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EVALUATION OF METHODS USED FOR MAPPING THE GEOMETRY OF UNDERGROUND SPATIAL (3D) STRUCTURES IN THE COURSE OF REVITALISATION

Keywords: *geometry, mapping, spatial (3D) structure, underground objects, graphic recording, revitalization.*

Old underground structures are a part of cultural and natural heritage. They demonstrate the level of technological advancement during the exploitation of natural resources, providing an excellent example of symbiosis of human activity and geological surroundings. Nowadays old underground structures are considered to be a part of world cultural heritage and natural reserve areas or were granted the status of natural monuments. Stabilisation of old underground structures, as a part of an investment project, involves restoration works undertaken in degraded or abandoned plants and objects. Thus, the life quality of local inhabitants is improved, new features can be added and social networks restored. In order that underground structures can be effectively revitalised and stabilised, it is required that the geometry of the existing 3D structure should be projected onto a 2D drawing.

The study provides a systematic description of various geometries of underground structures, giving examples of traditional and computer-assisted methods used for recording the geometry of underground structures. The methods enable the reconstruction of the structures' geometry and development of detailed drawings, a prerequisite for effective revitalisation and stabilisation old underground structures. Underlying the selection of mapping method is the analysis of the current conditions on the site, definition of potential hazards and the objectives of the restructuring programme. The main difficulty involved in revitalisation projects lies in the structural intricacy of underground objects. Underground structures were formed by natural processes (grottoes, caverns) or in the course of human activity (pits, mine workings, underground cellars, military structures). There are several methods to be used in mapping the geometry of 3D underground structures: geophysical and geodetic methods, photogrammetry and laser scanning well supporting the photogrammetry techniques. They are based on traditional measurement methods but also make use of the state-of-the art. digital technologies. Thus obtained data are used to develop geometric models of underground structures. Evaluation of the mapping method adequacy based on the

analysis of the existing geometry of a 3D underground structure enables the process to be optimised. The final product is the development of engineering specification for revitalisation of an underground structure.

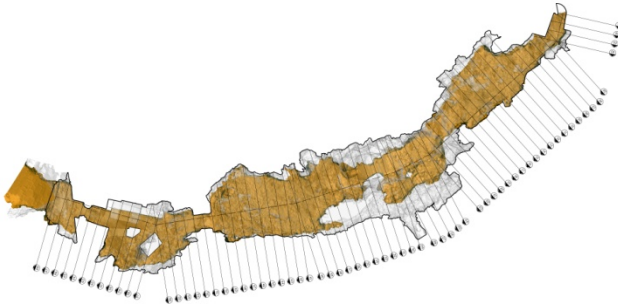


Fig 1. A laser scan of geometry of a natural underground feature: The Dragon's Den in Cracow

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