King Fahd University of Petroleum and Minerals

City and Regional Planning Department

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Prospective sites for Giant stores super markets in United States of America.

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Contents:

1. Introduction:

Geographic Information System is simply a computer based system, which can be used to hold and analyze data describing places in earth surfaces (Rhind, 1989). The definition of geographic Information System, like any other newly developing fields of research, is still a subject of debate in literature (Timmermans, 1994). The subject has been variously defined and described as an integrated computer system for the input, storage, analysis and output of spatially referenced data (Childhood, 1988), or an organized assemblage of hardware or software used to capture, store retrieve and analyze various form of spatial data (Burrough, 1986). It has been more comprehensively defined as a system of hardware, software and procedure designed to support the capture, management, manipulation and modeling and display of spatially referenced data for solving complex planning management problems (Rhind, 1989).

Finding the best way for expanding business requires several types of information, which linked with geographic location. Information about the amount of customers who need the service and where these customers living is important, as well as the accessibility to these service locations.

2. Project statement:

The Giant stores super markets owner has decided to expand his business and open new branches in United States of America. The owner wants to find the best sites for his new super markets. From economic point of view such decision depends upon the amount of population in specific area and the accessibility of these super markets.

The project was designed in order to propose suitable sites for the Giant stores super markets, considering the following stages:

Stage 1*:*

In the region that has population >48 millions, open super markets in the cities those within 1.5 miles from the highway and have population > 14 thousands.

Stage 2:

Then, open super markets in all cities those within 3 miles from the highway and have population > 12 thousands.

Stage 3:

Provide the customers with the nearest Giant stores super market.

3. Literature review:

Data handled by GIS are basically of two types, spatial or geographical data, which indicate the geographic location of a feature and the attribute information data, which refers to descriptive characteristics of the geographic feature (Aranoff, 1989 and Chen, 1994). For example, data on a land parcel will include the geographic coordinates as its spatial referenced data while records of its serial No, area, perimeter certificate of ownership, cost etc will constitute its descriptive attributes.

Two broad classes or formats of GIS exist, the vector and raster based formats (Aranoff, 1989; Wiggins and French, 1991 and Chen, 1994). The raster based format involves the storage of data structure as array of grid (matrix) cells with a separate layer of each type of attributes. It is used for the classification, analysis and use of satellite images; processing and display of digital elevation data and its visibility study; for the dimensional; graphic display and regional suitability analysis requiring the overlay and weighted combination of many factors (Wiggins and French, 1991).

Vector based format attempt to represent the position of a geographic feature as a precise as possible by one or more paths of coordinates. It is different from the raster format because it uses topological data structure i.e represents the position of an object by one or more paths of x, y coordinates (Wiggins and French, 1991). A topology describes the relationships between the elements of a map. The basic elements of a map are represented by points, lines or polygons.

Geographic Information System has some basic functional elements which allow the complex operations of its system. These are:

Data acquisition: This component of GIS operation involves identifying, sourcing and gathering the data needed for a project. This GIS component is typically the major bottleneck in its implementation. It constitutes a significant part of a GIS budget, covering between 70 to 80% of the total cost or about five to ten times the total cost of hardware and software (Aranoff, 1989 and Wiggins and French, 1991). GIS could be sourced fro existing paper maps, air photographs, satellite imagery and survey data. The accuracy and well documentation of data are critical to the success of GIS operations.

Data input: This aspect of the GIS project implementation, deals with the processing of data into suitable format and its input into the computer system. Data processing includes manipulation, reduction and generalization, editing and

registration of the data layers as well as developing a consistent framework for specifying and recording location of objects. Data are entered into GIS system using keyboard, coordinate geometry, manual digitizing, scanning and inputting or generating existing data.

Data management: GIS data management includes those function needed to store and retrieve data from the database (Aranoff, 1989). It involves creating a GIS database and managing its operations. Most GIS system incorporate a database management system (DBMS) which basically controls, manipulates, protects the integrity and provide multiple access to the database as well as ensuring one central database maintenance and independence of the database.

Data manipulating and analysis: These functional components of GIS form the core of GIS and determine the information that can be generated by the system. Analytical tools and operators are used to perform spatial analysis on database to generate information. Both spatial and non-spatial data of database are manipulated and analyzed to provide answer to real word questions. The analytical functions of GIS include reclassification and aggregation of spatial data, spatial data query, buffering and overlying, centroid determinations, statistical analysis, modeling etc.

Data input: This is the procedure by which information from a GIS project is presented in a form suitable to the user. This information is essentially the results of the queries, buffer analysis or modeling or any other spatial operations performed. Data output could be in form of hardcopy, softcopy or electronics (Aranoff, 1989). It could also be produced as charts, maps, graphs or tables.

3.1 GIS application:

General review:

GIS combines the analytical capability of database management with high resolution computer graphics (Rhind, 1989 and Wiggins and French, 1991). Base on proximity and combination of attributes from multiple sources and by creating new information. Hence, its significance results from its ability to relate attribute data to geographically referenced data within a single system.

GIS enhances improved productivity in the provision of public information; improved efficiency in updating and storage of data; ability to track and monitor growth and development over time and in the performance and display of different professional analysis rapidly. Other specific benefits of using GIS include

enhancement of better decision or policy formulation and the ability to aggregate data for specific sub-areas (Aranoff, 1989 and Wiggins and French, 1991).

GIS implementation and application are usually constrained by problems including, lack of staff and training; management support; difficulties with data input and conversion, maintenance of databases and difficulty with system implementation (Yeh and Batty, 1990). Other basic problem that may constrain its implementation are visualization issues which include feature representation which emerges when changes in map scale are involved; handling of multilayered data which are not easily visualized and presentation of many features within a small area and map generalization which require feature to change in size, symbolization, shape and location according to map scale. The most important requirements needed for successful implementation of a GIS project include:

1. Management support: Organizational management support is crucial a successful implementation of a GIS project. Management support is required in the area of coordination, decision making, providing the funding and other resources to commence and continue with the project. The management is also in position to take a broader view on the potential benefits of such project (Aranoff, 1989 and Somers, 1994). Benefits that could be grained, stand as the necessary impetus for the management to give any organizational support to any GIS project.

2. Staff support: The main goal in designing GIS staff structure is to provide support for GIS development and operation (Somers, 1994). GIS staff function include management, coordination, system support, database support, users support and production (Somers, 1994). Availability of experienced and skilled staff is required for successful implementation of a GIS project (Yeh and Batty, 1990; Wiggins and French, 1991 and Somers, 1994).

3. Data availability: The application and implementation of a GIS system depend on the available data for management, manipulation and analysis. The quality of the data needs more consideration than the data packaging in the implementation of a GIS project (Worall, 1990). Data quality determines the usability of the data set in analysis and eventual output. According to Yeh and Batty (1990), there is little or no pint in developing sophisticated system vehicle for adding value to data through the generation of information in a GIS where the data are problematic.

4. Cost: Relative or typical office automation applications such as spreadsheets, a GIS system is more expensive (Wiggins and French, 1991). The high

costs of hardware and software are comparatively a small fraction of the actual total implementation cost of a GIS project. About 70 – 85% of the total project budget is expended on the acquisition and preparation of data (Aranoff, 1989 and Wiggins and French, 1991). It is therefore important to really evaluate the strategies of the implementation of GIS where the resource is limited.

5. Type of GIS system: The type of GIS system an organization has, will determine the degree of the successful of its (GIS) application and implementation.

The ability of GIS to perform spatial analysis on geographically referenced data has enhanced its application in a wide range of disciplines that have geographic elements. GIS is being intensively used in urban planning to keep track of zoning; transportation planning and analysis; street address; records of properties; site selection etc. An example is the regional and urban information system developed for the city and county of San Diego and California. GIS has also been found useful in demographic data acquisition and analysis. The TIGER GIS system developed for the 1991 national population census in the United States of America.

GIS serves as a useful tool in assessing and monitoring agricultural activities such as crop production, livestock grazing practice etc. Canada developed the first national GIS system in the 1960 s for the purpose of land use classification especially for the agricultural use. The United Nation Food and Agricultural Organization has also developed agriculturally based GIS (Crain, 1987 and Tomlinson et al, 1987). GIS systems are also being used to keep records of forestry and natural resources such as timber felling, wide life habitat, water supply, protection of endangered species and mining activities.

Archeological application of GIS involves either of analysis of sites or the prediction of location of yet discovered sites. Recently, GIS ArcInfo system was adopted to study and model the structure of a thirteen century Morderburg Castle wall in Switzerland in order to reactivate and restore its original structure (Oswald, 1996). GIS gas also proved useful in the study of environmental protection and pollution control.

4. Analysis tool:

One of the software that being used for GIS application is ArcView 3.2a, which is developed by Environment System Research Institute, Inc (ESRI). It is software that can be used to generate a complete Geographic Information System

(GIS) that can works for any type of drawing and spatial data. In ArcView 3.2a the work is organized by project, which is a file that contain five documents: Views, tables, charts, layouts and scripts. Each document does a different job and has its own set of menus, buttons and tools.

5. Objective:

The specific object of the project was to propose suitable sites for the Giant stores super markets. Moreover, to provided customers by the nearest Giant stores super markets.

6. Methodology:

Spatial analysis carried out to identify the suitable sites for the Giant stores super markets. The spatial analysis performed on the project include the following stages:

Stage 1:

United States was classified to 9 regions and the states with every region were merged.

Summary table containing regions and numbers of counties was constructed; another summary table containing population by region was created. The two tables were linked, as well as the population of White, Black, Indian, Asian and Islander, Other and Hispanic.

The region that has population > 48 millions was selected using query builder. (fig. 1).

Cities within South Atlanta region (the selected region), those within 1.5 miles from the highway were selected by using select by theme tool (fig.2). Those cities were refined by selecting cities those have population > 14 thousands using query builder tool (fig. 3).

Stage 2:

Cities within South Atlanta region, that within 3 miles from the highway were selected by using select by theme tool (fig. 4). Those cities were refined by selecting cities those have population > 12 thousands using query builder tool (fig. 5).

Stage 3:

Zip code attributes were spatially jointed to the cities attributes. Using the nearest relationship the distance field was created. When a caller gives his zip code, the nearest Giant stores super market site can be located from the table (fig. 6).

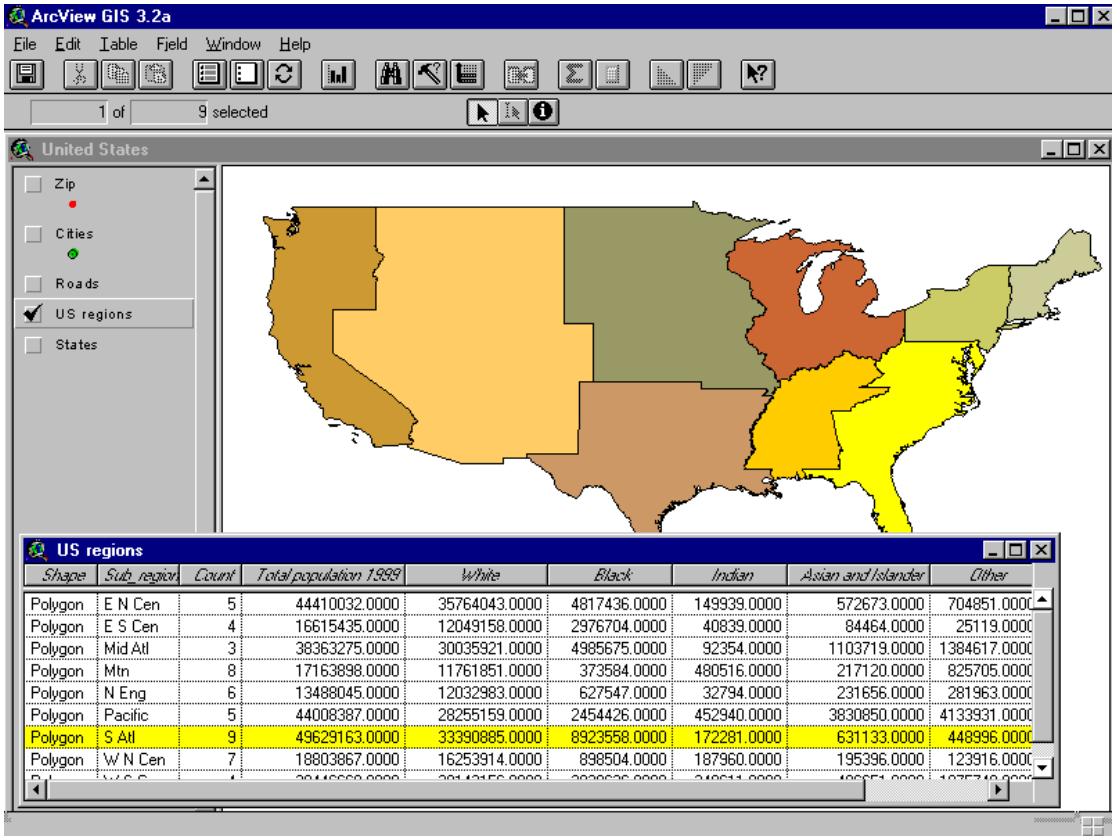

Fig. 1: The region that has population > 48 millions (South Atlanta) was selected using query builder

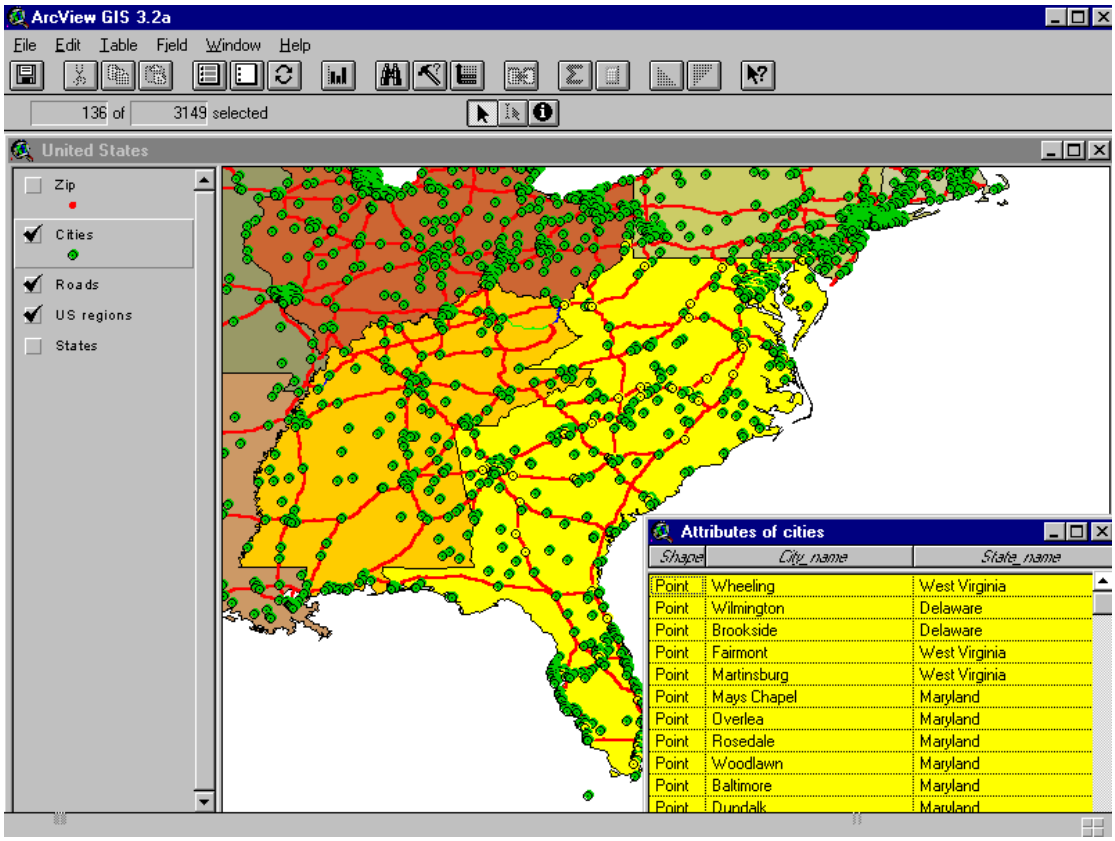

Fig. 2: Cities within South Atlanta region (the selected region), those within 1.5 miles from the highway were selected by using select by theme tool (136 sites).

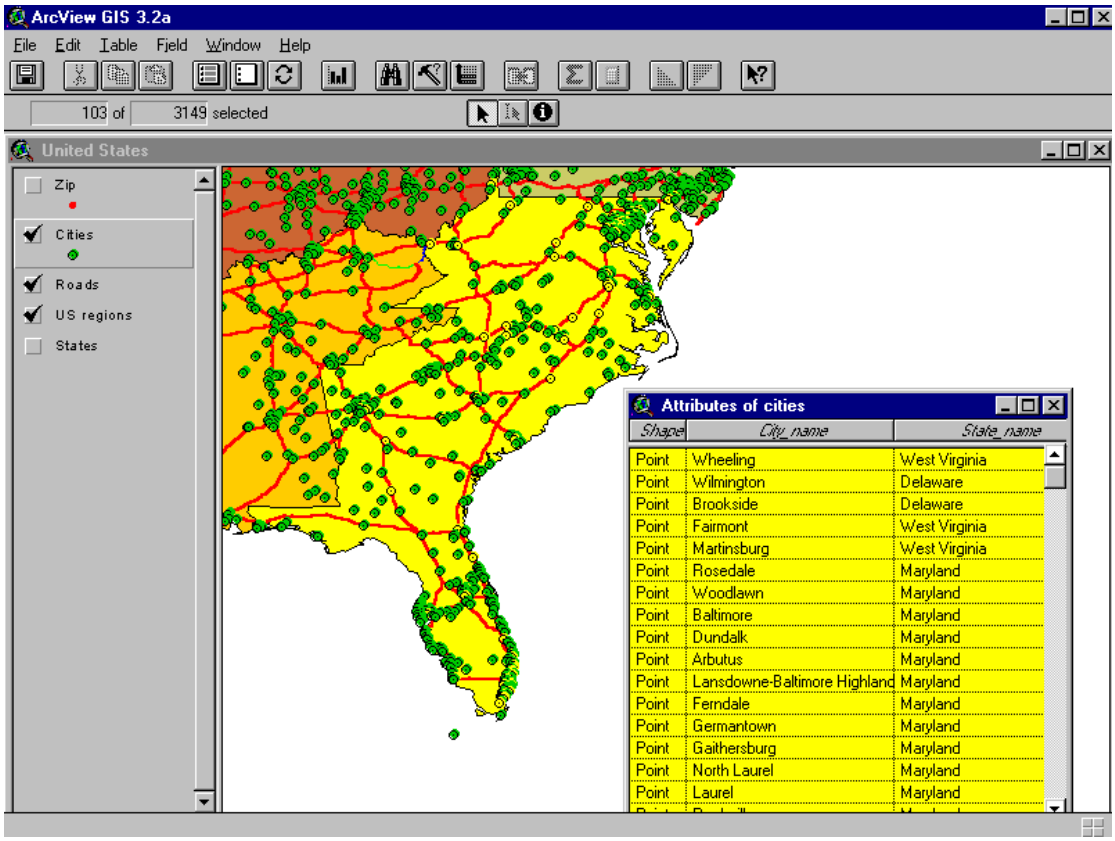

Fig. 3: Cities within South Atlanta region (the selected region), those within 1.5 miles from the highway were refined by selecting cities those have population > 14 thousands using query builder tool (103 sites).

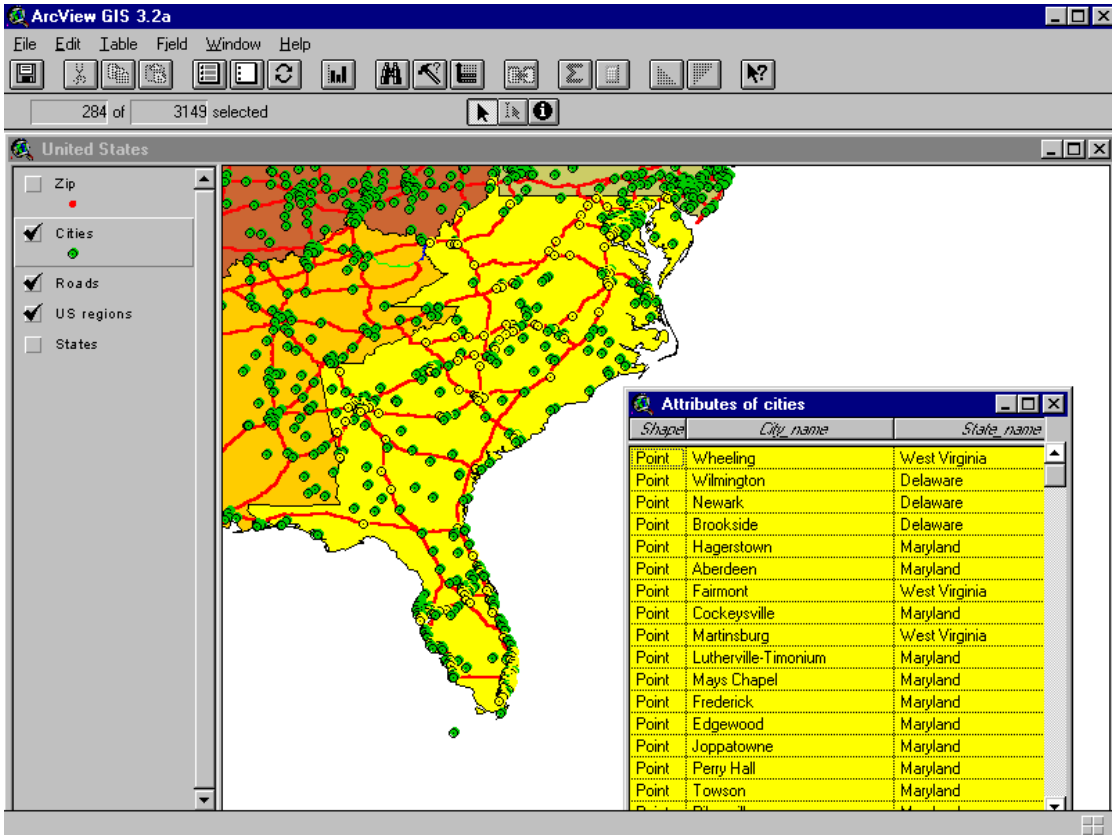

Fig.4: Cities within South Atlanta region, that within 3 miles from the highway were selected by using select by theme tool (284 sites)

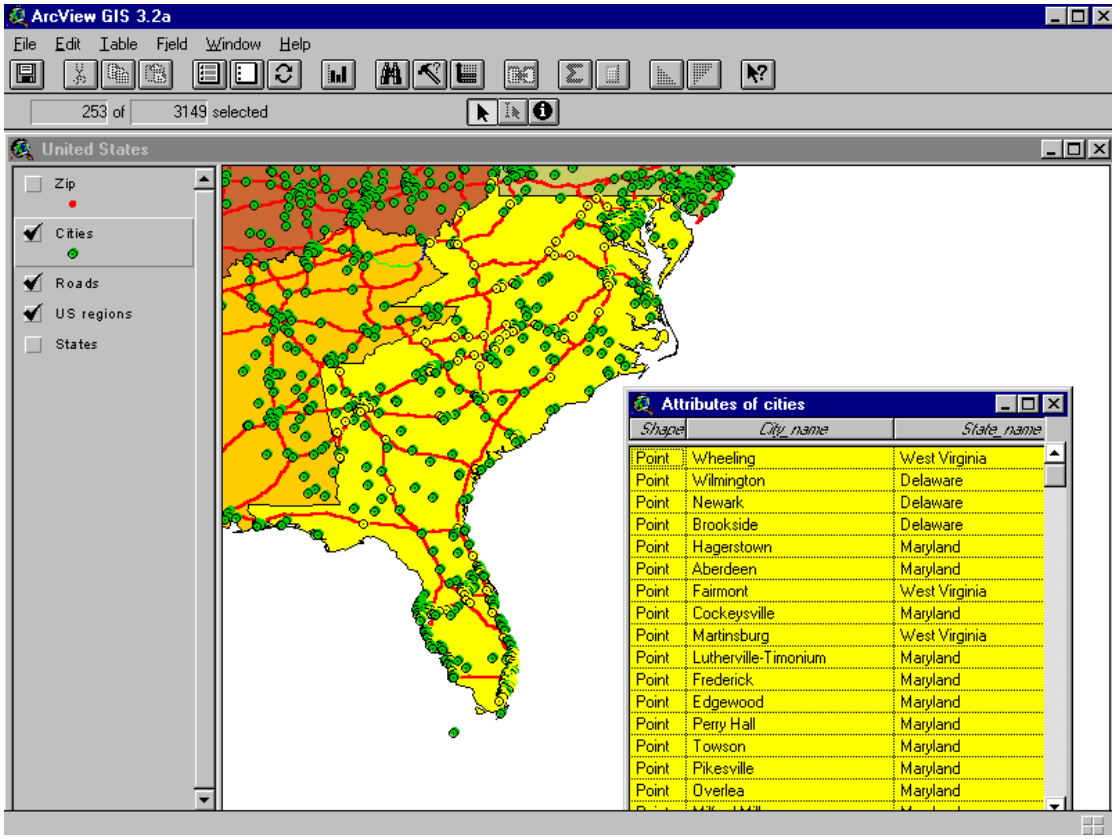

Fig. 5: Cities within South Atlanta region, that within 3 miles from the highway were refined by selecting cities those have population > 12 thousands using query builder tool (253 sites).

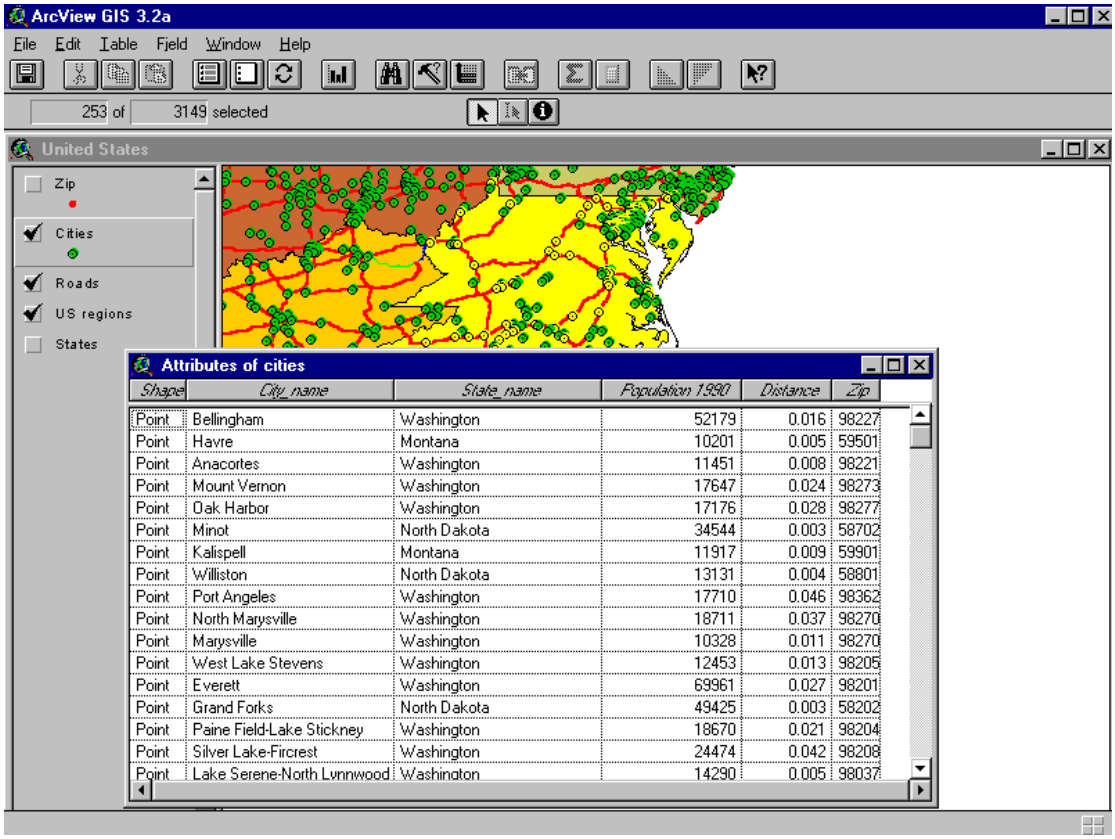

Fig. 6*:* Zip code attributes were spatially jointed to the cities attributes. By using the nearest relationship the distance field was created.

7. Findings:

In the final stage of the project, graphic representation in form of map was created with its corresponding legend. The first map showed the prospective sites for the Giant Stores super markets, while the second one shoed the United States regions.

8. Conclusion:

ArcView represents a suitable power to produce suitable output for this project. The aim and objective of designing this project was achieved in the sense that the prospective sites for the Giant Stores super markets were identified at the final stage of this analysis. In the first stage 103 sites were opened and another 150 sites (total 253 sites) were added in the second stage. Finally, a service for providing customers with nearest Giant stores super markets was accomplished.

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