

GEMCOM PCBC™

Leading Block Cave Technology

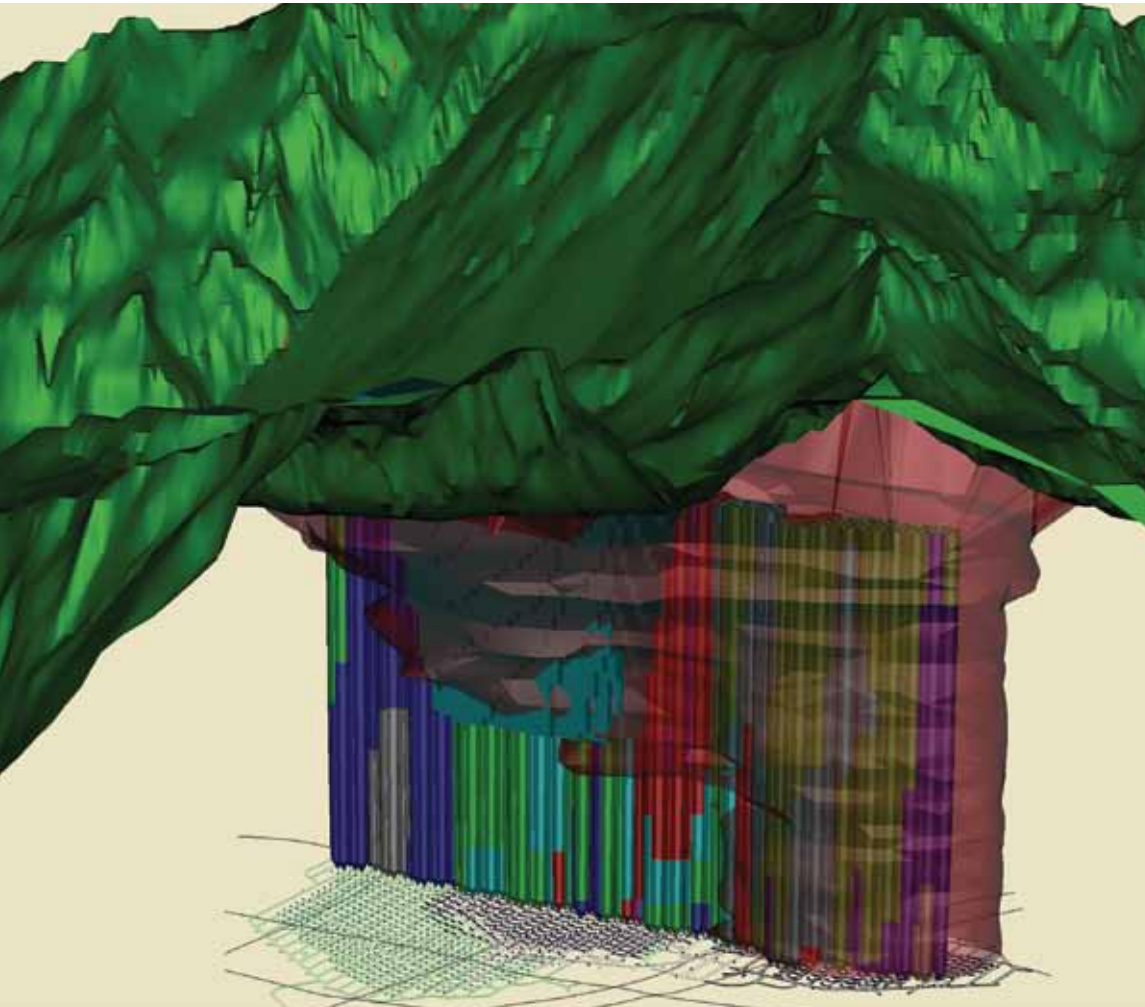


Photo: Sandvik



Gemcom PCBC™ – Virtually every major mining company involved in block caving relies on PCBC's comprehensive functionality to assist with feasibility studies, design, and production management.

Benefits:

- Risk reduction for large capital projects by evaluation of multiple scenarios.
- Better grade modelling and forecasting by using multiple material mixing options.
- Complete integration from pre-feasibility modelling right through to daily production which is unmatched in the block cave industry.
- Powerful production scheduling which can rapidly be updated and modified for real production statistics.
- Provides powerful management reports for effective monitoring of dynamic situations.

Bring Power And Flexibility To Your Block Cave Operation

Gemcom PCBC is a robust system designed specifically for the planning and scheduling of block cave mines. It has been developed over the course of more than 23 years by some of Gemcom's most experienced technical professionals and has evolved to become a leader in its field. Today, PCBC is assisting with processes at most of the major mining companies involved in block caving projects, performing tasks from feasibility studies to daily draw control.

PCBC has a proven track record for providing critical information needed in the multi-million dollar start-up/development stage, as well as for the ability to help keep production schedules current under the dynamically changing conditions of an operating mine.

Key Features

- Full integration with the Gemcom GEMS system. Ready access to block models, polylines, points, graphics and underlying GEMS workspace technology reduces the setup time and increases confidence in the results.
- Draw cones definition and slice file construction are extremely flexible. Draw cone dip and orientation can be

controlled for individual draw points. Variable cone dimensions with time can be modelled.

- Slice files can be constructed from homogenized (regular) block models or from partial block models and/or using multiple triangulated surfaces to control loose surface (or broken) material.
- Various mixing algorithms have been developed including pre-vertical mixing, sequential mixing, Laubscher's and Template Mixing. These allow for modelling of vertical or horizontal mixing, toppling and other cone related phenomena.
- Best Height Of Draw (BHOD) calculations are fast, flexible and effective. Use these calculations to determine mineable reserves, footprint outline and draw point valuations and column heights.

Block Cave Scheduler

Block Cave Scheduler is the flagship of PCBC. Proven in use at dozens of projects, it brings together all of the critical components that affect the block cave schedule, including:

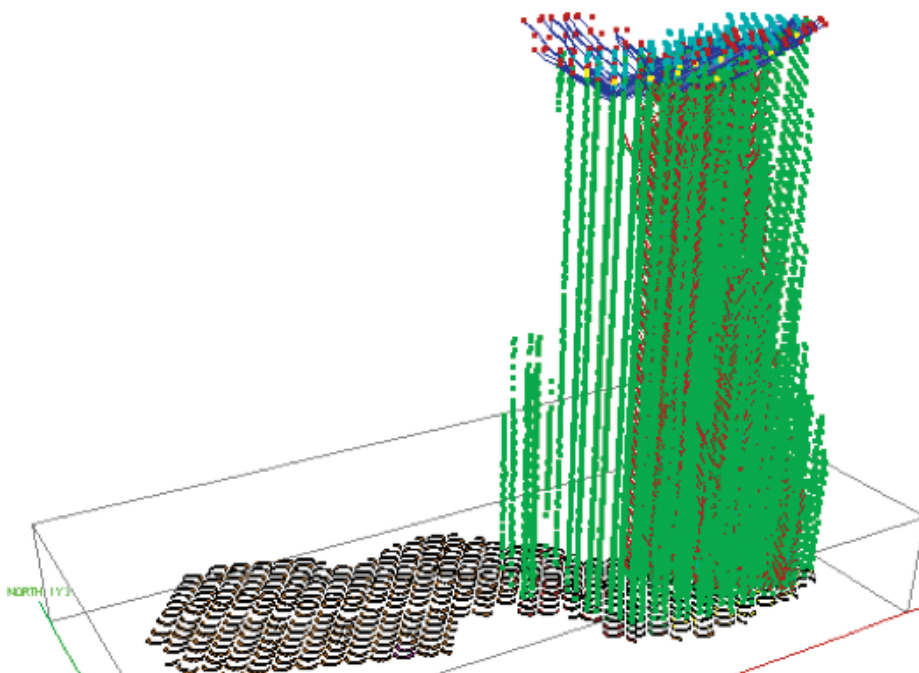
- Draw point sequence. There are several ways to control and input a sequence.

- Rate of development of new draw points.
- Production Rate Curves (PRC) or maturity curves for each draw point.
- Variable production targets and shut-off grades per period.
- Accounts for past, minimum, maximum and total tonnage constraints per draw point.
- Numerous scheduling methods to control the way the cave develops and advances, including PAST (historical), AUTO (oldest first), LINDO (NPV optimisation), DILUTE (dilution minimisation), EVEN, SCALED and others.
- Strong interface between PCBC and Microsoft® Excel® for both input and reporting.
- Numerous display options, including draw column depletion, HOD surface propagation, sequence analysis and interactive charting in Excel during a run.

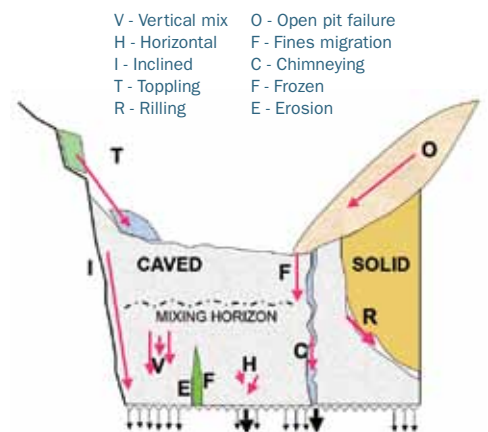
Related Block Cave Modules to PCBC

Cave Management System (CMS)

It is well known that draw control is a critical element of the overall cave management of a block caving operation. PCBC's CMS is designed specifically to automate and optimise this process. Developed for daily operation, the CMS will improve the productivity of cave management technicians, as well as provide powerful management reports for



Template mixing example.



Different forms of material movement.

effective monitoring of dynamic situations.

- Strong interface capabilities with LHD dispatch and monitoring systems, including Tamrock and Modular Dispatch.
- Extensive use of Excel for reporting. This greatly facilitates implementation at an operating mine where technicians are more comfortable working with Excel. CMS still retains the ability to store key data in a secure SQL database.
- Storage of multiple data sources in different SQL tables for improved security access.
- Numerous configurable options to control the draw order.
- Interactive draw point information display for easy status interrogation with user-configurable status codes.
- User-configurable reporting for draw order, draw summary, exception reports and compliance.
- Effective highlighting of draw point exception conditions.
- Smooth month-end transition. Avoid the dangers and hassles of changeover from one month to the next.

Footprint Finder

This is very useful in an early stage project to help identify the optimal elevation(s) at which draw point footprint(s) should be located.

- Block based optimisation. No need to generate a full draw point layout.

- Flat or inclined base surface. Can be made to follow any triangulated surface.
- Simple vertical mixing on the fly using Laubscher type mixing.
- Vertical discounting accounts for time taken to mine tall draw columns.
- Summary results to Excel for fast analysis.

LSQ Using Least Squares Sample Analysis in Block Caving

LSQ is intended for use at operating mines where sample analysis vs slice file forecast values is required.

- Efficient storage of monthly composited assays in a secure database.
- Compare actual grades with model (slice file) grades.
- Modify slice file based on assay data where appropriate.
- Use modified slice file data to generate improved production schedules.
- Process is analogous to the use of blast holes in an open pit to better estimate short range grades for mill feed and planning purposes.

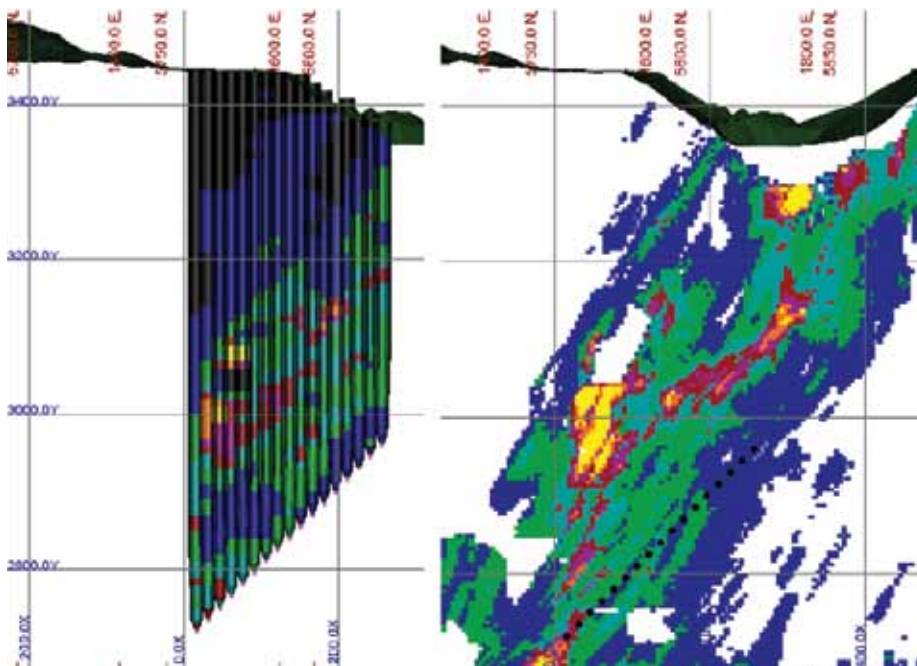
Block Cave Schedule Optimisation

Provides more effective techniques for computing production schedules subject to multiple constraint sets and corporate planning objectives.

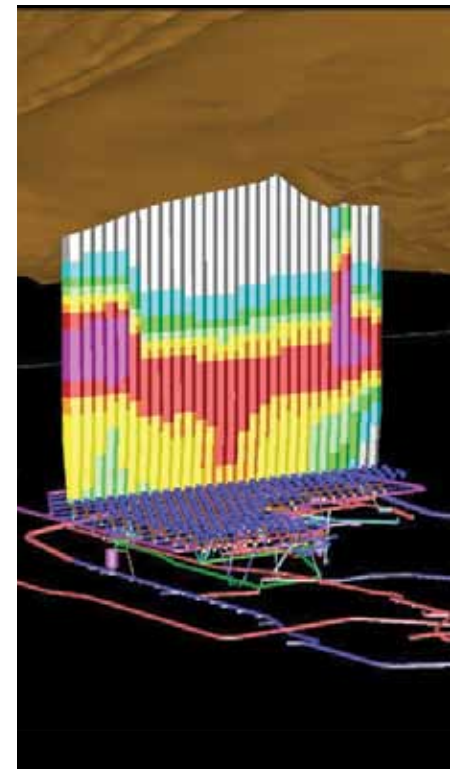
- The optimisation algorithms are embedded into the production schedule.

“We have been using PCBC since 1997. The system provides what we call “PCBC grade,” because the predicted grades very closely mirror actuals. PCBC has enabled us to mine more effectively, providing us with a complete solution encompassing long-term planning and daily draw control, which are linked through a central database. Our ability to maintain quality control/cave management with PCBC is enhanced because we always have direct access to the latest, correct data.”

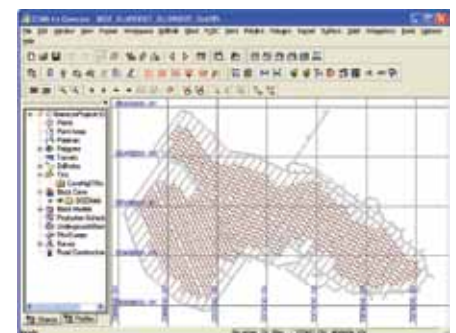
— Rudy Prasetyo,
General Superintendent for Cave Management, PT Freeport Indonesia.



Create slice file from a block model.



Draw column representation of grade distribution.



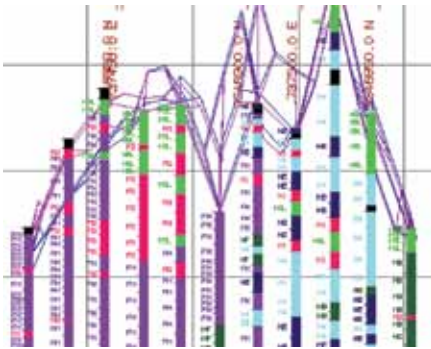
Typical draw point layout.



- Different scheduling methods such QSMOOTH, QP and SURF provide access to specialised Linear (LP) or Quadratic Programming (QP) optimisers. Dilution constraints can also be applied.
- These LP and QP schedule options allow for use of production block (or tunnel) constraints to better model maximum overall production capacity.

Operational Tools for Block Cave Mines

Provides the infrastructure to capture and analyse draw point geology observations such as rock type percentages.



Effective storage and plotting of draw point observations in drillhole format.

- Efficient storage of monthly draw point geology or geotechnical observations.
- Comparison of actual vs forecast geological conditions per draw point and better mill forecasting.
- Generation of pseudo drillhole type displays to show historical geological information for comparison with block models or other drilling information.
- Analysis of cross sectional reconciliation, material migration and mixing conditions.
- Draw rate and cave surface propagation analysis.

There is also a highly specialised module which assists with the storage and analysis of convergence monitoring information in an active block cave. It is a critical component in an efficient cave management program.

- Efficient storage of tunnel convergence observations.
- Contouring of convergence data to highlight draw points which may be receiving excessive loading.
- Easy addition and management of convergence station data.

Companies Using PCBC

- **Freeport - McMoRan**
Phoenix Arizona Office
- **PT Freeport Indonesia**
Deep Ore Zone (DOZ)
Future/prospective ore bodies
- **Rio Tinto**
Regional Offices
Palabora
Northparkes
Argyle Diamond Mine
Resolution
Bingham Canyon
- **Codelco**
Andina
El Teniente
El Salvador
- **Newcrest**
Ridgeway
Cadia East
- **Ivanhoe – Oyu Tolgoi**
- **Chevron – Questa Mine**
- **De Beers' Finsch and Venetia Diamond Mines**
- **Philex Padcal Mine, Philippines**
- **Stantec Inc, Arizona**

For more information email pcbc@gemcomsoftware.com.

Disclaimer and copyrights

This document gives only a general description of products and services and except where expressly provided otherwise shall not form part of any contract. Changes may be made in products or services at any time without notice. Copyright 2010, Gemcom Software International Inc. Gemcom, the Gemcom logo, combinations thereof, and PCBC are trademarks of Gemcom Software International Inc. All other names are trademarks, registered trademarks, or service marks of their respective owners.