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Solution Of A Complex Of Mine Survey Problems Of Open Pit Mining Based On Modeling Using Laser Scanning

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ABSTRACT: The aspects of the production of shooting works using laser ranging technology are considered. A description of the laser ranging technology is given, the theoretical foundations of laser ranging are disclosed, and a description of the application of the technology in the field of mining operations is given.

KEYWORDS: Ground laser scanner, open pit mining, 3D modeling.

INTRODUCTION

Currently, laser scanning is used for a wide range of mine surveying and geodetic works, such as: topographic survey, creation of 3D models of mine workings, monitoring of deformations, creation of survey and reference justification, scanning of inaccessible underground cavities and solving other engineering and geodetic problems.

To date, in foreign countries, including Uzbekistan, laser scanning systems have taken strong, promising positions in the list of technological tools for obtaining geospatial data (Fig. 1, 2). Such devices and equipment make it possible to obtain a set of geospatial data at an enviable speed and in a colossal volume, characterizing the scanned space with a relatively high accuracy.

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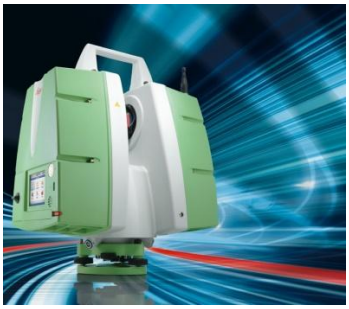

Figure 1. Leica ScanStation P50 laser scanner

Figure 2. Trimble TX8 standart laser scanner

The new technology has many undeniable advantages over traditional types of shooting, moreover, there are obvious fundamental differences in terms of the direct execution of work and the results obtained.

THE MAIN FINDINGS AND RESULTS

Ground laser scanning is by far the fastest and most efficient way to obtain accurate and most complete information about a spatial object. Ground-based laser scanners can be seen as a simplification of aircraft-based scanners. When using such devices, scanning is carried out from the ground and with a stationary position of the scanner unit, i.e. exterior orientation elements remain unchanged in every session. The current position of the laser scanner is determined using high-precision GPS or GPS / GLONASS - receivers operating in differential mode (simultaneous operation of GPS receivers on the scanner and on the ground at polygonometry points). Thus, it is possible to accurately determine the coordinates of the points of reflection of the laser beam [3].

In modern mine surveying and geodesy, scanning already occupies a considerable niche. Many mining enterprises have and are widely used various scanning systems. Scanners are mainly used to perform areal surveys and surveys of inaccessible workings. However, scanning systems allow you to perform many other important tasks as well.

Currently, at mining enterprises, the bulk of the work on the industrial use of 3D laser scanning technologies in the production process is carried out by mine surveying services. The obvious advantages of converting all available mining-graphic data into digital form make it possible to significantly facilitate the process of obtaining initial information for planning and designing mining operations. Creation of any kind of sections and cuts is done quickly enough within a short time.

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The laser scanner is controlled from a laptop using special programs. Modern software products allow, based on volumetric digital models of geo objects, to automate planning, design, forecasting and support of mining operations [4, 5].

3D laser scanning methods make it possible to create geological and structural models of deposits with a complete infrastructure of mine workings along the horizons and treatment blocks with reference to geodetic coordinates using GPS receivers, benchmarks and marks. As a rule, the construction of geological and mine surveying drawings is a rather laborious operation, and specialists must be equipped with software tools for digitizing the topographic surfaces of industrial sites of quarries and mines, which will make it possible to promptly make the appropriate changes. The implementation of work on three-dimensional design must be carried out taking into account the ideology, principles of creating models of mining and geological objects and the interfaces of the software used (Fig. 3).

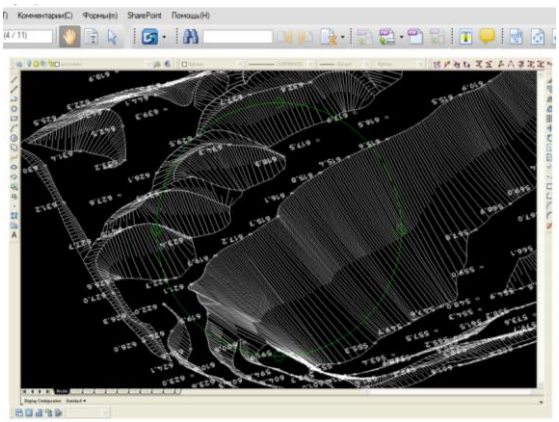

Figure 3. Topographic plan of the section based on the scan results

CAD systems provide a prompt solution to technological problems in the conduct of open and underground mining. Among the functions performed in the system: construction of quarry boards with the entry of transport communications, taking into account design decisions; construction of embankments with the calculation of the volume of the moved rock mass; construction of models of sidetracks and explosive blocks, construction of isolines, as well as calculating the volume and content of minerals in sidetracks, blocks and horizons. 3D visualization allows you to visually display current and operational planning and its results, monitor technological processes.

CONCLUSION

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Thus, with the development of 3D laser technologies, mining operations in open pits and mines become available for monitoring their implementation at any time for all services of mining enterprises, being a unified information base for making technically sound decisions on the development of mineral deposits. High costs for the creation of 3D models can significantly reduce the time for the implementation of design decisions and planned directions for the development of mining operations and provide the ability to make the most optimal engineering solutions, taking into account multivariate studies and calculations.

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