Geophysical Research Abstracts
Vol. 19, EGU2017-12846, 2017
EGU General Assembly 2017

The Combine Use of Semi-destructive and Non-destructive Methods for Tiled Floor Diagnostics

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The combination of semi-destructive and non-destructive methods was used to asset the conditions of a tiled floor in the historical monument Minaret, situated in the park complex of the Chateau Lednice (South Moravia Region, Czech Republic), before its renovation. Another set of measurements is going to be performed after the conservation works are finished. (The comparison of the results collected during pre- and post-remediation measurements will be known and presented during the General Assembly meeting in Wien.) The diagnostic complex of methods consisted of photogrammetry, resistivity drilling and georadar. The survey was aimed to contour extends of air gaps beneath the tiles and the efficiency of filling gaps by means of injection, consolidation and gluing individual layers.

The state chateau Lednice creates a part of the Lednice-Valtice precinct, a UNESCO landmark, and belongs among the greatest historic monuments in Southern Moravia. In the chateau park there is a romantic observation tower in the shape of a minaret built according to the plans of Josef Hardtmuth between 1798–1804. The Minaret has been extensively renovated for many decades including the restoration of mosaic floors from Venetian terazzo.

During the static works of the Minaret building between 1999–2000, the mosaic floors in the rooms on the second floor were transferred and put back onto concrete slabs. Specifically, the floor was cut up to tiles and these were glued to square slabs which were then attached to the base plate. The transfer was not successful and the floor restoration was finalized between 2016–2017. The damage consisted in separating the original floor from the concrete plate which led to creating gaps. Furthermore, the layers of the floor were not compact. It was necessary to fill the gaps and consolidate and glue the layers. The existence of air gap between individual layers of the tiles and their degradation was detected using two different diagnostic methods: semi-destructive resistivity drilling, and non-destructive georadar, and the results were compared.

Floors were measured by 3D laser scanning technology and captured by the camera before reconstruction work. Using SFM photogrammetry were achieved results: ortomozaik (0.3 mm / pix) and DEM (0.6 mm / pix). These results were a basis for restoration work and also allow comparisons with the original state at any stage of the project.

Drilling resistance measurement is used for indirect determination of strength profile based on resistance to drilling depending on into the depth. The observed resistance to drilling correlates with the strength and toughness of the measured material. The method is referred as a micro- or semi-invasive, since sampling is not necessary and but the drilling diameter is usually 3-5 mm. The ultrasonic measurement consists in the measuring of the longitude as well as the transverse waves – velocity, shape, amplitude. The propagation velocity is a characteristic values for the material influenced by its composition and compactness.

Georadar (GPR) is a high frequency electromagnetic pulse method. For measurement the GPR RAMAC system coupled with 1600 MHz shielded antenna was used. Two tiles (one with defects and one in relatively good condition) were surveyed in a regular grid of perpendicular lines 5 cm separated. Data were processed by means of ReflexW software and performed in the form of cross sections and amplitude maps. The map of the amplitude summed over a time window 1 – 1,4 ns (representing the intensity of the reflection from the tiles bottom) gave good result. The areas of registered relatively high amplitudes correspond with the position of airgaps.

A correlation was observed between the results of different survey methods.