EVALUATION OF THE EFFECT OF PGV/PGA RATIO OF STRONG GROUND MOTIONS ON RESPONSES OF SOIL STRUCTURE SDOF SYSTEMS

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Generally, in order to evaluate the seismic demand of structures, it is assumed that the structure is located on a rigid soil. However, with increasing the soil flexibility there will be significant variations in the structural response, i.e. the effects of Soil-Structure Interaction (SSI). Furthermore, in the near-field zone, pulse-like motions play crucial roles in the design of structures. This paper addresses the effects of Peak Ground Velocity to Peak Ground Acceleration ratio (PGV/PGA) of near-fault ground motions as a compound intensity index that can describes the frequency characteristics of ground motion on response of various soil-structure SDOF systems. A total 49 near-field ground motions records were selected which have been classified into two categories: first, records with a strong velocity pulse, (i.e. forward-directivity); second, records with a residual ground displacement (i.e. fling-step).

Parametric studies between PGV/PGA ratio of pulse-like ground motions and maximum relative displacement (U_{max}) indicate that with increase in structure-to-soil stiffness ratios($\bar{S}$), earthquakes with higher PGV/PGA ratio produce greater responses. Moreover, increasing in slender ratios ($\bar{h}$) and decreasing in mass ratios ($\bar{m}$) result in the responses of soil-structure SDOF systems become greater in all structure-to-soil stiffness ratios.

Table 1. The characteristics of near-field ground motions with forward-directivity effect (The normal component)

No.	Earthquake	Year	Station	M_w	Dist. (km)	PGA (g)	PGV (cm/s)	PGD (cm)
1	San Fernando	1971	Pacoima Dam-Left Abutment	6.61	11.86	1.45	115.66	30.46
2	Gazli	1976	Karakyr	6.8	12.82	0.599	64.94	24.18

Table 2. The characteristics of near-field ground motions with forward-directivity effect (The parallel component)

No.	Earthquake	Year	Station	M_w	Dist. (km)	PGA (g)	PGV (cm/s)	PGD (cm)
1	San Fernando	1971	Pacoima Dam-Left Abutment	6.61	11.86	0.827	34.43	18.67
2	Gazli	1976	Karakyr	6.8	12.82	0.71	71.05	24.7

Table 3. The characteristics of near-field ground motions with fling-step effect

No.	Earthquake	Year	Station	Comp.	M_w	Dist. (km)	PGA (g)	PGV (cm/s)	PGD (cm)
1	Chi-Chi	1999	TCU074	EW	7.6	13.75	0.59	68.9	193.2
2	Chi-Chi	1999	TCU074	NS	7.6	13.75	0.37	47.95	155.4

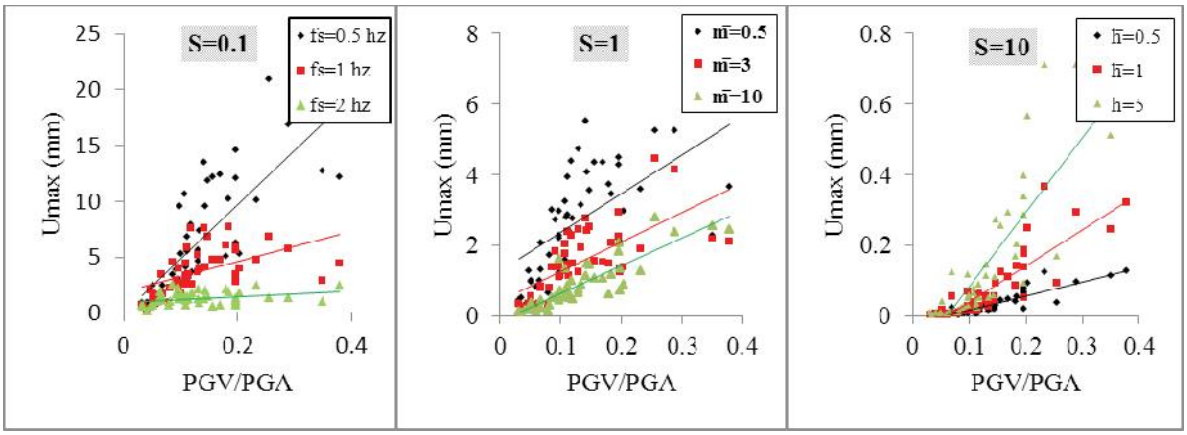

Figure 1. Relationship between the relative displacement of soil-structure SDOF system and PGV/PGA ratio

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