Evaluation and Effect of Errors in Digital Elevation Models on Cost of Raw Materials Inventory

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SUMMARY

In the mining industry the cost of exploited raw materials existing in inventories is quantified. Those inventories are generated by topographic surveying done at the end of each month. The evaluation of the errors in the digital elevation models are very important because of its high economic value and because relevant decisions are made in consequence. The quality of an digital elevation model is affected mainly by 5 factors (Li,Z et, al 2004): the accuracy of the measurement method, the density of the sample and the distribution of the gathering data, the morphology and the interpolation method. In topography, maybe is possible to have control of all the variables, but to what extend a sufficient quantity of points is taken in a topographic field, aiming to fulfill with a determined precision in terms of volumetric efficiency with a total station?

In this article, the Volumetric Curves Calculation technique created by A. Meneses et al, (2005) is developed. This technique will be applied to a 7 digital elevation models as references, which are differentiated among them by the density of points and size of stockpile. The empirical experiment was conducted at Argos, a cement factory, located in Sogamoso, Boyacá, Colombia.

The technique is based on the obtaining of DEM measured with a high density of points gathered with total station. Then, a systematic and random reduction of points is applied, where it is possible to observe the DEM volume behavior.

The Volumetric Curves are characterized by its representation of the volume in terms of the percentage of the Y axis, and the points' percentage in the X axis. But there is a problem: how can we evaluate the DEM volumetric error after being measured, just by obtaining the number of points, the surface area and the reported volume of DEM? It is necessary to convert the measured density of points to percentage of points through a density abacus, built especially for this purpose.

From the experiment it was possible to obtain one abacus to determine the percentage of points, and other one to evaluate DEM errors in terms of volume, affected by the density of points under local conditions.

It was possible to establish the mathematical expression of optimal density (99.5% of the maximum volume) according to the size of the stack to be measured, which allows planning the volumetric efficiency of topographic measurements.

According to the topographical measurements (in the inventories done at the end of the months in factory, Sogamoso) it was found that in 2011, the efficiency over the cost of raw materials, in terms of volume and weight were 98.07%, 97.07% y 97.45% respectively.

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