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To cite this version:
Ahmed Hosni, Silvain Yart, Thomas Dewez, Florian Masson. ZEB-REVO, A digital 3D mapping tool in a closed environment. 4e Symposium International sur l’Innovation et la Technologie dans l’Industrie des Phosphates, OCP Maroc, May 2017, Ben Guérir, Morocco. hal-01498559

HAL Id: hal-01498559
https://hal.science/hal-01498559
Submitted on 30 Mar 2017

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ZEB-REVO, A digital 3D mapping tool in a closed environment

Ahmed Hosni\textsuperscript{a}, Silvain Yart\textsuperscript{a}, Thomas Dewez\textsuperscript{a}, Florian Masson\textsuperscript{a}

\textsuperscript{a}BRGM, 3 avenue Claude Guillemin, BP 36009 Orléans cedex 2 45060, France

Abstract

As part of its activities related to instabilities of underground cavities, in particular those of shallow mining, BRGM is required to map the geometry of the structures studied and to georeference them. This information is necessary in order to verify the presence of vulnerable buildings and infrastructure at the level of these cavities. On the other hand, they make it possible to carry out a diagnosis of ascent of possible instabilities towards the surface (fontis).

Stability analysis methods are generally based on simple geometric parameters, often two-dimensional, to characterize mine work: width and height of the galleries, nature and thickness of the grounds of the covering and their proliferation, etc. The real state of the gallery is generally observed in situ and integrated into the expertise. The author of the stability diagnosis does not have a precise 3D survey of the gallery examined enabling him to visualize at any time the actual appearance of the work as it was at the time of the visit (Eg local flaking of the pillar, local fall of roof blocks). Such a three-dimensional survey would be very expensive in time and money.

The BRGM has equipped itself with a so-called "ZEB-REVO" tool, a high-performance scanning tool, which allows fast, accurate and high-quality geometric data capture. Its simultaneous location and mapping algorithm (SLAM) allows it to quickly map closed environments, freeing itself from a GPS. This tool has been successfully used by the BRGM to map shallow galleries in the central region of France.

ZEB-REVO could be used in a material transport duct to diagnose volumetric variations due to possible deposits (precipitation, sedimentation, etc.). With a high degree of precision, this tool could easily establish the visible variations on the internal wall of a duct with respect to an initial state; the latter being predefined by the initial shape of the duct.

Monitoring the walls of the Slurry pipeline could be a very good example of application of the ZEB-REVO tool in order to guard against a possible fouling phenomenon which could inevitably lead to a reduction in transport flows. Thanks to its speed of execution, the robustness of its calculations and its maneuverability, this tool could prove very useful from the point of view of monitoring the transport structure.