Spatial Preference System For Roads Maintenance

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***Abstract* – Information technologies have made great progress in the last 50 years and have started to be at the center of our lives. Information can be access quickly, share it easily and efficiently.**

The objective of this paper is to develop spatial preference system for roads maintenance valuation operations. The tool will determine the road damage percentages based on relevant parameters such as, distance from main roads, distance from city center, distance from city halls, distance from schools, distance from markets, distance from bus terminals and distance from hospitals. In this study, the author has adopted GIS application software – ArcMap. The tool developed in ArcGIS-Arctoolbox environment using Python programing language. multi criteria decision analysis MCDA used to evaluate preference. Data were mange, processed, and assist through the tool. The tool effectively and systematically evaluates roads for maintenance. Safranbolu-Karabuk data is used as a case study to further clarify the application of tool in road maintenance valuation. The tool prove that it is capable to effetely, accurately and speedily evaluate the roads for maintenance operations.

***Keywords* – Road maintenance, ArcMap, Geographic Information System.**

I. INTRODUCTION

The nations development and economic growth are closely associated to its accessible transportation system. Efficient road transportation infrastructure abilities promote industrial and socio-economic development [1]. To provide safety, good condition and comfort roads to drivers at all times, a comprehensive and schedule roads maintenance must be formulating and adopt. Preventive maintenance works, such as road rehabilitation help to reduce the major road repairs, expenditure, accidents and reduce the traffics [2].

Suitable Geographical information systems GIS database is necessary step to effectively conducting the road preference for maintenance. As a result of the integration of spatial data with tabular data, GIS is strongly recommended to perform road preference valuation. GIS has been use to service the human to make their life easier, accurate and faster [3].

GIS is an information system that performs several functions such as collecting, storing, processing and presenting the graphic and non-graphic information obtained from several sources. GIS enable us to record, edit, structure, model and analysis our complex, location-based information [4]. Along with the developing in GIS Technologies, roads maintenance system still need several improvements. There is a need for a fast, economical and accurate system for redundant roads maintenance valuation operations [2].

The purpose of this paper is to develop spatial preference system for roads maintenance valuation operations. The tool will determine the road damage percentages based on relevant parameters. The development of this tool will help the roads maintenance departments in municipalities to manage the limited budget and guide the maintenance operations for the most urgent roads. The tool

II. METHODOLOGY

This section will mainly focus on the methodology that involves handling and managing data. Within the process of data collection, two sets of data are classified; raster data and attribute data. Raster data are achieved. Processes involved in this research are illustrated in Figure 1.

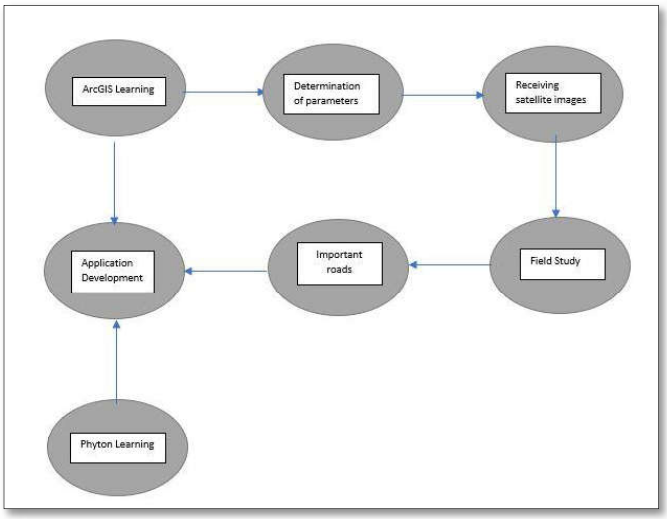

Figure 1 Research Methodology

A. Generating Vector Data

In this study, ArcMap software used to construct the vector data [5]. Roads represented as line segment for evaluations. Essentially, all most relevant factors for road valuation constructed. Each factor represented as vector layer in ArcMap. Roads represented as line segments for evaluations. Other parameters were determine based on experts such as main streets, hospital, park, market, city hall, and school etc.

B. Generating Raster Data

In raster dataset, each cell (which is also known as a pixel) has a value. The cell values represent the phenomenon density. In this tool, raster data calculated from vector data convert using the Python programing language. For each road segment, the distance from evaluation parameters (distance from main roads, distance from city center, distance from city halls, distance from schools, distance from markets, distance from bus terminals and distance from hospitals) were calculated automatically.

C. Attribute Data Extraction

Essentially, attribute tables are constructed for each road segment from all input raster parameters (distance from main roads, distance from city center, distance from city halls, distance from schools, distance from markets, distance from bus terminals and distance from hospitals). Data extracted based on the develop tool using Python language.

D. MCDA analysis

In this step, vector road segment data with its attributes data has been feed to this stage. The end-user need to decide and obtaining the final preferences by applying MCDA.

E. Tool development

The tool was developed in Arctoolbox environment using python programing language. The tool exhibited in Figure 2,

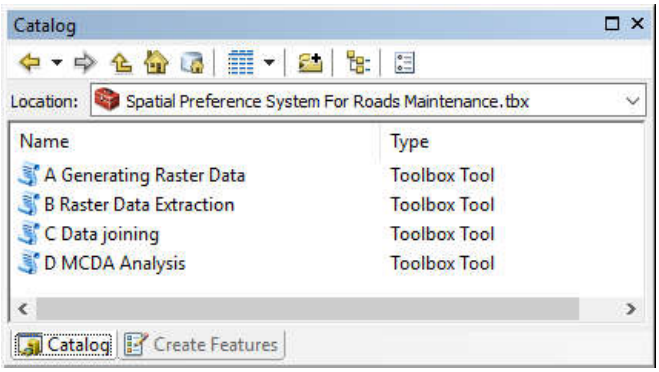

Figure 2 Spatial Preference System For Roads Maintenance

III. APPLICATION

In this study, Safranbolu-Karabuk data is used as a case study to further clarify the application of tool in road maintenance valuation. Necessary parameters determined for roads maintenance in Safranbolu. Then, parameters data were generated for Safranbolu in ArcMap. Satellite images used to generate the parameters maps and roads segment map as illustrated in Figure 3.

Our parameters: distance from main roads, distance from city center, distance from city halls, distance from schools, distance from markets, distance from bus terminals and distance from hospitals. The reason of choosing these parameters is to find out which way is more important to make maintenance. In addition, maintenance will be according budget set by the municipality.

After creating spatial data of parameters, raster data generated and tabular data extracted. The last stage is to perform MCDA in order to calculating most important road segment for maintenance.

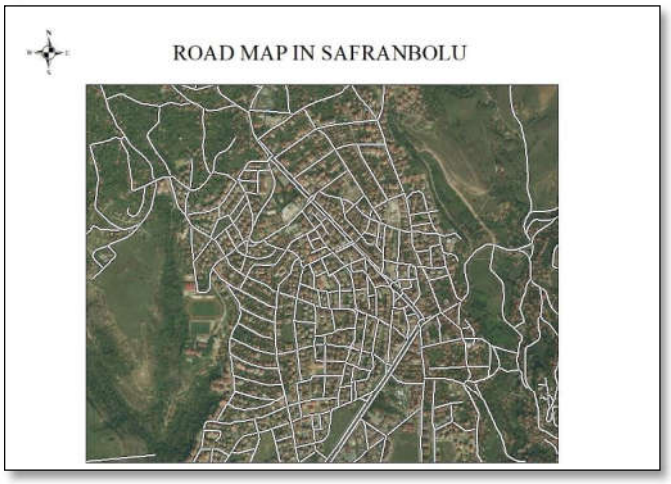

Figure 3 Safranbolu-Karabuk study area

IV. CONCLUSION

The adoption of GIS will lead to a more organized management of digital data especially those related to road data. Particularly, this system application will also increase work productivity in managing road maintenance.

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