Amirkabir University of Technology
(Tehran Polytechnic)
Vol. 46, No.1, Summer 2014, pp. 29- 31

Amirkabir Journal of Science & Research (Civil & Environmental Engineering)
(AJSR - CEE)

Laboratory Studies to Diagnosis Problematic Soils of Ardakan

Kh. Mahmoodi[1], H. Mehrnahad[2*], K. Barkhordari[3]

1- Lecturer, Faculty of Engineering, University of Yazd ardakan
2- Assistant Professor, Department of Civil Engineering, Yazd University
3- Assistant Professor, Department of Civil Engineering, Yazd University

(Received 18 Oct 2012; Accepted 29 May 2013)

ABSTRACT

Ardakan is located in Iran's central desert. Cracking has caused significant damage to buildings and arteries in this region. Different theories have been associated with the explanation of these cracks, the strongest of which is the problematic soils (expansive soils, dispersive soils and collapsible soils). In this respect several geotechnical tests performed on five bores up to 14 meters in depth. To determine the swelling potential of soil, direct (standard A methods of ASTM D4546) and indirect (various criteria including Chen, AASHTO, Kaldveer, Vander Merwe and free swell test) methods were used.

It was concluded that soils have moderate swelling potential. This feature in some cases can cause cracks in the structures. It has also been concluded that the dispersion and collapse potential of soil are negligible.

KEYWORDS

Problematic Soils, Cracking, Ardakan, Swelling, Direct Assessment.

* Corresponding Author, Email: hmehrnahad@yazduni.ac.ir

1- BREIF INTRODUTION

Ardakan is located in Iran's central desert. Cracking has caused significant damage to buildings and arteries in this region. Different theories have been associated with the explanation of these cracks, the strongest of which is the problematic soils (expansive soils, dispersive soils and collapsible soils). In this respect several geotechnical tests performed on five bores up to 14 meters in depth. To determine the swelling potential of soil, direct (standard A methods of ASTM D4546) and indirect (various criteria including Chen, AASHTO, Kaldveer, Vander Merwe and free swell test) methods were used.

2- METHODOLOGY

Collapse potential was measured by direct and indirect method. Consolidation test (ASTM D5333) were used in the direct method. For indirect method, Handy, Zur & Wiserman, Holtz & Hylf and Denisov criteria were used. The dry density and soil porosity are used to estimate the collapse potential in Denisov, zur & wiserman and Holtz & Hylf criteria. and percentage of particles smaller than 2 microns is used in Handy criterion. Cramb, hydrometer and pinhole test were used to determine soil divergence.

To determine the swelling potential of soil, direct and indirect methods were used. Direct evaluation of swelling potential, means direct measurement of swelling pressure and swelling percentage. Direct method is the simplest and most satisfactory method for assessing the swelling potential. Indirect assessment of swelling potential, including the ways in which the physical properties of soil such as Atterberg limits, soil activity & clay content, specific gravity and weather condition are used.

3- MAIN CONTRIBUTION

Comparison of different criteria for estimation swelling soil, suggesting that the AASHTO and Kaldeveer criteria have the best fit, to the result of direct method. Analyzing of the results explores that the swelling potential of the soil is moderate.

Increasing swelling potential of boreholes is as follow:

BH1<BH5<BH3<BH4<BH2

This study also highlights the fact that the dispersion and collapse potential of soil is negligible.

4- SIMULATION RESULTS

For estimation swelling potential of borehole 2, different criteria are used. The results of which are reflected in figure 5 and 7. Figure 5 shows the results in14 meters depth. The figure 7 shows the results up to 8 meters in depth too. Consolidation test have been performed at depth of 4 and 8 meters, to assess swelling potential with direct method. The swelling assessment result, using Chen criterion and relative free swell test, quite similar, that is reflected in figure 7. Comparison of figure 5 and 7 shows that swelling potential increases as the depth increases. The results of figure 7 concord more closely to reality, because the low depths are more effective in creating swell. Also the results of AASHTO and Kaldeveer criteria bestly suits direct assessment method that is reflected in figure 6.

What is mentioned above it can be concluded, that borehole 2 has a moderate swelling potential.

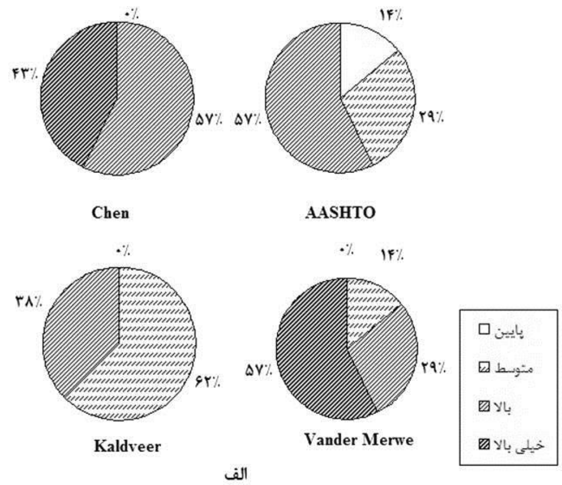

Fig. (5): The swelling potential 's estimation by using indirect methods in14 meters depth for bore 2

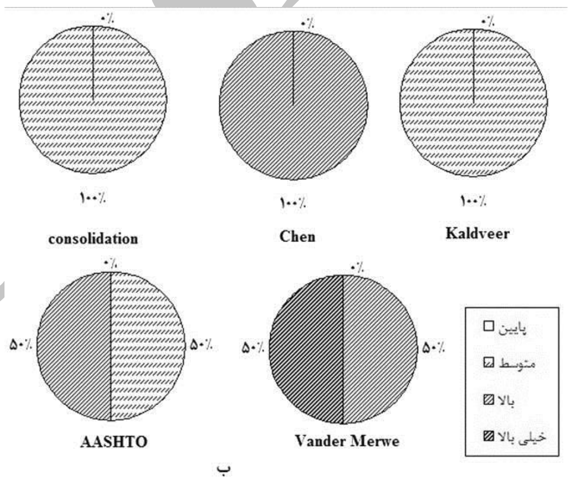

Fig (6): Comparison of direct and indirect methods in the depth of 4 and 8 meters for bore 2

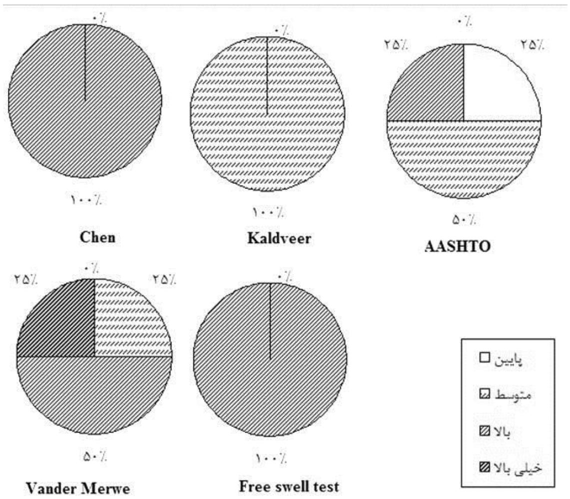

Fig. (7): The swelling potential 's estimation by using indirect methods in 8 meters depth for bore 2

5- MAINREFRENCES

[1] Janalizade, A. Ramazanianpur, M. ,"The improvment of Mazandaran's clays", Third National Congress on Civil Engineering, 1386.

[2] Ra'ee, E. ,"The effect of Compression on geotechnical parameters of Rostaq district of Yazd's loose soils", Master dissertation in Civil Engineering, Yazd University, 1388.

[3] ASTM,"Standard test method for measurement of collapse potential of soils", Designation: D5333, 2000.

[4] ASTM, "Standard test method for dispersive characteristics of clay soil by double hydrometer", Designation: D4221, 2000.

[5] ASTM,"Standard test method for identification and classification of dispersive clay soils by the pinhole test", Designation: D4647, 2000.

[6] ASTM,"Test method for liquid limit, plastic limit and plasticity index of soils", Designation: D4318, 2000.

[7] ASTM ,"Test method for particle-size analysis of soil", Designation: D422, 2000.

[8] ASTM ,"One-Dimensional Swell or Settlement Potential of Cohesive Soils", Designation: D4546, 2000.

[9] Sridharan, K. Prakash ,"Classification procedures for expansive soils", Proc. Instn Civ. Engrs Geotech. Engng, 2000.