

URBAN ROAD NETWORK ANALYSIS USING GIS SOFTWARE: A REVIEW

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Abstract: *The urban road network infrastructure vital role in the development of the city. It is the key city social-economy activities and transportation carrier. now a day due to high increasing the number of vehicles and those things have to be proportional to the condition and good infrastructures of road. Due to this the planning and proper management of road is essential for good mobility of peoples and goods with in the city. To prepare the main advantage of using GIS software for this analysis is to combine spatial and non-spatial data together as the same time for better result as well as for usage of the output information for further purpose. Hence, this report tries to analyse road network of the city using ARCGIS software by using suitable and appropriate road network data.*

KEY WORDS : Accessibility; Road Network; GIS; Route; Spatial Analysis

I. INTRODUCTION

The Transportation System is a critical component of urban infrastructure and the link of the city. It plays a significant role in the economic growth of that region. An efficient route planning and accessibility facilitate and produce sustainable development. Presently, data regarding road locations and their characteristics is stored within geographic databases which enable numerous Geographic Information Systems (GIS) applications. Road network data allows to enable a variety of services and source of information which include satellite navigation, healthcare accessibility planning, route-planning, transportation system modeling, as well as road infrastructure management and traffic system management. Network Analysis helps in identifying optimum locations with consideration of distances for services to be provided in a region. In this study, some service centres and road in part of Vadodara city area have been selected for the network Analysis. Complicated networks data of roads require analysis to expand the movement of people, goods, services, and the flow of resources in well manner. To perform this works Geographical Information System (GIS) software is used to determine the quickest way or the shortest way between those locations in accurate analysis by using spatial and non-spatial(attribute) data's. The non-spatial data of the road network is collected to develop the database(catalogue) of road network and an optimal route. An optimal route representing the total distance of route in meters as well as in minutes are established. The result of analysis includes the directions to travel on that route.

II. REVIEW OF LITERATURE

Ritesh R Kakade, 2013, Studied to prepare road network analysis using geo-informatic technique for Akola city which discussed on network Analysis aims at finding solutions to routing problems related to reversibility, rate of flow, and network connectivity. It helps in identifying optimum locations for services to be provided like finding the closest hospitals to an accident, the closest police stations to a crime scene and the closest store to a shopper's address by easily finding a simple route between the required locations or one that visits several locations, people usually tries to take the best route.

Hu Weeping, et.al, presented three main road network accessibility evaluating indicators, introduced theory basis of the model construction in detail, and the model of construction process. Using Foshan city as an example, this model was tested using the urban road network data. Lastly, further urban road network accessibility evaluation models are deliberated on this study.

Parveen Kumar, et. al, 2013, Studied on Network Analysis using GIS Techniques: by using network analysis tools shortest route was created amongst two different locations, which is more effective in terms of subsequently and less time, cost spent in travelling. Shortest route analysis finds the path with smallest cumulative impedance between nodes on a network. The route may connect just two nodes which are an origin and a destination or have specific stop between these two nodes.

Gopala Raju, et.al.,2012, studied on analysis of road network using GIS is carried out with an idea to connect major roads in Visakhapatnam in the shortest route as possible. The required data has been collected from Google Earth, Geo referenced in ERDAS imagine and then represented using ARC GIS software applications. The major roads networks in city have been identified and digitized by classified, major junctions and landmarks that are represented. The shortest route between any two points within the road network is determined using GIS. The work also can be prepared to generate a traffic control mechanism provide many solutions to develop fastest route, closest service area and closest facility etc.

Sanmarga Mitra, 2014, studied on preparing a methodology for evaluation of a city-level road network for Passenger Transportation in Kolkata city, which identified that data and information available in most Indian cities are also inadequate. The methodology for evaluating the city-level transportation network developed and an attempt to provide a decision-making mechanism within the limitations of data and information characteristic of Indian cities.

Sarbjeeet Kaur, 2013, studied on Shortest Path Finding Algorithm Using Ant Colony Optimization, this paper presents an Ant Colony Optimization based algorithmic approach on find the shortest path in the network using dynamic system. The algorithm presented in this study no longer operates in well-defined restatements. The significances of this modification are that applying global updates to pheromone levels becomes unreasonable. Instead of this, the algorithms presented in this study only use local updates by exploration or primer ants. This

restriction makes the algorithms more easily deployed in spread environments. With the help of double tie experiment pheromone concentration is analysed at different time. Lastly, it is able to find the size of pheromone on the shorter pathway to grow faster than on the longer one and therefore, the probability with which any single ant chooses the path to follow is quickly biased in the direction of the shorter one.

Mostafa Abdel, et.al., 2011, The paper presented on the road network in New Sohag to introduce a theory-based model construction in detail, including the construction process. Taking New Sohag city in Upper Egypt as an example, the models were tested using the urban road network data. Finally concluded that GIS is an important tool for the success of the new urban development strategy employed by the Egyptian government to facilitate informed decision-making in its planning process. He visualizes the road system in the terrain to see how it is designed and how it fits with the natural conditions.

Sidhtharthan.et. al., 2015, studied on road network analysis of pondicherry union territory using GIS, Network analysis has been conducted on the study area with effective field study. Network dataset for the study area is created and various analysis such as new route, Service area analysis, closest facility, OD cost matrix, Vehicle routing problem, Location allocation has been performed and presented with the corresponding layout.

Idhoko K.E, et al, 2016, studied on has done by using geographic information system (GIS) to for the analysis the basic to answer on how to accessible one location is to another location effective and efficiently. For the collection of attribute data Social survey was carried out using oral questionnaire and personal observation. The geospatial datasets were georeferenced and link with attribute database by using the ArcGIS software. The inclusive aim and objectives were completed based on the spatial analysis carried out for accessing places and facilities within the city by establishing the minimum path travel, distance, time for effective emergency response services and also for solving travel sales man problem and expand the standard of life with in the study area.

Jemil Awel, 2007, studied on GIS based road network analysis in the sub city of Addis Abeba, which is intended to use GIS as a tool in analysing, integrating and displaying information. The overall activities of the work were concentrated around sub area selected as the study site in the Arada sub-city (kifle ketema) of the main capital, Addis Ababa. To establish the use of road network analysis, this project focused on determining the best route between two destinations, the closest facility from a given incident, and a service area for a given facility.

III. SUMMERY

The system of archival of (road transport system) road data prevalent in most cities are through outmoded road maps, engineering drawings and road statistics registers. Huge and scattered data, maps in different formats and scales, difficulty in retrieving the statistical information of a map feature etc. were some of the irritants in the prevalent system. A need was increasingly felt in the organizations to have a more scientific and systematic approach for the archival of maps and retrieval-of-statistical-information. Maintaining existing roads and building new ones are challenges for any growing municipality. Without coordinated digital tools for planning, scheduling, and performing work. Status reporting was activity based and did not address asset-based accounting or inventory. When we observe Google earth, it provides information only the route that can be followed between any two points selected, but the route would be shown by using the major roads only, but network analysis should have to include information on road infrastructures of within city, vehicles volumes with in the city to evaluate the capacity and the usage of the major and minor road links in addition to when we are doing analysis of the road network we have to consider current information on the road and other additional traffic data for better analysis. The main advantage of using the analysis of network is to combine spatial and non-spatial data together for better result as well as for usage of the output information for further purpose. Generally, With the help of ArcGIS, it would overcome these problems by showing the shortest path weighing all the routes available between the points selected by using information on the route that is provided would be the best considering all the alternatives. The work done would be helpful in further developing new service area, closest facility, fastest path, etc. Therefore, by improving different methods it is possible to analysis the required road network information. preparation of road network information system to improve decision making associated with emergency planning, response, regaining, moderation efforts and transportation planning has been identified within the study area as a problem for this study.

REFERENCES

- [1]. Ajay D. Nagne, Bharti W. Gawali, "Transportation network analysis by using Remote Sensing and GIS a review", International Journal of Engineering Research and Applications (IJERA), 2013.
- [2]. Atsuyuki Okabe, Kei-ichi Okunuki and Shinno Shiode, A Toolbox for Spatial Analysis on a Network. Geogr. Anal., 2016.
- [3]. Er. Sarbjeet Kaur, "Shortest path finding algorithm using ant colony optimization", International Journal of Engineering Research & Technology (IJERT), 2013.
- [4]. Gopala Raju, Durga Rani K, Balaji, "Analysis of road network in Visakhapatnam city using geographical information systems" Indian J. Innovations Dev., 2012.
- [5]. Hu Weiping, Wu Chi, "Urban road network accessibility evaluation method based on GIS Spatial analysis techniques", The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences, 2013.
- [6]. Idhoko K.E, Ndiwari, E. L., Ogeh, V. C., & Ikegbulam, S. C., "Urban road network analysis of Yenagoa, Bayelsa State Using GIS", International Journal of Engineering and Computer Science ISSN: 2319-7242 Volume 5 Issue 1 January 2016
- [7]. Michael t. Winn, "A road network shortest path analysis", Northwest Missouri State University, Utah January 2014.
- [8]. Mostafa Abdel-Bary Ebrahim, and hab Yehya Abed-Elhafez, "Planning road networks in new cities using GIS", The Case of New Sohag, Egypt, 2011.
- [9]. Praveen Kumar Rai, "Network analysis using GIS", International Journal of Emerging Technologies in Computational and Applied Sciences (IJETCAS),2012.
- [10]. Ritesh R Kakade, "Network Analysis Using Geo-informatic Technique for Akola City", Maharashtra State, India, 2013.
- [11]. Sikdar, P.K., Durai, B. K., Rao, I.P., and Jain, P.K. "GIS Based Highway Information System." National Seminar on "Road Transportation in India-Emerging Trends and Technologies, ROTRAN, IIT Kharagpur, 2002.
- [12]. Sanmarga Mitra, "A Methodology for Evaluation of a City-Level Road Network for Passenger Transportation: Case Study Kolkata", International Journal of Engineering Research and Applications (IJERA), 2014.

- [13] Sidhtharthan, Durgadevagi, "Road Network Analysis of Pondicherry Union Territory Using GIS", International Journal of Technical Innovation in Morden Engineering & Science, Volume 2, 2015
- [14] Williams, H. C. W. L. "On the formation of travel demand models and economic evaluation measures of user benefit," Environment and Planning A, 1977

