BASIC METHOD TO CLASSIFY SPATIAL DSTRIBUTION OF SITE FACTOR USING SINGLE MICROTREMOR IN ASHGABAT, TURKMENISTAN

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Background

This paper presents the progress on spatial distribution of calculated seismic intensity of the project "Improvement of the Earthquake Monitoring System in and around The Ashgabat City in Turkmenistan" funded by Japan International Cooperation Agency (JICA) since 2017. Technology Transfer Projects donated by JICA has accelerated how to create seismic hazard and risk assessment in many countries. OYO International Corporation has supported several international projects on seismic hazard and risk assessment.

Figure 1 shows the flow of this study. This study focuses on a basic method of how to classify site factor using single microtremor measurement data is introduced. In order to grasp site effect for hazard mapping, it is common to refer to geomorphologic classification map. However, we do not always find such classification maps. If there are geomorphologist to interpret local topography in details, we will create a geomorphological classification map based on topographic maps or aero-photos. Geological maps are also employed in the study, but these scales do not always meet the details requirement.

In Ashgabat City, unfortunately we cannot find any geomorphological classification maps, only found a geological map in national scale. Institute of Seismology and Atmospheric Physics of Academy of Sciences of Turkmenistan (SI) has been conducted single microtremor measurement in Ashgabat City for past several years. The total number of measurement data is over 1000.

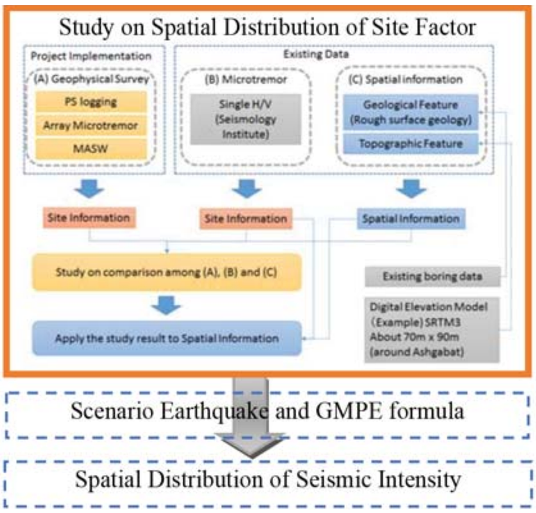

Figure 1. Flow of this study.

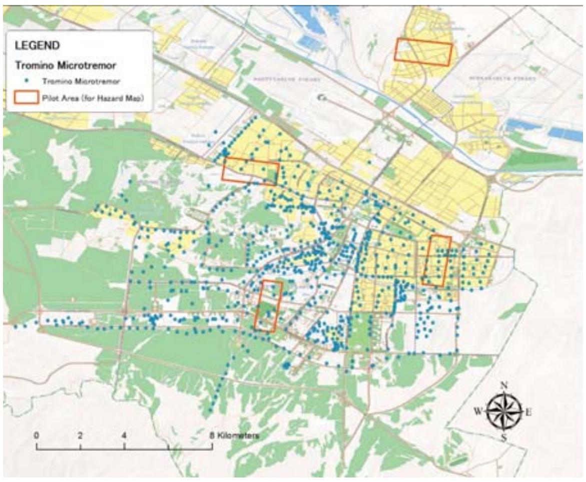

Figure 2. Single Microtremor Measurement Sites.

Figure 2 shows the distribution of single microtremor measurement sites in blue dots. Red rectangles are candidates of pilot area for seismic hazard assessment. We examined H/V spectra for the purpose of classification of site effect using Geographic Information System (GIS).

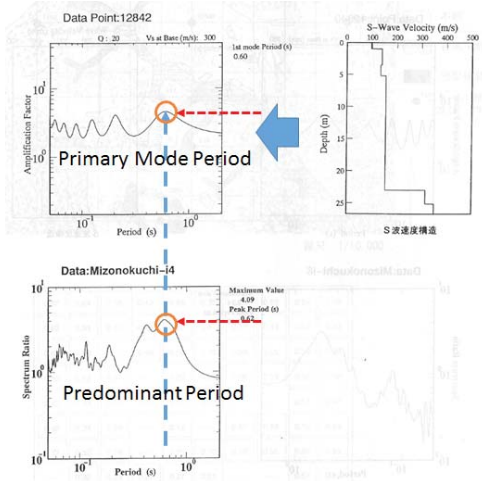

Figure 3. (A) Shear wave velocity structure from borehole soil column, (B) Transfer function from (A) based on Haskell's method, (C) H/V Spectrum from single microtremor measurement (Hasegawa, 1995).

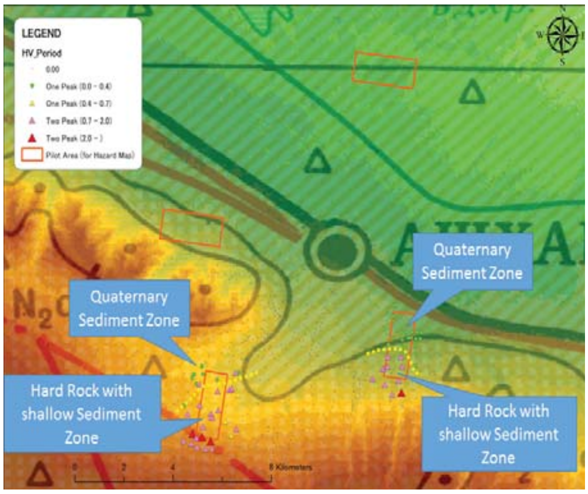

Figure 4. Trial of Classif cation of Site Factor by Interpretation of predominant period of H/V spectrum on topographic map.

BASIC METHOD

Author's Master thesis showed a good example of correspondence of peak period of transfer function from Haskell's multiple reflection method with predominant period of H/V spectrum from single microtremor measurement. Figure 3 shows an example of comparison among them. S-wave velocity (Vs) structure was estimated from borehole soil column and empirical formula after Ohta and Goto (1976). It means predominant period of H/V spectrum represent characteristics of S-wave velocity structure of the ground, especially depth to a clear difference of impedance of layers.

PROGRESS TO DATE

Some of the H/V spectrum from single microtremor measurement data provided by SI in and around pilot candidate areas were examined especially focusing on predominant period. After examination, it was found that there was a difference of predominant period and characteristic of H/V spectrum shape, between Quaternary sediment sites and hard rock with shallow sediment ones. Figure 4 shows the result of analysis. Background of the map is a geological map of scale 1:200,000 and Digital Elevation Model overlapped to show a topographic feature. Difference of dot shape and colour represent difference of characteristics of H/V spectrum. Yellow dot curves were drawn to classify the different characteristic areas. This result shows a basic characteristics of H/V spectrum but if we analyse densely distributed H/V spectrum data and plotting on the map with geological and topographic feature map, such spatial information will allow us to classify site factors in detail.

CHALLENGES AND SOLUTIONS

It is much better to estimate average shear velocity to depth 30 m (Vs30), which has a good correlation with amplification factor of sites, not only predominant period characteristics from single microtremor. C40 (phase velocity of surface wave with wave length of 40 m) from Array Microtremor measurement shows good correlation with Vs30 after Konno and Kataoka (2000).

A GIS dataset of predominant periods from H/V spectra and Vs30s estimated from array microtremors will assist classifying amplification factor considerably.

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