EVALUATION OF THE LIQUEFACTION HAZARD POTENTIAL ON BUSHEHR NUCLEAR POWER PLANT (BNPP)

Mohammad Hossein MOLLAZEINAL
Head of Civil and Structure Department, OCE, Tehran, Iran
M_mollazeinal@yahoo.com

Atefeh FARAJI
Geologist of Environmental Studied Department, OCE, Tehran, Iran
Ati.faraji@gmail.com

Keywords: Liquefaction, Bushehr, Nuclear Power Plant, Seed and Idriss

One of the important phenomena and main factor of the damages on the structures and buildings in the seismic events especially in the regions constructed on the sand soils is liquefaction. Many researchers try to decrease the damages caused by the liquefaction effects with considering the requirement in design of the structures via to represent of the documentations and their results as graphs and experimental relations. In this research, according to the obtained results from experimental studies on some boreholes in the (BNPP) nuclear power plant of Bushehr (Dames and Moor, 1974) perform the analysis on the liquefaction potential in the BNPP region as per Seed and Idriss method (1974) and exhibit safety factor (FL) of the region. Afterwards according to produced results regarding to liquefaction potential on the site, considered several graphs of the safety factor of liquefaction event and a parametric study is implemented for the different values of the a_{max} (maximum design acceleration) and M_w (earthquake magnitude).

The studied region is coastline of the Persian Gulf in the Zagros geology zone. For the liquefaction study in the region, the result of SPT test has been used in the different boreholes according to the last studied as per Table 1.

Table 1. SPT Test Results in Different Boreholes (Dames and Moor, 1974)

Borehole No.	1	2	3	4	5	6	7	8	9	10	11	12
The studied depth	26.5	19.25	22	22.1	21.85	21.85	18.95	23	22.5	23	17.95	22
SPT	72	46	53	99	78	55	32	87	68	92	29	84
	196	112	203	231		132	56		161	162	65	154

For the evaluation of liquefaction hazard we applied Seed and Idriss method, because of the numerous data of SPT test and facility of the test. In this method, two main parameter are needed that included CSR and CRR. CSR and CRR parameters are "CYCLIC STRESS RATIO" and "CYCLIC RESISTANCE RATIO" respectively. According to the studied region parameters and the design basis acceleration value (equal to 0.4g) and earthquake magnitude equal to 7.5 for the Bushehr nuclear power plant, the calculated values of safety factors with iteration calculate 2.7. So according to the Classification of the Liquefaction potential as per Table 2, the studied region is in "low potential" classification.

Table 2. Classification of Liquefaction Potential (Dames and Moor, 1974)

Region	Safety Factor	Liquefaction Potential
1	FL < 1.0	Very High
2	1 < FL < 1.5	High
3	1.5 < FL < 2.0	Moderate
4	2.0 < FL < 3.0	Low
5	FL > 3.0	Very Low

Also, in this research, a sensitiveness analysis on the seismic acceleration levels and seismic magnitude implemented and the liquefaction potential in the different value of these parameters (a_w and M_w) has been evaluated. Figure 1 shows

change of safety factor (FL) in liquefaction against the acceleration level of seismic in different seismic magnitude and also change of safety factor (FL) in liquefaction against the seismic magnitude in different acceleration levels.

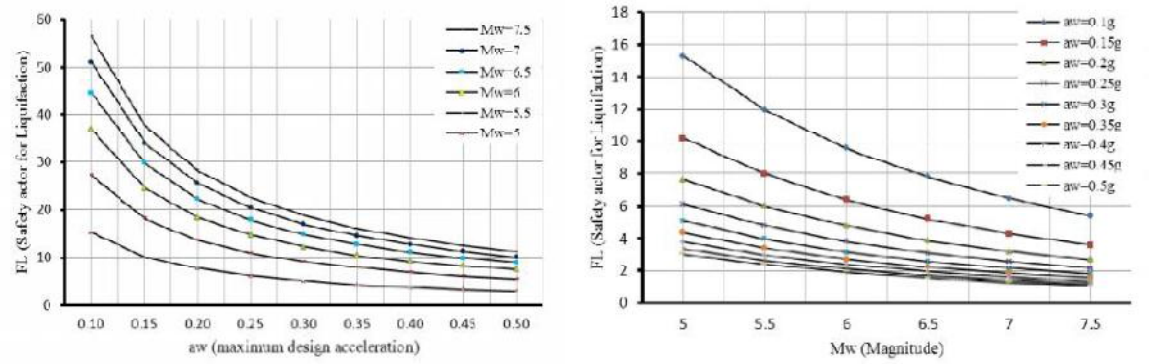

Figure 1. Change of Safety Factor for Liquefaction with aw in different Mw (Left) and Change of Safety Factor for Liquefaction with Mw in different aw (Right)

The results show the considered area for the Bushehr nuclear power plant as per the different design parameters located in the area with low and middle liquefaction potential category. Also, the studies show the high liquefaction potential (FL<1) in this area under the earthquakes with magnitude less than 7.5 and the acceleration level less than 0.5g don't occur and the area is suitable location for construction of different structures from the liquefaction viewpoint.

REFERENCES

Dames and Moor (1974) Final Report Geotechnical Studies Iran 1, 2 Nuclear Power Plant of Bushehr, International S.R.L., Consultants in the Environmental and Applied Earth Sciences

Seed HB and Idriss IM (1971) Simplified procedure for evaluating soil liquefaction potential: Proceeding of the American Society of Civil Engineers, Journal of the Soil Mechanics and Foundations Division, 93(SM9): 1249-1273

Seed HB and Idriss IM (1982) Ground motions and soil liquefaction during earthquakes: Earthquake Engineering Research Institute, Engineering Monograph, v. 5, 134 p

Seed HB, Idriss IM and Arango I (1983) Evaluation of liquefaction potential using field performance data: American Society of Civil Engineers, Journal of Geotechnical Engineering, 109(3): 458-482