

Application of geophysical prospecting methods for soil structure characterization of the Cathedral of Santo Domingo, Dominican Republic

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ABSTRACT

The Hispaniola Island is in the edge of interaction between the North American and Caribbean plates. In this zone, the occurrence of earthquakes greater than 5.0 Mw is frequent, characterizing as seismically active zone. These earthquakes cause considerable material damage and can provoked loss of human lives. The Cathedral of Santo Domingo, Primate of the Americas, is located in the Colonial City of Santo Domingo, is the most important colonial building in Dominican Republic, built between 1521-1541, is a masonry building made with stone ashlars and cover with stone ribbed vault. However, is essential to know the superficial structure of the soil where they are supported and the possible seismic behaviour that it could have in case of a relevant earthquake to try to avoid possible damage to the heritage. For this reason the aim of this research is to apply the geophysical prospecting methods for soil structure characterization of the Cathedral of Santo Domingo. For this study, the geophysical methods used were: MASW (Multichannel Analysis of Surface Wave) [1], H/V spectral ratio [2] and Georradar [3]. The Georradar was used to identify caverns and validate the results of the MASW method and H/V spectral ratio. The soil was characterized with the values of the average velocity of shear waves in the top 30 m of soil (Vs30) obtained with the first method, from which geomechanical and dynamic parameters were obtained such as PGA, PGV and AI. The latter was carried out with the application of a soil movement scenario through earthquakes used as inputs. As a main result it was found that the site seismic class determined with the MASW method through the obtained VS30 results was type C (360-760 m/s) (very dense soil and soft rock), according to the NEHRP classification. In addition, the Georradar tests allowed confirming that there are no unknown caverns in the basement of the Cathedral in the first 5 m, thus it is accepted as valid the seismic classification of the surface structure of the soil obtained by the MASW method.

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