



## Quarry – Two Solutions in One

More and more quarry operations are seeking to capitalise on the benefits of computer technology for quarry design, deposit modelling, site assessments and quality control. Using a modern data handling structure, Gemcom Surpac Quarry Edition centralises data from drillholes, surveys, aerial photographs and drafting packages to give a complete representation of any operation. The heart of the package is the 3D graphical work environment for real world design and presentation. As Quarry is a modular system, a project can start with the tools required today and then add modules as the project evolves over time.

### Engineering Design

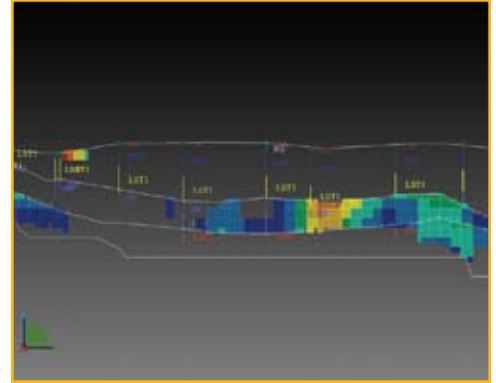
The Computer-Aided Design (CAD) style tools in Quarry allow engineers to rapidly design and plan new quarries. Slope angles and bench heights can be set and designed to specific horizons or geological surfaces. Management of ramps, roads and safety berms are set by the user. Drafting tools are intuitive and easy to use. Design choices include working from a topography surface down or from the bottom of a horizon up. A key advantage of using Quarry is that it allows the engineer to work in an interactive environment with all information present to ensure design rules are automatically included and zones of interest are honoured e.g. town boundaries, existing roads etc.

Throughout the design process, reports can be generated which can include the breakdown of volumes by level or quality within each level and pit optimisation tools can be incorporated to test economic sensitivities of the design.

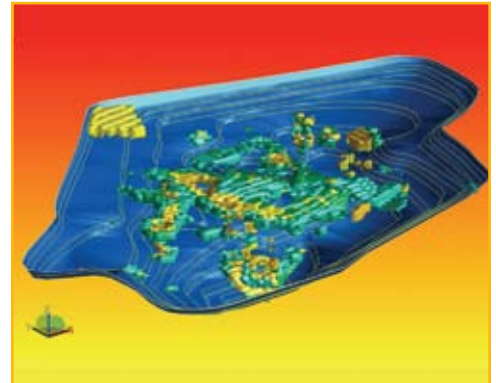
### Visual Geological Display

Geological data such as drillholes, lithology and chemistry results are displayed interactively in 3D. Click-and-drag mouse action is used to create cross-sections through drillholes, surfaces and quarried areas. Display styles can be setup for geological zones and quality ranges to aid visualisation of data. Topographic surface modelling is easily achieved using DTM triangulation techniques and can be made very realistic by draping an aerial photograph over the area. Quarry offers geological modelling tools for simple lateral deposits and more complex faulted and folded deposits.

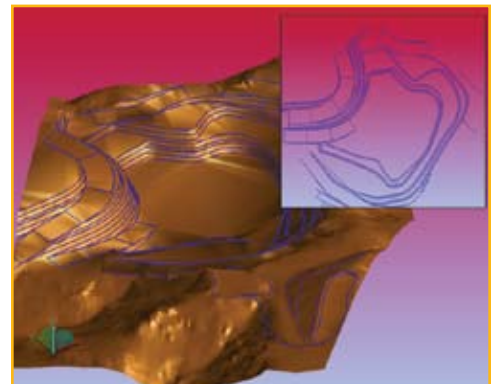
Results can be plotted as contour maps, plan views, cross-sections or graphical log reports. Quarry allows presentation of valuable data, including 3D image capture and animated flyovers. Users can also transfer images with ease to other packages for web site publishing or slide show presentations.



Cross-section showing drillholes, surface profile, upper and lower ore zones, pit profile and ore/waste blocks.



Ore and waste blocks help the mine planner during the conceptual mine design process.



Multiple viewports are easy to add and greatly enhance visualisation.

## Pit and Dump Design

One of the key advantages of using an integrated geology and engineering software system is that the engineer can interact directly with the resource model to build the most economically sensible design. Within Quarry, engineers work efficiently with a visual set of 3D CAD tools specifically built for pit and dump design. The user always remains in full control over ramps, roads, berms, slope gradient and bench width parameters. Drafting tools are intuitive, easy to use and can highly automate the design process.

By direct interaction with a block model, the quarry may be designed around quality zones. Quality and tonnage calculations at each level through the deposit can be generated as the quarry is designed. Upon completion of the design, reports are generated which include breakdown by level and quality. Reports can be written to a choice of formats, including easy output to spreadsheets for further processing and reporting.

## Block Modelling

Within Quarry, for each block in a modelled area, attributes are nominated which represent the numerous qualities of the rock within the area of interest. These attributes might include lithology, grades or densities. Geostatistical interpolation methods result in numerical or descriptive values being assigned to cells, based on the raw drillhole data, which can then be reported in a number of ways. For example, “Within the designed pit, what is the economic reserve?” or “How much of a particular material type is there within 20m of the surface?”

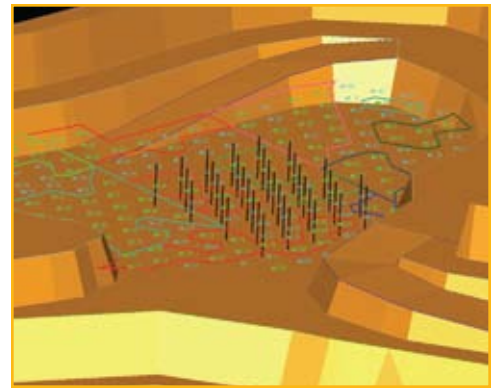
For meaningful visualisation, blocks within Quarry can be colour coded based on any numerical attribute and using the constraints engine, the model can be displayed in combination with features such as topography surfaces, ore-bodies, seams and pit designs.

Adaptability of the modelling tools to any geological setting is critical. With Quarry, there is no restriction on the number or orientation of blocks.

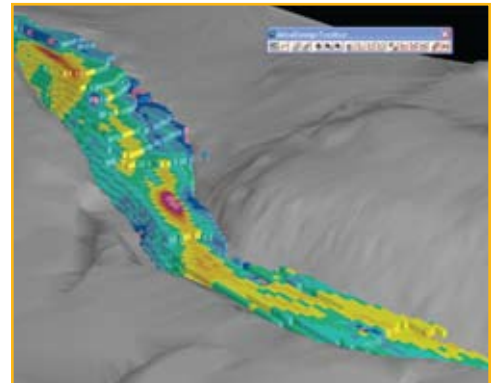
For precision reporting, user-defined sub-blocking is employed to refine resolution along contacts and percentage reporting may be employed to show the ratio of a block inside or outside a constraint. Re-blocking allows for a quick change to the user defined block size. Documentation of all modelling procedures is automatically captured through the audit facility.

## Drill and Blast Design

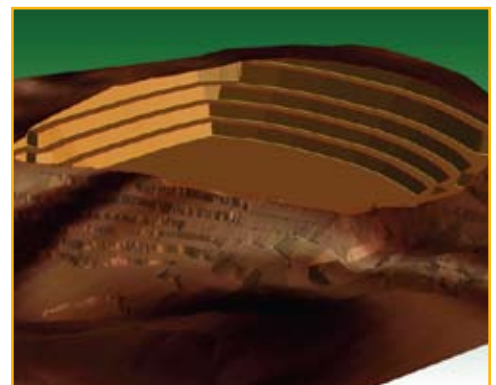
Quarry’s Drill and Blast module contains the ultimate set of tools for designing, planning and reporting on an open pit drill and blast pattern. The user has the flexibility to create and charge vertical or inclined holes using different user defined grid patterns. Pre-split holes can be designed to follow a curve where the lengths of the holes are determined by a specified hole depth or the hole’s intersection with the quarry design. Once the drill and blast has been designed, holes can be stored in the drillhole database for further merging with quality data.



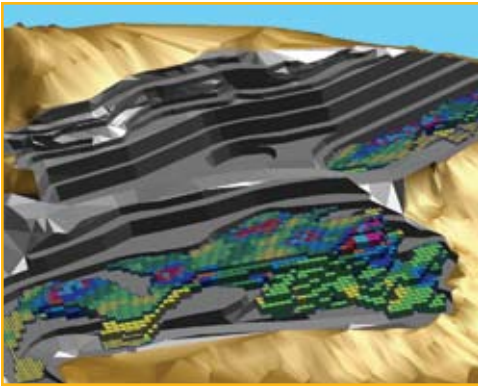
Blast layout with grade control polygons.



Quarry block model constrained by topography and coloured by grade.



A pit design showing a push back into an existing topography with a draped texture.



Open pit target based production schedule.

### Graphical Sequencer

The Graphical Sequencer assists with planning by sequencing the mining blocks to achieve quality tonnage targets. It is an interactive graphics program where mining blocks are simply selected with a mouse and the production tonnage and quality are tabulated and compared to pre-defined targets. Blocks from multiple benches can be mined in a period, but the program ensures only exposed blocks can be extracted. This allows for rapid “what if” sequences to be run to determine which scenario meets the desired production blend.

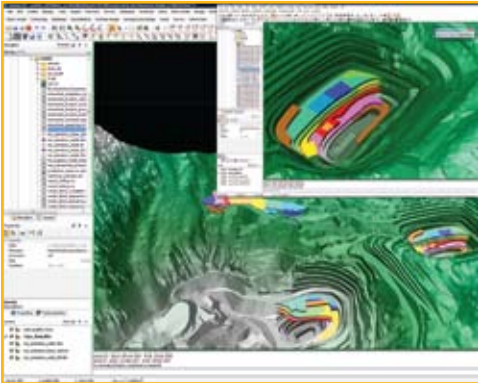
The Graphical Sequencer is a basic, introductory scheduling tool that can be included with Quarry. Users that require advanced scheduling should consider Gemcom MineSched, which can be added to the Quarry package.

### MineSched

Mine production scheduling can be automated with the MineSched modules in Quarry. Scheduling is resource based, which ensures practical, levelled schedules for both long-term and short-term scheduling. The ease with which mining schedules can be automatically generated allows mine planners to spend their time planning and evaluating different scenarios, rather than manually creating schedules in a non-graphical environment.

Quarry’s 3D graphics allows schedules to be validated graphically. The three dimensional graphical environment provides an effective communication tool for presenting the schedule, in addition to maps, reports and Gantt charts, which can also be produced. MineSched’s integration with Quarry gives a seamless interface to the resource block models and pit designs - no time is wasted exporting data from Quarry and importing data into another product for scheduling.

With MineSched’s blending capabilities cutoff grades can be calculated so as to meet grade target thresholds while maximising product quantity. A stockpile blending option minimises material rehandle while meeting product grade and tonnage targets. MineSched’s powerful tools provide mine planning solutions which can have significant economic benefits, solutions which simply cannot be determined from manual scheduling.

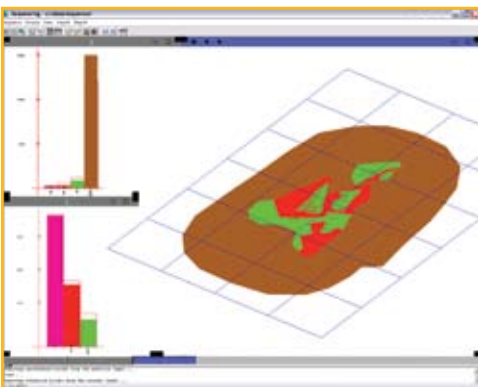


With MineSched both long-term and short-term schedules can be created.

### Data Connectivity

Quarry software supports seamless data connectivity with numerous mining, CAD and Geographic Information System (GIS) packages, such as AutoCAD, MicroStation, ArcInfo and other pit design software. All files are directly read by Quarry without conversion. Data can be manipulated immediately and saved to different file formats so that it can be read by other packages making interaction between packages quick and easy.

Quarry accepts drillhole data in many formats, including the ability to link into existing Microsoft Access, Oracle and SQL Server databases (and other ODBC compliant types) so that visualisation can begin immediately. All database management can be handled through Quarry and if the user is importing raw data, Quarry will always validate the data before inserting it into the database. Small to large operations can use Quarry to develop their own data management strategy or hook into an existing corporate approach.



The Graphical Sequencer showing ore/waste zones within a bench as well as tonnage graphs per polygon.

## Surpac Quarry Edition Modules

The core Quarry package incorporates data management and visualisation of geological information with interactive design tools in a powerful, yet easy to use 3D environment. Numerous optional modules can be added giving each user the flexibility to tailor Quarry to suit their requirements.

CORE FEATURES AND FUNCTIONALITY	
<b>3D Graphics Display</b>	Sophisticated and powerful 3D modelling environment
<b>Plotting</b>	Create, preview, annotate and print user-defined plots
<b>CAD Tools</b>	Create and work with point and line data
<b>Geological Drillhole Database</b>	Manage, query and display drill hole and rock quality
<b>Basic Statistics</b>	Tools for general data analysis, min, max, mean
<b>Wireframe (DTM) Tools</b>	Create and work with wireframe surfaces
<b>Solids Modelling</b>	Create closed wireframes of geological features
<b>Pit and Dump Design</b>	Comprehensive open pit mine and dump design toolkit
<b>Language Support</b>	English, Chinese, Russian, Spanish, German and French
<b>Online Help / Tutorials</b>	Documentation, examples, tutorials and data

OPTIONAL MODULES	
<b>Autoplot</b>	Quick plots to scale with basic user defined options
<b>Data Plug-ins</b>	Read and exchange data with multiple geoscience applications
<b>Block Modelling</b>	Tools for modelling and reporting material attributes in 3D
<b>Road Design</b>	Basic road design toolkit featuring transition curves
<b>Drill and Blast Design</b>	Design, charge and report surface blast hole patterns
<b>Graphical Sequencer</b>	Simple, interactive polygon scheduler
<b>Network Licence Manager</b>	Share and manage licenses across the network

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