ABSTRACT

In the process of optimisation and the need to get the best value from a mining operation, reducing hauling costs is a key requirement. The positioning of orepasses at Venetia Mine, which uses a sub-level caving underground mining method, will be of great importance. This will impact on the tramming distances that Load Haul Dumpers (LHDs) will have to travel from drawpoints to orepasses. This will also impact on the hauling distances for trucks from underneath the orepass to the underground crushers.

In the case of Venetia Mine, tramming is planned to require diesel, tyres and other consumables. This also uses up the operational hours of machinery during its commissioned life. This study aims at analysing the current positioning of orepasses in the Venetia Underground Mine design. The current position of orepasses at Venetia Mine is decided based on experience and geotechnical constraints. This study compares this positioning to positions optimised using a linear programming approach and the genetic algorithm approach. Other optimisation techniques were available but, these two were considered because these are the best-suited optimisation techniques for solving the orepass location problem and some research on optimal facility location has been previously done using these techniques.

A Microsoft Excel model was produced to calculate the equivalent cost per tonne metre for each orepass using the total tramming distance from the loading point to the orepass. This model was also able to determine the ideal orepass for each loading point by selecting the orepass with the shortest loading distance.

The Microsoft Excel model had been developed in house at De Beers to test whether the orepasses had been positioned in the correct positions in the design and to also determine what the total tonnage from each orepass was during the life of mine. This excel model was then optimised using Palisade Evolver ® software.

The OptQuest ® tool was used to solve the linear programming solution as one of the model constraints was not a linear function. The constraint in question is that the orepasses are not to be closer than 40m from the orebody based on geotechnical recommendations.

The optimisation results showed that the genetic algorithm optimisation resulted in a 12% improvement in the total tonne metre cost for the orepasses on the K01 orebody. The linear programming solution resulted in an improvement of 10.5% on the total cost per tonne metre in the model from a base value of R 20 941 per tonne metre.

The results indicated that optimisation could bring about an improvement in operating cost. However, there needs to be future work done to consider geotechnical and geological constraints which will be encountered in a real-world mine design scenario.