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THE CREATION OF TRANSPORTATION GEOGRAPHIC INFORMATION SYSTEMS TO PREPARE A COMPREHENSIVE PLANNING AND DESIGN OF PARKING SPACES (CASE STUDY)

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ABSTRACT

Nowadays by the increasing of the users of Al-Nahrain University, all of them suffer from the lack of public parking spaces because the parking demand grows often too quickly, significantly and unexpectedly. Public parking spaces as one of the important parts of Al-Nahrain University transportation system, plays an important role in decreasing the load of traffic. Suitable site selection for public parking spaces not only increases the parking efficiency, but it also decreases marginal car parking and so results in increase of streets width and traffic fluency. At the moment in the university, public parking site selection is done by traditional methods, which is randomly distributed in the site. In this traditional method, considering all of the effective parameters in site selection is almost impossible and site selection is done by just considering some limited factors. In this paper, we introduce an optimum method for parking site selection by the use of GIS and considering almost all of the effective parameters simultaneously. Also effective factors are considered from two main points of view including parking efficiency and the problem of providing required land for parking in the region of the University. Then, conceptual model of parking site selection is presented. Suitable design for parking is also selected for one of the high traffic regions of the university site. Different methods for information and layer integration are used and finally these methods are compared and the most suitable one was proposed.

Keywords: ACAD, accessibility, car parks, decision making, GIS, land value, land-use, TGIS.

INTRODUCTION

Spatial technologies, such as Geographic Information Systems (GIS), are particularly appropriate for integrating transportation data and enhancing the use and presentation of these data for transportation planning and operation by using spatial relationships to relate geographic and geometric objects and events [7]. To different degrees, transportation planning, such as parking design and distribution, involve relations between objects and events located in different spatial positions. Because the data used in the decision-making process have spatial components, the use of spatial technologies emerges as a very appealing alternative. Spatial technologies may enhance the analysis of several transportation-related issues and may improve the quality of the decision-making process [4, 6].

Any vehicle traveling on a highway will at one time or another is parked for either a relatively short time or a much longer time, depending on the reason for parking. The provision of parking facilities is therefore an essential element of the highway mode of transportation. The need for parking space is usually very great in area where land uses include business, residential, or commercial activities. The growing use of the automobile as a personal feeder service to transit system (peak-and-ride) has also increased the demand for parking spaces at transit stations. In areas of high density, where space is very expensive, the space provided for automobiles usually has to be divided between that allocated for their movement and that allocated for parking them, [1].

Types of parking facilities

Parking facilities can be divided into two main groups: on-street and off-street, [1].

a) On -street parking facilities

These are also known as curb facilities. Parking bays are provided alongside the curb on one or both side of the street. These bays can be unrestricted parking facilities if the duration of parking is unlimited and parking is free, or they can be restricted parking facilities if parking is limited to specific times of the day for a maximum duration. Parking at restricted facilities may or may not be free. Restricted facilities may also be provided for specific purposes, such as to provide handicapped parking or as bus stops or loading bays.

b) Off-street parking facilities

These facilities may be privately or owned; they include surface lots and garages. Self-parking garages require that drivers park their own automobiles; attendant-parking garages maintain personnel to park the automobiles.

A PRELIMINARY TO STRATEGIC PARKING PROVISION

The primary characteristics of urban and regional planning, despite any theoretical difficulties this might present, [1]:

a) The core domain of planning activity concern with the ways land and natural environments are valued, used, conserved, developed, or organized using spatial understanding.

b) Planning must always be orientated to the future.

c) On basis, planning seeks to modify the way future activities are distributed in space as an ongoing process of decisions.

d) Strategic planning seeks to influence the future spatial arrangements of places to accrue the benefits and avoid the disbenefits of particular arrangement of housing, industry, agriculture, conservation, social equity, transport and the like.

DESIGN IMPROVEMENT REQUIREMENTS

Rather than focus on individual land uses, planning for parking should actively shape public space. The following strategies show how cities can improve the design of surface parking, parking structures, and residential parking, [6]:

A. Improved design of surface parking

Because of their ubiquity, parking lots create great problems for urban design. They will continue to be built but better design strategies can help integrate them into the built environment and improve the public realm. It can also require that surface parking be screened:

a) Parking areas adjacent to a public right-of-way shall be provided with landscaping that is designed and maintained screen cars from the view from the street to a height of forty-two inches, measured from the surface of the parking area.
b) The reason for limiting the size of parking lots, dropping them partially below grade, and screening them is that conventional parking lots are visually unappealing.
c) Other than concealing them, how can we make them more attractive, one strategy is to use landscaping?

B. Parking structure design requirements

Locating parking in structures occupies less land than surface parking. Parking structure design only occasionally enhances the built environment. In rare circumstances, collaboration between a skilled architect and an enlightened developer leads to a beautiful and functional parking structure, but developers often neglect the architecture and build parking structures as cheaply as possible. Most developers will voluntarily spend money to improve the appearance of a parking structure only to the extent that it increases the value of the residential or commercial development it serves. Because the private economic incentives for good parking design are weak, parking structures need architectural controls and review to ensure good urban design. One strategy to improve urban design is to build parking structures that look like regular buildings .This was a common practice in the early part of the last century. A more contemporary approach is to "wrap," or surround, a parking structure with retail or other uses. In such cases, cities may offer the developer a higher floor area ratio as compensation. Alternatively, cities can require retail or residential uses only at the street level and some modest architectural details on the upper level facades.

TGIS SOLUTIONS FOR URBAN AND REGIONAL PLANNING

The TPGIS project expands by developing an array of interactive tools utilizing GIS that are designed to aid transportation planning in conducting alternatives analyses, transportation forecasting, and facilitate other planning functions. The TPGIS provides an analyst with the ability to modify data and assumptions and to recognize the implications of changes. Although the system, as developed, uses a combination of advanced hardware and sophisticated software, technology is becoming available to many planning organizations to allow similar capabilities (desktop mapping and high-speed yet affordable personal computers), [4,8].

The goal of the TPGIS is met through the following objectives:

a) Evaluate the design of the TPGIS with regard to transfer and application of the system.
b) Modify and enhance the TPGIS as required for implementation in a production environment.
c) Evaluate the usefulness of the TPGIS for alternatives analysis, and demonstrate the ability of the TPGIS to study the implications of selected policy decisions.
d) Use the TPGIS to study the sensitivity of model outputs to input data and assumptions thereby enhancing model calibration techniques.
e) Evaluate potential TPGIS for statewide transportation planning and congestion management.

CAR PARKING AS A CASE STUDY

Geographic Information System (GIS), as a science of analysis of spatial and attribute data, is an efficient tool to find optimum place for public parking. In this field of studies use of GIS results in decrease of field visit and increase of accuracy and reliability of results. In this project, we introduce an optimum method for parking site selection by the use of GIS and considering almost all of the effective parameters simultaneously. Also effective factors are considered from two main points of view including parking efficiency and the problem of providing required land for parking in the region of the University [6].

The ultimate goal of the selected case study was:

a) To assist the Traffic, Parking and Transportation planning of the university in improving the quality of life for the community by regulating traffic through efficient management and monitoring of parking resources within the university. This involved designing database systems and using spatial modeling software to produce project that can be used as a decision-making support tool to formulate policies and ordinances in order to control parking.
b) To develop a user-friendly version of TPGIS, which may be used for investigating the outcomes of alternative decisions and understanding the sensitivity

of forecasts to network supply and demand assumptions and quality of data?

c) Transportation data is usually associated with spatial data, like traffic counts from particular sites, the traffic volumes along particular roads or links. Geographical Information System (GIS) can be used as a database for storing transportation data. The primary advantage of using GIS as a database for transportation data is the fact that GIS can integrate the spatial data and display the attribute data in a user-chosen format.

In this paper ArcView is recognized as the intelligent choice for work in site development, surveying, transportation, planning and public works. It provides the rich set of databases and spatial tools needed to manage civil information for design, modeling and maintenance. Thus it is recommend that the seek the assistance of the GIS to complete linking of the Access database to the map layers in ArcView to allow for editing of information in the database from ArcView and real-time reflection of these changes in the database and vice-versa, since it will vastly enhance the usefulness of the system and make it easier to maintain by simplifying data entry tasks. Then the above three requirements can be achieved by applying it to a case study area through the following steps.

Step 1: Input data

The first step of this work is getting an image for Al-Nahrain University site from google map (2010), and using it as initial input data to the ArcView software without any corrections, as shown in Figure-1.

Figure-1. The districts of Al-Nahrain, Google Earth, (2010), [2, 5].

Step 2: Developing the transportation map

After saving the new theme we can now starting a new theme and drawing the main road, as shown in Figure-2.

Figure-2. Drawing the main road.

By this way we made the following themes:

1. Main road use theme: in this theme, all university main roads were developed over the google image and had the same scale of the image, as shown in Figure-3.

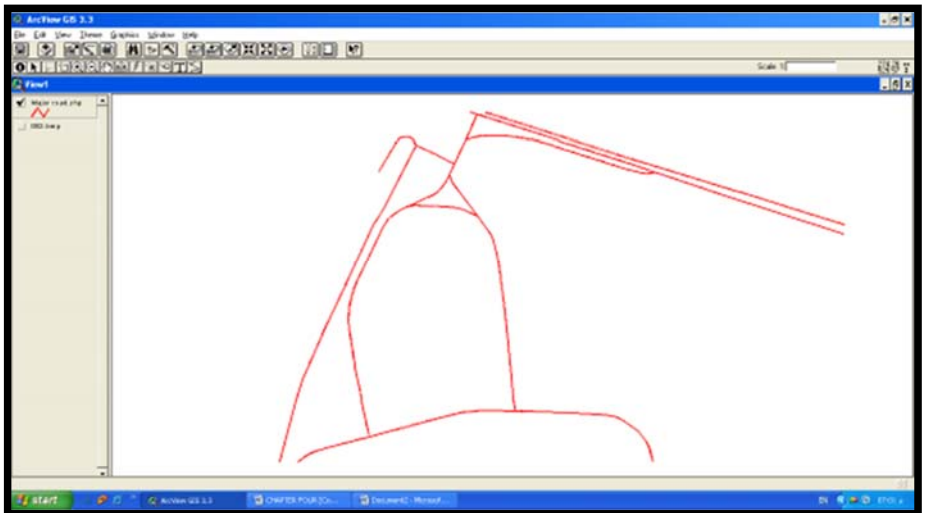

Figure-3. The main road theme.

2. Local road theme: this theme contents all the local roads of Al-Nhrain University site, as shown in Figure-4.

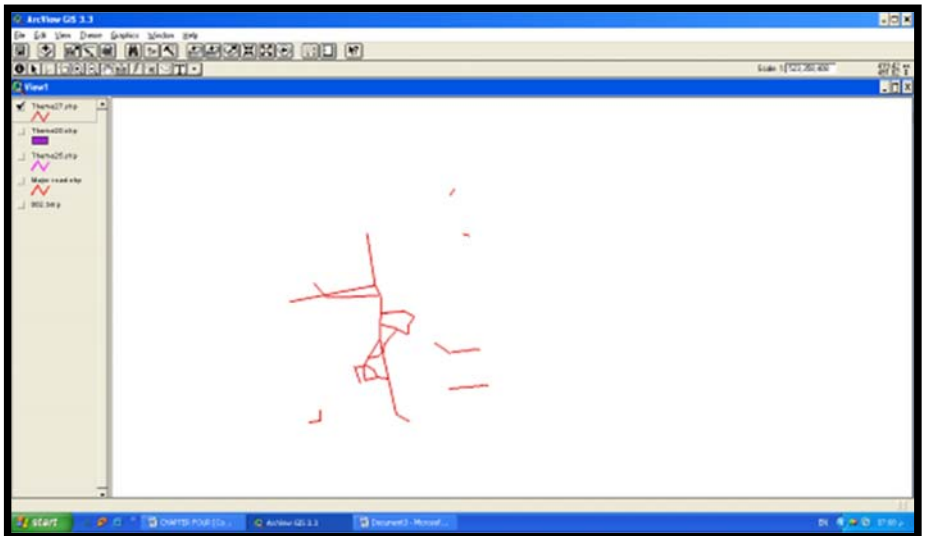

Figure-4. Local road theme.

3. Park theme: this theme contents all the parks of university as shown in Figure-5.

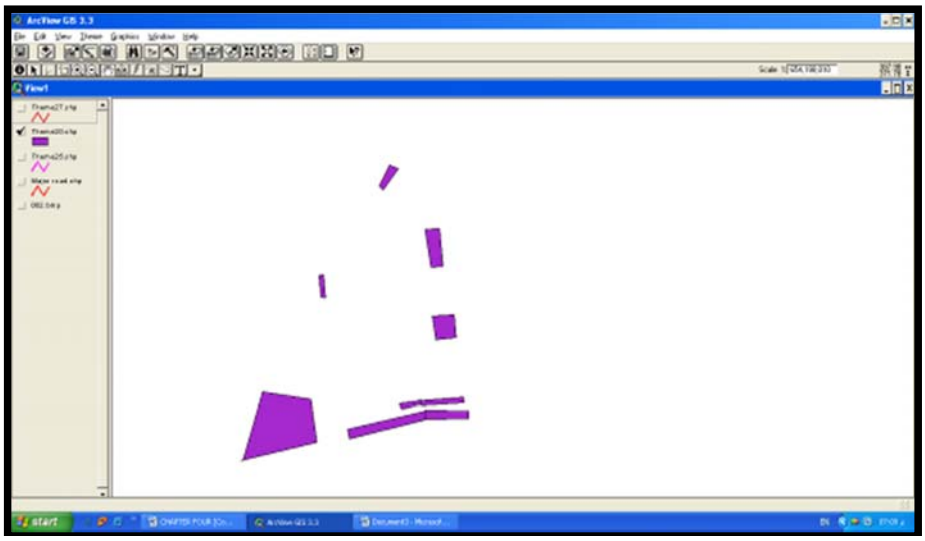

Figure-5. Park theme.

4. Passing road theme: this theme contents the passing roads of university as shown in Figure-6.

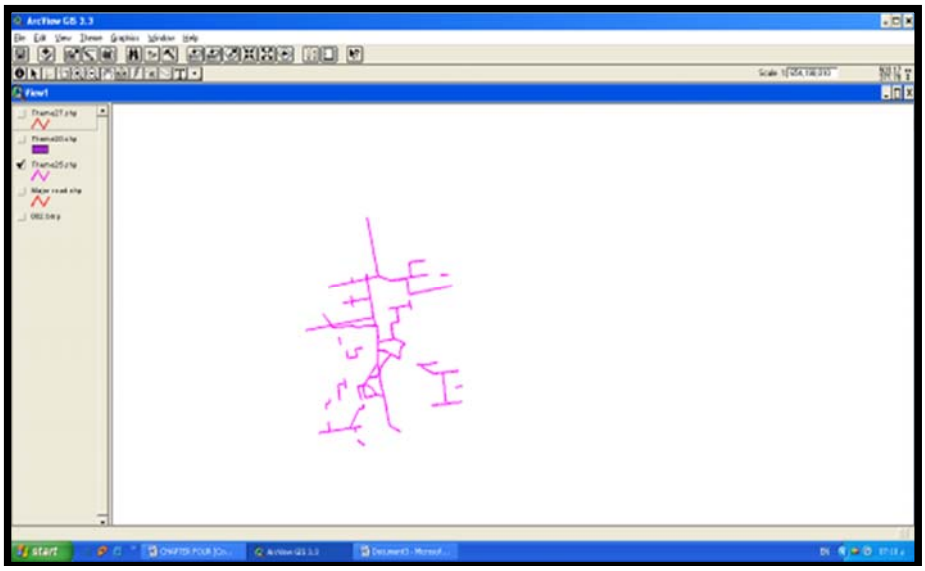

Figure-6. Passing roads theme.

By selecting all the themes, parks, major roads, local roads and passing roads, the transportation map can be shown as in Figure-7.

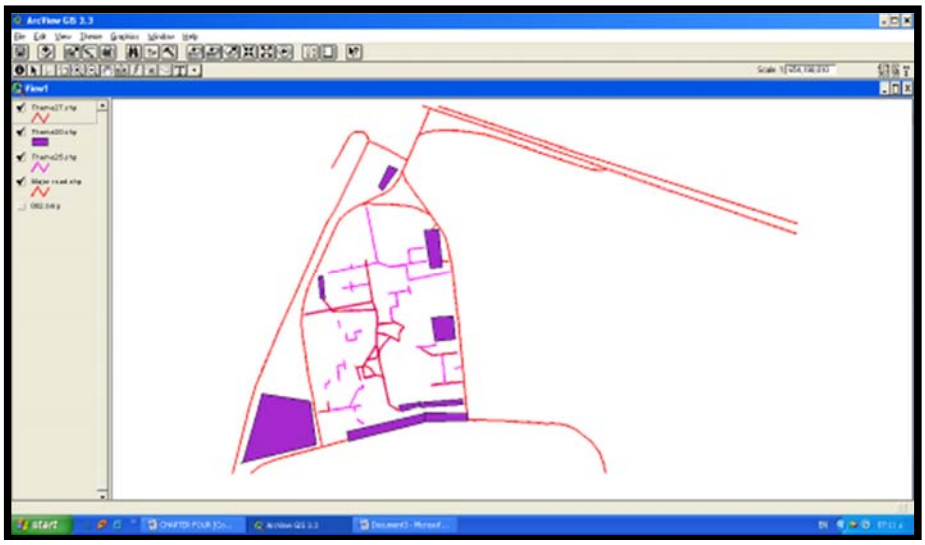

Figure-7. The transportation map.

Step 3: Building the database and labeled command

By using ArcView software we can input the information on any map like name, area and type of any building or road. It can be done by using a TABLE command, where a table will appear and we can input all required information in it. For Al-Nahrain University we input the area of parking and number of cars, as it is clear in Figure (8), (9), (10) and Tables (1) and (2).

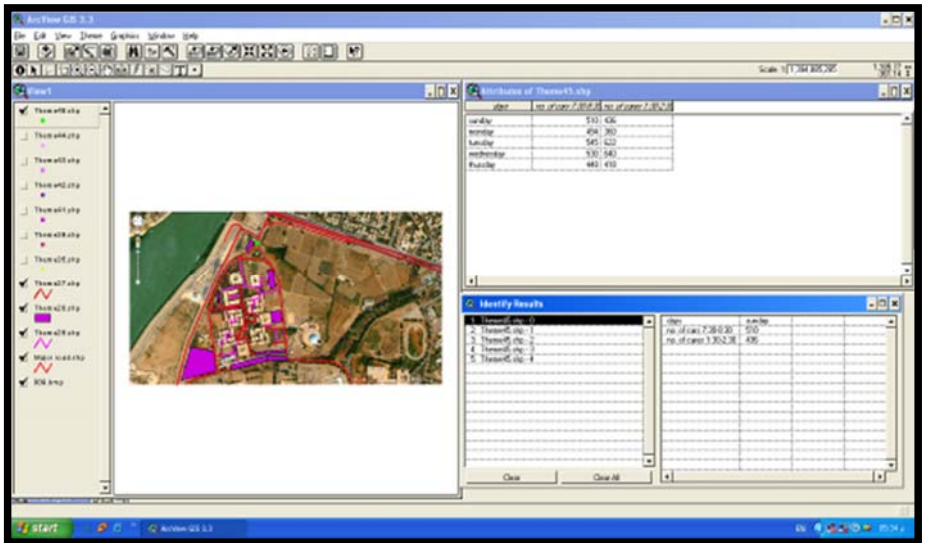

Figure-8. Input data and information of the peak hour volume.

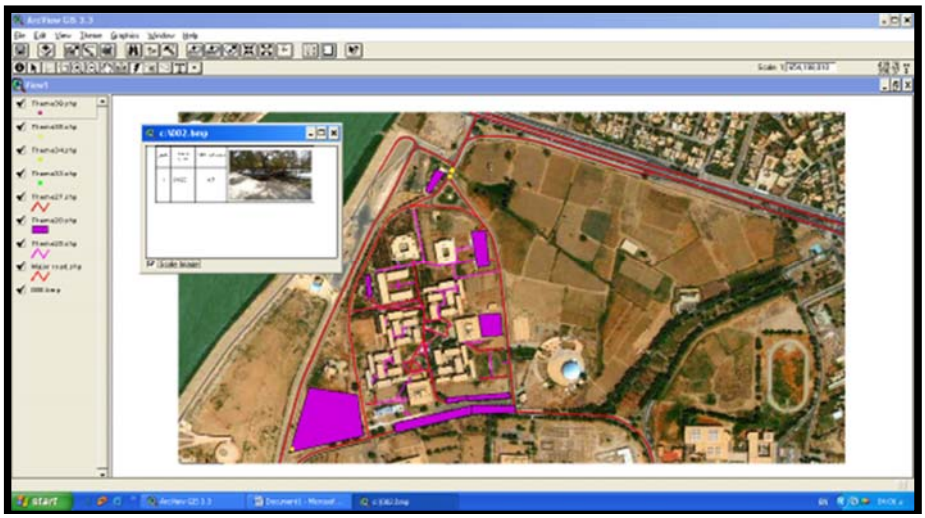

Figure-9. Input data about parking.

Figure-10. Locations of parks in Al-Nahrain University.

Table-1. Number of the cars interring Al-Nahrain University site during the peak hour volume.

Days / Time	Sunday	Monday	Tuesday	Wednesday	Thursday
7:30-8:30	510	494	545	530	448
1:30-2:30	436	360	622	640	415

NO. Of buses is constant for all day of the week =22 bus.*

Table-2. Area and number of cars in the recommended parks.

Park Label	Area (m²)	No. of cars
P1	23109	95
P2	1012	65
P3	1100	36
P4	2570.5	84
P5	1500	22
P6	2790	148
Total number of cars		450

Step 4: Recommendation a new design for the existing parks

Parking facility design and operation refers to physical layout, construction and day-today management. Improved design and operation can better integrate parking facilities into communities, improve the quality of service experienced by users, support parking management, and help address specific problems.

After making the necessary surveying works, and found that we have two choices. The first is the re-setting designs for the existing parking depending on the standards of designing off-street parks presented by Guarber and Hoels (2010). Then feed our developed GIS project with those designs as shown in Figures (11 to 15) below.

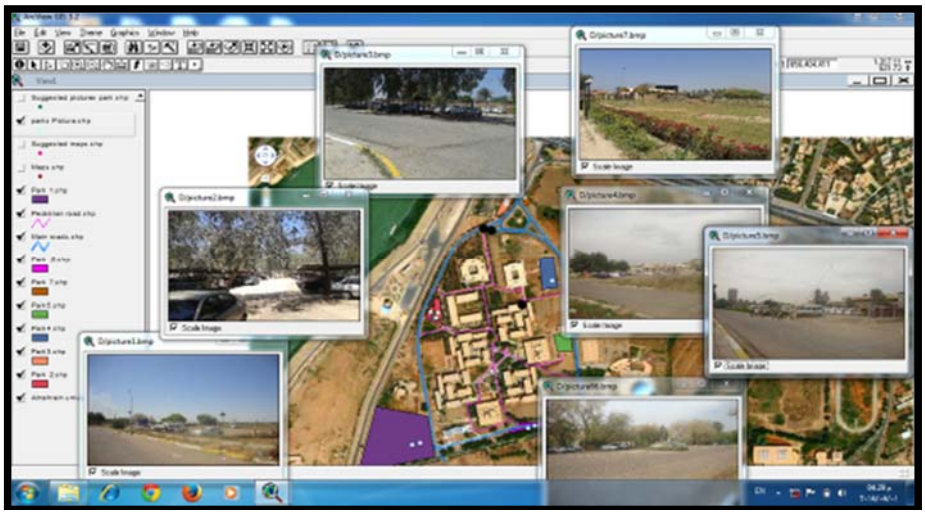

Figure-11. Digital photos of the existing parks in Al-Nahrain University.

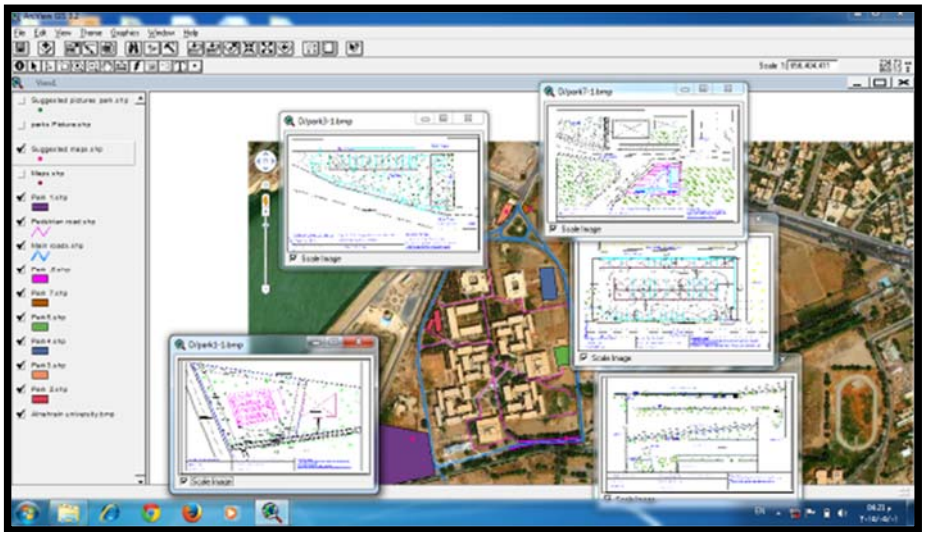

Figure-12. The recommended design of the parks in Al-Nahrain University (Design 1).

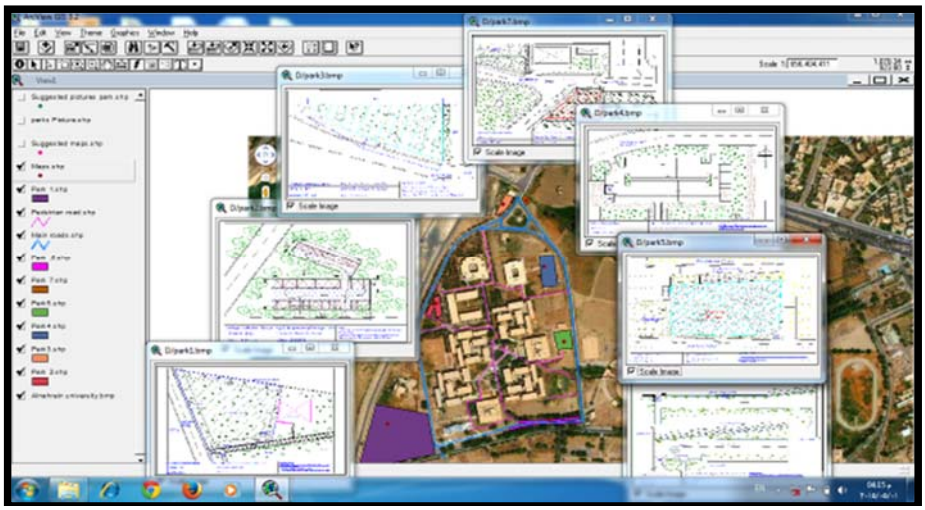

Figure-13. The recommended design of the parks in Al-Nahrain University (Design 2).

Figure-14. The recommended design of the parks in Al-Nahrain University (Design 3).

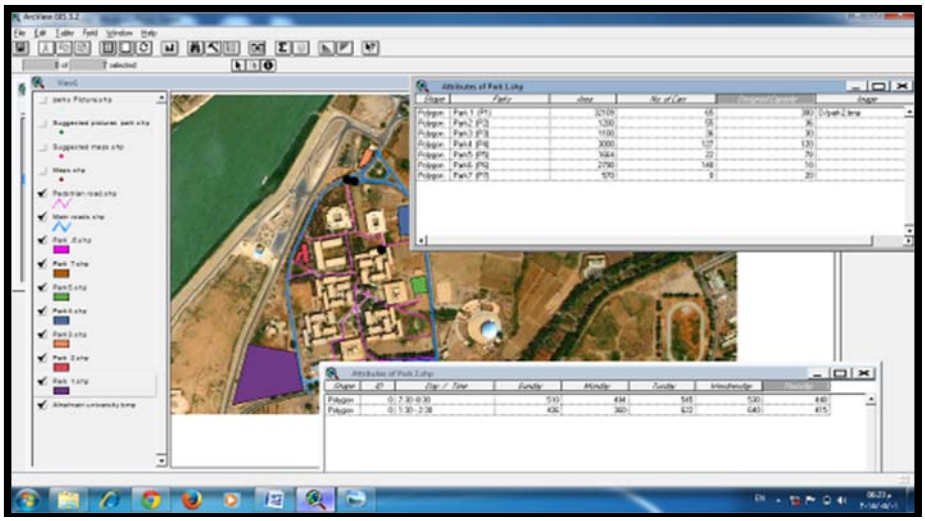

Figure-15. Area and number of cars in the recommended parks.

The second choice is recommended to build a multi-storey car park that will serve all users in the University and canceled the rest of the existing parks and using them for other purposes. The suitable solution is to develop a new area behind Al-salam hall (P1) as shown in Figures (16 and 17).

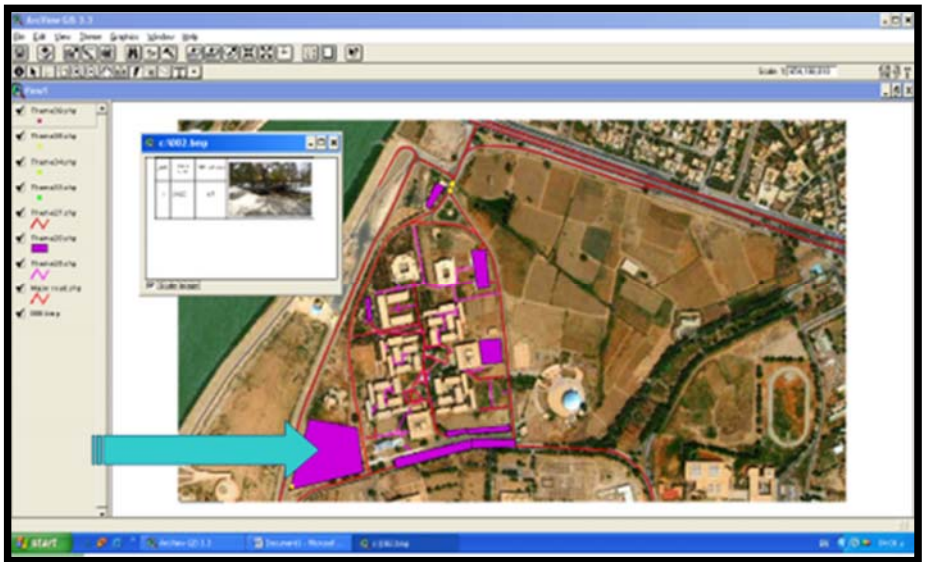

Figure-16. New suggested parking area in P1 location.

Figure-17. Some suggested designs of the multi-story park in P1 location.

CONCLUSIONS

The conclusions drawn from this paper can be summarized as follows:

a) Transportation planning requires substantial amounts of data and cooperation among transportation planning agencies. Advances in computer technology and the increasing availability of geographic information systems (GIS) are giving transportation planners the ability to develop and use data with a much higher degree of efficiency.

b) The Area of Al-Nahrain University has seen explosive growth in the number of visitors and patrons as the result of revitalization, development of departments, and the general trend of ever-increasing mobility. Parking is increasingly becoming an important aspect of transportation planning.

c) GIS is more than just computer software. A GIS essentially consists of a set of spatial or map information and a database containing the attributes, both quantitative and qualitative, of this geographic information. In this paper the database attached to a map of Al-Nahrain University had contain information regarding its main road, local road, passing road, parking (number of cars and parking

Area), and level of development. These sets of information are dynamically linked, using geographic location as the common identifier, such that the attribute data may be accessed through the map or vice versa. Moreover, the data utilized need not relate to only one specific theme, such as parks.

d) Car parking is an important object class in many traffic and civilian applications. With the problems of increasing traffic congestion in Al-Nahrain University and the ever increasing shortage of space, these car parking is needed to be well equipped with automatic parking information and Guidance systems.

e) Parking management and control is important for Al-nahrain University because it has the potential to modify demand on an area-wide basis yet, despite being readily available to authorities, often seems under-utilised to tackle traffic congestion.

f) Through collecting the data about the parks of Al-Nahrain University it is found that the problems arising from the gap between demand and supply of parking spaces are becoming increasingly acute in most parks. The importance of controlling parking spaces as an integral element of the traffic and trip demand management process, together with the need to ensure a close-linked conceptual approach, has been defined and defended for quite some time.

g) To supply a new parking can be reconstruct and reline the parking bay, develop a new area or built a parking building. The suitable solution is to develop a new area behind Al-Salam hall parking should be built as new Multi-storey Park.

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