Smart Data for Smart Government – a Show Case from Abu Dhabi Distribution Company

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Introduction

Geographical Information Systems (GIS) has become an important and smart tool in planning, and serving the community, the local authorities and governments, decision makers and planners, etc.

This paper is a showcase of GIS application in planning and managing the water infrastructure system in Abu Dhabi, United Arab Emirates (UAE), in particular the maintenance. It emphasizes the importance of smart data in decision making and smart planning.

- An ArcGIS Database for Water Supply/Demand Modeling and Management was done by a water resource scientist and its team in Abu Dhabi Emirate, UAE

- This research showed how developing the GIS/Database is an important tool for future assessments and decision making.

Overview of ADDC

- Abu Dhabi Distribution Company (ADDC) was established in November 1998.

- Its role is to distribute water and electricity to all customers in the emirate of Abu Dhabi and guarantee the high quality of its services.

- It covers the three regions: Eastern Region (Mussaffah and Baniyas), Western Region (Liwa, Silla) and Abu Dhabi Island. ADDC's is responsible for the planning, design, construction, and operation of the Abu Dhabi water and electricity distribution network.

- ADDC is owned by the government of Abu Dhabi through the Abu Dhabi Water and Electricity authority (ADWEA), which determines all business relating to the formulation, development and implementation of the policy of the government in relation to the water and electricity sector in Abu Dhabi. However, ADDC continues to operate within the overall policy framework set by ADWEA, particularly in the areas of personnel, procurement and financial policy.(ADDC website, 2016)

General description of the types of damages in water pipes

- According to the literature, the damages in water pipes maybe caused by several factors, some of them are purely technical, others are related to nature and catastrophes and the rest are caused by humans. Hereunder, we mention the most known ones:
  1. Technical, such as an unexpected high pressure of water that exceeds the capacity of the pipes.
  2. Some unusual continual flow in the water pipes causes **Burst pipe risk**
  3. Material of the water infrastructure affects the "life' of the pipes. Some materials become **rusted** after short times.
  4. Neglecting monitoring of the ambient temperature of water flow leads to some damages in the pipes, such as if the temperature falls below 3 degrees there is a **risk of freezing, which is not applicable in our case.**
  5. Natural disasters such as Floods and earthquakes, explosions   breakage in the pipes
  6. Sometimes after a long period of installing the water infrastructure, it is **aging and deteriorating causing leaks.**
  7. A **third party** factor that might intentionally cause damages to the pipes such as during constructions.
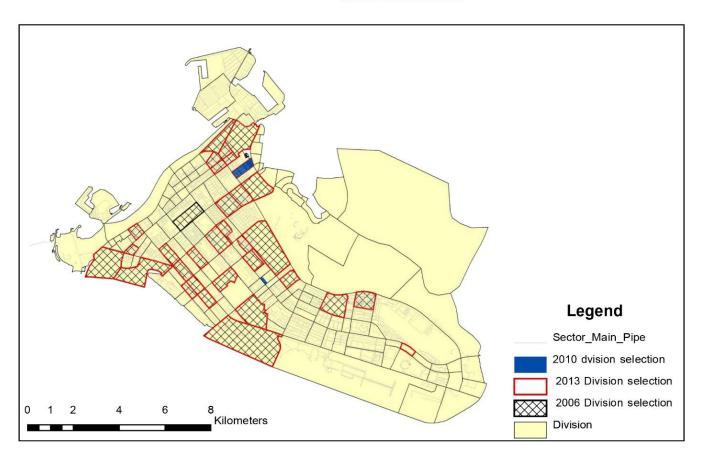
Methodology

- This research is about mapping the damages of the water supply pipelines in central Abu Dhabi area, in UAE from 2006 to 2013 having an equal time intervals of 3-4 years that was chosen for convenience purpose.

- With the corporation of the Abu Dhabi distribution company (ADDC) we got the GIS data that needed for this application, which is related to the plots and divisions, the rods, the pipes and main pipes network. The excel sheets that stored the following information have also been provided:

- The year of the damage stored in the database as day, month and year.

- The type of the damage

- The location of the damage saved as district and division, identified by numbers and characters (Table 2)

- The number of damages per year was figured out from the initial data.

Methodology

- **The First outcome** of our application is 3 maps (**2006, 2010, and 2013**) based on the following steps:-

- Identify the location of the damages on each year based on the SQL (select by attributes).

- Create layer for the chosen years.

- Gather all the layers of the different years in one general map named **location of damages map**
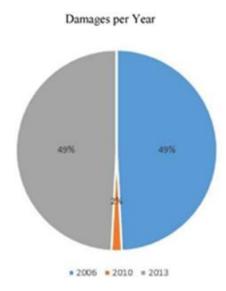
First report:- location

Location of Water pipes damages map
In Abu Dhabi central area

Legend

Sector_Main_Pipe

2010 dvision selection

2013 Division selection

2006 Division selection

Division

0 1 2   4   6   8
Kilometers

Findings :

In the above map, the pipelines are damaged in Al Bateen area, Bainunah Street, and the area around Al Salam Street.

This is because of the constructions happened in these areas during the Interval period 2006 to 2013. Due to Abu Dhabi 2030 plan These construction areas are getting renovated and this caused the accidents in the pipelines.
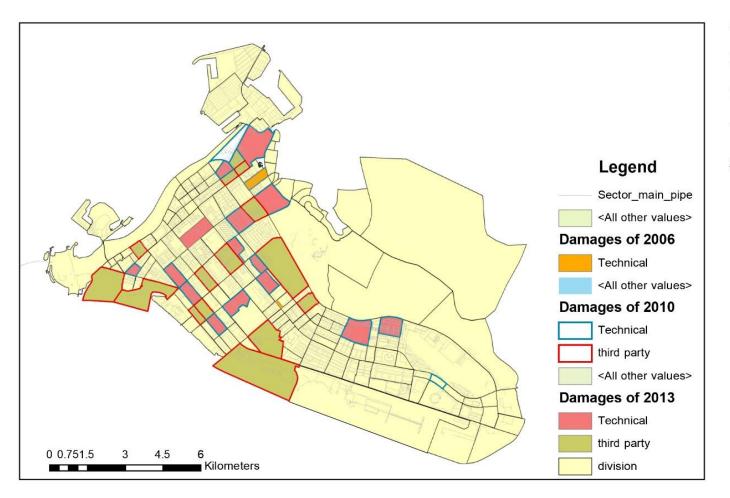
Damages per Year

49%   49%

• 2006 • 2010 • 2013

Methodology

- Choosing the best colors to present each layer (each year).

- **The second outcome** of our application is also 3 maps (**2006, 2010, and 2013**) based on the following steps:-

- Identify the type of damages of each year by determining the values in each layer defined in the field done in the table of attributes.

- Gather all the layers of the different years in one general map named **Type of damages map**

Second report:- damages

Types of Water pipes damages map
In Abu Dhabi central area

Legend

— Sector_main_pipe

<All other values>

Damages of 2006

Technical

<All other values>

Damages of 2010

Technical

third party

<All other values>

Damages of 2013

Technical

third party

division

0 0.751.5   3   4.5   6
Kilometers

Findings

In the above map, the pipelines are damaged in Al Bateen area,

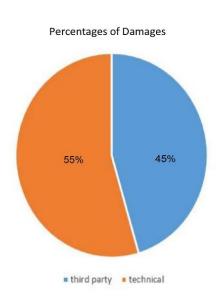Bainunah Street, and the area around Al Salam Street.

As we can see in the graph the third party is higher than the technical

Due to the constructions happened in these areas during the

interval period 2006 to 2013. Due to Abu Dhabi 2030 plan

These construction areas are getting renovated and this caused the

accidents in the pipelines.

Percentages of Damages

55%   45%

■ third party   ■ technical

Findings

- The GIS maps show that the water pipelines damages happened mainly in some arrea because of the constructions that happened in these areas during the interval period 2006 to 2013, due to the urban development that follows the Abu Dhabi 2030 masterplan.

- The Analysis also shows that the third party caused more damages due to the constructions that happened during the study period 2006 to 2013 as explained earlier.

Recommendations

- It is important to note here that showing the results of the analysis to a decision maker at ADDC, has helped her getting a better understanding of the situation: location of the damages through year and their causes/ types. This inspired her to think about the following points in order to find a solution to decrease the number of accidents and damages:

- It is sometimes easier for a rich contractor who damages the pipe to pay the penalty amount without any problem, hence a second thought has to be given to the financial penalty imposed to third party after causing damages.

- The legislative penalty Might not be enough or strong.

- Maybe there is no enough control onsite from the ADDC or other governmental entity to check and control the construction project in order to avoid the pipe damages while digging.

ACKNOWLEDGMENT

Thank you

The overall structure and data across the GIS database are shown in Figure (1). The database design incorporates:

The first stage was compiling the data and information in ArcGIS database, containing the supply and demand data. A supply-demand model balance up to year 2020 has been developed, linking the demand locations to the supply sources to predict the future water surpluses and shorts.
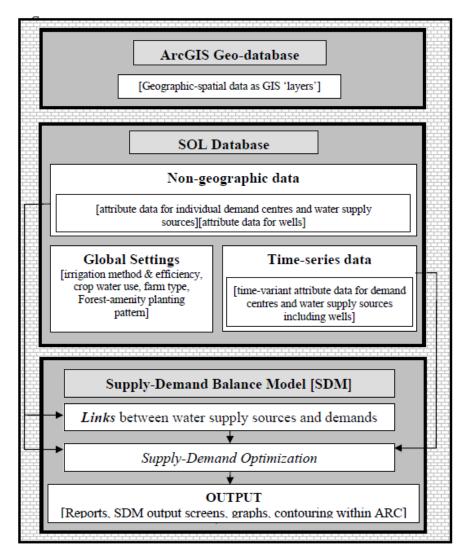

Figure.1: Database-GIS Structure