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ROLES AND FUNCTIONS OF GEOGRAPHIC INFORMATION SYSTEM (GIS) IN VARIOUS FIELDS

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Abstract

Data management is important and it useful especially when retrieving the data soon. As growth in information system in various industries, the ability of Geographic Information System (GIS) in improving operational efficiency is one the reason a lot of data are stored by using this software. Thus, the paper explains the roles and functions of GIS development in various sectors. With help GIS technology, the data are stored in the form of softcopy and people can make quick decisions. ArcCatalog is a backbone program in GIS when storing and managing the data. As the result, attribute tables will represent all data and will relate with geographic referenced.

Keywords: *GIS, Geographic Information System, Retrieving,Efficiency, ArcCatalog*

1. Introduction

Geographic Information System (GIS) plays a crucial role in management and allocation resources management in the era 21st century. The system helps a lot in managing the data and gives a better decision. Other than that, in the context of sustainablity, there are important to store a data and able to retrieve to the next generation. Moreover, books or printed hardcopy looks outdated and users demand for attractive sources with huge information. Thus, it shows the uniqueness of GIS in meeting human needs and satisfaction.

1.1. Definition

There are various definitions of GIS especially in books, journals, GIS bulletins and other sources. Most of the books, journals or other sources explain GIS as the system which is able to capture, store, retrieve, the geographical feature. Chang (2010) gives a similar definition as GIS is geospatial data which shows location and attribute data and the data is stored, managed and mapped by using the system. After the data is mapped, GIS helps a lot in demonstrations and presentations. Zulkifli, Hamidah (2010) in their article explain that GIS is a system for mapping and analyzing any object on earth.

Three components which relate to GIS namely computer software, software module and organizational context (Burrough, 1986). The examples for computer hardware are computer, monitor, digitizers, printers and plotter. They will provide space for storing data and programs. On the other hand, the software consists of technical modules such as data input and verification, data storage and database management, data output and presentation, data transformation and interaction with the user (Burrough, 1986). In addition, the proper organizational may be support GIS such as people, cultural environment, administrative and etc.

1.2. GIS Roles

Many agencies in Malaysia are already using this current information technology in many fields such as government, environment, business, and planning. The Department of Survey and Mapping, The Department of Town and Planning, The Ministry of Health, The Ministry of Transportation, and The Department of Environment are applying this system. On the other hand, Jabatan Ukur dan Pemetaan Malaysia or (JUPEM) is a body that plays an important role in strengthening the measurement and mapping system in Malaysia. Its role is to provide elements

of knowledge, particularly in geographical aspects. Most mapping information in JUPEM is constructed by using Geographic Information System (GIS) software.

1.2.1 Planning Development

GIS technology already used in planning activities and monitoring development for many times ago. Moreover, Yaakup (2004) said the GIS Development contribute a lot of benefits to planner especially in understanding real planning problems and planning scenario. For example, in land use planning, GIS can able to store a data either in cartographic data and database. In addition, the application of GIS in transportation planning is to manage roadways, highways, airport facilities and traffic.

1.2.2 Health and Human Services

In health and human services, the role of GIS is to provide access information about health resources especially community health centers (Chang, 2010). In Malaysia, GIS helps in solving management issue for example, monitoring diseases distribution pattern and risks, the distribution of doctors, distribution of hospital beds and facilities and also numbers of 1 Malaysia Clinic.

1.2.3 Environment

The management of waste is essential especially to prevent the quality of environment in Malaysia. Average 760,000 tan solid domestic wastes produced by Malaysian especially in town (Zamali, Mohd Lazim, Abu Osman, 2009). Therefore, the location and distribution of dust bin, recycle centers and location of landfills is needed to solve the waste problems. Here, GIS plays the role in managing and controlling the data requirements.

1.2.4 Geotechnical Engineering

Mohd Zulkifli (1998) stated that, point features in geotechnical engineering such as boring site, depth of boring, groundwater depth, soil and bedrock permeability and individual boreholes can shows by help of GIS software. Again, in his article, soil types can also easily visual using GIS tools.

1.2.5 Water Resources Management

The roles of GIS in water resources management is to monitoring flood hazards, sewage disposal, and provision of reservoirs (Mohd Zulkifli, 1998). Pipe networks or drainage, rain forecast also store and control using this system.

1.2.6 Forestry

GIS in application of forestry industry is to manage, plan and to sustain the development of forest resources (Alias, 2001). Khali (2001) also said, GIS helps in alignment of logging road especially during forest harvesting and indirectly it will contribute minimum environmental disturbances.

1.3. GIS Functions

Basic functions of GIS is to capture the data, storage, manipulate or edit the data and lastly to display the data.

1.3.1Data Capture

This is the first step in apply this system which is capture the data. The data will able to capture from various methods for example site situation such as aerial photos, maps, topographical maps. Other than that, soil structures information are getting from geological maps or geotechnical data. Geohydrological maps also give some

information regarding water management, cables, pipeline and others. However, current major input of data is from Global Positioning System (GPS).

1.3.2 Data Management

After the data are gathered, the next process is to integrate the data. Data management is important in GIS because it will affect the maps they produced. Database Management Systems (DBMS) is software to store and manipulate the data into attribute data or cartographic data.

1.3.3 Data Manipulation

There are various ways to manipulate the data. One of them is by transferring the data into the maps. The map or model used to edit and modify. Here, the map can divide into different layers. Each layer is overlapping each other and contributes different feature types.

1.3.4 Data Display

Data display is the last process by using this software. The modified map or model will display to public to review and comments.

2. Storing Data In Database Management System (DBMS)

After the collection of data from various methods, the data are stored in the form of DBMS. The integration of data is to avoid from many tables are produced. Thus, data type's selection such as integer, float, or date is important (refer figure 2). Moreover, ArcGIS tools such as joins and relate also can used. In DBMS, single tables are produced which the data is stored in individual row, and the column intersections referred to as a single value (refer figure 3).

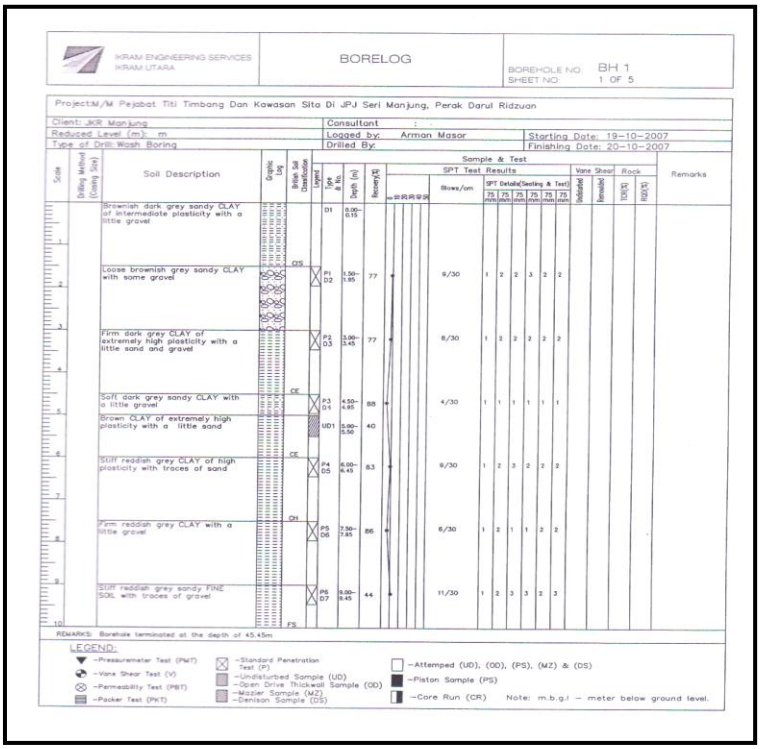


Figure 1 Example of data capture from Boreholes Log (IKRAM, 2008)

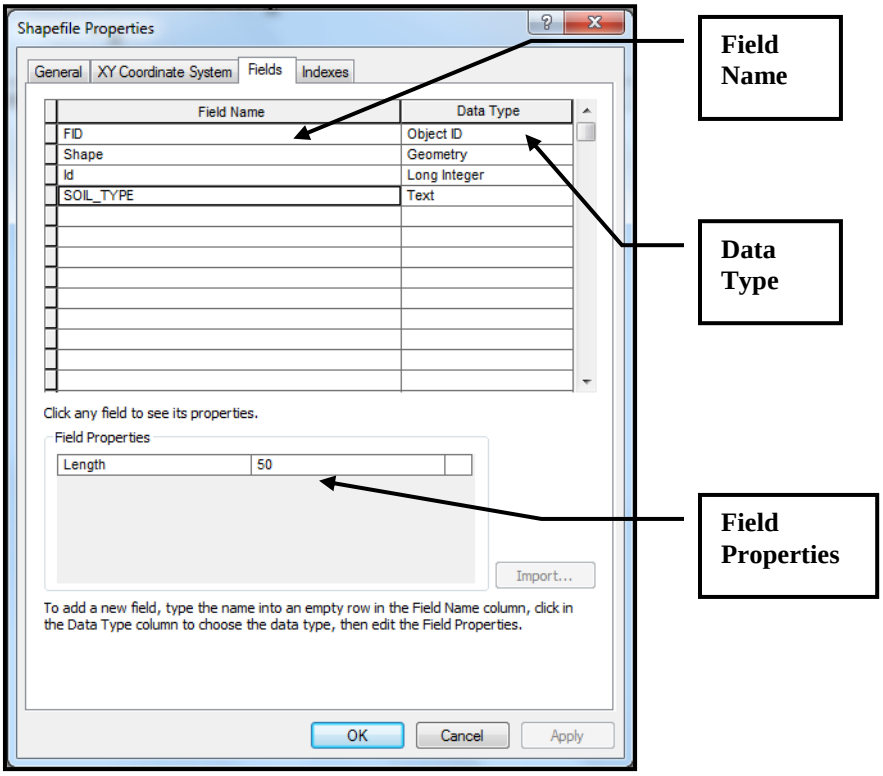
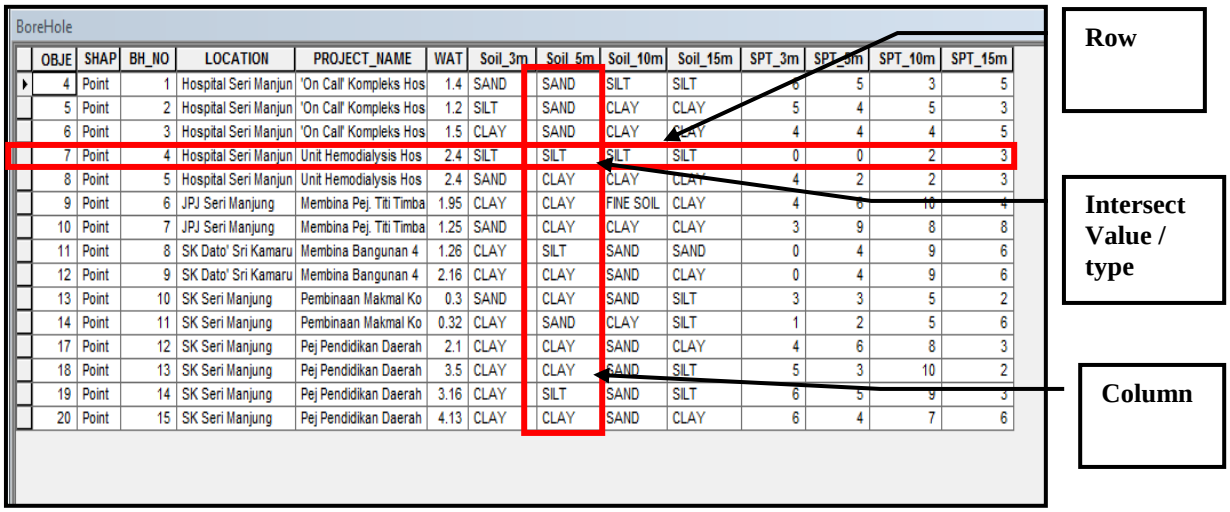


Figure 2 Data types selection



OBJE	SHAP	BH_NO	LOCATION	PROJECT_NAME	WAT	Soil_3m	Soil_5m	Soil_10m	Soil_15m	SPT_3m	SPT_5m	SPT_10m	SPT_15m
4	Point	1	Hospital Seri Manjun	'On Call' Kompleks Hos	1.4	SAND	SAND	SILT	SILT	6	5	3	5
5	Point	2	Hospital Seri Manjun	'On Call' Kompleks Hos	1.2	SILT	SAND	CLAY	CLAY	5	4	5	3
6	Point	3	Hospital Seri Manjun	'On Call' Kompleks Hos	1.5	CLAY	SAND	CLAY	CLAY	4	4	4	5
7	Point	4	Hospital Seri Manjun	Unit Hemodialysis Hos	2.4	SILT	SILT	SILT	SILT	0	0	2	3
8	Point	5	Hospital Seri Manjun	Unit Hemodialysis Hos	2.4	SAND	CLAY	CLAY	CLAY	4	2	2	3
9	Point	6	JPJ Seri Manjung	Membina Pej. Titi Timba	1.95	CLAY	CLAY	FINE SOIL	CLAY	4	6	10	4
10	Point	7	JPJ Seri Manjung	Membina Pej. Titi Timba	1.25	SAND	CLAY	CLAY	CLAY	3	9	8	8
11	Point	8	SK Dato' Sri Kamaru	Membina Bangunan 4	1.26	CLAY	SILT	SAND	SAND	0	4	9	6
12	Point	9	SK Dato' Sri Kamaru	Membina Bangunan 4	2.16	CLAY	CLAY	SAND	CLAY	0	4	9	6
13	Point	10	SK Seri Manjung	Pembinaan Makmal Ko	0.3	SAND	CLAY	SAND	SILT	3	3	5	2
14	Point	11	SK Seri Manjung	Pembinaan Makmal Ko	0.32	CLAY	SAND	CLAY	SILT	1	2	5	6
17	Point	12	SK Seri Manjung	Pej Pendidikan Daerah	2.1	CLAY	CLAY	SAND	CLAY	4	6	8	3
18	Point	13	SK Seri Manjung	Pej Pendidikan Daerah	3.5	CLAY	CLAY	SAND	SILT	5	3	10	2
19	Point	14	SK Seri Manjung	Pej Pendidikan Daerah	3.16	CLAY	SILT	SAND	SILT	6	5	9	3
20	Point	15	SK Seri Manjung	Pej Pendidikan Daerah	4.13	CLAY	CLAY	SAND	CLAY	6	4	7	6

Figure 3 Attribute table of Boreholes

3. Discussion

3.1Data Manipulation

There are many ways to manipulate the data from attribute data created. The example shows the histogram created from the attribute data. The 2-dimension histogram below shows the spatial query and visualization too. The vertical bar chart shows a Standard Penetration Test (SPT) vs Depth of boreholes into interval of five. Therefore, Standard Penetration Test (SPT) as independent variable and depth as dependent variable in that figure. At the depth of 45m, the highest water level is determined, while the lowest value is at 10m deep. From the graph creation, the results are concluded as quantitative graph because it shows the value of SPT or water level (refer figure 4)

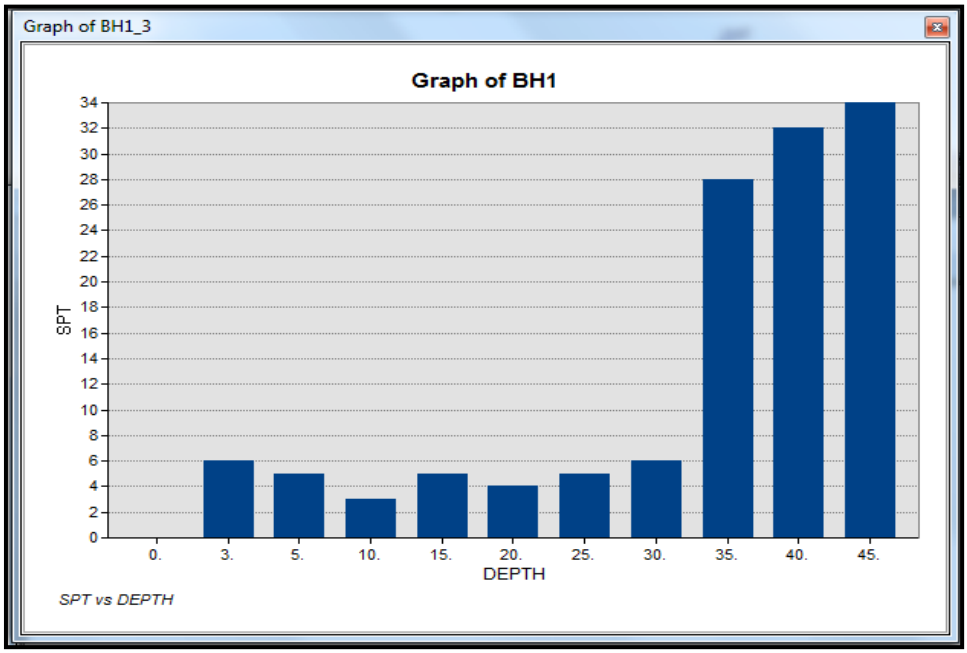


Figure 4 SPT vs Borehole depth graph

Conclusion

As conclusion, GIS helps in many fields as it produced a lot of beneficial information and decision making especially in determining the development on specified area. For the example given, the type of foundation also can design according to the soil type and SPT strength. Moreover, the geotechnical data can save as store and well manage in GIS format.

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