THE GEOTECHNICAL MAPS FOR
BEARING CAPACITY BY USING GIS AND
QUALITY OF GROUND WATER FOR AL-
IMAM DISTRICT (BABIL - IRAQ)

Asst. Prof. Kadhim Naief Kadhim and Ahmed Awad Matr Al-Abody
Department of Civil Engineering, College of Engineering, Babylon University, Iraq

ABSTRACT
In this research presents the use of Geographical Information Systems (GIS) to production a Geotechnical maps for bearing capacity for soil of Al-Imam district in Babil Governorate, Iraq. As well as the description of the layer of soil, and show quality of ground water for the study area. Geotechnical maps provide a powerful database and strong visual presentation of geotechnical data. This research is performed in several stages that started with get a space map and administrative boundaries of the study area then collect the data required for the research from National Center for Construction Laboratories (NCCL), AL-Mawal Company for soil investigation and Consultation Office at the University of Babylon. Then enter this data to the program (ArcGIS9.3) after determining their position using a GPS. The total number of test wells used in this research (17) well them depth up to (10m). Results obtained from this research stressed the possibility of producing Geotechnical maps for bearing capacity in Al-Imam district. This Geotechnical maps can provide a description fast and easy access to these properties such as bearing capacity. As well as showing the quality of ground water.

Key words: Geotechnical Maps, Geotechnical Maps by Using GIS and Ground Water of Al-Mam District.

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1. INTRODUCTION
The establishment of any engineering construction whether this construction (building, bridge, road, tunnel, dam, box culvert, etc) needs to soil investigation, this soil investigation needs time and cost. To reduce costs and shorten the time we need
to geotechnical maps. Geotechnical maps are a tool used to describe soil of any studied area, these maps protected in several ways and several programs. In this research will be used GIS program (Geographic Information System) because it is suitable to the requirements of search.

Geographical information systems (GIS) have developed over the years as a very important tool for graphic representation of geospatial data. Geotechnical, geologic and hydrologic data as represented in GIS based maps has put a great impact on civil engineering, especially in regards to how subsurface geospatial data is communicated with clients and with people at large. GIS has evolved as the principal technical communication medium over the last four decades because data represented in GIS formats can be widely and easily disseminated through the World Wide Web.

This research will be discus some Geotechnical properties for soil of residential areas of Al-Imam district in Babil governorate- Iraq. This Geotechnical properties are: Bearing Capacity (B.C), Soil layer description and Ground water quality. The property that will be analyzed by GIS is bearing capacity (B.C) other properties will be analyzed according to the result of lab tests as will show later.

2. STUDY AREA
The study area is situated in Iraq- Babil governorate- Al-Mahawil city- Al-Imam district at (3604000- 3624000) latitudes and (450000- 470000) longitudes by UTM system as shown in figure (1). The area covers geographical area of about (233.4 km2) bounded on North and East Al-Mashroa district on West Al-Mahawil city and on South Al-Neel district. The study area is almost flat. In general study area has a desert climate which is characterized by a lack of rainfall ranging between (50-200mm) annually. With high temperatures in summer of up to 50 cº.

![Figure 1 Location of Al-Imam District](image)

3. DATA COLACTION
The data that used in this research took from the National Center for Construction Laboratories (NCCL) reports, Consultation Office at the University of Babylon and AL- Mawal Company for soil investigation. Data collected concerning to (17) test boreholes are distributed randomly on residential areas in Al-Imam district; these test boreholes have depth up to (10m).
4. GEOTECHNICAL PROPERTIES

4.1 SOIL LAYER DESCRIPTION

Soil layer is one of physical soil properties. According to the data that collected, soil of Al-Imam district is a layered soil, this layers are: clayey silt, silty clay and silty sand distributed randomly on the depths as in figure (2) that shows some samples of boreholes in Al-Imam district, the other boreholes are similar to these boreholes approximately.

![Figure 2 Samples of boreholes in Al-Imam district](image)

4.2 BEARING CAPACITY (B.C)

Bearing capacity is one important of engineering soil properties. In this research bearing capacity analyzed by GIS version (ArcGIS 9.3). After entering the data of B.C in the program has been producing geotechnical color maps represent B.C distributed to residential areas for each (1.5m) depth up to the depth (10m) as shown in maps (1,2,........, 7). Depending on these geotechnical color maps concluded the following: maximum B.C is (16.9 T/m²) at depth (10m) bounded by the coordinates (452362.23, 3619776.16), (458996.84, 3619876.68) and (452110.92, 3616509.12), minimum B.C is ( 2.01 T/m²) at depth (1.5m) bounded by the coordinates (452563.28, 3610527.92), (459851.29,3610477.66) and (452613.54, 3616157.28). The foundations of installations designed depending on bearing capacity of soil because that, it is considered the most important engineering properties. In general the bearing capacity of residential areas in Al-Imam district increase with depth and in the north direction due to changing soil layers, as well as the shallow depths, large change in groundwater levels that effect on bearing capacity, and due to increased levels of natural ground in the north direction.
The Geotechnical Maps For Bearing Capacity by Using GIS And Quality of Ground Water For Al-Imam District (Babil - Iraq)

Map(1): B.C (T/m) for Al-Imam district at depth 1.5m from N.G.L.

Map(2): B.C (T/m) for Al-Imam district at depth 3m from N.G.L.
Map (3): B.C (T/m) for Al-Imam district at depth 4.5m from N.G.L.

Map (4): B.C (T/m) for Al-Imam district at depth 6m from N.G.L.
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Map 5: B.C (T/m) for Al-Imam district at depth 7.5m from N.G.L.

Map (6): B.C (T/m) for Al-Imam district at depth 9m from N.G.L.
4.3 GROUND WATER

In general ground water table is seasonally variable, depending on the temperature of the region, the rain falling and the remoteness of the area for the ongoing rivers. Ground water of Al-Imam district has pH ranging between (7.6-8.2) in other words, behave alkaline behavior because the soil of Al-Imam district is alkaline soil. pH and other chemical properties shown in table (1).

<table>
<thead>
<tr>
<th>B.H No.</th>
<th>Date of measurement</th>
<th>Depth of water level (m)</th>
<th>pH</th>
<th>SO₃ ppm</th>
<th>X</th>
<th>Y</th>
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5. CONCLUSIONS

1. The utilization of the geographic information system (GIS) in the work concerning geotechnical engineering helped in linking the geotechnical properties to known and specific locations, and this can be served the geotechnical engineer as very effective tools for non-spatial data area prediction.

2. Soil of Al-Imam district is a layered soil, these layers are: clayey silt, silty clay and silty sand distributed randomly on the depths depths.

3. Maximum B.C is (16.9 T/m²) at depth (10m) bounded by the coordinates (452362.23, 3619776.16), (458996.84, 3619876.68) and (452110.92, 3616509.12), minimum B.C is (2.01 T/m²) at depth (1.5m) bounded by the coordinates (452563.28, 3610527.92), (459851.29, 3610477.66) and (452613.54, 3616157.28).

4. Ground water of Al-Imam district has pH ranging between (7.6-8.2) in other words, behave alkaline behavior and it is seasonally variable.

5. Through looking to geotechnical maps pertaining to bearing capacity and (Design Loads for Buildings and Other Structures (ASCE/SEI 7-10)) can be take an appropriate decision on type of foundation and number of floors in the building.

6. RECOMMENDATIONS

1. Geotechnical maps must be updated when the released version of (ArcGIS) more efficient than (ArcGIS9.3), to produce Geotechnical maps more clarity and efficiency. Geotechnical maps are based on data for residential areas, so these maps be more efficient as we get closer to residential areas.

2. Use the Geotechnical maps does not cancel the soil investigation of the site, but also reduces the number of test points and gives an initial idea of the nature of the soil site.

3. Data used in this research concerning residential areas of the study area only.

REFERENCES

[3] Consultation Office at the University of Babylon.


