# Numerical analysis of gradient-changing slope under earthquakes

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A two-dimensional finite element numerical model (Fig.1) was proposed to analyze earthquake responses of gradient-changing slope based on a shaking table test. In the numerical model, infinite elements were set on the boundaries of both sides. Earthquake waves were input on the bottom boundary. The parameters used in the numerical model, i.e. unit weight, Young's modulus, model size, and peak acceleration of input seismic waves, were obtained in consistent with those of the shaking table test. The validation of soil parameters and simulation results were verified by Shake91 program (Fig.2) and the shaking table model test (Fig.3), respectively.

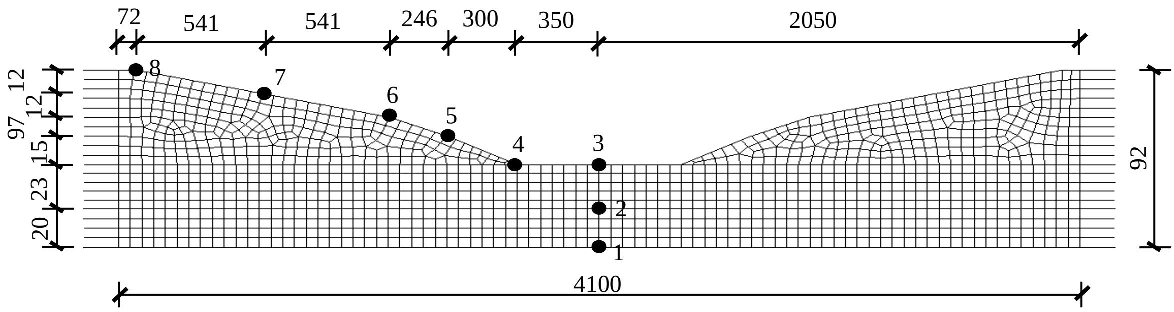



Fig.1 Finite Element Model of slope (Unit: mm)

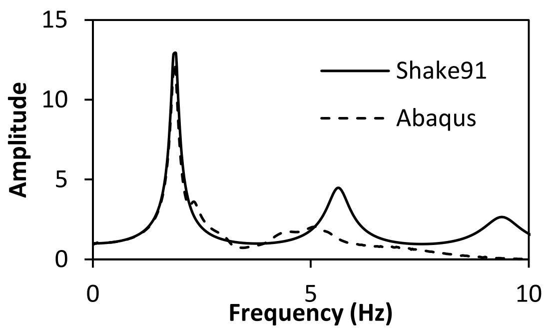



Fig.2 Transfer Function in Frequency Domain

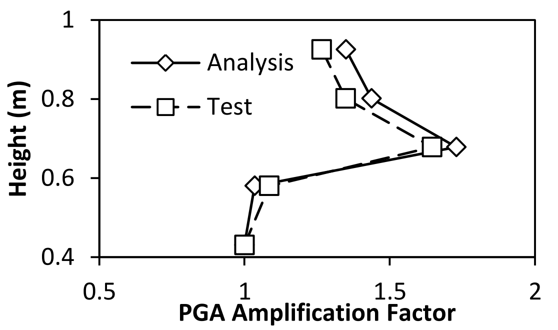



Fig.3 Comparison Numerical Simulation and test results

Figure 3 is a plot of the comparison of numerical results and test data. Results from the Fig.4-5 indicate that, amplification factors of PGA (abbreviation of Peak Ground Acceleration) imply magnification trend from bottom to top through soil. In the vertical direction, low frequency signals are amplified, while high frequency signals are filtered (Fig.6). The maximum PGA is observed at the gradient-changing location along the slope surface.

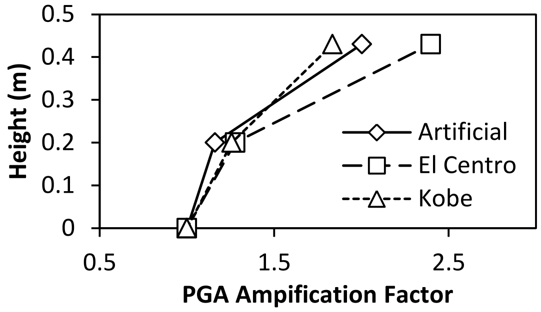


Fig.4 Vertical Amplification

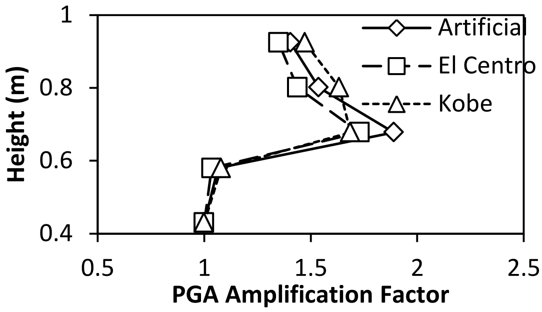
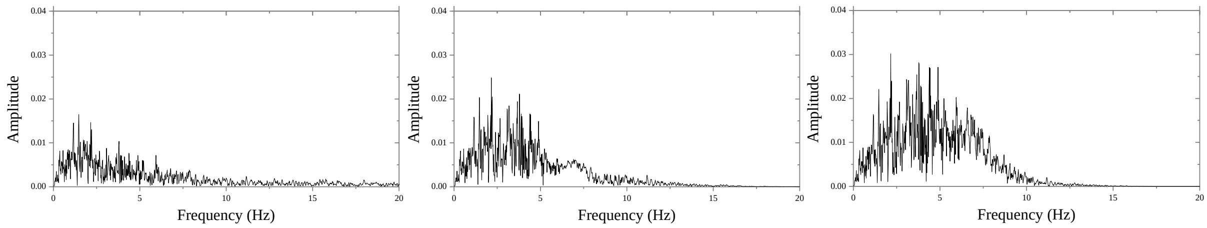


Fig.5 Slope Surface Amplification



(a) bottom ( b) middle (c) top

Fig.6 Frequency Spectrum

Figure 7 shows that the amplification factors of PGA increase with the decreasing frequencies of input earthquake waves along the slope surface, and the distribution trends of PGA amplification factor appear raise at the first, then decrease. The trends of PGA amplification factor distribution are nearly the same in cases of different peak acceleration.

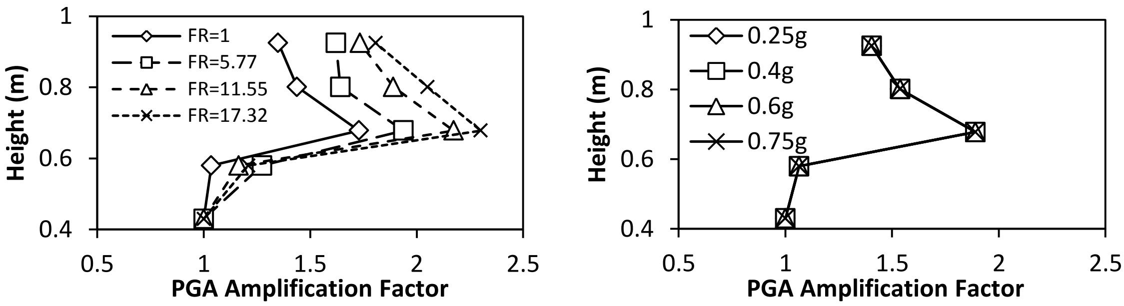


Fig.7 Dynamic Response of Slope Surface

The results are helpful to further study on mechanism of slope stability under earthquake.

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