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Geotechnical zoning of Ahvaz soil using Geographic Information System (GIS)

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ABSTRACT: The present study, which is of an applied type, was conducted in 1400 with the aim of geotechnical zoning of the soil of Ahvaz city using GIS. By collecting geotechnical information obtained from 200 drilled boreholes to a depth of 10 meters and using ArcGis software, soil geotechnical parameters were zoned in Ahvaz. Factors affecting soil bearing capacity including soil adhesion, internal friction angle and soil specific gravity were selected for zoning. The results of stress calculations showed the existence of a linear increase relationship between its values at different soil depths. The zoned interpolation map of internal friction angle in Ahvaz city showed that with increasing soil depth, internal friction angle has increased. The highest internal friction angle at a depth of 2 meters was recorded in the northeast of Ahvaz (Kianpars area) with more than more than 41 degrees. With increasing depth, the internal friction angle has increased, so that at a depth of 10 meters, in most boreholes drilled in the mentioned areas, the amount of internal friction angle has increased to more than 41 degrees. The results of the adhesion zoning map based on the drilled boreholes showed that there is no statistical relationship between this geotechnical component and the depth increase. Also, the study of soil specific gravity based on drilled boreholes and zoning interpolation map in the present study showed that with increasing soil depth, the average specific gravity increased significantly from 1.6% at 2 m depth to 47.9% at depth 10 Meters has been reached. In general, these components, especially specific gravity, are related to determining the load-bearing capacity of the soil and can be used to assess the feasibility of choosing the best spatial option for the construction of specific projects.

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1- Introduction

One of the key parts of civil engineering projects is geotechnical studies. These studies will have economic and qualitative effects on structures and increase the safety of residents in the construction and operation stages [1,2] Spatial information systems, which are a platform for real-world simulation, are capable of storing, managing, timing, processing, complex spatial and non-spatial analysis, modeling, forecasting, and display using their analytical functions [3]. The scope of using geotechnical data is growing with the expansion of spatial information systems, mainly in other fields, including urban, environmental infrastructure and risk potential analysis and sustainable development [4,5] Given that drilling and conducting studies for a small project is not economically viable and most employers refuse to do this part of the project, due to the access of GIS-based software from the drilled borehole information and the use of this information and the capabilities of GIS written software such as ArcGIS, the geotechnical parameters available in the city of Ahvaz can be zoned. Thus, for each area, according to the zoning, the appropriate geotechnical parameters were estimated and provided to the design engineers.

2- Methodology

In this research, by drilling 330 boreholes and soil sampling and performing appropriate tests, an acceptable approximation of different parameters in different parts of Ahvaz is presented (Fig 1). In this research, by coordinating the location of geotechnical studies of residential structures and creating a suitable database, using the capabilities of spatial information systems, an overview of the geotechnical situation of the region, by preparing large-scale zoning maps. Therefore, considering the strategic nature of Ahvaz in terms of military and industrial facilities and the existence of huge oil and gas reservoirs, as well as the sandiness and level of groundwater has led to a more detailed study in terms of soil geotechnical potential.

Based on the choice of IDW interpolation method, according to the mentioned analyses, to ensure the zoned maps, in five points of Ahvaz city that were not sampled, drilling operations and field experiments were performed and the number Adhesion was harvested to a depth of 2 m.

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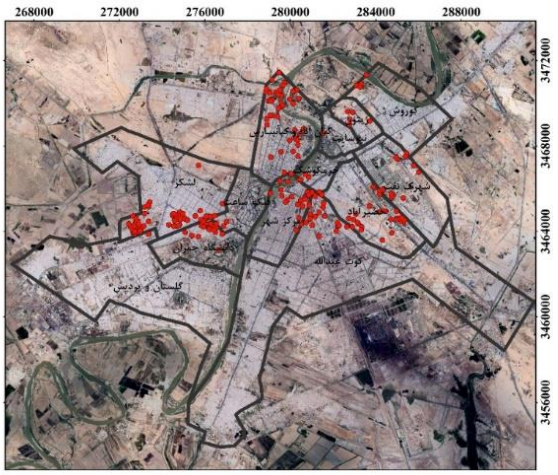

Fig. 1. The location of boreholes drilled in Ahvaz city.

These numbers are compared with the values determined by the zoning maps. The results show the accuracy of the maps created by IDW interpolation. In this study, by collecting geotechnical information obtained from 330 boreholes drilled to a depth of 10 meters and using Geographic Information System (ArcGis) software, soil geotechnical parameters in Ahvaz city are zoned.

3- Discussion and Results

Zoning of the internal friction angle of soil showed that at a depth of two meters only 18.7% and at a depth of 10 meters 11.2% of soils have a friction angle of less than 28 degrees and with increasing depth, its amount has increased. This relationship is established linearly. Therefore, to describe these soils, they can be classified as medium and relatively dense soils. The results of soil adhesion zoning showed that the highest average soil adhesion level is at a depth of 10 meters and the lowest is at a depth of 2 meters. Soil specific gravity zoning showed that with increasing soil depth, the average specific gravity increased significantly from 1.6% at a depth of 2 meters to 47.9% at a depth of 10 meters.

Among the management measures that can play a significant role in reducing the damage caused by geotechnical hazards, the classification of different areas of a city in terms of soil resistance parameters, soil layers, and in a general sense, the geotechnical zoning of the city to use Urban management planning. Geological and geotechnical components of soil in Ahvaz are affected by groundwater and sediment-plain environments on both sides of the Karun River. Sedimentary rocks of Aghajari Formation are the only outcrop in Ahvaz that is located under alluvial deposits. This formation is folded in the Ahvaz anticline. The present research, which is of descriptive-applied type, seeks to obtain desirable information from the geotechnical components of Ahvaz to a depth of 10 meters. This data, along with information such as fault status, can be used in any type of development project. It should be noted that the most important fault of the area is the Ahvaz fault, which started from the north of Susangard city and while passing through Hamidiyeh and Ahvaz cities, has been extended to the southeast of Ahvaz.

4- Conclusion

The zoned interpolation map of the internal friction angle in Ahvaz City showed that with increasing soil depth, the internal friction angle has increased. The highest internal friction angle at a depth of 2 meters was recorded in the northeast of Ahvaz (Kianpars area) with more than more than 41 degrees. Its values in the southeast (Kut Abdullah) and west of Ahvaz (Golestan and Pardis) and also in the north (Lashgar) were at levels of 30 to 40 degrees. With increasing depth, the internal friction angle has increased, so that at a depth of 10 meters, in most of the boreholes drilled in the mentioned areas, the amount of internal friction angle has increased to more than 41 degrees.

The results of the adhesion zoning map based on the drilled boreholes showed that there is no statistical relationship between this geotechnical component and depth increase. Adhesion levels in soil were different in different parts of Ahvaz and varied between 0.008 to 8 kg /cm^2. The highest values are recorded in the west of Ahvaz in the Golestan region at the rate of 2 to 8 kg per square centimeter. Examination of soil-specific gravity based on drilled boreholes and zoning interpolation map in the present study showed that with increasing soil depth, the average specific gravity increased significantly from 1.6% at a depth of 2 meters to 47.9% at a depth of 10 meters. it is arrived. Most of its values were in the urban center, west, east, and south of Ahvaz.

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