Stone quarry scanning techniques using DR Total Stations

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ÖSSZEFOGLALÁS

Az alábbiakban leírt adatgyűjtési és –feldolgozási technika nagyban megkönnyíti a kőbányák (és nemcsak) szkennelési eljárását, illetve hozzájárul ezen bányák hatásosabb és gazdaságosabb kitermeléséhez, amelyek mind környezetvédelmi, mind gazdasági szempontból véve fontos elvárások. Az eljárás alapja egy, már-már klasszikusnak nevezhető, szervómotorral és prizmanélküli mérés lehetőségével ellátott totál mérőállomás, amelynek képességei tökéletesen megfelelnek ezen munkák pontossági követelményeinek, továbbá a feldolgozáshoz használt szoftver képességei lehetővé teszik a kitermelés későbbi megtervezését.

A bemutatott technika, figyelembe véve a különböző hatósági- és magánszervek egyre szigorúbb követelményeit, lehetővé teszi a nagyobb pontosság elérését, illetve a kis- és közepes méretű bányák szkennelését.

1. LEGAL BASIS

In Romania, mining activities are governed by laws and reglementations. The law governing activities in the mining domain is the Law of the Mines (Law no. 85/2003), and the topographical activity in mining is reglemented by the Mining Topography Reglementation.

The latter mentioned indicates the ways to obtain field data, the presentation mode of the final products, as well as the required periodicity of making these observations.

If we apply the technology-method principle, then we must treat the mining domain at current standards.

The main beneficiaries of these information are:

- NAMR (National Agency for Mineral Resources – or ANRM in Romanian)

- NACREP and OCREP (National Agency of Cadastre and Real Estate Publicity and territorial Offices of Cadastre and Real Estate Publicity – or ANCPI and OCPI in Romanian)
- National Agency for Protecting the Environment
- town halls
- other institutions

2. APPLIED METHOD

The basis for this work is the scanning of the working front through laser tracker (step by step) and processing these information with adequate programmes. The scanned objective is the Urviş stone quarry in Bihor county, Romania.

The comparative calculations are the result of the necessity to make two measurements over the same entity or to distinguish a result by two different calculation methods.

The scanning of the working front represents a series of advantages:
- reduced work time
- when using the Total Station-GPS technology with stationing basises which were anterior detemined, the problem of the classical positioning dissapeares
- for volume calculations, only the excavated zones are used
- reduced time span for obtaining the results
- relevation of the zones in the snag

3. TECHNOLOGY USED

For data acquisition we used the Trimble S6 Total Station. In the following picture, we will present the characteristics of the total station regarding the scanning process and the total station itself.

		Trimble S6
selection of scanned surface		polygonal, rectangle, specify 3 points, through the telescope
angle accuracy		5 ” (1.5 mgon)
distance accuracy	*Standard*	± (3 mm + 2 ppm)
	Tracking	± (10 mm + 2 ppm)
scanning speed	*Standard*	1 point / 1 - 5 sec.
	Tracking	1 point / 0.4 sec
min. dist. between pts.		10 mm

Figure 1. The Trimble S6 Total Station

This total station has the possibility to measure points in reflectorless mode up to 150-200 meters on hard rock surface. Also, the total station has a large amount of memory at it's disposal to record all the data from the field. The scanning process was realized using steps between 0,5 – 1 meters (due to the large surface and the lack of important details) and manual observations were added in the zones of higher importance.

The points resulted from the scanning process were imported and processed in the Trimble Business Center software, which gives us the possibility to create the 3D model of the scanned area from the point cloud obtained after the scanning. Besides this, the software allows us to overlay different models created after different scanning sessions in order to calculate the excavated volume.

4. WORK PROCESS – IN PICTURES

Figure 2. Work zone – stone quarry, Urviş locality, Bihor county

Figure 3. Work zone – stone quarry, Urviş locality, Bihor county

Figure 4. Scanned zone in detail – stone quarry, Urviş locality, Bihor county

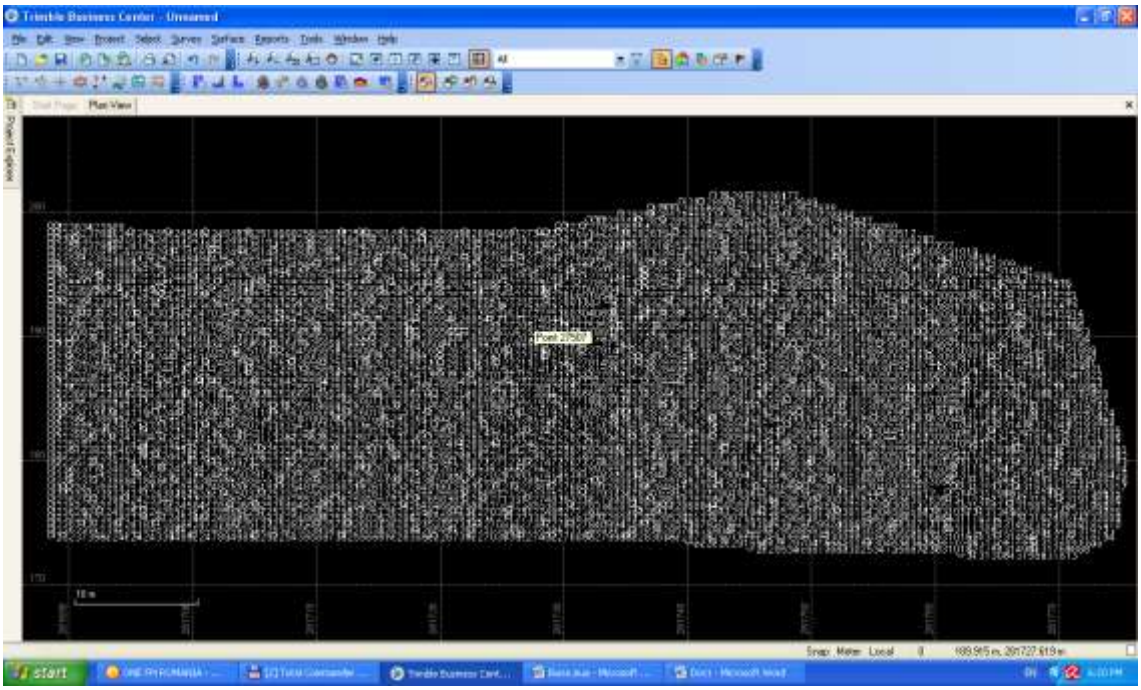

Figure 5. Point cloud obtained after the first scanning session

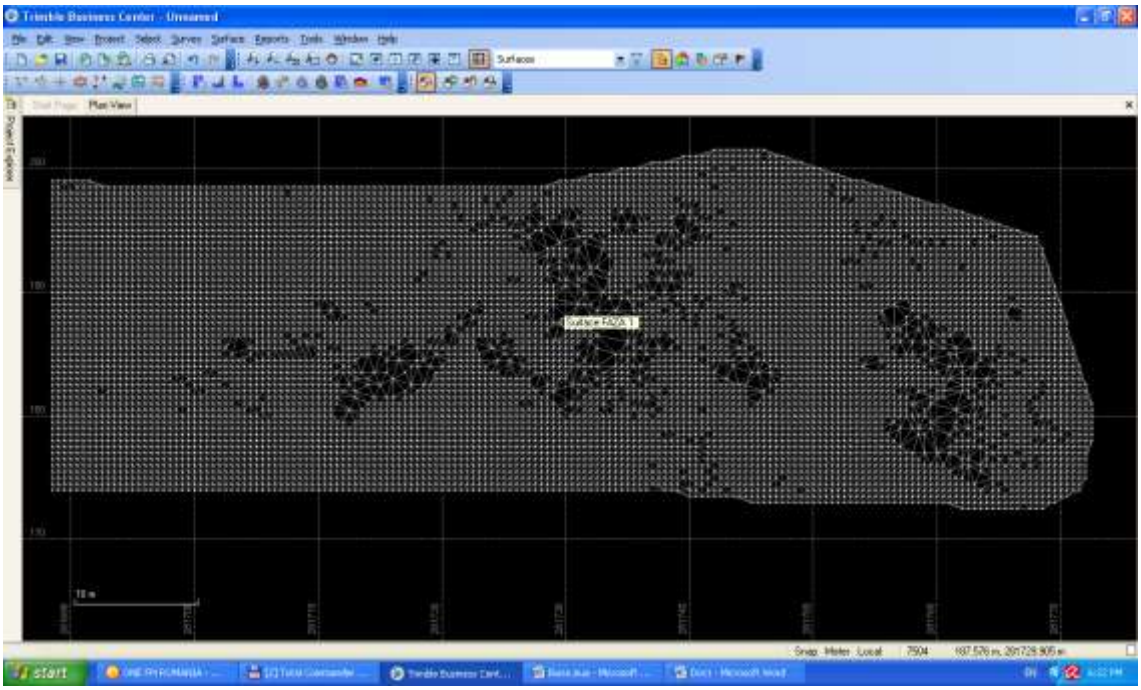

Figure 6. TIN (Triangular Irregular Network)
created after the first scanning session, before the blasting

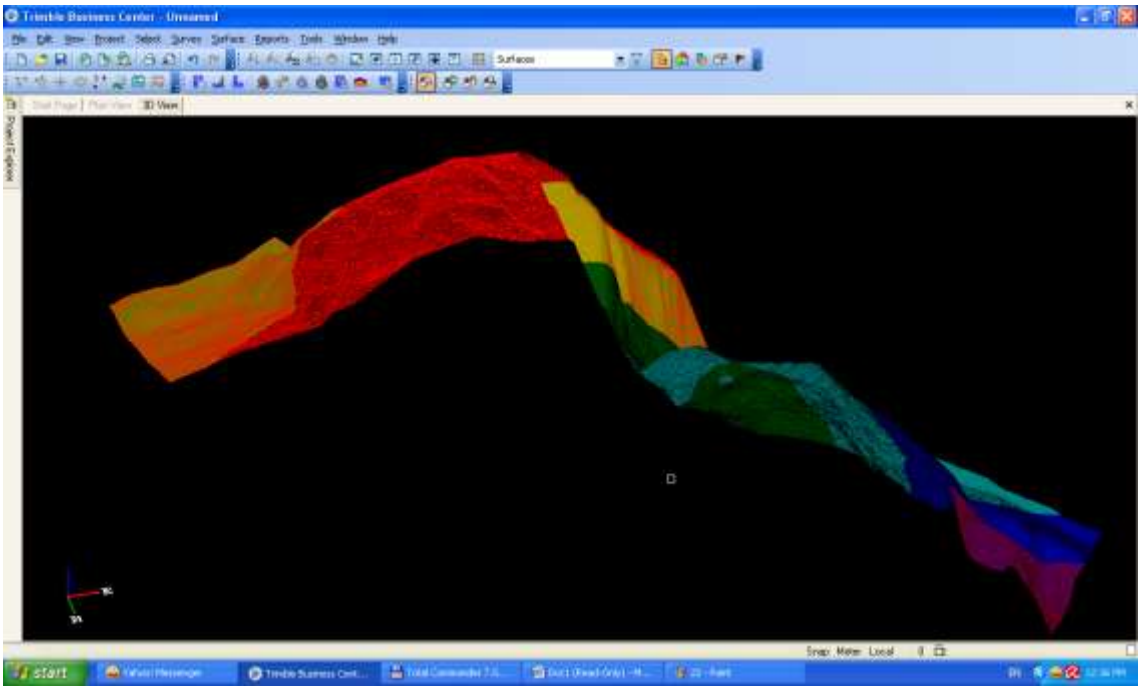

Figure 7. Color coded 3D model

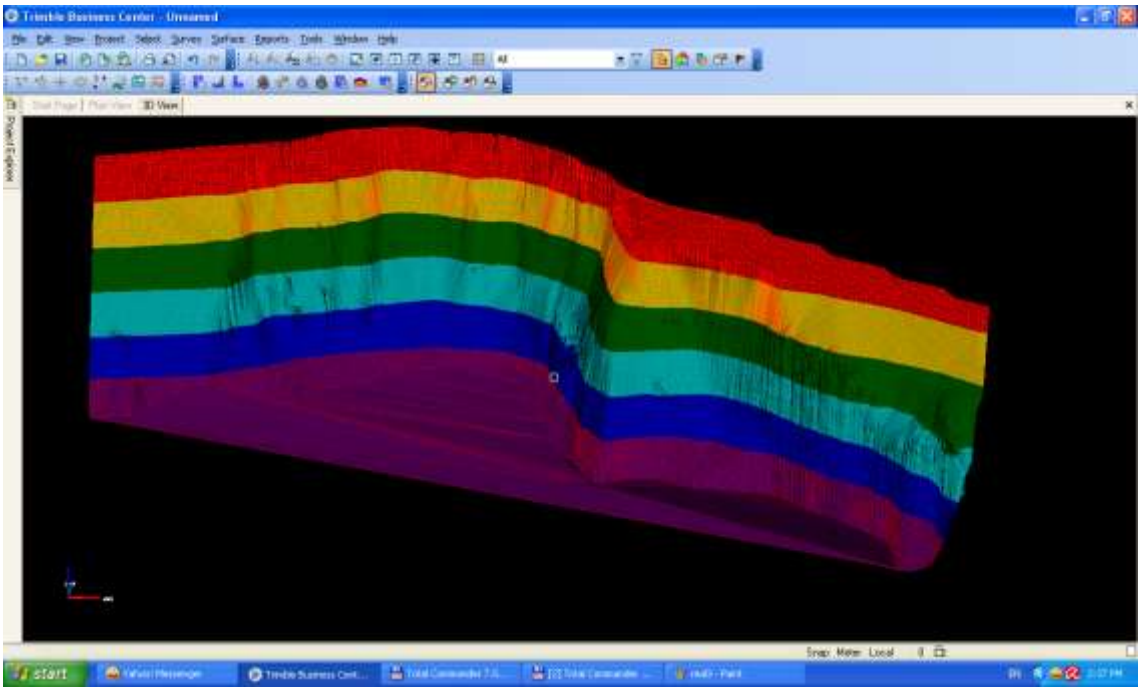

Figure 8. Color coded (by height) 3D model of the whole site

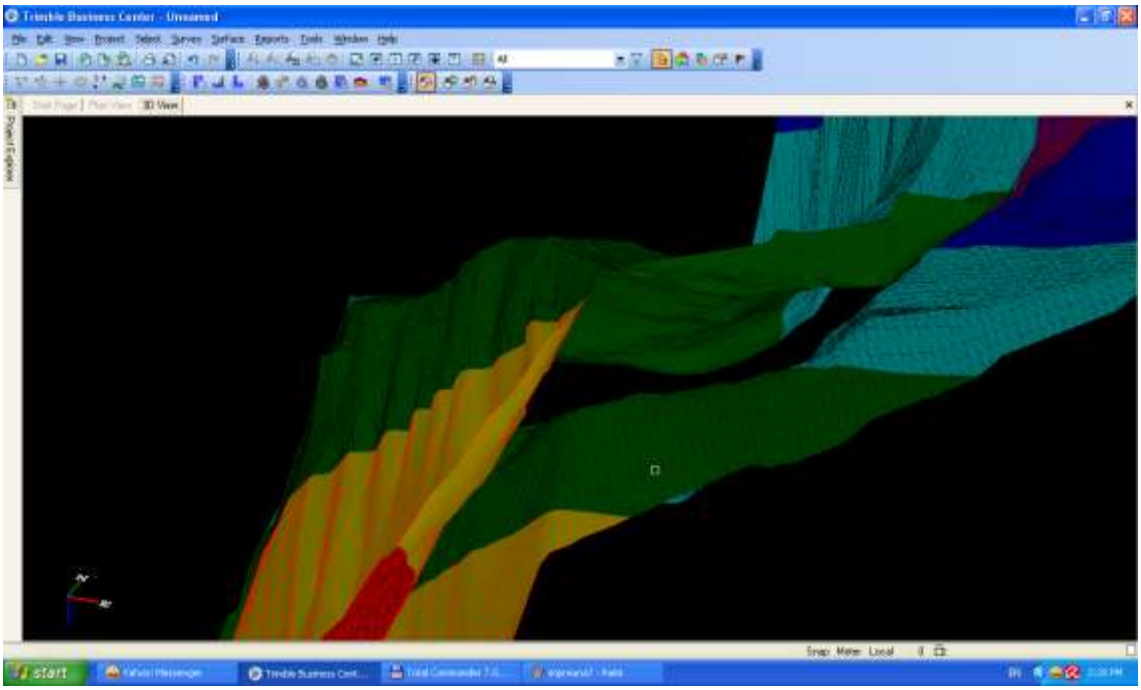

Figure 9. Detail of overlayed models resulted from two different scanning sessions

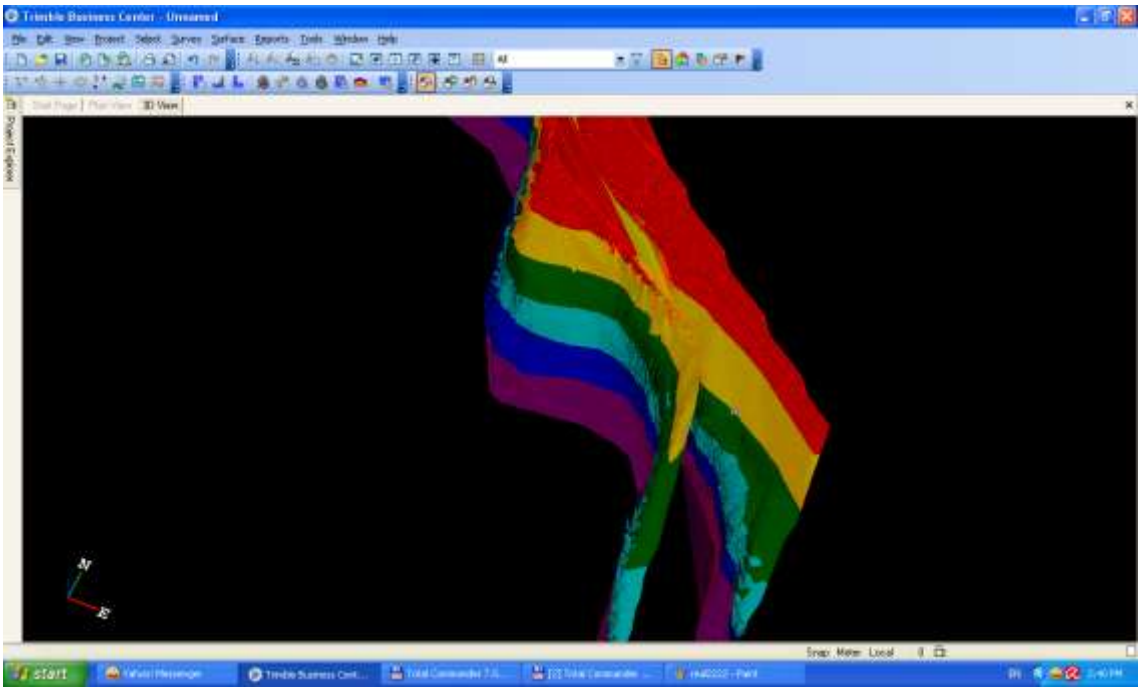

Figure 10. Detail of overlayed sites resulted from two different scanning sessions

5. CONCLUSIONS

The presented technique makes for easier data acquisition on the field and resolves some problems which appear during the calculation of excavated volumes. The reality on the field leads to the apparition of new problems, which needs solutions based on the actual technology.

The step by step scanning technique represents a solution with applicability in the case of the small and mid-sized quarries. The used apparatus can be considered classical if we have in mind that scanning operations can be made with any total station equipped with servo direction and reflectorless distance measurement capability up to the distance of 200 – 300 meters.

In conclusion, we can better approximate the excavated volumes, which will enhance the quarry's material and economical efficiency.

IRODALOM

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A szerző(k) elérési adatai

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