SEISMIC BEHAVIOUR OF TRIANGULAR ALLUVIAL VALLEYS SUBJECTED TO VERTICALLY PROPAGATING INCIDENT SV WAVES

Peyman AMINPOUR
Graduate Student of Geotechnical Engineering Research Center, IIEES, Tehran, Iran
Jafar NAJAFIZADEH
PhD Candidate of Geotechnical Engineering Research Center, IIEES, Tehran, Iran
Mohsen KAMALIAN
Associate Professor of Geotechnical Engineering Research Center, IIEES, Tehran, Iran
kamalian@iiees.ac.ir
Mohammad Kazem JAFARI
Professor of Geotechnical Engineering Research Center, IIEES, Tehran, Iran

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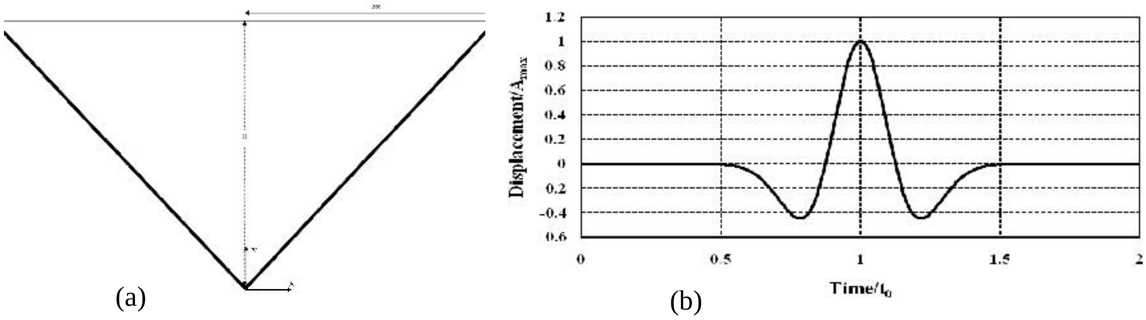
This paper is concerned with the problem of soil amplification and seismic site effects due to the local topography and geotechnical characteristics. It focuses on 2D triangular alluvial valleys subjected to vertically propagating incident SV waves. The geometry of the 2-D homogenous triangular alluvial valley investigated by this study is defined in Figure1-a where ax and H denote the half-width of the soil layer along the ground surface and its depth at the center line, respectively. A broad range of 2D triangular alluvial valleys resting on a rigid bed rock with different shape ratios (H/ax) of 0.2, 0.4, 0.6, 0.8, 1.0 and 2.0 were considered. The incident SV waves were chosen as the well known Riker type (Figure1-b).

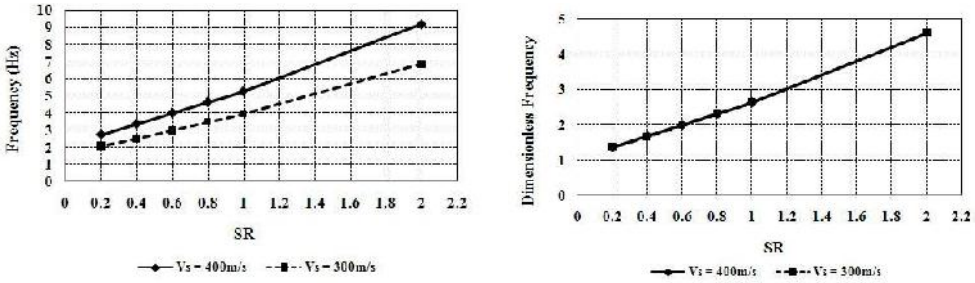


(a) (b)

Figure 1. (a): Geometry of the 2-D homogenous triangular alluvial valley; (b): Displacement time history of the incident wave

A numerical parametric study has been carried out to study the seismic response of triangular alluvial valleys subjected to vertically propagating incident SV waves. The behavior of the alluvial was assumed isotropic linear elastic and the surrounding rock was assumed to behave rigidly. An advanced formulation of the spectral finite element method (Najafizadeh et al., 2014) was applied in order to carry out the site response analyses.

It was seen that the amplification pattern of the valley and its frequency characteristics depend strongly on its shape ratio. In each triangular alluvial valley and irrespective of its shape ratio, the maximum amplification ratio along the ground surface occurs at the center of the valley and when one moves from each of the corners towards the center, the maximum amplification ratio of the ground surface increases. Figure 2-a demonstrates how the natural frequency of the triangular alluvial valley alters with its shape ratio. The natural frequency of the triangular alluvial valley decreases as the shape ratio of the valley decreases. Two curves are presented that corresponds to two different alluvial with a shear wave velocity of 300 and 400m/s, respectively. As can be seen, the curves are similar and infuse the idea of being capable to become non-dimensionalized. Figure 2-b demonstrates these two curves once again, this time normalized to the natural frequency of the corresponding 1D uniform soil layer over the bed rock. As expected, the curves coincide.



(a) (b)

Figure 2. (a): Natural frequency of the triangular alluvial valley via its shape ratio for two different shear wave velocities of 300 and 400 m/s; (b): Dimensionless frequency of the triangular alluvial valley via its shape ratio

Some simple formulas have been proposed for making initial estimation of maximum amplification as well as the natural period of the valley in site effect microzonation studies.

REFERENCES

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