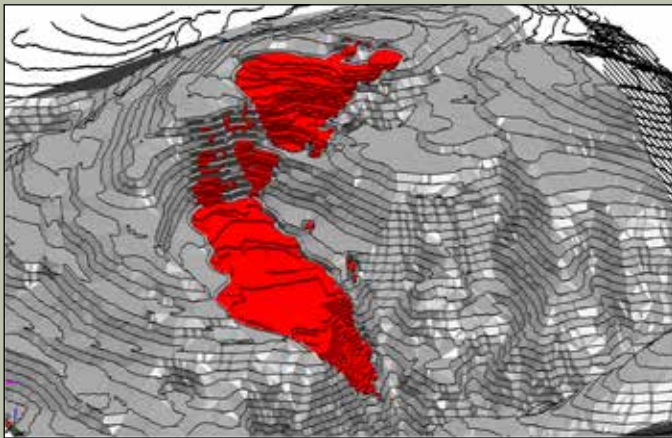
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**GeoMine FlowPit** module is an ultra-fast pit optimizer. It is based on the industry standard **Lerchs-Grossmann's** (LG) 3D pit optimization algorithm with a novel implementation. FlowPit is capable of handling huge block models with up to 100 million non-air blocks without use of super-blocking. This advance in computational speed with guaranteed optimality makes FlowPit an effective tool where mine planners frequently need quick and reliable answers to “what if?” questions.



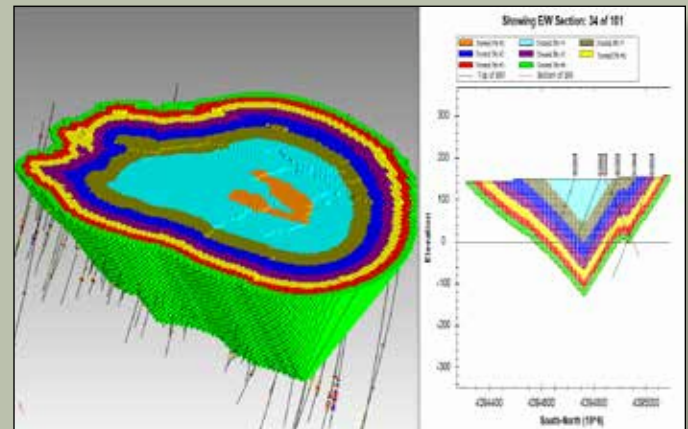
- Determines the ultimate pit and nested pits.
- Includes two options for creating nested pits: LG nested pits for creating LOM schedules (with the **iScheduler**) that maximize NPV and equal-sized geologically optimum pits for creating smooth LOM schedules that have relatively constant production rates.
- Allows the pit slope angle to vary by sectors, levels or by rock types.
- Formula Editor calculates dollar values for single or multi-mineral blocks.
- Supports both sub-blocks and percentage blocks and provides options to normalize and re-block input block model if needed.
- Sensitivity Analyser allows the user to analyse the impact of changes to any pertinent variable (price, costs, or grade uncertainty) on the total profit of the project.
- Flexible Report Generator outputs proven and probable reserves for public reporting without the need for custom scripting.
- Also includes all features of **GeoMine Foundation** module.

## Key Benefits:

**Scalability:** 64-bit parallel version handles huge block models with precision and accuracy without use of super-blocking.

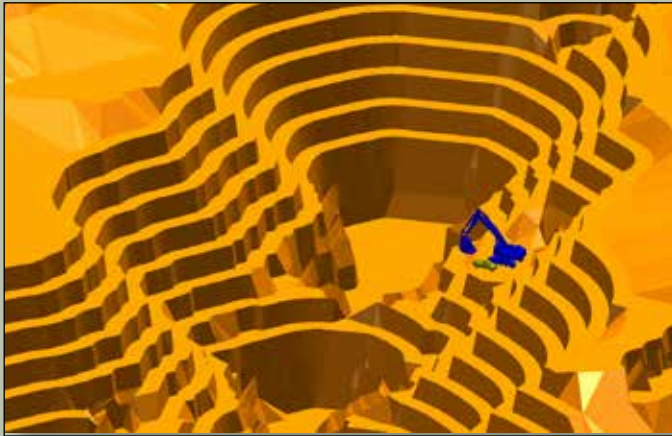
**Flexibility:** Visual Formula Editor's versatility opens a door to virtually infinite possibilities for mine planners that make a difference.

**Informative:** Ability to preview, inspect and correct any potential errors of input block models helps round the package.





**GeoMine QuickPit** module is a rapid open-pit design tool that allows a mine planner to build a complete pit or dump design with ramps in a matter of minutes. It features a powerful incremental pushback and dump creation tool with an unlimited undo/redo history. QuickPit stands above its competition by offering a greatly simplified workflow that automates the traditional pen-and-paper pit design process using bench contours. Also included in the package is a unique reconciliation module for comparing and reconciling the designed pits with the **Lerchs-Grossmann (LG)** pit or the as-built pit.



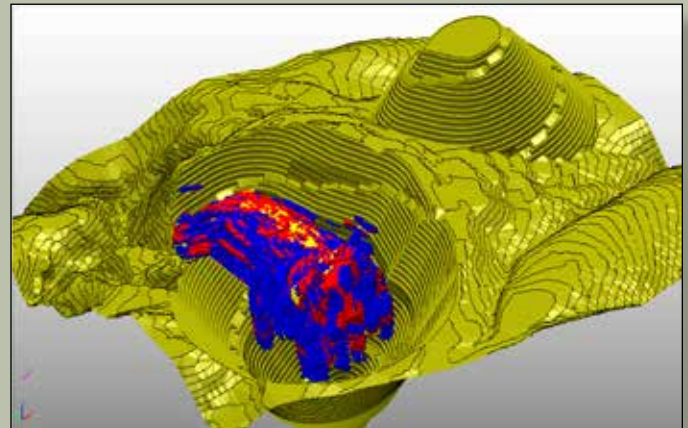
### Key Benefits:

**Simplified workflow:** Automates the traditional pen-and-paper pit design process with bench contours.

**Informative:** Compares and contrasts any pit design with the LG pit or the as-built pit to facilitate greater understanding and help identify areas of improvement.

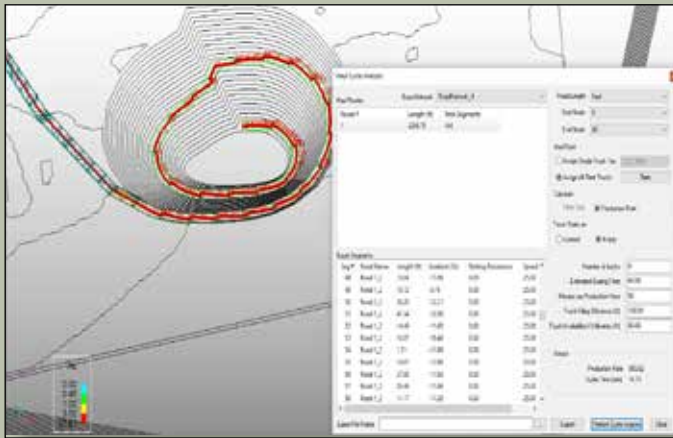
**Increasing productivity:** Creates complete pits, dumps, phases and plans with in-pit ramps in a matter of minutes, all within a unified user interface.

- Quickly designs and edits pits, phases and dumps with pushback or dump increments. Each push-back or dump increment automatically updates the active topography.
- Creates pushback increments by projecting a base contour up or down while allowing the slope angle of each increment to vary by sectors and/or levels or by rock types.
- Compares and reconciles any pit design with the LG pit or the as-built pit to show the design variance.
- Creates dump increments anywhere including in the mined-out area and calculates dump volume.
- Creates multiple complete or partial in-pit ramps with multiple access points.
- Exports bench-by-bench reserve statistics.
- WYSIWYG (what you see is what you get) contour plots at any time.
- Ability to reconstruct any previous pit design at any given point, even after a design session is restarted.
- Generates pit designs for gridded seam models (for coal or seam type deposits) by Margin Ranking.
- Also includes all features of **GeoMine Foundation** module.





**GeoMine HaulCalc**, provides detailed analysis of haul routes and is an ideal fleet budgeting tool: it can be used to determine the the truck fleet required to meet a target production rate or the achievable production rate based on a given truck fleet. This module is comprised of Road Network Manager, Fleet Manager and Haul Route Analyzer. The Road Network Manager adds a suite of road generation and editing tools to the GeoMine platform; the Fleet Manager features an extensible truck database and the Haul Route Analyzer partitions a given road network into road segments and performs route analysis on user-selected routes.



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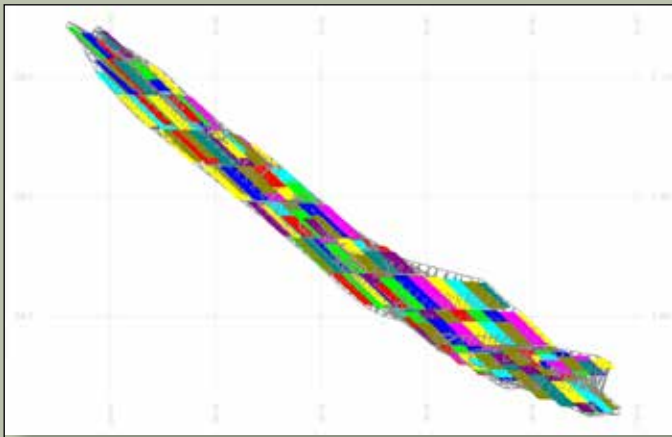
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**GeoMine Stopemizer** module is a 3D stope optimization tool for underground mine planning. Given a block model and a set of engineering and economic parameters, Stopemizer creates the optimum stopping boundary and then mineable shapes from a given stope layout. For existing stopping mines, Stopemizer can determine the shortest distance between a newly designed stope and the existing excavations. Furthermore, Stopemizer also includes a powerful Stope Design Reconciliation tool.



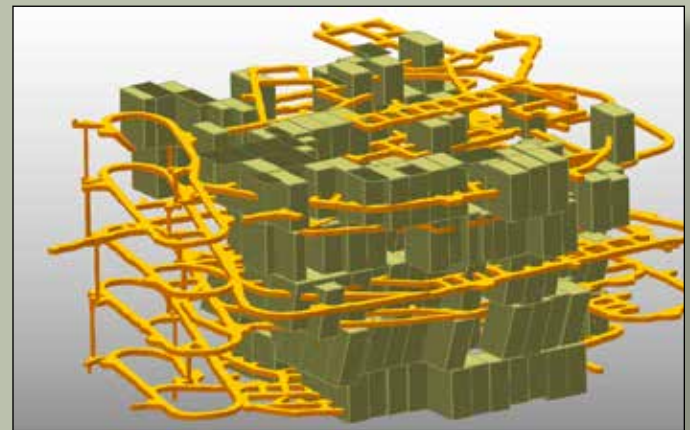
### Key Benefits:

**Powerful:** Optimizations usually takes minutes to complete, affording rapid what-if-analyses.

**Advanced analytics:** Compares and reconciles stope designs with mined-out stopes for incremental design refinement.

**Flexible:** Ability to specify pillar sizes and positions and to create stope designs and mineable shapes from any imported solid meshes.

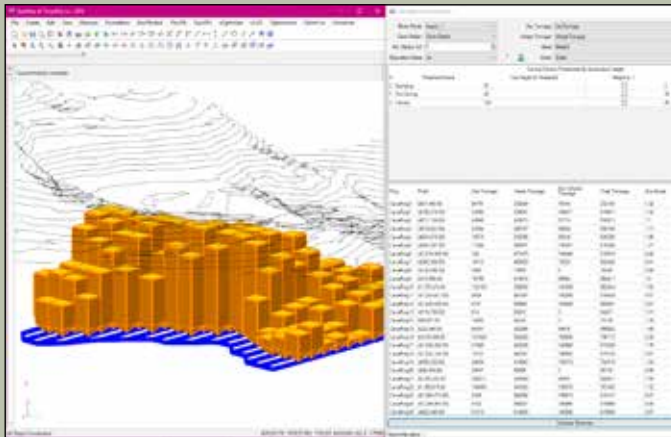
- Interactively or automatically creates and edits stope layouts with variable stope size.
- Defines hanging wall and footwall angles, and the locations of draw points in 3D.
- Calculates mineable reserves by specifying a cut-off grade or by maximizing total profit for a given stope layout.
- Interrogates a set of closed meshes against a given block model for economic evaluation.
- Automatically creates mineable shapes from an optimal or a manual stopping envelope.
- Tools for reporting ore and waste statistics for mineable shapes.
- Compares and reconciles different stope designs with as built stopes.
- Supports both sub-block and percentage block models.
- Also includes all features of **GeoMine Foundation** module.





**GeoMine Cavemizer** module is a powerful 3D block caving (BC) and sub-level caving (SLC) optimization tool. Cavemizer includes an automatic footprint finder and a parametric cave designer. Given a grade model and a set of economic parameters, Cavemizer automatically determines the best footprint and interactively generates the corresponding cave design that models user-defined caving stages, each with its own recovery and external dilution.

- Determines the best footprint with Cavemizer's Automatic Footprint Finder.
- Creates and iterates your design with Cavemizer's Parametric Cave Designer.
- Automatically generates cross-cuts for the specified block caving design and each sub-level of a specified sub-level caving design.
- Defines your own caving stages, each with its own recovery and external dilutions.
- Reports mineable reserves by cave rings and by sub-levels.
- Includes all **GeoMine Foundation** and **uCAD** modules' feature lists.

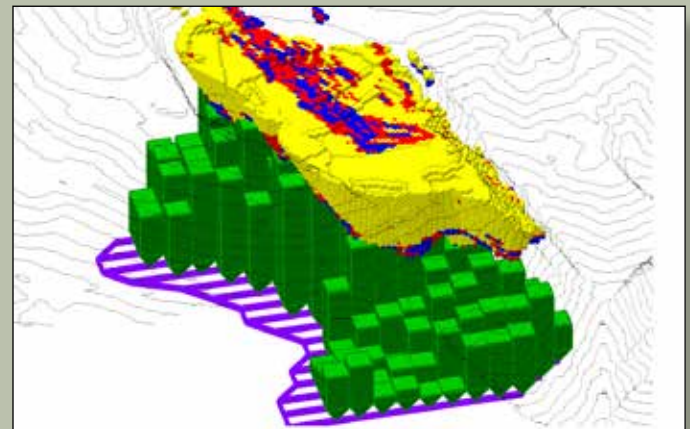


### Key Benefits:

**Powerful:** Each Cavemizer run takes seconds to minutes to complete.

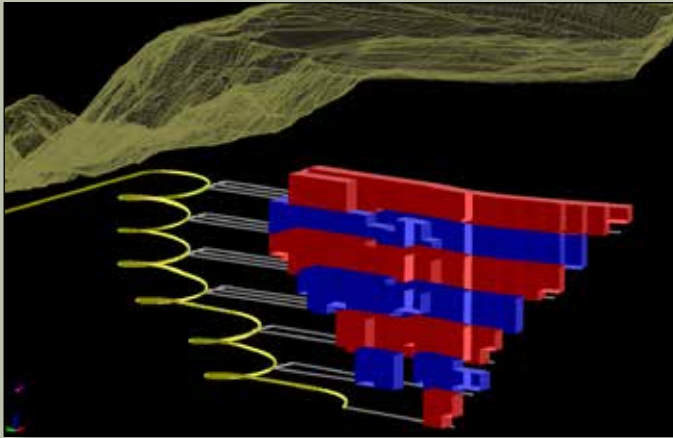
**Practical:** Cave designs created with Cavemizer respect both geometric and essential geotechnical constraints.

**Advanced analytics:** compares and reconciles cave designs with existing caves for incremental design refinement.





**GeoMine uCAD** module is a specialized CAD tool for underground mine design. It features one of the most productive 3D CAD interfaces, which is made possible with a powerful command stack and a concurrent, non-blocking command dialog paradigm. uCAD includes a set of tools that are purposely engineered to boost mine designers' productivity. With uCAD, creating an underground mine layout is no longer a tedious task as with generic CAD packages.



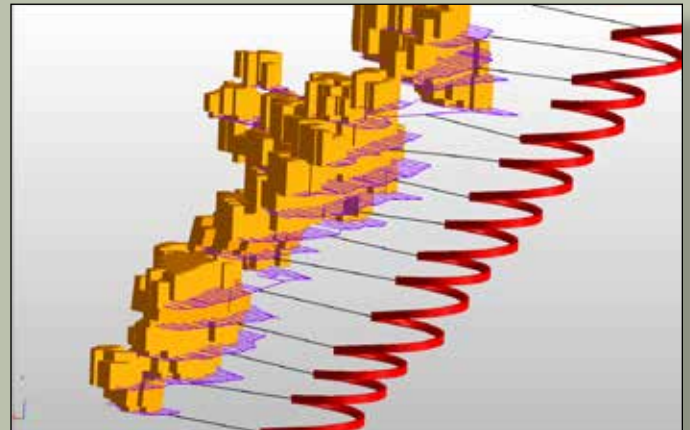
### Key Benefits:

**Integrated:** Works seamlessly with the other modules (**Stopemizer**, **Cavemizer** and **iScheduler**) in GeoMine.

**Easy-to-use:** uCAD's non-blocking interface features a powerful command stack and command dialog which work in tandem to make uCAD one of the most productive 3D CAD editors for mine design engineers.

**Flexible:** Imports and exports AutoDesk DXF files; also imports over 30 other 3D file formats.

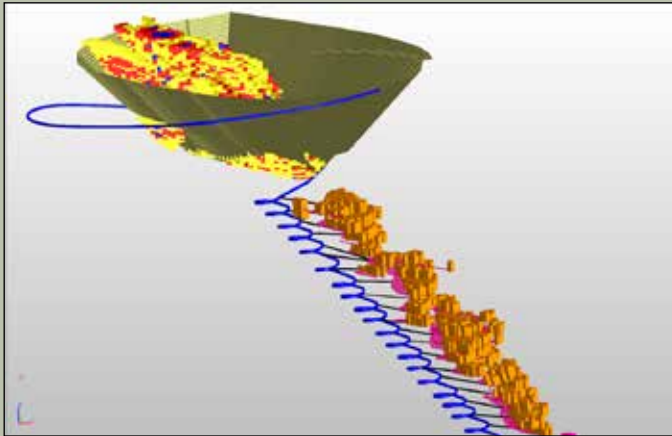
- Interactively creates and edits design center lines representing shafts, drifts and cross-cuts.
- Parametrically or interactively creates declines and ramps.
- Batch mode for creating level developments, each comprised of drifts and cross-cuts.
- Interactive editing of level developments.
- Designs block caving or sub-level caving rings with a few mouse clicks (requires a **Cavemizer** license).
- Generates solid meshes from design centerlines and level development objects.
- Profile Editor for creating custom cross section profiles.
- Also includes all features of **GeoMine Foundation** module.





**GeoMine Optimizer** module is an Open-pit to Underground transition optimizer. Optimizer allows a mine planner to determine the optimal transition zone from open-pit to underground mining with the objective of maximizing total profit of the entire mine. Optimizer is built upon three of ThreeDify's mature optimizers:

**FlowPit** for pit optimization, **Stopemizer** for stope optimization and **Cavemizer** for caving optimization. As a result, the transition plan created by Optimizer is optimal for both open-pit and underground mining. There is no longer a need for a trial and error design process.



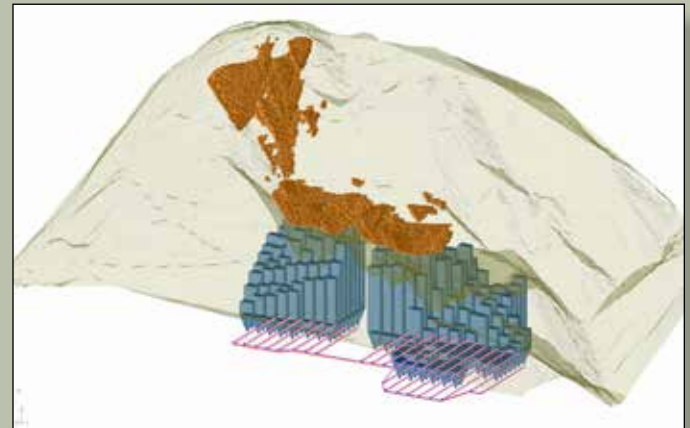
### Key Benefits:

**Guaranteed Optimality:** Generated transition zone is guaranteed to maximize total profit of the entire mine.

**Productivity:** Automatic determination of the optimum transition zone eliminating the needs for the trial and error process and thus greatly improving productivity.

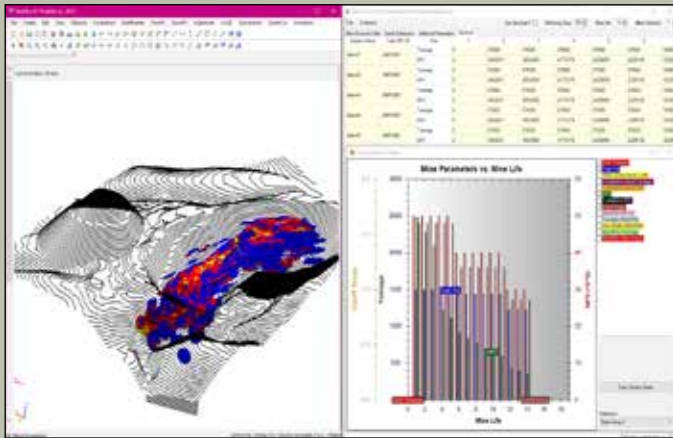
**Power:** Ability to maximize NPV when combined with the **iScheduler-OP** and **iScheduler-UG** modules.

- Generates a set of nested pits that maximize total profit assuming the deposit is mined with open-pit mining.
- Generates a stope or a caving design that maximize total profit assuming the deposit is mined with underground mining.
- Defines the optimum transition zone from open pit to underground mining from the generated nested pits and stope or caving design.
- Maximizes NPV (or other variable) when combined with the **iScheduler-OP** or **iScheduler-UG** by defining the best overall option considering infrastructure development and mine preparation with the aim of ensuring plant feed (ramping up, stockpiling, etc.) within one integrated software package, **GeoMine**.
- Supports various mining methods, including all stoping methods, block caving and sub-level caving methods.
- Visual Formula Editor enables users to decide how they want to calculate the dollar values of a block when mined as part of an open-pit and/or as part of an underground mine.
- Also includes all features of **GeoMine Foundation** module.





**GeoMine OptimCut** module is a dynamic cut-off grade and production rate optimizer. Given a set of nested pits or a stope/cave design, OptimCut finds N-best yearly cut-off grade and production rate policies, each of which maximizes NPV over the life of the mine while respecting the precedence constraint using a **Constrained Dynamic Programming** algorithm based on the Principle of Optimality. The output of OptimCut (N-best optimal cut-off grade and production rate policies) can be used for preliminary project evaluation or as input to the **iScheduler** module for subsequent Life-Of-Mine (LOM) scheduling.



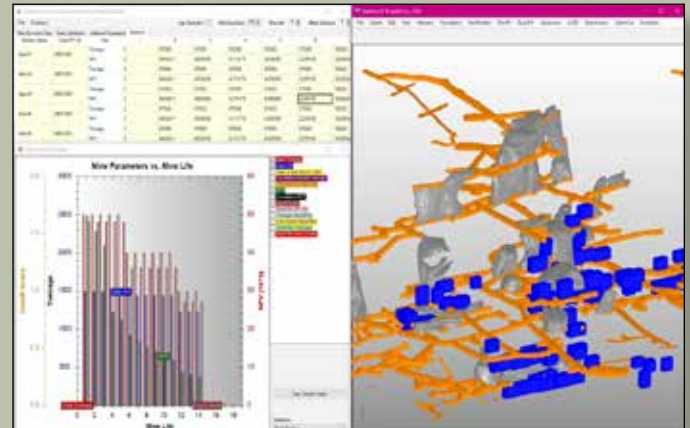
### Key Benefits:

**Powerful:** Create constrained, unconstrained or static cut-off grade and production rate policies. Metal price can vary over time, so can mining, processing, transportation and any other costs.

**Scalable:** Multi-threaded implementation utilizes all available CPU cores to speed up calculations for large projects.

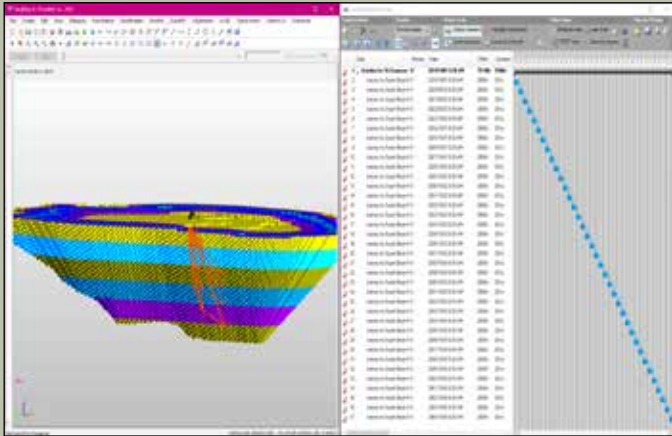
**Flexible:** Ability to define your own dollar formula to adapt to your specific mining project.

- Determines the optimal yearly cut-off grade and production rates that maximize the Net Present Value (NPV) throughout your entire mine-mill life with a choice of N-best solutions.
- Offers both standard and constrained optimization modes with stockpile option and multi-mineral handling.
- Fully integrated with **FlowPit**, **Stopemizer** and **Cavemizer** for cut-off grade optimisation and stockpile utilization.
- The results can be directly used for preliminary project evaluation or used as input to the **iScheduler-OP** or **iScheduler-UG** to create optimal LOM schedules.
- Ability to define and customize the dollar formula (expressed as a function of metal price, recovery, fixed and/or variable costs of mining, processing and refinery, etc.) to account for multi-minerals and real-life mining constraints.
- Also includes all features of **GeoMine Foundation** module.





**GeoMine iScheduler** module is an integrated activity and resource based 3D mine production scheduler for surface and underground mines. It features a fully interactive 3D activity and dependency editor, activity and resource Gantt Charts, a PERT chart and a Network Diagram, as well as a Resource Levelling algorithm. It is purposely built for sequencing and scheduling various kinds of mining activities and resources for short to long term (non-strategic) mine planning. iScheduler consists of **iScheduler-OP** and **iScheduler-UG** which can be licensed individually or together.

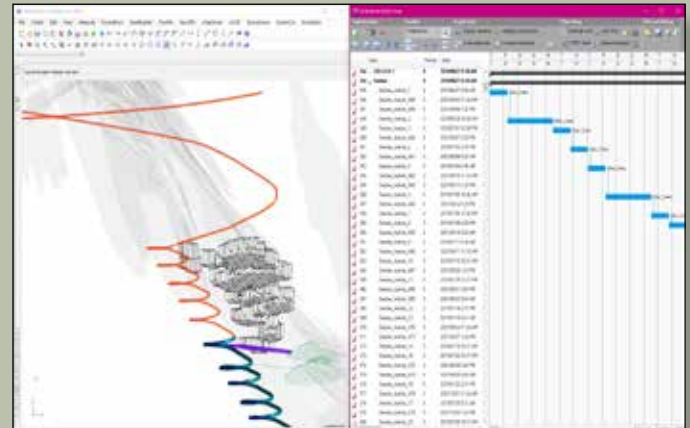


### Key Benefits:

**Comprehensive:** A single unified “unblocking and reactive” interface that seamlessly integrates all tasks of the complex mine scheduling process in a highly interactive 3D workspace. Capable of creating strategic and tactical schedules in the single unified interface.

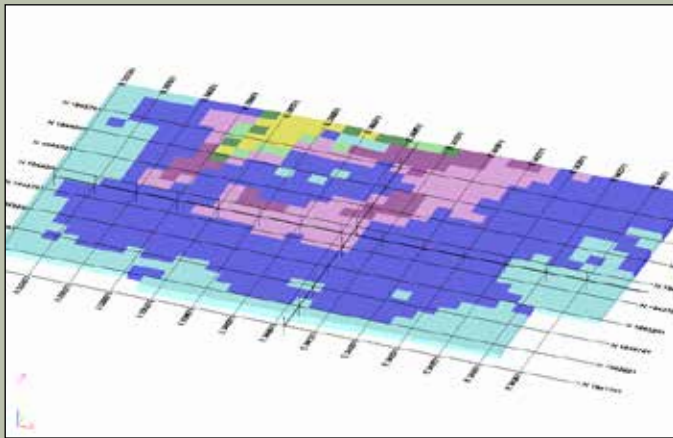
**Integrated:** Directly uses and schedules all relevant geological and mining data generated by all other modules of GeoMine without the need for the error-prone import/export steps that are typically required by standalone scheduling tools.

- Interactive or automatic schedule creation for short, medium and long term planning of both open-pit and underground mines with support for multiple block models, pit designs, stope or cave designs, mine development layouts and stockpiles.
- Creates long-term production schedules from nested pits.
- Interactively creates short-term bench mining cuts from long-term schedules incorporating precedence constraints.
- Creates short-term pit activities from the short-term bench mining cuts.
- Interactively creates and edits development activities from design center-lines, or level development layouts.
- Creates stope or cave slice activities from stope or cave designs.
- Creates excavation activities from underground excavations.
- Uses the “schedulability” property to control what schedule to create.
- Generates Gantt-Charts, Resource Charts or Network Diagrams from mining activities and tasks.
- Schedule animation and playback including pause, resume, fast forward and backward.





**GeoMine GSM** is a suite of GeoMine modules for Gridded Seam Modelling, Optimization, Design and Scheduling. GSM module is specifically tailored for stratified deposits such as coal seams, thin phosphate or limestone deposits whose horizontal extent is considerably larger than the vertical extent, which imposes challenges to conventional 3D block modelling.



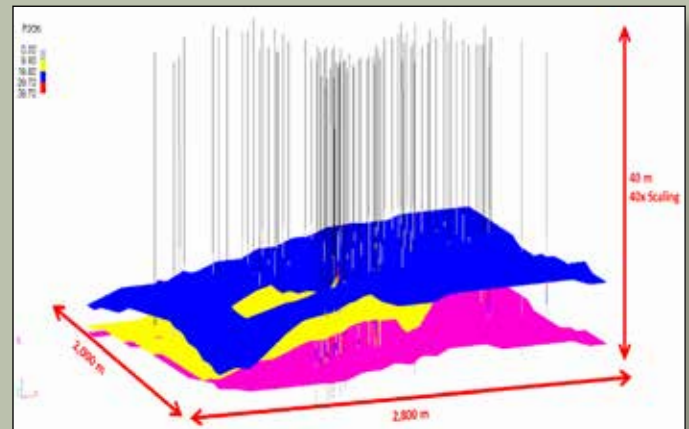
### Key Benefits:

**Accurate:** Tools are tailored for modelling, evaluating and designing stratified deposits.

**Easy-to-use:** Parametric Designer allows either incremental or parametric generation of pits or dumps with ramps.

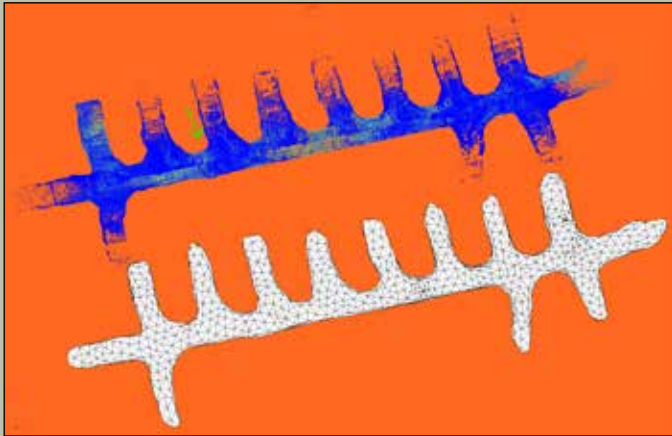
**Fast:** Build entire models and pit designs in minutes.

- Easily import and visualize 3D drillholes with geometric and histogram plots.
- Creates Gridded Seam Models (GSMs) directly from drill holes, with support for faults and other geometric constraints.
- Ability to repair and validate seams, and enforce correct seam sequences.
- Options for both 3D compositing and compositing by seams.
- Ability to create continuous and/or categorical attributes and assign them to GSMs.
- Provides multiple estimation tools, including Inverse Distance, Kriging and Radial Basis Functions.
- The built-in Pit Optimizer determines the optimum pit limit and allows the user to incorporate any constraints using GeoMine's unique Visual Formula Editor.
- Creates surface roads on any existing mine topography.
- Generates resource reports for GSMs and reserves reports for designed pits.
- Creates mining activities and resources, and schedule them using the built-in Gantt Chart with an automatic resource levelling algorithm.





**GeoMine CloudMesher** module is a powerful point cloud meshing tool for 3D scanners and UAVs. Very large point clouds with hundreds of millions of points can be viewed in an interactive speed on commodity laptops. Several meshing tools are included for creating 3D surfaces or solids that honour the original point clouds and that can be subsequently used as actionable mining objects for downstream design purposes, such as pit or stope reconciliations, cross sectioning, summarization of underdig, overdig, and percentage of volume variance.



### Key Benefits:

**Extendable:** Takes point clouds as input directly from 3D LiDAR scanners, robotics, drones, and geotechnical monitoring systems.

**User-friendly:** Seamless workflow makes processing scan data quick and easy.

**Integrated:** Works seamlessly with all other modules in GeoMine to turn point clouds into actionable mining CAD objects.

- Interactive viewing and mark-ups of large point clouds.
- Color-coding point clouds by specified attribute intervals
- Tools for filtering, segmenting and performing Boolean operations on point clouds.
- Turns point clouds into high quality surfaces or water tight solids that honor the original points.
- Mesh repairing tools including hole filling and mesh solidification.
- Easy to use modelling and CAD tools for underground survey applications, including cross sectioning, volume and surface area calculations.
- Applies colour schemes to highlight areas of interest.
- Includes reconciliation tools to show design variance, areas of conformance, and underdig and overdig.

