Seismic geotechnic and soil fundamental period In Saghez city Nw of Iran

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Abstract
The earthquake is a natural disaster that always causes fear and fright .it usually accompany with hurting people's life. The safety against earthquake disasters needs envisage site feature and building's safety. The safety of sites relates to geotechnical properties of sites. In this paper, we study geological engineering & geotechnical of Saghez city. Combining geotechnical and seismic borehole data in one step show a nice evaluation of seismic characteristics and response in the place of Saghez city. All the data have been interpreted with one dimensional linear method. On the basis of the obtained results in this site, the amplification coefficient is approximately around the frequency of 2 (Hz). So it seems that the amplification with the first peak is not reasonable in the frequency of 9 (Hz). The exception is alluvial terraces in north and northwest of city and also stream margin. The minimum amounts of SPT were found in northeast and southwest of city that increase toward city center gradually. The maximum amounts of Gs in east and west of city and the minimum amounts in north and southeast were recorded.

Keywords: *Earthquake; Geotechnic ; Site effect; Saghez*

INTODUCTION
In seismic geotechnical survey for Saghez city that has been done with average precision, geotechnical data, earth classification on the basis of geological data and shear wave velocity profiles are used. In most of the similar studies, the focus is just on one or two of these methods will be used. For example Dikmen (1984), analyzed the stress function for seismic response of a site. Finn (1991), also just discussed about the geotechnical aspects of the seismic microzonation.

SEISMIC GEOTECHNICAL ANALYSIS
Prior to study one dimensional equivalent linear analysis (Aki, 1988), Obtaining an appropriate image from ground motion (which is recorded on a station plugged in a rocky formation) is essential. For this purpose, the nearest station with respect to the area is used. With respect to the survey area and the length and magnitude of Tabas earthquake, 1979, it is also used as the reference earthquake of the survey. In preparing the describing models for Layers, achievable data of the borehole from various areas are specially noted too. Equivalent shear wave velocity of 750 (m/s) is applied in analysis of seismic bed rock depth in these boreholes.

Table (1) - Maximum acceleration of seismic bed rock in the borehole

Returning period(year)	100	200	475
Acceleration versus g	0.159	0.183	0.22

In digging borehole, various examinations such as shear wave velocity determination, density of formation, Special weight determination, grain size, SPT and compressional velocity of the layers is conducted. Table 1 shows the maximum of earth acceleration in this seismic bed rock in the place of borehole.

Four different models with respect to grain size and type, shear wave velocity and special weight introduced. All the profiles recorded with three accelerator coordinates placed on the Deihouk station. The results are shown for the Tabas earthquake with 100 year returning period. Geotechnical profile of the soil including shear and compressional wave's velocity is listed in Table 2.

Figure 1 shows Fance diagram of subsurface soil type in Saghez city.

Table (2) - Characteristics of soil profile in the well place

V_s(M/S)	V_P(M/S)	density	Class	Sample
196.9	448.5	1.71	Silt	1
244.8	564.3	1.43	Silt	2
		1.44	clay	3
3371	777.8	1.14	G.Sand	4
		1.58	Gravel	5
400.9	913.6	1.75	Gravel	6
			Gravel	7
449.2	1015.5	1.4	M.Sand	8
			M.Sand	9
494.2	1100.9		Gravel	10
			M.Sand	11
490.9	1112.5	1.4	M.Sand	12
			M.Sand	13
506.2	1148.6		M.Sand	14
			M.Sand	15
521.8	1177.3		G.Sand	16
		1.5	Silt	17
536.2	1200.7		M.Sand	18
			M.Sand	19
548.4	1220.1		M.Sand	20
			G.Sand	21
568.9	1250.5		Gravel	22
			G.Sand	23
584.3	1263.6	1.6	Gravel	24
			G.Sand	25
602.1	1287.5		Gravel	26
			Gravel	27
621.1	1314.9		Gravel	28
			Gravel	29

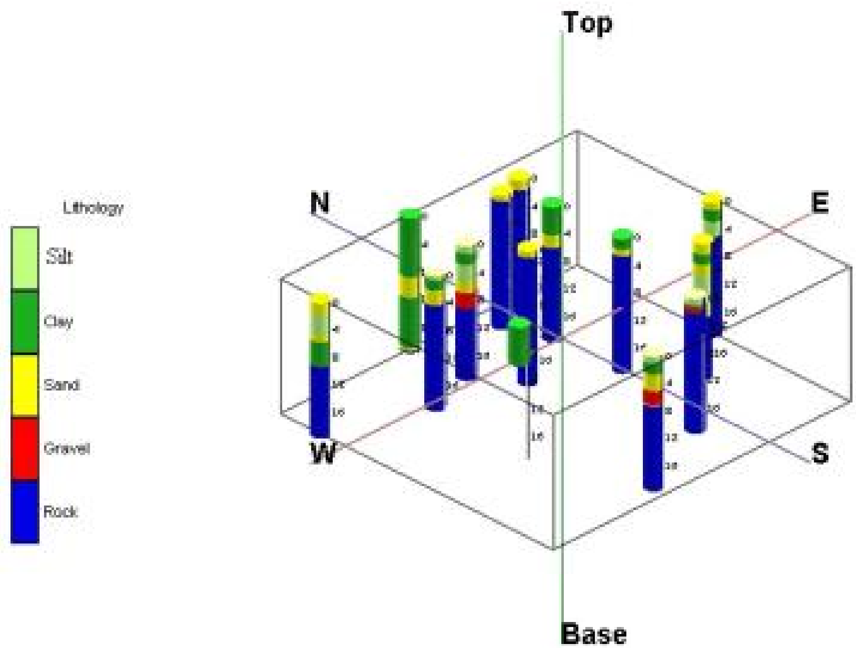

Fig. 1, Fance diagram of Subsurface soil type in Saghez city

Figure 2 shows some profiles of the model. Response spectrum of the model to the Tabas earthquake with the returning period of 100 years for various depths is shown in figure 3, 4 and 5.

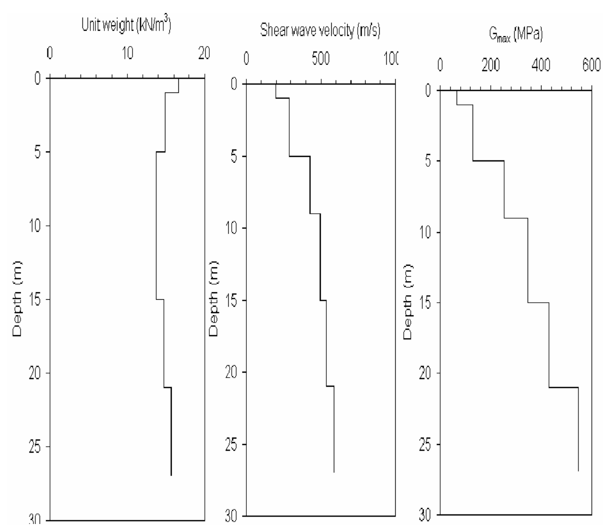

Fig. 2. Model 1. Maximum shearing coefficient profile changes, shear wave velocity and density in the borehole

Figures 6, 7, 8 and 9 shows the second model and its results when applying Tabas earthquake acceleration. The third model and its analysis are shown in figures 10, 11, 12 and 13 introduced the forth model and their results.

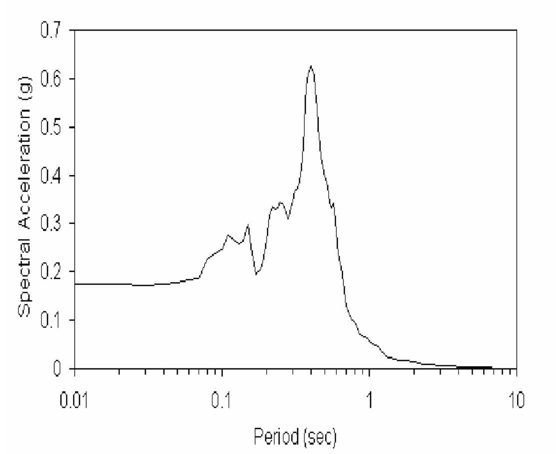

Fig. 3. Spectral acceleration on earth surface With respect to period (First model).

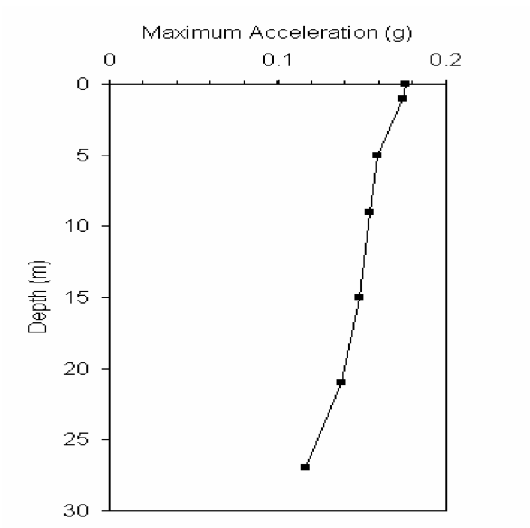

Fig. 4. Maximum ground motion acceleration on various depths for period of 100 years (first

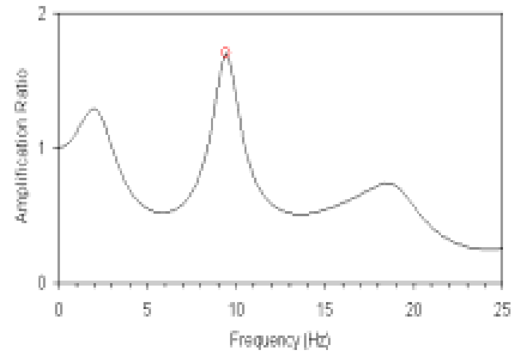

Fig. 5. Shear wave amplitude diagram in terms of frequency from (first model)

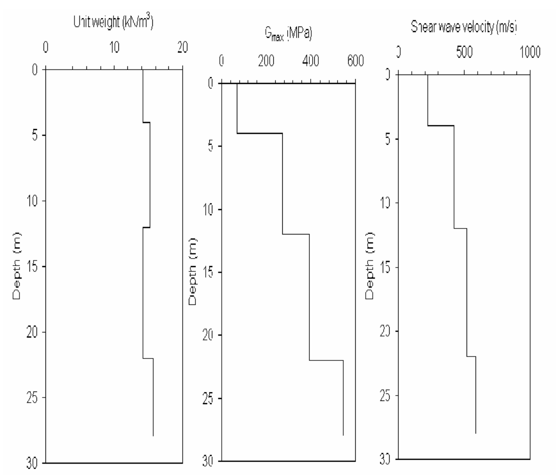

Fig.6. Model 2. Maximum shearing coefficient profile Changes, shear wave velocity and density

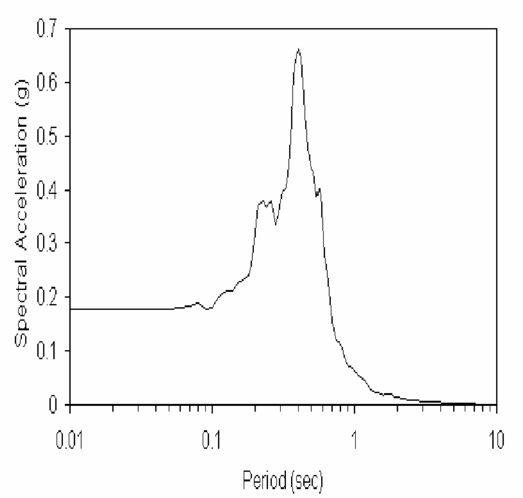

Fig. 7. Spectral acceleration on earth surface with Respect to period (Second model).

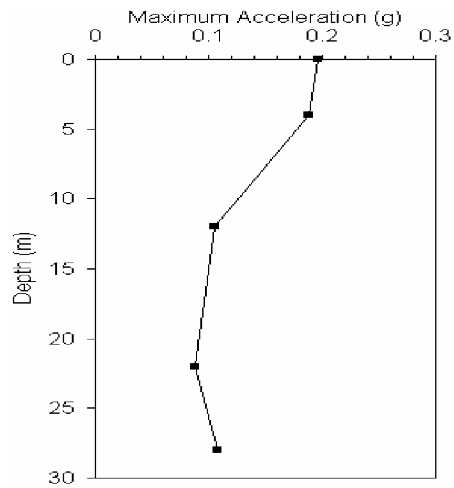

Fig. 8. Maximum ground motion acceleration on various depths for period of 100 years (Second model).

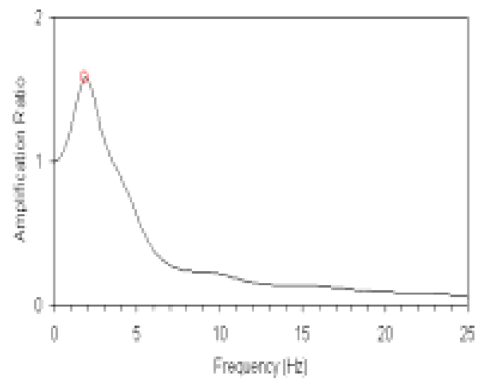

Fig. 9. Shear wave amplitude diagram versus Frequency (Second model).

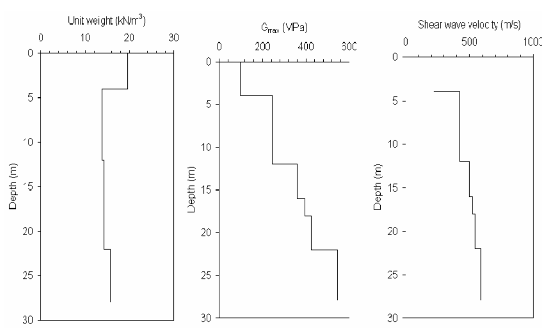

Fig. 10. Model 3. Maximum shearing coefficient Profil Changes, shear wave velocity and density

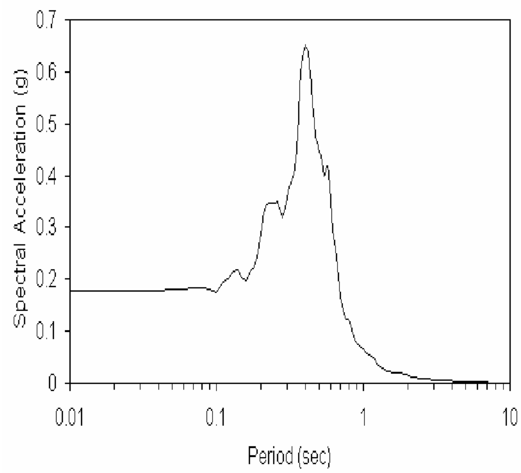

Fig. 11. Spectral acceleration on earth surface With Respect to period (Third model).

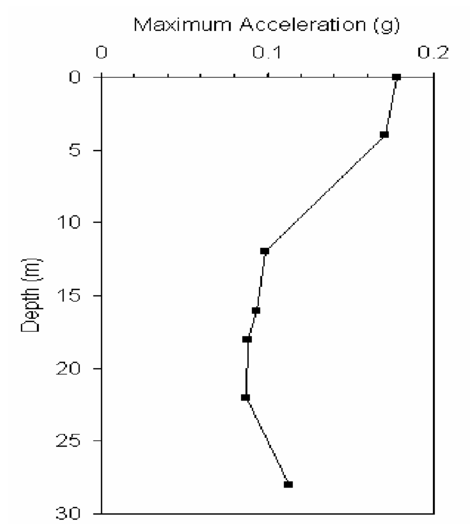

Fig. 12. Maximum ground motion acceleration on various depths for period of 100 years (Third model).

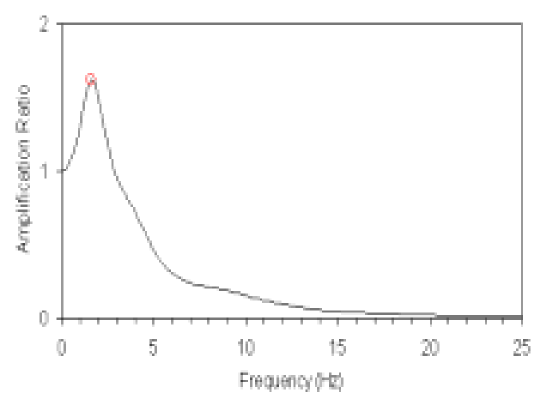

Fig. 13. Shear wave amplitude diagram versus frequency (Third model).

Table 3- Amplification frequency and coefficient Resulting from four proposed models analysis.

model	Amplification coefficient	Amplification frequency
No 1	1.300	2.000
No 2	1.583	1.800
No 3	1.622	1.600

INTERPRETATION AND CONCULSION

With respect to the results, apart from the first model which describes the maximum amplification coefficient about 9 Hz, the other models with a little deviation, shows the amplification coefficient around 2 (Hz). Regarding the situation of the area from the viewpoint of sedimentation, it is thought that the 9 (Hz) components are not reasonable. So as the other models proved, the second peak of amplification is occurred in the frequency of 2 (Hz).

Table 3, shows the frequency, wave amplitude amplification coefficient in the four models. For the conclusion of the survey, the average coefficient and amplification frequency from resulting models is used. So in the above borehole, shear wave amplitude in the frequency of 1.8 amplified with the coefficient 1.5.

Table 4- Maximum acceleration of ground motion on the surface versus (g)

Return period (years)	100	200	475
Model 1	0.176	0.201	0.239
Model 2	0.196	0.226	0.272
Model 3	0.178	0.205	0.246

REFERENCES

1-Aki, K., 1988, Local site effects on strong ground motion. Proceedings, Earthquake Engineering and Soil Dynamics II- Recent Advances in Ground Motion Evaluation, ASCE, Geotechnical Special Publication, 20, 103-155.

2-Bard, P.Y., and Gariel, J.C., 1986. The seismic response of tow-dimensional sedimentary deposits with large vertical velocity gradients, B.S.S.A, 76, 343-356.

3-Dikmen, S.U., and Ghaboussi, J., 1984, Effective stress analysis of seismic response and liquefaction, theory, Journal of Geotechnical Engineering, ASCE, 110, 5, 628-644.

4-Finn, W.D.L., 1991, Geotechnical engineering aspects of microzonation, Proceedings, 4ht International Conference on Microzonation, Earthquake Engineering Research Institute, Stanford University, Palo Alto, California, 1, 199-259.

5-King, J.L.,and Tucker, B.E., 1984, Dependence of sediment-filles valley response on the input amplitude and the valley properties, B.S.S.A, 74, 1, 153-165

6-Rial, J.A., Saltzman, N.G., and Ling, H., 1992, Earthquake-induced resonance in sedimentary basins, American Science, 80, 6, 566-578.

7-Sanchez-Sesma. F., and Campillo M., 1993, Topographica effects for incident P, SV, and Rayleigh waves, Tectonophysics, 218, 1-3, 113-125.

8-Schnabel, P.B., Lysmer, J., and Seed, H.B., 1972,

9-SHAKE: a computer program for earthquake response analysis of horizontally layered sites, Report EERC 72-