Conceptual GIS Application for Decision Making of Parking Site in Khabarovsk

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Abstract. This article addresses research questions about decision making of parking site in Khabarovsk city using the principles of geographic information system (GIS). Khabarovsk is growing smaller by day and, as a result, downtown becomes more overcrowded and suffers from lack of parking lots which make heavy traffic on the street. Consequently public parking as a part of a modern urban transportation system plays an important role in decreasing the load of heavy traffic and it's essential in servicing different needs. However, public parking site selection which done by traditional methods or just by visiting of the site is difficult and complicated process. Using the GIS methodology leads to make decision about parking site easily and fast by considering all of the effective parameters simultaneously. For building the decision making GIS model this study suggests four process definitions as follows: Build up desirable area for new parking site map. Build up desirable area for new parking sites by distance map and qualified land use and area map. Build up population and employment density with more than 2,000 people on one SQKM map. Build up general suitable parking sites map.

Keywords: Public parking site selection, GIS, model of parking site selection process

1 Introduction

1.1 Background

Khabarovsk is a city in Russia, a center of Khabarovsk krai and Far Eastern Federal District. In 1858, it was founded as the military outpost of Khabarovka, named after a Russian explorer Yerofey Khabarov. The post later became an important industrial center for the region[5].

Nowadays Khabarovsk City is a rapidly growing and developing Russian City. Historically the city started to grow up with the central part which has been deemed as business and commercial city center. The commercial and trade leaders companies and big shopping centers are placed in this part and the number of working people are growing every year. Due to this the downtown of the City suffers from lack of

parking spaces and a lot of people have to leave their cars on the roadway, blocking the traffic and causing traffic jams .

Thus, the goal of the project is to find the best location with desired conditions that satisfy predetermined selection criteria.

1.2   Study Area

As it was mentioned above, historically Khabarovsk City began to grow up with a central part where 156 years ago first buildings were raised [5]. Therefore majority of historical and architectural heritage of the City is concentrated in central part and preserved by government. Due to this area is already organized and built up, siting of new parking place is undesirable(bordered with a black line Fig. 1). The study area is focused on area out of black line boundary with a distance from it less than 15 min of walking which around 1000 meters.
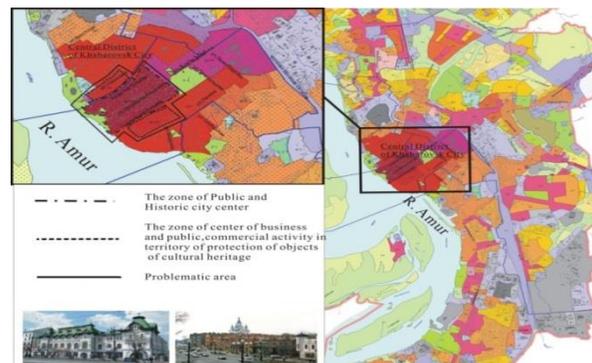

Fig. 1. The Map of Land Using and Urban Zoning of Khabarovsk City

1.3   Objectives and Methodology

This research discusses the areas which we can apply GIS applications to determine optimal site selection for neighborhood parking facilities and implementing it and will propose a model which we can utilize with GIS model builder application to make plans of the most effective zone for new parking sites.

1.4   Determine Efficient Criteria in Parking Site Selection

There are many parameters to determine site selection of parking lots. Considering civic construction and traffic critics views, effective parameters in parking site selection are classified into five main classes, which every class includes several subclasses (Table 1)[1,2].

Table 1. Efficient Criteria in Parking Site Selection

Criteria	Sub-criteria
Distance to major centers (not far than 1000 meter buffer)	From commercial centers, from the official-governmental centers, from the residential area;
Population	Population density, employment density
Efficient landuse for parking places	Type of land using is not residential, location in study area, site not less than 500 SQM
Attainment of major streets	Pedestrian and streets crossing, streets width, distance to first grade street, second grade street, third grade street
Existing parking facilities	Existing parking facilities in study-area, in problematic area

And the following parameters have been applied as limitation layers in site selection.

2   GIS Possibilities for Managing Parking Facilities

Geographic Information Systems (GIS) based method has provided an excellent platform in planning, managing, quantifying, displaying and analyzing geographical transport related information. GIS is the most promising and universally accepted new technologies in the field of decision analysis and data management. It is an innovative means of organizing database by geographic area and presenting the information in spatial forms. The use of GIS makes site/area-specified data more accessible and information can be displayed in an easily understood format. In the last few years, there have been many applications of GIS in assisting traffic engineers and transport planners in dealing with complicated transport problems. It has played an important role in planning and decision making process. They can be used to display spatial information, query particular attributes or features and to create new data set based on existing resources of data. One of the applications is to use GIS in managing parking facilities[1].

Evaluation of future needs of parking is very difficult because of following different factors such as increasing of private cars, growth of population, development of commercial areas, and increasing the shopping areas. They will be reasons for increasing of displacement of population cases such as current parking capacity, purpose of the trip, park time, walking distance from parking to destination; they have an important role in determining the future parking [2]. However, with use of GIS technologies we can receive the most accurate and effective results of this complicated process, considering all factors.

Using a GIS makes it possible to store data about individual parking spaces in a logical and precise way. Through simple searches, it is possible to view the many

different types of parking that exist in a city. The ability to sort the different characteristics of a parking space by location and to view these characteristics on a map make GIS an invaluable tool. Another benefit of GIS is the ability to easily update the map layers. Every time a new space is added, or characteristics of an old space are changed, it is far easier to update the information digitally than in a traditional system[3].

Further, GIS can help support parking (structured and unstructured, on-site, off-site) visualization and analyses, potentially in real time, to ease campus congestion and increase customer satisfaction[4].

3   GIS Model Building Process Definition

In this study, modeling processes are divided into five major phases, which is interrelated to one phase to another. In order to clearly understand process of building model for parking site selection we will describe all phases one by one, according to Modeling for Mapping and Analysis Task Lists:

- Phase One: Build up desirable area for new parking sites map
- Phase Two: Build up desirable area for new parking sites by distance map and Build up Qualified land-use and area map
- Phase Three: Build up Population and Employment density with more than 2000 people on one SQKM map
- Phase Four: Build up general suitable parking sites map

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