EXTENDED
CASE STUDY

MAPTEK™ Vulcan™

Innovative Mining Solutions Worldwide

LIFE OF MINE STUDY FOR LIMESTONE OPERATION

Life of mine study for limestone operation

Penrice Soda Products mines chemical grade limestone at its quarry in the Barossa Valley, north of Adelaide in South Australia. The open cut operation is multi-benched, with quarrying active on many of these benches.

Penrice has been using Maptek Vulcan™ to streamline mine planning since the early 1990s.

More recently, Penrice contracted Maptek to produce a broad 30 year, life-of-mine plan, to replace the previous plan which was based on a 17 year mine life. Six new 90 tonne trucks have recently been leased to increase production capacity.

The factors considered when developing the plan were:

- the need to uncover stone reserves to ensure short term operation
- matching overburden removal to stone production
- the location of the crusher and type of crusher to be used
- bench and ramp widths to accommodate operation of 90 tonne trucks
- optimising the benefit of increased overburden removal with introduction of larger capacity trucks
- allowing operational flexibility so that final pit boundaries can be adjusted if economic circumstances change
- setting the final boundaries based on the lowest strip ratio

The first objectives were to develop a model based on current costs, and an economic pit design.

Maptek defined an economic mine plan for the Penrice deposit with the final boundaries determined by the economic stripping ratios and the total stone quantity required for 30 years of operation. Stage plans were developed to demonstrate the sequential development of the quarry and to illustrate how the plan can be achieved. To identify operational issues arising from the new plans, Maptek produced plans in six monthly stages for two years, then five yearly.

Penrice's soda ash plant at Osborne, a western suburb of Adelaide, processes 1,165,000 tonnes of stone each year. In this study 34 million tonnes of stone has been delineated down to RL240. This equates to 30 years operation with a waste to stone ratio of 1.01:1. While the overall strip ratio and cost is attractive, there will be higher overburden requirements in the early years of the plan to uncover resources on the lower levels.

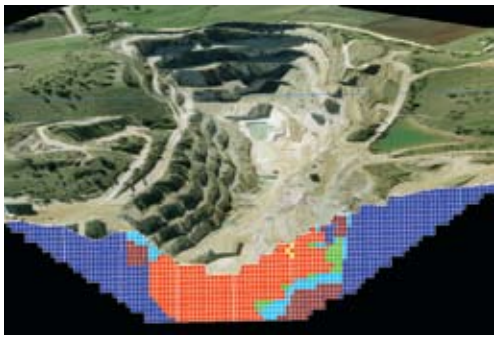
This is due to the fact that the Penrice Quarry has been operating for many years and the good quality stone on the upper levels has been mined.

Other goals were to identify the impact of improved stone recovery, determine the profitability of stone available for different products, and identify further methods for pit optimisation.

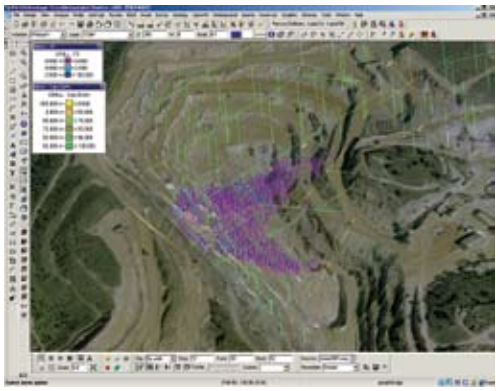
The geology of the Penrice operation was reinterpreted on the eastern and western boundaries to prove the extent of the resource and track it north from the present pit limits. Both geological interpretation and assaying of drillholes was undertaken. Recent drilling has confirmed the new orebody boundaries in the area of the crusher.

Stage plans were developed to demonstrate the sequential development of the quarry. To identify operational issues arising from the new plans, Maptek produced plans in six monthly stages for two years, then five yearly.

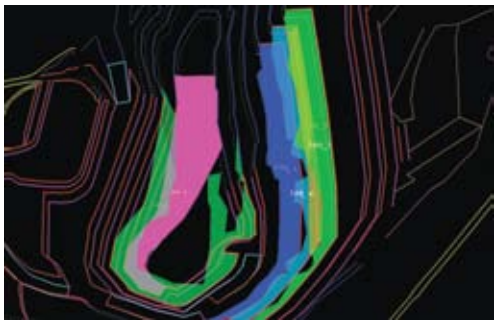
For detailed mine planning, the quarry was divided into six areas for estimation purposes; initial excavation is planned for the area with the lowest strip ratio.



Block model section, coloured by final products



Drill and blast holes in the southwestern section of the Penrice pit



Bench polygons coloured by mining periods based on stage plans

Drilling in the southwestern area indicated a high grade variation; averaging the model gave a lower grade but more consistent material, which was not the case. New drilling defined a boundary of variability which was used in the block model. All material within this boundary was deemed waste for the study.

For detailed mine planning, the quarry was divided into six areas for estimation purposes; initial excavation is planned for the area with the lowest strip ratio.

Since the completion of the Penrice model and the 30 year plan, further work has been completed by Maptek to modify the plan to best utilise the extra capacity of 90 tonne trucks. It was found in the process of compiling the report that the current position of the crusher was unsuitable to the long term future of the operation.

A substantial quantity of high quality stone was directly under the crusher and it was determined that avoiding the extraction of that area of the pit was not an option in the short or long term.

A combination of practical knowledge from the operational staff and the pit design capability of Vulcan resulted in a favourable solution to the issue.

The design incorporated a change of pit access in line with the final pit design while still retaining access to the current crusher location. A secondary crusher could then be used while the new crusher is installed and the excavation can continue unhindered.

When the operation approaches the final pit shape, the potential exists to further extend the mine life of this unique deposit.

From the new geological boundaries a model was created using blocks 5m x 5m x 6m deep. Schist boundaries run approximately north-south until they reach the nose of the anticline where they turn approximately east-west.

Where the stone meets the schist boundaries, sub-blocks of 5m x 5m x 1m deep were used to improve the geological definition.

The estimation process consisted of four stages. Samples used in the estimation were from blast and exploration holes located within the schist boundaries defining the deposit. The first stage of estimation consisted of using the blast holes and interpreting grades into blocks that were within ellipse dimensions of 25m north-south, 20m east-west and 12m above-below.

The exploration holes were then used, keeping to the same limits andnot overwriting the blocks that already contained grade. Three more passes were completed using dimensions of 50m x 40m x 24m, 100m x 80m x 48m and 150m x 100m x 60m, considering blast holes first and then exploration holes.

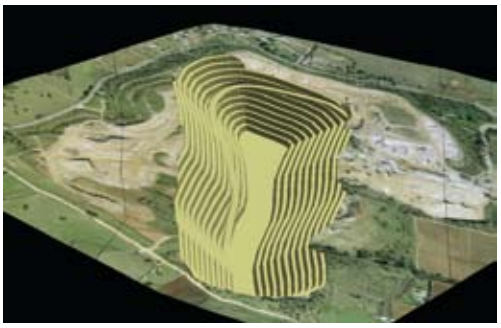
In this manner, grades were interpolated into more than 95% of the deposit as defined by the block model.

A variable has been included in the block model to identify the different stone products suitable for different customers. An economic mine plan was then developed with the final pit boundaries determined by the economic strip ratio and the total stone quantity required for 30 years of operation.

Minimising the annual rate of overburden removal while retaining an economic mine plan is essential to achieving the best financial outcome for Penrice.

There is a short term imperative to increase the rate of overburden removal as the southwestern area planned for excavation in the previous mine plan did not yield the expected stone quality.

Initial exploration drilling and analysis results indicated good quality, but subsequent drilling revealed that the stone was sub-standard and the area was removed from the plan, leading to a shortage of available reserves. Therefore, development of reserves in the short term will be necessary to sustain the operation whilst the longer plan is developed.



Penrice final pit design (above); and showing new ramps (below)

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