III－125 EVALUATION OF COHESIONLESS SOILS BIHAVIOR IN NORTHWESTERN PART OF IRAN (GILAN PLAIN)

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INTRODUCTION

Iran earthquake of June 20 1990 caused extensive damage to life, and various engineering structures sush as buildings, roads, life line facilities and farm lands. The earthquake had a magnitudes of Mb = 7.3 and Ms = 7.6 and focal depth about 10 KM (2). It caused several huge landslides near to epicenter region and along the rupture fault zone, liquefaction in urban area and farm lands area, mostly along the channel of sefiedroud river, rock fall, and rock slips.

The distribution of earthquake damages in gilan plain area shown in figure 1. one of the most important geotechnical aspects of the earthquake damage is liquefaction in gilan plain, specialy in lahijanand Kiyah-shar area.

sand liquefaction caused extensive damage such as foundation bearing failure, differential settelment , destruction of buildings, destruction of roads and conceret water channels, oppening and cracking of the ground surface, uprooting of large trees, sand boils in farm lands and filling of water wells by sand boill-ing. Figure 2 shows the damaged zones by liquefaction phenomenon in Gilan plain. The liquefaction damage in this area, studied by a number of researchers. In this respect to study the geotechnical aspects of earthquake, author visited damaged area.

In this paper the emprical equation which have been given by Seed & Idriss(1982) and Iwasaki et.all(1978) for evaluation of liquefaction potential, were used to check the applicability of the equations for liquefaction damaged area.

DATA SOURCE

For this purpose, the collected results of 139 site investigation projects containing geotechnical information such as soil classification, N value, water table,...and seismic data were used.

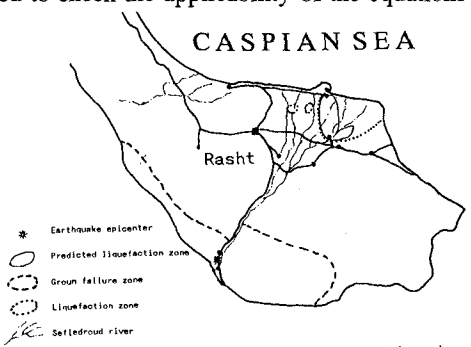

Fig 1. Damaged area by 1990 Iran earthquake

DATA ANALYSIS

To evaluate soil liquefaction potential in the area, a simplified procedures using a liquefaction resist-ance factor and liquefaction potential, given by Iwasaki et.all(1978) and Seed & Idriss(1982) were used. For this purpose the area which according to geological features and the results of geotechnical boreholes were suspicious to liquefaction potential were chosen. Figure (4) shows the distribution of type of soils in selected area. For these locations liquefaction resistance factor(F_L) were computed as below:

$$F_L = R/L$$

where R is cyclic shear strength of soil to an earth-quake loading and is equal to :

$$R = R1 = .0882\sqrt{N/\sigma'_0} + 0.7 + 0.225 \log (0.35/D_{50})$$

and L is the earthquake load in the soil induced by a seismic motion and is equal to:

$$L = a_{max}/g \cdot \sigma'_0/\sigma_0 \cdot rd$$

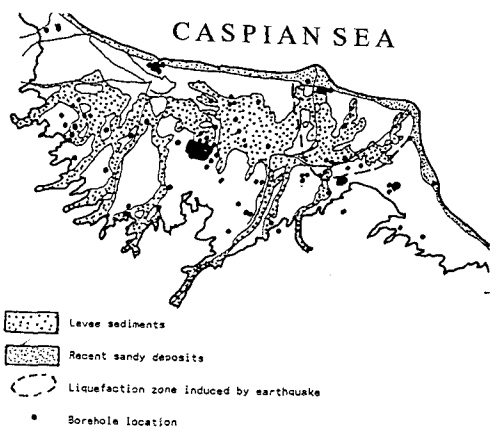

Fig 2. Distribution of levee sediments in Gilan plain area

The locations with F_L smaller than 1.0 considered as a liquefied zones and the locations with F_L greater than 1.0 considered a non liquefaction zones. Figure 1 shows the results of this study. It can be seen that, the liquefied zones are mostly in two direction, one direction from Astaneh toward Kiyahshar area and other direction is Astaneh toward Pahmadan and Naserkiyadeh. Geotechnical and geological investigations shown these two zones are the channel of sefiedroud river.Figure 2 shows the distribution of the sefiedroud river channels in Gilan plain area.

CONCLUSIONS:

1. The results of this study show good agreement with those happened during 1990 Iran earthquake(i.e the area which were characterized as liquefaction phenomenon during earthquake specialy in Astaneh to Kiyahshar).

2. The most important factors for occurance of liquefaction ,are loose sandy and silty sandy layers with high water table level in Astaneh toward Kiyahshar.

3. The evaluation of liquefaction potential by N value for Gilan plain area have shown in figure 3 .This figure reveals that, the points with F_L smaller than 1.0 located in liquefied zone of chart and the points with F_L gereater than 1.0 located in non liquefaied zone on the chart.

4. This study indicate, the empirical equations given by Iwasaki et.all(1978)can be used for evaluation of liquefaction potential in Gilan plain.

REFERENCES

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3- Seed & Idriss(1982), Evaluation of liquefaction potential using performance data, Jnl.Geotechnical Eng., Div,ASCE.

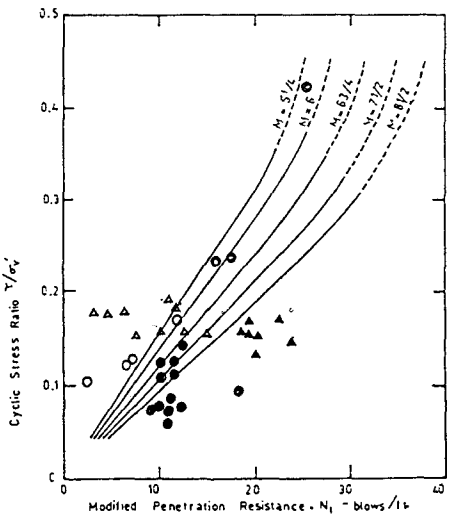

Fig 3. Evaluation of liquefaction potential of Gilan plain soils

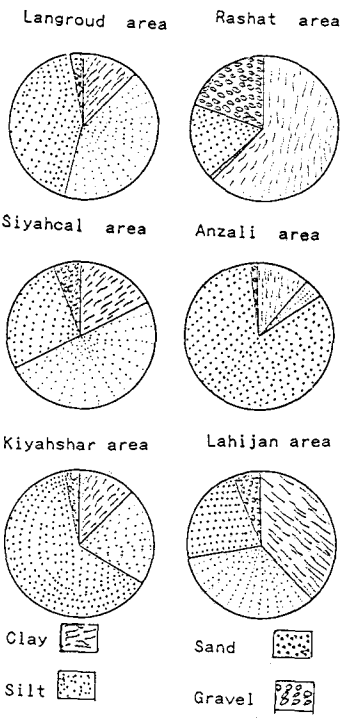

Fig 4. Distribution of soils in Gilan plain