

# GEMCOM CUSTOMER CASE STUDY



## Cerrejón achieves world-class coal mining with end-to-end Gemcom Minex™ solution



One of the world's largest earthmoving operations tames complex stratified deposit with Minex, increasing annual recovered coal from 18 to 32 million tonnes over seven years

**Country:** Colombia

**Objective:**

Maximise efficiency and productivity of coal mining operations in a highly complex environment to ensure competitiveness in the world market.

**Approach:**

Employ Gemcom Minex software for surveying, geological modelling, and all phases of planning, leveraging Gemcom's knowledge of and experience with large, complex stratified deposits to optimise the handling of reverse thrust faults and through-seam blasting.

**IT Improvements:**

- Advanced 3D geological models represent coal and overburden volume, quality parameters, and comprehensive mineral analysis.
- Integration of required tools in one system minimises the risk of manual data import.

**Business Benefits:**

- Increased annual recovered coal from 18 million to 32 million tonnes over a seven-year period with no increase in the mine planning staff.
- Supports complex deposit which includes five different mining zones, numerous reverse thrust faults, and more than 40 coal seams.
- Effectively plan mining operations at one of the world's largest earthmoving operations, with 250 million BCMs of material moved each year.
- Create detailed, cyclical monthly plans for 40 shovels of different sizes and applications in two to three weeks.
- Improved modelling and mine planning capabilities have contributed to increase coal recovery of 4% over the last five years while achieving a calorific value (CV) of +/-10Btu/lb against the modelled CV.

*"I believe Minex is technically the best software available for this type of complex deposit."*

*— Juliano Maran, Superintendent for Strategic Mine Planning and Geotechnics, Carbones del Cerrejón*



Panoramic view of Cerrejón's Tabaco Pit, the largest pit in the operation, currently producing more than 11Mtpa of coal.

## Coal mining on a mega-scale

*Carbones del Cerrejón (www.cerrejoncoal.com), a world-class coal producing and exporting company, is jointly owned by Anglo American, BHP Billiton, and Xstrata. Cerrejón comprises not only the mine itself, but also dedicated rail and port facilities. It represents one of the most complex stratified deposits and largest earthmoving operations in the world.*

By any measure, Carbones del Cerrejón is huge. The vast open pit coal mine in northeastern Colombia produces 32 million tonnes of coal annually. In order to uncover and export all this coal, Cerrejón moves a tremendous amount of material—some 250 million bank cubic metres (BCMs) per year—making it one of the largest earthmoving operations in the world. The deposit covers an area approximately 50 by 10 kilometres, within which five different zones are mined concurrently. Cerrejón even boasts super-sized fossils: Vertebrae of the largest snake ever found, the 60 million year-old Titanoboa cerrejonensis, were recently unearthed in one of the pits.

Cerrejón is as complex as it is massive, which is why the company uses powerful Minex software for geology and mine planning. Approximately 40 different seams—ranging in thickness from 60 centimetres to over four metres, and with thousands of data points for each structure—have been modelled and are presently being mined. The seams dip steeply in some areas, and reverse thrust faults are common. “The dipping and faulting not only make mining more difficult—we have to mine across the strike in what we call an area fashion—but also the geological modelling becomes very complex,” says Juliano Maran, Superintendent for Strategic Mine Planning and Geotechnics. “I believe Minex is technically the best software available for this type of deposit.” Cerrejón has relied on Minex since the mine started operation in the mid-1980s.

### Planning for 40 shovels

At Cerrejón, Minex is used in the geology area and in all phases of mine planning. Borehole information in a database form is imported into Minex. The raw information is used to create a 3D geological model that represents a broad range of critical data—not just the volume of the coal and overburden, but also quality parameters (for example, ash, sulphur, and calorific value) and a comprehensive mineral analysis.

Once the 3D model is created, verified, and accepted, Cerrejón uses Minex to lay out various pit shells and determine the optimal approach to development. The life-of-mine plan, which is updated annually, is rolled out to mid-range planners for five-year mine plan sequencing. From there, planners use Minex to produce a detailed month-by-month forecast for the first two years, which becomes Cerrejón’s business plan. Finally, short-range planners lay out monthly mine plans for 40 shovels of different sizes and applications, a cyclical process that takes approximately two to three weeks. Detailed weekly and daily plans are also created.

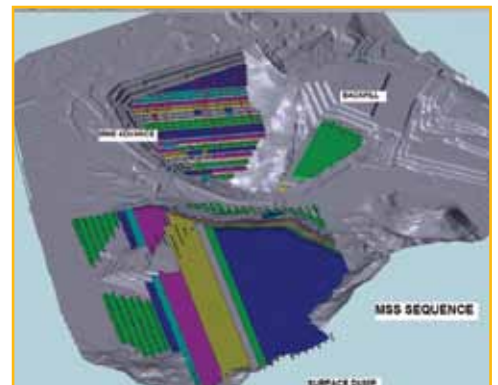
“With Minex, our engineers generate high-quality maps, reports, and other information,” says Steven Sides, Vice President of Technical Services. “We literally hand these outputs to the production department, and they implement the plans that have been developed. The driver behind all of this is Minex.” Using Minex along with operational improvements in the field, Cerrejón has increased coal recovery 4% over the last five years and has been able to achieve a CV of +/-10Btu/lb against the modelled CV.



Waste rock excavation using hydraulic excavator and haul truck.



Field geologist working with highly complex geological model.



Detailed life-of-mine plan including pit, surface dumps and backfill sequencing.

“Minex provides us with an integrated system for surveying, modelling, planning, and blast design so we can manipulate data and interchange information freely. Any kind of manual re-entry always opens up room for error; the same holds true if you’re exchanging data electronically between systems with incompatible formats. Minex helps us avoid these risks.”

— Steven Sides, Vice President of Technical Services, Carbones del Cerrejón



Surveying crew in one of the pits collecting data to update the mine’s grids.

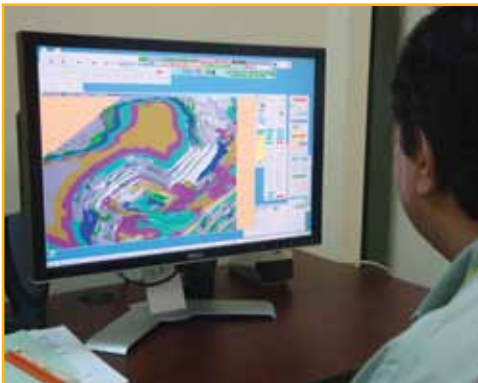
“Without Minex, we would be very unproductive, because we’d be mining in areas without proper planning or a clear understanding what the geology looks like,” Sides continues. “Minex allows us to see below the surface of the ground, thus providing us with a good picture of what it looks like before we get there.”

### End-to-end integrated solution

A key benefit of Minex is the fact that so many capabilities are integrated into a single package. Standard features include graphics, plotting, surface modelling, and CAD tools. Other modules enable users to load boreholes from multiple sources, analyse trends, minimise dozer push distances, optimise pit design, lay out blasthole patterns, manage topographical data, design dumps and roads, schedule open pit mines, and much more.

The value of this benefit is not lost on Sides. “Minex provides us with an integrated system for surveying, modelling, planning, and blast design so we can manipulate data and interchange information freely,” he says. “Any kind of manual re-entry always opens up room for error; the same holds true if you’re exchanging data electronically between systems with incompatible formats. Minex helps us avoid these risks.” He adds that Minex enhances productivity at Cerrejón by minimising the number of different applications his engineers need to learn. Cerrejón also values the fact that Minex interfaces easily with other end-user software and database products.

The ability to evaluate different scenarios quickly with Minex is another essential feature of the product. “Once we’ve determined what the optimal shell looks like, assessing the relative advantages of different mining sequences is fairly straightforward,” says Sides. Minex allows Cerrejón’s geologists to develop accurate geological models, from which the mine engineers can develop numerous mining alternatives. This flexibility has resulted in the selection and implementation of optimal mine plans, leading to an annual increase in recovered coal from 18 million to 32 million tonnes over a seven-year period, with no increase in the mine planning staff.

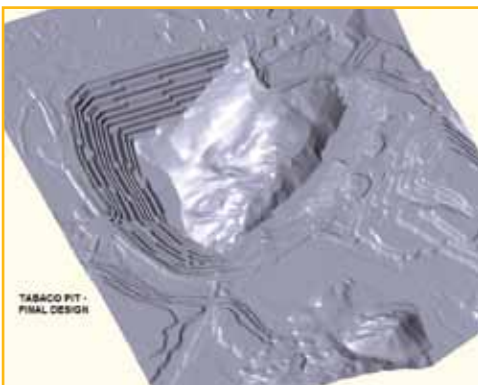


View of detailed sequencing of complex, multiple pit, multiple seam mining operations.

### Time is money

The complexity of Cerrejón’s deposit presents special challenges vis-à-vis the worldwide coal market. The company must take all the reverse faults—not to mention the various dips, rolls, anticlines, and synclines—and develop meaningful, feasible mining plans that enable it to compete with producers that have more straightforward, easily mined deposits. “There are not many software packages for geological modelling and mine planning that can handle reverse thrust faulting, and this is one area in which Minex is superior to other products on the market,” says Sides. “The ability to deal with multiple, steeply dipping seams is also critical. Minex meets the needs of our complex environment very well.”

Although Cerrejón regularly evaluates alternative mine planning software, Minex continues to provide the best integrated solution for the company.



Final pit configuration of one of the seven pits in the current Cerrejón life-of-mine plan.

# GEMCOM CUSTOMER CASE STUDY



“Time is money,” says Sides. “Any software that helps us do our job faster and more thoroughly will deliver a competitive advantage. I don’t think any of the software that goes up against Minex would allow us to perform the modelling and planning in that same timely manner.”

## A valuable partnership

Cerrejón and Gemcom have enjoyed a synergistic relationship for many years, and Sides particularly appreciates Gemcom’s responsiveness to his company’s unique needs. One example is a special Minex module for through-seam blasting, a technique that Cerrejón uses routinely because of the high number of steep dipping coal seams. Using Minex, the boreholes are logged and the seam locations are entered into the computer; each blasthole is designed differently, because it intersects the seams at different elevations. Minex makes it possible to identify the optimal location for the blast charges, thereby minimising damage to the coal and maximising recovery.

Another powerful Minex module focuses on reverse faulting. “If your model is not predicting these faults correctly, you are either overstating or understating a tremendous amount of coal,” says Sides. “Minex allows us to accurately predict reverse faults and associated tonnages. When we get to them in the mining process, we have an excellent idea what the outcomes will be.”

Cerrejón is already working on plans to expand annual production well beyond the current 32 million tonnes, and Minex will be a pivotal element in ensuring the company’s ongoing success. “Minex helps Cerrejón develop effective mine plans that can be utilised to make prudent business decisions,” Sides concludes. “It gives us an important edge as we compete with other producers around the world. We are only as good as the vendors that serve us, and Cerrejón is very fortunate to partner with a company like Gemcom.”

## Carbones del Cerrejón Solutions at a Glance

### Primary Applications:

→ Gemcom Minex

### Gemcom Services:

- Technical support
- Onsite training
- System configuration
- Software customisation

For more information email  
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