P- AND S-WAVE VELOCITIES IN SUBSURFACE LAYERS OF GROUND IN JAPAN

by

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In recent years it has become more and more necessary to make clear the dynamic properties of the ground and to study the dynamic response of the ground during an earthquake for engineering purposes. In this way, in situ measurements of the P- and S-wave velocities of the ground have come to take an important significance, as being the fundamental data which evaluate the dynamic characteristics of the ground and have some possibilities of application to engineering study.

Under these circumstances, we have been making effort for the past ten years to establish the in situ measurement technique of the P- and S-wave velocities and to accumulate data thereon of ground, especially soft soil ground of the urban areas in Japan.

The measuring method has been established as the PS logging system, a kind of the well shooting method in borehole, based chiefly on the borehole geophone specially designed to be clamped at any depth. This method of directly measuring the travel time downward is more useful than the refraction method for seismic prospecting. The velocities of soil layers can be determined with an easy operation in limited working space of any ground whatever by this method. It is not affected by any surface waves, and large wave-generating energy or long space for geophone array is not necessary. It is applicable to any velocity layering, including the intercalating low velocity layer. Measurement is done repeatedly with the adequate depth interval of 1 to 2 m. As the wave-generating method, wooden plate hammering, weight dropping and small amount of powder blasting are used.

We have carried out these measurements in 242 holes. These sites are distributed over the country, and so the data represent almost all the urban area of Japan. We derived some interesting facts from a lot of these data. In this paper, we have studies how the velocity of P- and S-wave varies according to geology and soil type, in regard to the Alluvial, Diluvial and Pliocene Tertiary deposits. In the S-wave velocity, it is possible to recognize a certain relation between the S-wave velocity and the soil type.

And, we have examined the relation of some index values in Soil Mechanics to P- and S-wave velocities. It has been found that fairy good correlations are discernible between S-wave velocity and engineering properties of soils, such as N-value of standard penetration test or unconfined compressive strength. The explanation of these relations has also been tried. Besides, we have investigated the deformability of soils.

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