

Using Laser Scanning for Estimating Mine Output Volumes and 3D Modelling of Geological Situation

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Basic indicator of mines efficiency is the volume of the extracted ore or rocks. Mine surveyors estimate the volume in the process of work, this being an urgent problem. The accuracy of work (with traditional surveying methods) amounts to 3 – 5 %. Incorrect output volume determination may result in large financial losses of enterprises. Nowadays it is a good practice to use total station and aerial photographic surveys in mining for surveying mine workings and storage yards. Aerial photographic survey is conducted several times a year in major deposits. But the current problems are solved by means of land surveys with significant errors caused by complicated forms of mine fields, which are difficult to take into account in total station surveying. Besides it takes a long time to conduct it. The way out may be found by using high-efficiency remote measuring devices i.e. terrestrial laser scanners. They are three times as fast as the traditional land surveying methods as concerns mining fields surveys. Moreover the technology facilitates and improves 3D modeling of deposits

The paper presents the experience of SSGA (Siberian State Academy of Geodesy) in surveying the manganese mine of 200 by 400 m and about 25 m depth. The survey was conducted to determine the volume of ore and substitute rocks extraction. 5 scanning stations were used and measurements were made from mine edges without lowering.

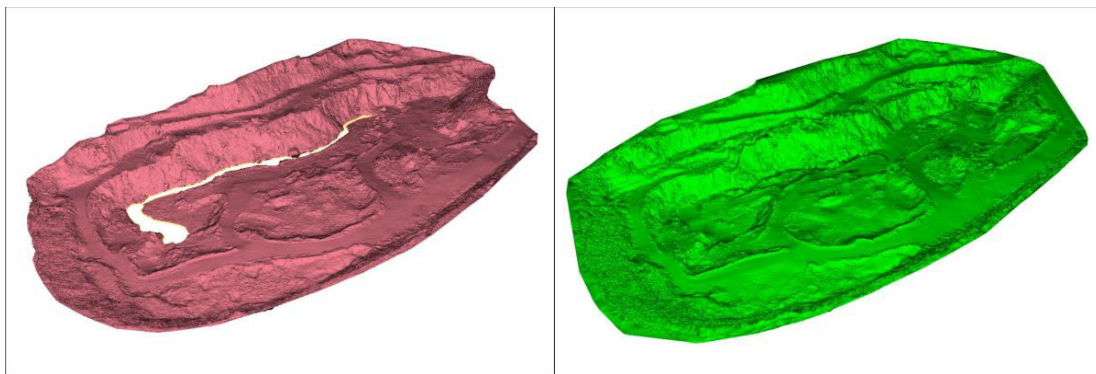


Figure 1: Mine models developed in different periods of time

On the basis of the given models the volume of the extracted rock was determined. The density of the model nodal points is 0.5 m that testifies to the high accuracy of the volume determination. It seems to be inexpedient to achieve such density and detailization of the relief description using total station surveying. The volume was determined by comparing two models using special software. The models were given to the enterprise mine survey service in AutoCAD format to be used in further work.

In the process of the given works the specialists came to an idea of developing a 3D model of the deposit geologic structure and matching it with the 3D model of the mine surface. The idea was successfully realized using digitized geologic sections and tying them to the set coordinate system according to the test boreholes and pits.

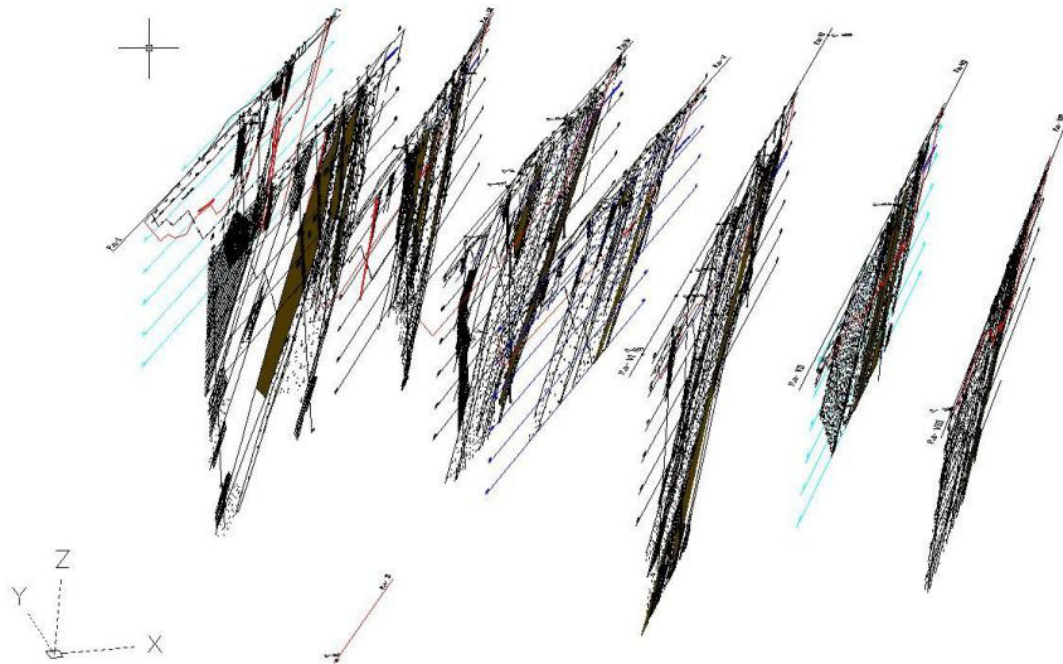


Figure 2: Geologic drawings in AutoCad format

On the basis of the sections 3D models of ore bodies were developed and later matched with the results of scanning.

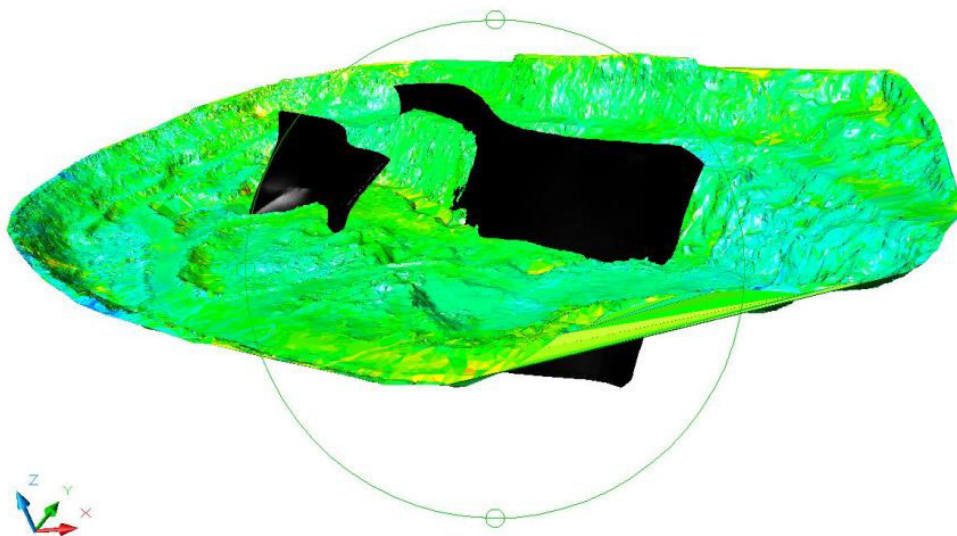


Figure 3: 3D geologic structure of the mine

The developed model may be used for efficient work planning, and the presented techniques allow keeping a record of the mine output volume.

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