

Mine entry created

A greenfield mine site requires the establishment of essential infrastructure which draws on the contractor's multidisciplinary skills and experience, writes *David Poggiolini*.

While public-sector projects in South Africa have been few and far between, the mining sector continues to be a significant driver of civil activity. Two of Sasol's much-anticipated coal projects have finally seen the light of day, making it a client body of note.

Sasol's new Impumelelo Mine has transformed the province of Mpumalanga, South Africa, into a hive of construction activity as various civil contractors play out their roles in bringing the project to fruition.

The greenfield project calls for the establishment of extensive basic services while shaft-sinking progresses and temporary surface infrastructure is tackled.

In March 2011, Liviero Civils arrived on site to start constructing 12 km of mine-access roads, and 28 km of conveyor formation and associated access road. When *Civil Engineering Contractor* visited the site in October 2011, Liviero was trying to make up time after experiencing significant delays due to environmental issues. Liviero has also been tasked with constructing various concrete reservoirs and earth dams as well as the associated pump stations and pipework. The capacity of the reservoirs is 3.6 M³, 9 M³ and 1 M³, and the dams are 84 M³, 9 M³ and 7 M³.

Meanwhile, the bulk earthworks component of the mine project is also being undertaken by Liviero. The challenges are more than meets the eye with the contractor having to contend with clayey soil conditions, ongoing changing design parameters and delays in the issuing of water licences for the many different water crossings. In addition, suitable material for layer works is not available on the site which requires a change in the design parameters of the roadworks. The contractor has taken these tests in its stride and was progressing steadily when *Civil Engineering Contractor* visited the site in late 2011. Rocla, closely linked to the success of the project, has to adapt to the changing design parameters of the many culverts it has supplied to the contractor.



David Poggiolini

Project: bulk earthworks
Value: R255-million
(about US\$31-million)
Location: Mpumalanga,
South Africa
Start: March 2011
End: November 2012
Main contractor: Liviero Civils
Consultant: RSV Enco-Goba
Coal Joint Venture



Essential infrastructure

One of two of Sasol's latest projects calls for the construction of essential infrastructure for the new Impumelelo Mine. Roads and the conveyor formation are top priorities on this challenging greenfield site.

Mine project @ a glance

The entire Impumelelo Mine contract is valued at R4-billion (about US\$500-million). On completion, the coal-mining complex will supply Sasol Synfuels with 8,5 Mtpm of feedstock.

Engineering, procurement and construction management was awarded to the RSV Enco-Goba Coal Joint Venture (JV) in 2009, and construction contracts were awarded in 2010 for the 42 month-long project.

The project will enable Sasol Mining to mine the No 4 and No 2 seams simultaneously via deep shafts. The shaft-sinking contract is already under way. The final shaft depth is about 225 m below surface.

Opening up will start in mid-2013 and first production in the first quarter of 2014. This is the first JV between RSV-Enco and Goba.

5 packages

Theunis McDukling, project manager, says the scope of work at Impumelelo Mine consists of the following packages:

- Package 1 – man material shaft
- Package 2 – ventilation shaft
- Package 3 – decline material shaft
- Package 4 – inter-shaft on coal development
- Package 5 – underground surge bunker

Package 1

The work includes:

- detail design, supply and installation of the sinking and permanent steel head frame and/or a combination of both
- execution of blind-sinking operations
- a round vertical shaft of 11,7 m internal finished diameter
- detail design, supply and equipping of the vertical service shaft for the permanent condition after completion of the shaft-sinking operation
- detail design, supply and equipping of the headgear for the permanent condition, excluding the supply and installation of two permanent hoisting systems complete with ropes
- roping up of the Koepe winders and application for licensing of the hoists
- shaft bottom at 240 m from top of collar (over-run is 15 m)

Package 2

The work includes:

- round vertical shaft of 6,6 m internal finished diameter
- concrete-lined shaft
- shaft bottom 225 m from top of collar
- supply and installation of the sinking head frame
- execution of blind sinking operations

Package 3

The work includes:

- opening up, support, consolidation and closure of the portal as per approved method statements
- supply and installation of sinking equipment
- surface spoil, muck and coal-handling facilities
- construction of shaft portal
- development of top and bottom vertical curves
- construction of 15 000 t coal raise-bored coal surge bunker below the No 2 coal seam horizon with associated steelwork
- provision of water-handling infrastructure for the new blind-sink and supported decline shaft (this will include the No 2 and No 4 coal-seam intersections as well as associated construction work for coal-handling purposes (including the No 2 and No 4 coal seam intersections and associated construction work for coal-handling purposes)

Package 4

Coal development will be done with mechanised methods on the No 4 coal-seam horizon and No 2 coal-seam horizon which will contribute to the safety of all with the minimum human footprint possible.

Package 5

The design, supply, provision and maintenance will include:

- a coal-loading gallery and a 7,1 m-diameter raise-bore surge bunker (1 500 t) raise-bored and constructed from the bottom of the decline through the No 2 seam and up to the No 4 seam horizon (piloted from surface)
- the raise-bored bunker to be enlarged and slipped to 10 m diameter between the No 2 seam and bottom-loading gallery
- lining of the underground coal surge bunker from No 4 seam to the loading gallery below No 2 seam which will be 25 MPa mass concrete with minimum thickness of 250 mm
- steelwork for two reclaim conveyor systems
- discharge support structure at the bottom of the underground coal-surge bunker comprising a reinforced-concrete slab and steel columns
- the loading gallery floor
- coal-bunker construction on the No 2 and No 4 seam horizons
- bunker steelwork including cast-in-steel work
- support brackets for future lights, cables and pipes

"The project will enable Sasol Mining to mine the No 4 and No 2 seams simultaneously via deep shafts."



Photographs by David Pogrebin

Crossings challenge

The road-construction programme is being tackled in sections – some more advanced than others when *Civil Engineering Contractor* visited the site in late 2011. Unfortunately, in some places, progress has been hindered by red tape which is out of the hands of the contractor.

Clint Dietrich, site agent for Liviero, says late issuing of water licences by the authorities has been a challenge in terms of creating delays in the programme. The road-construction programme has 38 crossings and the conveyor route has 36 until the 18 km mark. The crossings mainly comprise pipe culverts with one portal culvert for the road-construction programme.

Three water licences are needed on the conveyor between the 1.4 km and 2.7 km marks and six in the road-construction programme.

Meanwhile, the earthworks component of the project comprises one culvert crossing where access was granted without any delays.

The pipeline-construction component of the project has been subcontracted to WK Pipelines which, as a result of the delays, was only able to construct the outlets late last year. Work on the inlets has yet to commence on 14 km of the conveyor route.

Third revision

In the meantime, there have also been changes to the sizes and qualities of the various culverts produced and supplied by Rocla. Late last year, the contractor was busy with the third revision of the scope of works which Dietrich describes as quite a big change to its predecessor. While this is a challenge for the contractor, it has also tested the

Comment

The precast-concrete manufacturing sector is dominated by a number of small participants. In this highly overtraded sector, the ability to absorb the challenges faced by Rocla in this specific project is invaluable. The logistics handled by material suppliers such as Rocla sometimes far outweigh the value of the product.

1 4 000 t and counting

A total of 4 000 t of culverts have been supplied to the project.

2 Flexibility key

The works had to be sequenced around the granting of water licences.

abilities of the culvert producer which has had to build these contingencies into its daily business.

Bernard Truter, regional sales manager for Rocla, says the company has been contracted to produce a total of 4 000 t of culverts as part of the construction programme. The culverts range in size from 1,2 m x 0,6 m to the largest at 3,6 m x 2,4 m which began to arrive on site in July to be placed on the slabs poured by Liviero.

Rocla had to be extremely flexible; fielding changes in culvert production from Liviero with a few weeks' notice. The contractors have been impressed with the quick adaptation to the fast-track programme. In one instance, for example, the contractor had to alert Rocla that it would only accept 55 of the 100 culverts produced and that it awaited delivery at the production plant.

The precast-concrete producer has been able to absorb the changes in programme but not without difficulty. At one stage, its yard in Roodepoort, Gauteng, South Africa, was full of culverts which could not be used for the project while items ready for delivery were put on hold as they would only be needed next year.

When *Civil Engineering Contractor* visited the site, there was a strong possibility that the contractor and Rocla could expect more changes in the programme.

■■ on site



Forging ahead

Despite these hold-ups, Dietrich and Terence Khumalo, site engineer for Liviero Civils, are confident that the team is able to complete the project on time and within budget – based on progress made before the rainy season.

Khumalo says the road comprises five layers and surfacing – two selected layers, two sub-base layers, one base layer and surfacing. The road will have a double-seal surfacing only on the intersections while the conveyor alignment comprises two pavement layers – one selected layer and a wearing course.

By May 2011, the contractor had completed the first 6 km of the conveyor route and all crossings except for two held up due to late granting of water licences. On the main access road, Liviero had completed the final levels between the 6 km and 12 km marks which still had to be surfaced.

Dietrich notes that phasing of the work was not an issue despite the other contractors working on site. Blasting for shaft sinking, for example, is only undertaken at 17:00 every day.

Clay abounds

The construction site comprises significant quantities of clayey material. The road-construction programme, therefore, entails excavation of a 500 m box cut and removal of the material and spoiling it off-site before commencement of the road-construction programme.

Liviero will be using 11 borrow pits for construction materials. Unfortunately, with most of the material found on site, the best is a G6- and then a G9-quality stone based on the assessment of the material accessed from four borrow pits to date. Khumalo says that the road-construction design will be changed to accommodate the challenge: accommodating a G6 to G7 stone.

Alternatively, stone will have to be brought to site at a higher cost. Blasting to open up more was set to start in November 2011.



Photographs by David Pogreben

More construction

A deviation road is being constructed to serve as a temporary road during construction.

"Phasing of the work was not an issue despite the other contractors working on site. Blasting for shaft sinking, for example, is only undertaken at 17:00 every day."

Liviero has been tasked with all the crushing in the borrow pits – using a mobile crushing and screening plant.

When we visited the site, Liviero was tackling work on a temporary deviation to the main road. It was placing 20 x 6.2 t culverts in a 25 m x 3.6 m excavation. A 100 t crane was used to tackle the lift – a 50 t crane was not suitable.

Civil Engineering Contractor looks forward to revisiting the site in the foreseeable future when the roads to the construction site have been completed and to witness the prospects which emerge from this catalyst for future civil-related projects. ■