

# ***Interactive comment on “Study on the applicability of microtremor HVSR method to support seismic microzonation in the town of Idrija (W Slovenia)” by Andrej Gosar***

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Response to Referee #2 comments

Comm.: The English should be revised by a English speaking person, as there are many errors remaining throughout the text.

Response: The final version of the manuscript will be corrected by professional English proof-reader.

Comm.: In the References section, each reference should start by a tabulation, as it is, otherwise, not possible to separate them when looking for a particular reference.

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Response: The Reference section will be corrected as suggested and according to the instructions for authors.

Comm.: A main point should be kept in mind throughout the paper: in order to be useful for engineers who make the design or control of buildings against earthquake, a microzonation study should provide response spectra associated to each micro-zone. Alone, resonance frequency and amplitude maps are of no use for the earthquake engineering community, and thus of no use for seismic risk reduction. The resonance frequency is useful to calibrate the Vs profile of a site, very uncertain even when Vs measurements are conducted. Resonance frequency measurements only are the very first step of a complete microzonation study that should lead to the definition of site specific response spectra for engineers.

Response: The purpose of the study will be additional described and justified throughout the paper. I fully agree with the comment that resonance frequency measurements are only the first step of a microzonation, but at the same time a very important one for given conditions in the town of Idrija. I believe that this is clear enough from different parts of the manuscript as:

in the Title: . . . to support seismic microzonation . . .

in Abstract (last three sentences): The importance of microtremor method is therefore even greater, because it enables direct estimation of the resonance frequency without knowing the internal structure and physical properties of the shallow subsurface. The results of this study can be used directly in analyses of possible occurrence of soil-structure resonance of individual buildings, including important cultural heritage mining and other structures protected by UNESCO. Second application of the derived free-field iso-frequency map is to support soil classification according to the recent trends in building codes.

in Introduction (last part): In the Idrija town area, no simple relation is expected between the extent, homogeneity and thickness of supposedly soft sediments and seismic site

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amplification. The application of advanced quantitative investigation methods is thus needed to support any microzonation study in the area. Since microtremor HVSR studies were so far mainly performed in sedimentary basins of rather regular shape, where the relation between thickness of sediments and resonance frequency is more straight-forward, any study performed in more complex geological setting is of wider scientific interest and contribute to the verification of the methodology.

in Conclusions (last paragraph): Sediments main resonance frequency ( $f_0$ ) derived from microtremor HVSR measurements has two basic applications in the seismic microzonation. It can be used directly, together with the data on the building fundamental frequencies, to assess the possible occurrence of soil-structure resonance (e.g. Galipoli et al., 2004; Gosar, 2012). Secondly, it can be a complement to the average S-wave velocity in the upper 30 m ( $V_{s,30}$ ) as proposed by Ansal (2004) and Luzi et al. (2011). Most of the seismic codes make use of the  $V_{s,30}$  to discriminate soil categories, although some doubts exist about the capability of  $V_{s,30}$  to predict actual amplification of sediments. Luzi et al. (2011) showed that there is a significant reduction of the standard deviation associated to the ground motion prediction when the classification is based on the couple of variables  $V_{s,30}$ - $f_0$ . However, further investigations on these issues are needed and any successful application of the microtremor HVSR method in complex conditions like in the Idrija town is a valuable scientific contribution to achieve the goals. In the Idrija town area both applications are feasible, because there is a great need to prepare a high level quantitative microzonation in the future and also to directly analyse the danger of soil-structure resonance for individual buildings, including cultural heritage mining and other structures protected by UNESCO, to prevent them from earthquake hazard.

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