

**Equivalent Single Degree of Freedom Method for the Soil Dynamic Analysis of
the Multi-layered Ground**

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We proposed a simple evaluation method of the waveform at the surface of the ground by using both the natural period of the ground and the waveform at the engineering bedrock. In this research, the “Equivalent Single Degree of Freedom method” was proposed based on the results of the static push-over analyses of many grounds with various properties. We compared the waveforms of the multi-layered ground obtained from the proposed method with the dynamic analysis. We then confirmed that those waves are almost identical, and the proposed method is applicable to the evaluation of the surface motion. Despite the existing railway line has only a few soil properties available, the proposed method enables the dense calculation of the surface motions alongside the line in an economical manner. These sets of waveforms will be utilized to identify locations where devastating damage is expected under strong earthquakes.