AN APPRAISAL OF THE UTILIZATION OF GIS IN AN URBAN CONSERVATION PROJECT IN ANTAKYA

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ABSTRACT:

In the fall semester of 2002-2003, one of the master studios in METU, Faculty of Architecture, Graduate Program in Restoration involved with Urban Conservation Project of a selected quarter in Antakya. During the studio process, GIS was used instead of conventional techniques through the documentation, analysis, evaluation and preservation phases of the study. Emanating from the case of Antakya, this paper aims to point out the *changes made in conventional methodology to adapt it to GIS* then *to discuss the advantages and disadvantages of GIS as a heritage information system* in preparation of an Urban Conservation Project both for educational and implementation purposes.

1. INTRODUCTION

Urban conservation is a multi-faceted issue, which necessitates utilization of complex data concerning geographical, architectural, social, economical and historical aspects of the town. It requires coping with various data types and data sources. Developments in the information technologies have been providing various tools in order to handle data, among which GIS take precedence in managing complex spatial data especially for the disciplines dealing with spatial problems. Urban conservation, being a spatial problem concerned with complex spatial data, deserves making advantages of this new technology.

In the fall semester of 2002-2003 Academic Year, one of the master studios is involved with Urban Conservation Project of "Zenginler Quarter" in Antakya, which is a town possessing several physical and social traces from different civilizations as a result of continuous settlement since antiquity onwards.

The first section of the paper introduces conventional methodology used in Urban Conservation Projects, including preparation, survey, analyses/evaluation and decision stages.

The second section covers the adaptation of conventional methods according to the requirements of GIS. Thereupon, *methodology* of Antakya Project is explained in detail with its main stages as pre-survey, survey; encompassing the collection and recording of data related to natural, built-up and socio-economic aspects, covering the classification of data designing the database and forming thematic clusters; analyses and evaluation; dealing with making various queries over the designed database to visualize the problems, values and potentials; and decision in which the proposal for the Urban Conservation Project is finalized by using the information accomplished through the processing of data in previous stages.

The last section of the paper is the assessment of GIS based method used in Antakya Project. Consequently, its superiority and inferiority with respect to conventional methods are discussed. The paper concludes with some recommendations for the enhancement of GIS according to the needs of urban conservation studies so as to contribute the relation between information users and information providers.

2. URBAN CONSERVATION PROJECT: THE CONVENTIONAL METHODOLOGY

The aim of the Urban Conservation Project is to document, analyze and evaluate the physical, economic and social characteristics of a historic urban tissue so as to develop proposals related to its conservation. The major stages of any urban conservation project consist of; *pre-survey stage* during which preparation of the site survey and the basis for the following stages are realized; *survey stage* during which various information related to different aspects of the town are gathered in order to find out the characteristics of the study area; *analyses and evaluation stage* embracing the analysis of the collected data and their assessment so as to define the values, potentials, problems; and finally *decision stage* in which proposals for conservation are made.

The *pre-survey stage* of the study, which includes preparation for the following stages, covers collection of the necessary documents related to the historical development and the existing situation of the study area. Accordingly, descriptive and visual information including written documents and illustrations (of earlier researchers, travellers' notes, engravings, photographs, serial photographs, etc), maps (current town plans, conservation plans, implementation plans, etc.) and existing measured drawings are gathered.

On the other hand, survey forms and base maps, which are to be used during the site survey, are prepared according to the information gathered from the literature survey.

By this way, besides preliminary information about the site to be studied, a visual and descriptive base for the following stages is provided.

In the *survey stage*, data related to general physical and socio-economical aspects of the site are collected. During the site survey, detailed data related to buildings within the study area is collected (in architectural scale) through the

previously prepared survey forms. These forms include detailed exterior and interior questionnaires for traditional, new and/or monumental buildings. In order to find out the existing social and economic structure of the inhabitants, social questionnaires are applied, which cover questions about the demographic features, income level, attitudes of the inhabitants towards the site, historic buildings and preservation, existing legal and administrative means, etc.

In the *analyses and evaluation stage*, data collected during the *survey stage* is analyzed so as to visualize the development and existing situation of the site and to define its general characteristics, values and problems. Together with the socio-economic aspects, classification and evaluation of architectural, visual, historical, traditional and present-day values of both the individual buildings and the whole site lead to the determination of the features to be protected. Besides, types, causes, reasons, effects and scales of the problems to be treated are searched for in this stage.

Evaluation of physical, social and economic aspects, is followed by the *decision stage*, in which policy for protection and rehabilitation of the site is proposed. Proposals include decisions related to future functions in consideration with the existing trends; classification of building groups according to the types and degree of intervention; principles of intervention types for building groups; definition of the scheme of the implementation according to the existing administrative, legal and financial frameworks, etc.

3. METHODOLOGY OF ANTAKYA PROJECT

Antakya, is a town where exist various traces of different periods and civilizations. Integrity of these different traces as well as complex transformations in time resulted in various values and problems, which should be considered in conservation and planning of the town. In order to come up with proper conservation interventions and policies in such complex cases, it is vital to analyze and evaluate complex data concerning various aspects of the town.

Therefore, the aim of the Urban Conservation Project prepared in Antakya has been defined as determination and evaluation of values, potentials, conservation problems and development of conservation decisions related to the selected site. Differing from the previous projects, this semester Geographic Information Systems(GIS) have been considered to be the main tool for the project. There upon, Antakya project followed the four similar stages of pre-survey, survey, analyses/evaluation and decision stages as in any urban conservation project, while the content and methodology within these stages have differed according to the requirements of GIS.

3.1 Pre-Survey Stage

During the preparation stage of Antakya Project, just like the previous urban conservation projects, research related to the historical development of the city has been carried out in general through written documents, providing descriptive data from earlier researchers, notes of travellers; and visual data covering old and new photographs, engravings and historical maps in order to understand the values of the Zenginler Quarter within the history of Antakya. To understand the contemporary situation of the city, 1/25000, 1/5000, 1/1000 scaled current maps are obtained beside conservation plans showing the boundaries of urban sites and conservation/planning decisions for each site.

For the collection of detailed data through the site survey, survey forms, which have been categorized as *traditional house form* and *new building form* are prepared. For the traditional houses, three types of survey forms as the courtyard, interior and exterior survey form are prepared. Additionally, to understand the social structure of the users in the site, an extensive social questionnaire form is prepared including questions about the demographic features (i.e., age, sex, education level) of households in each dwelling, their occupation status, income levels, existence of social security, from where/when and why they settled into this district, their attitude towards the conservation activities, etc.

For the new buildings, architectural features of which are different than the traditional houses, *new building forms* have been prepared searching for data related to the construction technique, number of storeys, number of dwellings and overall condition of the buildings. Data related to monuments and commercial buildings are decided to be collected through sketches, photos and descriptions.

Format and content of the forms are defined considering that GIS would be used in analyzing and evaluating the data that would be collected through these forms. Accordingly, a coding system is defined for each data entry so as to provide terminological and syntactic standards. For this, all possible data entries about the architectural/spatial features, architectural elements, structural/material properties, problems related to structural deformations, material deteriorations and alteration/changes of the buildings are tried to be predicted prior to the site survey. However, the system defined has been flexible enough to add new codes in case of coming across with new unpredicted data at the site.

3.2 Survey Stage

Survey stage has consisted of collection of data through the site survey, design of the database, recording and structuring of the collected spatial and attribute according to designed database.

Collection of Data: The selected study area in Zenginler District, which consists of 223 parcels and 420 buildings, has been defined as primary study area. All types of buildings in this zone are documented in detail through the previously prepared survey forms, and social questionnaires. The close environment of the primary study area, which forms a buffer zone, has been defined as the secondary study area. This zone has been studied in less detail when compared with the previous one, with the aim to provide data about the general features of the surrounding tissue and reveal the interaction of Zenginler District with the rest of the town. The data concerning the secondary study area is collected by using existing 1/1000 maps, without entering into the buildings. Besides, in both zones, data related to the elements and structure of the urban tissue, streets, building blocks and building types are collected directly onto the existing 1/1000 maps.

Design of database and Structuring of the Documentation System: Design of the database is the most important phase in a GIS based method. Therefore, before the data entry to the system, the database is designed considering the necessary spatial data together with their spatial object classes and the related attribute data. Thereupon, two parallel studies had to be carried on during this process: *creating the spatial objects*, in AutoCAD and *defining the attribute data* concerning each spatial object.

1929 cadastral plans that have been updated during the site survey are used as the reference base map. The spatial objects are digitized in AutoCAD R.14 and transferred into ArcView 3.2. During the vectorization of the drawings in AutoCAD, layers are produced in point, line or polygon format defining the type of the spatial objects after they are transferred into GIS media. The items, which are preferred to represent their existence with reference to their location only, have been showed in "points" such as architectural elements (i.e., door, window, fireplace, cupboard, etc); street elements (i.e., electric box, firehose, telephone post, etc.) and environmental features (i.e., tree, viewpoints, etc.). Features that have length are represented in "lines", such as topographical lines, pedestrian-vehicular traffic direction, etc. Items having boundaries and representing an area have been described in "areas" such as building block, building lot, building, space (room), etc. They are represented as closed polygons. Every single layer that has been used in AutoCAD is defined with spatial data and the types of spatial object class for each title is established. (Figure 1)
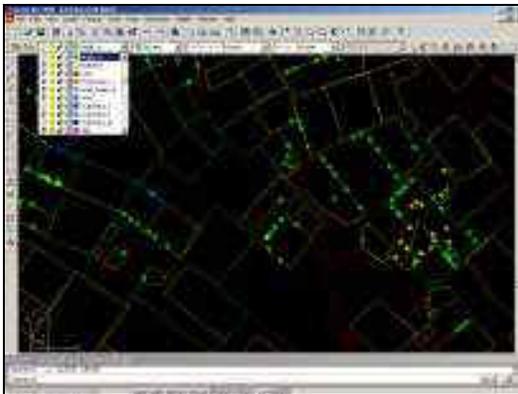

Figure 1. Created spatial objects through AutoCAD

At the second phase, the collected data through survey sheets are classified into meaningful data groups so that they would be handled during the further phases as well. According to the topics that would be necessary for the analyses and evaluation stages, thematic clusters of spatial objects and attribute data have been established. (Appendix I)

During this process content of each group has been studied in detail by establishing typological sub-groups according to the evaluation of collected data by survey forms. Afterwards, they are defined with a code number or code title so as to be recorded into the system according to the format of designed database. A descriptive legend and typological drawings explaining the detailed properties and coding system of all groups have been finalized with the same manner. By this way the structure of an utilizable documentation system has been established for the record of collected data. (Appendix II)

Data Entry: Different data types coming from different sources have been entered into the system in the form of a relational database. At that point, a coding system giving an ID number for each spatial object has been established so as to define the relevant relational structure among the data groups:

Coding System: A_0001_a_**01**_01

According to this coding system, ID of the block, lot number, dwelling number, ID of the space (room) and ID of the architectural element are indicated respectively.

Fields are defined which refer to different aspects of the spatial object and attribute data entry is made for each of the spatial object as different records in the table accordingly. As the attribute data is connected to the spatial data, by clicking onto each map feature, the attached attribute data could be seen. (Figure 2)

The visual data collected from different sources, including aerial photograph of Antakya, cadastral maps, conservation maps and historical map-sketches that have been prepared by the travellers who have visited Antakya during late 19th and early 20th centuries, maps prepared during 1930s showing the districts with important monuments-streets, ethnic structure of the neighborhoods of Antakya, have been converted into digital format
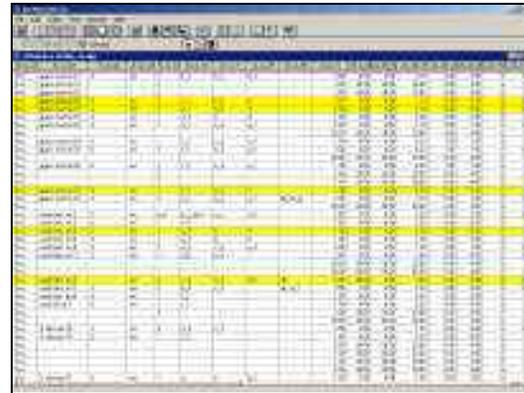

Figure 2. Entered data through database

All these materials have been transferred into GIS either by using geographical coordinates of the system or by aligning according to the selected common fix points, and thus, georeferenced raster images are provided. Since the historical maps haven't been produced according to the rules of the coordinate system of contemporary maps, their overlay with the existing maps was not precise.

Other visual data such as old and new photographs from the city and Zenginler District as well as engravings produced by the travellers have been scanned and converted into JPG files. They are attached to the related spatial objects using the hyperlinking property of GIS. Thus, by clicking onto related map feature, the linked visual data could be visualized as well. (Figure 3)
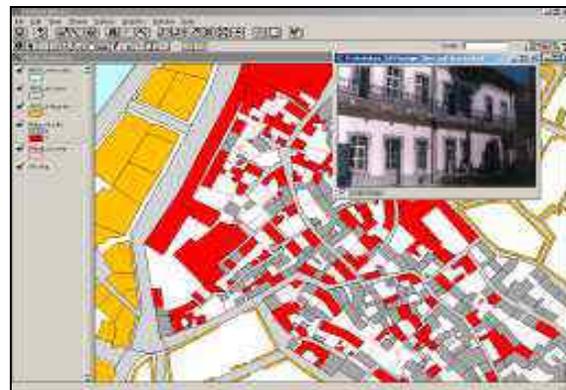

Figure 3. Attachment of JPG files

3.3. Analyses and Evaluation Stage

After the recording of descriptive data and attachment of related visual data for each group, an extensive database has become ready for spatial analysis and evaluation phases.

Overlay and Analysis of Data: During the analysis process, visualization and search of various topics concerning continuities, alterations and comparisons among physical and social aspects of the site has been studied. Due to the overlay and query property of GIS, working with various spatial data one by one or as combined layers of multiple groups has provided altogether analysis and evaluation of different features.

In order to evaluate the historical continuity of the Zenginler District a comprehensive understanding of the historical development of Antakya should be achieved. Therefore, to visualize the expansions or reductions of the city throughout history and to compare the changes, a set of overlay is prepared showing the layout of the city from different eras including Hellenistic, Roman, Byzantine, Arabian and Ottoman eras and existing situation. (Figure 4)
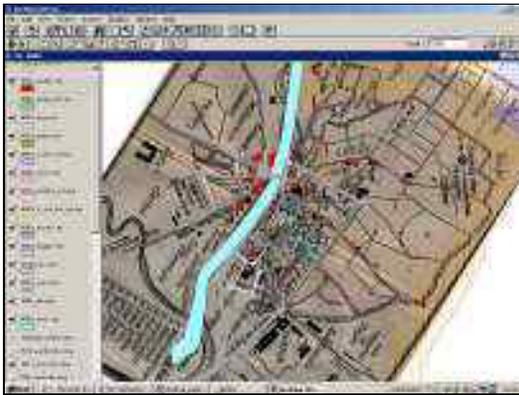

Figure 4. Overlay of historical maps

While producing overlay of visual documents onto the designed base map and database, 3D model of the topography and the study area is constructed so as to evaluate the silhouette of the context.(Figure 5)

Figure 5. 3D Model of the site

Besides, following queries over the attribute data have been carried on and their spatial distribution is visualized:

- *Classification* of buildings according to their types and conditions,

- *Alterations*, related to the building lots, space use, structural system, finishing material as well as spatial/mass alterations including the definitions of types of changes,
- *Continuities/discontinuities*, between original and current situation of physical and social aspects including function of buildings, use of spaces,
- *Relations*, among physical and social structure to understand the reasons, effects and causes of alterations and discontinuities.

Evaluation of Data: Analyses of the characteristics of the site has been followed by evaluation process of the displayed data in order to find out:

- *values* of the traditional buildings, defining categories of value degrees according to the architectural features they posses,
- *problems*, related to the environmental services, building lots, buildings, pattern of use (poor sanitary conditions in living and service spaces) including the definitions for the causes, reasons and effects,
- *potentials*, for the improvement of houses for future uses, participation of the inhabitants, implementation of the preservation and rehabilitation decisions.

In the framework of input data, various queries over designed database have provided juxtaposition and superimpose of different spatial layers during evaluation of the analyses.

Figure 6. Example from the queried results

Display of the results in various formats are obtained, such as maps, tables and charts, due to the different presentation options in GIS. (Figure 6)

3.4 Decision

According to the information accomplished during the evaluation stage concerning values to be protected, potentials to be developed and problems to be solved, an Urban Conservation Project for the study area is developed. The conservation decisions have included general preservation policy for the whole study area and physical interventions for individual buildings. At that point, specific types and categories of interventions have been defined according to the condition of building groups classified during the analyses and evaluation stage.

Besides, by querying of spatial data groups established according to the problems, potentials and values during the evaluation stage, special zones and areas having similar values, potentials or problems have been searched for. For these zones, which are defined as "Special Project Areas",

special conservation decisions have been developed in detail according to their conditions.

A scheme of implementation and an organization model that will handle the management of the site during the Urban Conservation Studies is proposed as the final stage of the project.

4. RESULTS OF THE ANTAKYA PROJECT: A PRELIMINARY ASSESSMENT

Urban Conservation Project prepared for Zenginler Quarter in Antakya, enables making a preliminary appraisal of advantages and problems of the utilization of GIS. Accordingly, taking the case of Antakya Project as the point of departure, the major advantages of GIS when compared with the conventional techniques can be listed as follows:

- *Providing an extensive spatial database:* GIS offer an invaluable medium for urban conservation projects as they are spatially referenced databases, which allow the connection of attribute data with the related spatial data. Hence, the spatial and attribute data concerning the historic site can be stored and studied in a single extensive environment. Consequently, the system enables visualizing spatial distribution of the attribute data, making queries over both attribute and spatial data, and creating thematic maps either one-by-one or as combination of multiple groups.
- *Providing an integrated environment:* GIS supply integrated environment, in which different formats and types of data produced or processed by different softwares can be transferred into the system. That is, although the drawing capabilities of GIS are not advanced enough for the requirements of urban conservation projects, they enable using spatial data produced in CAD. Besides, processing of images through other softwares and transferring into the system is possible.
- *Continuity between scales:* All the spatial data is entered into the system in 1/1 scale. Thereupon, GIS provide a continuous environment. That is, a wide range of different scales from 1/5000 including information about the town, to 1/50 including information about the architectural features of individual buildings could be studied and visualized altogether during the Antakya Project.
- *Easy renewal and correction:* Opportunity of easy renewal and correction of data in GIS supplies a great advantage for up-to-dating the information in the analyses, evaluation and decision stages. Therefore, additions, subtractions or changes of categories made in the database are automatically presented in the maps produced in GIS. Whereas, in conventional techniques this updating process should be made one by one on each map.
- *Variety of display possibilities:* GIS allow a variety in the display of results such as maps, tables and charts. All these increase the speed and richness of both the production and the presentation of the study.
- *Increase in speed and efficiency:* This provides easier, quicker and more efficient execution of analysis and evaluation stages, when compared with the conventional techniques. Besides, the query of various data during the analysis and evaluation stages has increased the efficiency of decision-making stage since various topics could be argued together.

However, as far as it is experienced through the case of Antakya, there are also some problems in using GIS as a tool in urban conservation projects. Those problems can be listed as follows:

- *Insufficient drawing /editing capacity:* The adaptation of GIS is not enough yet for architectural studies since they are developed for large-scale urban or regional studies. Therefore, creating and editing spatial objects in the essential detail of architectural drawings is not enough sufficient in GIS. The drawing capacity of the program stays limited and thus, the drawing capacity or support with CAD programs should be improved.
- *Problems of renewal and updating of data transferred from other softwares:* Even though GIS offers an integrated environment in which data produced and processed in other softwares can be used, the program does not enable the renewal and updating of such data. That is, when the spatial objects are drawn in CAD, like it has been done in Antakya Project, and when a correction or addition is needed to be done after transferring the spatial data into GIS and adding their attribute data, it is necessary to return to CAD, make the corrections, re-transfer all the spatial data and re-enter the related attribute data. This is a very long and time consuming process, and it is contradictory with the flexible environment that GIS offers.
- *Long-lasting preparation phase:* Especially because the corrections of spatial data in the further stages of the study is so hard as described above, it becomes necessary to be very careful during the preparation phase and make the decisions as to the spatial object class of each spatial object prior to transferring them into GIS. This elongates the preparation phase of the study.

5. EPILOGUE

Urban Conservation Projects necessitate coping with complex issues concerning values, problems and potentials related to natural, physical and socio-economic aspects of the historic towns. In order to develop proper conservation policy, the characteristics of the town must be evaluated well, which may turn out to be a complex process. Since correct information leads to correct conservation decisions, heritage information management related to the historic town becomes inevitably important in urban conservation process.

GIS allow establishing an extensive, flexible, continuous and sustainable heritage information system. Therefore, what is obtained with GIS is not only an urban conservation project. The project is just one of the various outputs of the whole extensive information system.

Existence of such a system is very beneficial for urban conservation process. However, the success of the system depends on accurate design of database and the structure of the data processing, defining intelligent and adequate questions during the queries, correct data entry and systematic up dating. Otherwise, studies may result with an unuseful mass of data. Besides, it is a fact that, even though providing an extensive heritage information system and consequencing urban conservation projects are essential components of the urban conservation process, the success of the process depends more on the ones who will realize the decisions made within the legal and administrative framework of the country. The most advanced technology and the most correct studies produced with them cannot guarantee achieving proper urban conservation.

Using GIS in urban conservation projects during the education process has also revealed advantages besides disadvantages. As a first tryout, during the Antakya project, various difficulties are faced with not only due to the deficiencies of the program but also due to the inadequacy of experience. Therefore, the time and energy spent has been more when compared with the previous projects prepared by conventional techniques. Especially the preparation stage has been nearly twice longer than the others. However, once the spatial and attribute data entry is completed, the analysis and evaluations over those data have been very quick. Besides, such a system enabled searching various relations between different data and establishing various queries and overlays, which would not be possible with conventional techniques. Therefore, even though similar stages in the preparation of the project are followed, the content and framework of the stages have changed indeed. This provided a wider viewpoint for the students and resulted in better understanding of the problems, potentials and values of the buildings and the site. Inevitably, this effected the results obtained at the end of the study.

Achieving better results in utilization of GIS for urban conservation and education purposes, necessitates the contribution of both the ones preparing urban conservation projects and the ones building the GIS systems. Specialists involved in urban conservation projects should develop the methodology and contents of the stages applied in urban conservation studies according to the terminology, system properties and requirements of GIS. Whereas, GIS programmers and specialists should extend the capabilities of GIS in urban conservation projects considering the encountered problems.

Therefore, being aware of potentials, advantages and problems in utilization of GIS, more experiences should be shared between the providers and users of this technology for the enhancement of GIS technology according to the needs of urban conservation studies.

NOTES:
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Appendix I. Table of Designed Database

LAYER Autocad	SPATIAL DATA	SPATIAL OBJECT CLASS	ATTRIBUTE DATA
Str	Street	Area	Name of the street Type of the street Vehicular traffic density Pedestrian traffic density Type of the pavement
Str element	Street Elements	Points	Car parks Street furnitures Manholes Firehoses Traffic lights
Opa	Open Areas	Area	Public courtyards Traditional courtyards Parking areas
Bldgbl	Building Block	Area	ID of block
Bldglt	Building Lot	Area	ID of the lot Registration Status Ownership Status Number of Dwelling Types of changes
Bldg	Building	Area	ID of the building Address Building type Function (current use) Number of storeys Structural System Exterior Finishing Deterioration/damage level Structural deformations
Spa	Space (room)	Area	ID of the space Function (current use) Interior Wall, ceiling, floor Finishings Spatial changes Material changes
Name of each arch element	Architectural Elements (courtyard)	Points	ID of each element Name (fountain, pool, livan, mahmel, etc) Type and Material Deterioration Condition level
Name of the arch element	Architectural Elements (in building)	Points	ID of each element Name (window, door, cupboard, fireplace, etc.) Type and material Deterioration Alterations and changes
Hane	Hane	Points	(data collected from survey forms) Occupation status Rent price Way of owning the building Duration of residence in the district/house Satisfaction from the district/house Repairs done Repairs they need Condition of wet spaces Income level Miscallenous