PRELIMINARY RESULTS OF THE SEISMIC RESPONSE STUDY OF THE POGGIO CANCELLI VALLEY (CAMPOTOSTO, AQ)

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Introduction. In this paper, we present preliminary results obtained by geological surveys and geophysical investigations for the evaluation of the local seismic response of the Poggio Cancelli valley (Campotosto, AQ).

Poggio Cancelli Valley. The Poggio Cancelli valley is located in the Central Apennine, at the NNW bounder of Campotosto Lake (Campotosto, AQ) and hosts the Poggio Cancelli village as well as an earthfill dam built in 1939.

In this sector of the Apennines, a thick silico-clastic synorogenic succession known as Laga Formation (Adamoli *et al*., 2007) was deposited since Messinian. The Laga Fm. includes three members among which the Campotosto Lake one widely outcropping in the study area and representing the geologic bedrock. It is composed by thick arenaceous strata interlayer with gypsum-arenite levels (Centamore *et al*., 1991; Artoni, 2003; Milli *et al*., 2007). Alluvial deposits consisting of sands, silts and clays with levels of gravel, directly overlying the Laga Fm., fill the Poggio Cancelli valley. The valley is bordered by Laga Fm. reliefs, which are covered by debris at the foot of the slope. In addition, alluvial fans can be also recognised at the transition between the ridge slopes and valley edges, where the alluvial fan deposits overlay the alluvia.

The NE side of Campotosto Lake basin is bounded by the Monti della Laga Fault System (MLFS), with a NW-SE trend and a length of about 30 km. MLFS is arranged in three splays with evidence of recent faulting (Galadini and Galli, 2003).

Materials and methods. In the last years, engineering geological surveys and geophysical investigations were largely applied in seismic microzonation and local seismic response studies (Delgado *et al*., 2000; LeBrun *et al*., 2006). Field engineering geological surveys, single station

seismic ambient noise measurements and Multichannel Analysis of Surface Waves (MASW) were carried out in the Poggio Cancelli valley to retrieve a detailed sub-surface model for seismic response analysis.

The Laga Fm. was characterized through geomechanical scanlines according to the Marinos and Hoek (2001) classification. In addition, the shallower alluvial deposits were sampled and tested in laboratory to estimate Atterberg limits, weight per unit volume and grain size distribution. Based on the obtained results, different engineering geological units were identified for both flysch and alluvial deposits.

Between October 2018 and July 2019, single station seismic ambient noise measurements were performed along 5 NNE-SSW oriented sections across the Poggio Cancelli valley. Two types of instruments were used: i) SL06 24 bit digitizers with built-in SS20 three-component velocimetric sensor (2 Hz eigenfrequency) manufactured by SARA Electronic Instruments; ii) three-component LE-3D/5s Lennartz seismometers (0.2 Hz eigenfrequency) coupled to Reftek 130-01 digitizer. The measurements were carried out with a sampling frequency of 200 Hz and 250 Hz respectively and had a duration of 1 hour. The Horizontal-To-Vertical Spectral Ratio (HVSR) method (Nakamura, 1989) was applied for the analysis as implemented in the Geopsy software (www.geopsy.org) to evaluate the fundamental resonance frequency (f_0) of the investigated site.

A Multichannel Analysis of Surface Waves (MASW) test was carried on July 2019 by employing a DoReMi seismic system designed by SARA Electronic Instruments. A linear array of 36 4.5-Hz vertical geophones (spacing 1.5 m) was deployed on the filling deposits in the middle of the valley and 23 shots with different offsets were carried out at both array extremities. The obtained fundamental mode Rayleigh wave dispersion curve (DC) was inverted to retrieve the shear wave velocity profile at the site. As a relatively narrow frequency band (15-30 Hz) was obtained for the DC, a joint inversion of HVSR and DC data was performed by the HV-Inv software (García-Jerez *et al*., 2016) to increase the investigation depth.

Results. The seismic ambient noise measurements showed clear resonance frequencies (f_0) in the range 0.9-2 Hz in the Poggio Cancelli alluvial valley likely due to a significant impedance contrast between the alluvial deposits and the seismic bedrock, which may be represented by the Laga Fm. Some measurements also show a second resonance frequency (f_1) at about 4 Hz. Measurements performed over the outcropping Laga Fm. do not show any resonance frequency, as expected.

The MASW test allowed estimating the Vs distribution within the alluvial body, which is characterized by low Vs range between 120 and 300 m/s. In addition, the seismic bedrock depth was estimated in the range of 45-60 m.

In order to evaluate the seismic response of the valley, including 2D effect, numerical modelling through a finite element approach will be performed across different sections of the valley to derive both AF (amplification factor), available for urban planning, and elastic response spectra to design ordinary or strategic structures according to the present National rule.

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