ASSESSMENT OF CURRENT STATUS QUO OF GIS AT DAMMAM MUNICIPALITY& A BLUE PRINT FOR AN ACTION PLAN

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PREAMBLE:

The increasing recognition of the potential benefits of GIS technology has lead an increasing number of agencies in the public service sector in Saudi Arabia to utilize this rapidly revolving and developing technology. Dammam Municipality, as will be seen later in this report, is one of those organizations that attempted relatively early to apply this technology.

The objective of this report is to assess and evaluate, at a general rather than a meticulous level, the overall GIS current status quo at Dammam Municipality. In this respect, attention will be specifically directed towards evaluating Doha District Pilot GIS project and its current state of affairs, as it is the primary attempt to incorporate GIS in Dammam Municipality. This report will conclude with a set of recommendations coupled with an action plan concerning GIS future at Dammam Municipality.

COMPUTING AT DAMMAM MUNICIPALITY: BRIEF BACKGROUND

In 1990, Dammam Municipality has established an Information and Computer Center (CIC) to serve the general computing needs of the municipality. To serve this purpose, CIC, in coordination with the Computer and Information Center of the Ministry of Municipal and Rural Affairs (MOMRA), has acquired a set of hardware to support some of its basic applications that were to be developed within a 5-year/5-phase plan spanning from 1990 to 1995. Backed by an IBM mainframe computer (AS/400 series), the list of applications identified within the 5-year/5-phase plan were as following:

I. Phase One (1990-91):

a) Financial and Management Information System
b) Personnel Information System

II. Phase Two (1991-92):

c) Planning Information System

d) Land Information System
e) Permit Issuance and Tracking System

III. Phase Three (1992-93):

f) Garage and Equipment Maintenance System
g) Storage Information System

IV. Phase Four (1993-94):

h) Management Communications System
i) Project Follow-up System
j) Agriculture and Garden System

V. Phase Five (1994-95):

k) Start-up of a prototype for a municipality-wide GIS Project (Doha District Pilot GIS Project)

MUNICIPALITY-WIDE GIS PROJECT AT DAMMAM MUNICIPALITY:

The last phase of Dammam Municipality's CIC 5-year plan included the initial establishment of a municipality-wide GIS project at Dammam Municipality through a prototype pilot project (see Doha District: Pilot GIS Project below). The main objectives that were set for implementing a municipality-wide GIS Project at Dammam Municipality are the following:

1) Develop a GIS database of all features within the jurisdiction of Dammam Municipality in terms of both their spatial representation as well as their associated descriptive attributes.

2) Set up an integrated system of hardware and software that would support advanced geo-processing analytical tools and high quality map production for the various departments of the municipality.

3) Develop suitable applications that would maximize the use of the GIS database for the different departments of the municipality.

PHASES OF THE MUNICIPALITY-WIDE GIS PROJECT

The proposed municipality-wide GIS project was to be carried out in five phases. The first phase consists of a prototype GIS project. Doha district in Dhahran was chosen to apply the prototype project. In the remaining

four phases of the project, the prototype is supposed to be extended to cover all of Dammam Metropolitan Area. These phases would include extensive data conversion[π] and will secure all needed hardware and software to support the Municipality-wide GIS project. It will also include the development of new GIS-based applications that would serve the various departments of the Municipality.

PROTOTYPE GIS PILOT AREA: DOHA DISTRICT

Doha district master plan was designed by Saudi ARAMCO in the early 1980s. Its land parcels were distributed as grants of land parcels to its employees as part of the company's comprehensive House Ownership Program. The total area of the district is around 25 square KM and it includes 4200 parcels that make up its 11 subdivision plans. Though the dominant land use of the district is zoned as residential, it does include some areas that are designated for commercial activities, various facilities, and green areas.

DOHA DISTRICT PILOT GIS PROJECT:

Doha District Pilot GIS Project was contracted out to a consultant[9]. The duration of the contract was one year starting April 1995 with an estimated budget of SR 8,000,000.

The pilot project identified the following set of objectives to be achieved within one year timeframe of the project:

1) Construct a high quality GIS database of all features within the jurisdiction of the study area. This GIS database has to be expandable to cover the whole jurisdiction of the municipality.

2) Develop five GIS applications that are supported with a set of advanced tools to meet the prospective users' needs in terms of map production and analysis.

3) Set up a system of hardware and software that is expandable municipality-wide on a later stage.

[π] Both graphics and attributes

[9] CAP Saudi Arabia Co., a Riyadh-based consultant company

4) Evaluate the sources of the GIS database, its conceptual design, as well as the functionality of the prototype hardware and software.

5) Provide technical as well as managerial training to municipality staff to manage the project and utilize its applications.

PILOT PROJECT'S DATABASE CONCEPTUAL DESIGN

Data collected were categorized to the following layers that will make up the database of the pilot project:

1) Topography
2) Regional subdivisions
3) Ownership and Real Estate
4) Landuse
5) Soil types
6) Sewer Network
7) Flood
8) Electric Network
9) Phone network
10) Survey Control Points

PILOT PROJECT'S DATA SOURCES:

The spatial data collected for the pilot project were based mainly on MOMRA's 107 Aerial Photography Project[Σ] carried out in 1983. Other sources were:

1) Land Subdivision plans at the Municipality,
2) Saudi Telecommunications Company (STC), and
3) SCECO.

PILOT PROJECT'S DATA CONVERSION:

Data conversion of maps for the pilot project was sub-contracted by the consultant to a local company[φ]. Maps that were converted are: 160 maps

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- [Σ] 107 Aerial Photography project[ɔ] was used as the primary resource for the basemap layer

[φ] Al-Rashid Geotechnical and Materials Engineers (RGME) / CAD Solutions Division in Khobar.

(scale 1:1000), 20 maps (scale 1:2000), 3 maps (scale 1:10000), beside aerial photos of the pilot project area.

PILOT PROJECT'S DELIVERED SW & HW

Intergraph MGE program was applied as the main GIS software of the pilot project. Meantime, MicroStation program was used as the graphics platform. Oracle package was utilized for attribute database management.

During the course of the Pilot Project development, the following hardware items were delivered:

- 2 Intel Pentium Based 66 MHz Workstations
- 2 Intel 486 based 66 MHz Workstations
- 18 mm Tape Cartridge (10 GB)
- 2 Non-Backlit Digitizer A0 (36"x48")
- One Electrostatic Plotter (36" wide)
- One Laser Printer A3 (11"x17")
- Dot Matrix

PILOT PROJECT'S APPLICATIONS DEVELOPMENT

Four GIS applications have been developed during the pilot project. For that purpose, Arabic attributes about land parcels in the pilot project area that are available in the AS/400 have been linked to their graphical representation. A transparent gateway, developed in-house, has managed to integrate Arabic and Latin data from the AS/400 machine with Arabic and Latin data from an Oracle database. The Oracle database resides on a Windows NT server for use on client Windows NT workstations running Intergraph products (Refer to AS/400 – GIS Gateway prepared by Oracle Inc.)

PILOT PROJECT'S SYSTEM CAPABILITIES

The developed applications have a variety of capabilities. Examples of capabilities of the pilot system include:

1) Pinpoint the exact location of phone, electric, water and sewer networks.
2) Ability to follow-up on maintenance requests for utilities

3) Ability to produce maps with varying scales: 1:1000, 1:2000, and 1:10000

PILOT PROJECT'S CURRENT STATE OF AFFAIR

After the conclusion of the pilot project in 1996, most of the staff, who have the GIS experience, have leaked away to other more competitive jobs in the market. The leak has included both the CIC director and the Pilot Project Manager. With these serious developments, the new management of CIC, with much less enthusiastic attitude about GIS, considered this project as a messy legacy of the previous CIC management. They based this action based on the notion that their responsibilities do not include such an activity. By this time, the pilot project with all of its remaining phases were totally abandoned.

In 1997, and based on a municipal decision, the abandoned project and all of its physical products were forwarded by CIC to Municipality's Urban Planning Directorate (UPD) on the notion that UPD might be able to create something useful of these items. Forwarded items included a CD containing all of the digital data of the pilot project, along with a set of documents and reports produced by the consultant of the pilot project and other related documents. Since 1997 and until now, UPD (the client of this report), is making efforts, to find ways and means to go beyond this project current state of affair.

EVALUATION OF DAMMAM MUNICIPALITY APPROACH TOWARDS GIS:

Dammam Municipality is considered one of the few municipalities in Saudi Arabia that made an early attempt to adopt GIS technology[λ]. However, by the conclusion of the pilot project in mid 1996, the Municipality-wide GIS project had faced serious complications that led to a complete halt of the project beyond the pilot project. Thus, the remaining four phases[♠], intended to lead to a Municipality-wide GIS of Dammam Metropolitan Area, were not carried out.

[λ] around 1990

[♠] Phases II – V

There are a variety of factors that led to the discontinuation of the remaining four Phases of the Municipality-wide GIS project. These are the main ones:

- Lack of awareness of GIS benefits among prospective users
- No comprehensive User Requirements Assessment (URA) was carried out
- Fragmental and single-departmental GIS adoption.
- No clear future plans, no proper GIS implementation and management plan
- Clearly understaffed
- Inadequate staff Training
- Problems with GIS expertise transfer/ retention
- Limited allocated budget

RECOMMENDATIONS & A BLUE PRINT FOR AN ACTION PLAN TOWARDS GIS IN DAMMAM MUNICIPALITY:

Given the centralized organizational structure of all municipal bodies in Saudi Arabia, including Dammam Municipality, a comprehensive top-down approach towards GIS at Dammam Municipality is highly recommended. Thus, a high-ranking GIS Steering Committee, representing all departments of Dammam Municipality, should be formed within the municipality. This committee should report directly to the Director of the Municipality.

For a successful GIS implementation, the GIS Steering Committee should seek means and ways to carry out the following tasks that are listed under two categories: *Organizational* and *Technical* tasks:

Organizational Tasks:

- Establish a GIS Unit that reports directly to the Mayor Office
- Study the organizational structure of the municipality and how information flow within the municipality
- Develop a long-term strategy towards GIS

- Establish a framework to carry out a comprehensive User Requirements Assessment[♣] (URA)
- At another scale, form and/or revive a higher committee involving other potential benefiting agencies: such as SCECO, STC (Saudi Telecommunications Corporation), and Directorate of Water and Septic Network
- Secure funds and support from high ranking officials

Technical Tasks:

- Identify the basic elements of the base map and its boundaries
- Build the base map and identify the potential layers (themes) of the GIS data base
- Establish the means to collect input data
- Device procedures to update the GIS database
- Identify the needed HW & SW
- Start with a pilot study covering a limited area within Dammam Municipality jurisdiction
- Utilize some of the budget of approved current or coming projects to finance some of the above applicable tasks[φ]
- Invest in prospective users through training

DELIVERABLE SERVICES BY KFUPM CONCERNING GIS AT DAMMAM MUNICIPALITY:

1. Provide part-time consultancy for GIS and GIS-related projects at Dammam Municipality,

2. Offer tailored GIS and GIS-related short courses that meet the needs of Dammam Municipality

3. Offer training courses on GIS and other relevant topics

[♣] A User Requirements Analysis (URA) is a detailed study of the needs of potential system users.

[φ] Such as Naming and Numbering, Master Plan and; Aerial Photography projects that have been approved lately.