

Transportation Network and Road Accident Analysis: A Case Study of Khandwa City-A Review Paper

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Abstract - Due to rapid globalization and increase in population need for infrastructure is rising rapidly. Transportation infrastructure act as a keystone in the overall development of society. To forecast the future traffic population transportation network models are to be developed for Khandwa city located in Nimar region of Madhya Pradesh. In study of accidental analysis of Khandwa city is to be performed. For this use of QGIS software for black spot analysis and evaluation of accidental severity index along various major sections of roads are to be done. Here in this paper, various literature related to this have been presented. Methodologies for model development, analysis have been suggested.

Key Words: Transportation models, Black spot, Accident severity index

1. INTRODUCTION

1.1 Transportation network modeling

The first step involved in modeling is Survey. For this study 2 types of surveys are to be performed: Home based surveys and non home based surveys. Vehicle counting at peak hour is also to be done during peak hours. Transportation modeling involves four stages: Trip generation, Trip distribution, Modal split, Trip assignment. Trip generation is based on average trip rates in a selected study area. It includes Home based trip as well as non home based trips. The generated trips from each zone are subsequently allocated to all other zones. Here origin destination matrix is developed. In third stage modal split analysis is to be performed, distributed trips are distributed as per mode choices. Mode choice analysis allows the modeler to choose which mode of transportation will be employed. In last stage number of travelers through each route is calculated and finally results are to be displayed in the form of network for different modes

1.2 Road accident analysis

According to the United Nations, one death occurs every four minutes on Indian streets, making it the world's most accident-prone country. Here for Road accident analysis the area selected is Khandwa city located at 21.83N, 76.33E. As per Census 2011 population of city is rising at rate of 11.04%. Various data required for accident analysis are to be collected from government departments which include

Nagar Nigam, Statistics department, Regional Transport office, Yatayat police station Khandwa. All these datas will be segregated and analyzed using various softwares such as Microsoft excel, QGIS. Suggested measures for minimizing road accidents are to be given.

2. LITERATURE REVIEW

2.1 Transportation network modeling

- **L.C. FREEMAN (1997)** has done research to develop social network analysis. Here special emphasis was given to important events that took place during those days. In sociological approaches communities are found out and empirically derived data is used for the analysis. Hierarchical clustering approach was used. Various methods for extracting communities out of the networks like single linkage method, complete linkage method.
- **M.E.J. Newman (2004)** did research in detecting community structures in networks. Here various approaches were discussed such as Traditional approach, computer science approach and sociological approach. Also, various functions such as benefit functions in Kernighan-Lin algorithm was used in case of computer science approaches. The authors have also discussed limitations of various methods. Finally various algorithms developed by M.E.J. Newman and Girvan, Wu and Huber man, Tyler et al and many others were studied. Bottlenecks of various algorithms have also been discussed.
- **Aman Arora and Manish pandey (2011)** did their research work aimed at finding solutions to routing problems. Area around south Delhi was used for network analysis. The author have found several irregularities like distribution of SBIs (state bank of India), various ATM (Automated tailor machine) etc. The author has emphasized on use of GIS as a tool in road network analysis. There were 4 kinds of datas broadly used: Google earth data, field collected data, web collected data and GIS data. The authors have also used ArcGIS 9.3, Google earth; MS excel software for their research work. Finally solutions to various problems identified in research work were found.

- **Bayes Ahmed (2012)** here author have discussed about traditional four steps transportation modeling using simplified transportation network: A case study of Dhaka city, Bangladesh. This study provides insights about transportation modeling process of Dhaka city. The cities have been divided into 10 zones. The models studied respectively are Trip generation, Trip distribution, Modal split and Trip assignment. All four models were analyzed. Dijkstra algorithm was used during modeling process. Microsoft visual C++ was also used at Trip distribution stage. Finally in last stage of Trip assignment generalized travel cost and generalized travel time have been found out and total number of vehicles was found out through each mode for different links. The results are represented graphically in a network format.
- **Andras and Andor Haznagy (2015)** have done network analysis of 5 Hungarian cities. The main aim was to identify similarities in various transportation networks of the cities. Two approaches were used for analysis weighted and un-weighted approach. And the results were compared. The most sensitive routes were identified and organizational consistencies were detected. Various Global network characteristics like Diameter, Average path length, Eccentricity distribution, Degree distribution, Community structures, Degree centrality, Local average connectivity, Closeness centrality, Betweenness centrality, Page rank centrality were studied. Finally various models were created for various transportation networks for different cities and the results were compared graphically.
- **V-G Stinga (2017)** has researched over finding out optimum transport route in a transportation network. In this research modeling of transportation network is done through an equilibrated transport problem. First a network is assumed and then Bellman and Kalaba's algorithm have been applied in order to find out optimum route transport. These models can be used for maritime.
- **R. Thapa, J.K. Shreshtha (2019)** did their research work aimed at finding optimal route of public transportation for pokhara city. The authors have used two stages to reach the final conclusion. In first stage impedance of bus trips were identified and in the second stage the collected data were analyzed. Microsoft visual 2017, Dijkstra algorithm was used for this purpose. For data analysis first the bus stops were ranked; each bus stop representing nodes a graphical representation of weighted graphs between nodes was formed. The network was optimized based on minimum travel time. Similar

procedure was adopted for optimizing transport network through minimum travel cost.

2.2 Road accident analysis

- **Sanjay Kumar Singh and Ashish Mishra (2004)** have done Road accident analysis of Patna city. Rise in population and limitation in spatial extent was shown as major concern for daily road accidents. This research paper makes an effort to highlight this scenario. Various Road accidents data were collected from various government departments of Patna city. Accident severity index, fatality and risk indexes were found out and accidents were categorized as per those indexes and were further subcategorized into age groups, weather conditions, type of vehicles used, time of accidents and location of accidents. Finally based on these studies accidents prone areas were identified for Patna city.
- **Aznarul Islam (2011)** did analysis of road accidents in Krishna nagar located in West Bengal. The author tried to focus on patterns on road accidents and their causes. The passenger's satisfaction regarding road safety has also taken into account. First the study area has been selected after studying that area for five years. Various primary and secondary data have been collected. The author has also used software tools MS excel, word to showcase the patterns. Rapid growth in number of vehicles, little coverage of area by roads, Overtaking, Technical problems of old vehicles have also been identified as major cause of road accidents in Krishna nagar region. Here suggestions to reduce number of accidents have also been provided for example separate provision for motorized and non motorized vehicles, flyover constructions, replacement of two way traffic with one way, increasing number of public transport modes etc.
- **George Yannis, Eleonora Papadimitriou (2012)** have done research to analyze the road safety situation and development over time in Greece. For this purpose sunflower footprint methodology was adopted. This model allows all aspects of road safety problems. Various indicators such as Road safety performance indicators. The authors have also portrayed attitudinal culture towards risk taking while driving. Rate of seat belt users, helmet wearing rates for drivers, front passengers, Rear passengers have been studied. Through this research Greece has been identified as the worst performing country amongst European Union states. The social cost of road accidents in Greece obtained from the research was estimated to be more than 4 billion Euros.

- **Amin Naboureh et al. (2019)** have done modeling of Traffic accidents. In this research significance of Road emergency stations (RES) in Khuzestan province, Iran was analyzed through fuzzy analytical hierarchy process (FAHP) and GIS. First site was selected for RES by adopting various criteria's. The area that was selected was Khuzestan province which is the centre for trade and commerce, pilgrimage. Topographic data was derived from Shuttle radar topography mission along with field information data. Here Fuzzy set theory deals with uncertainty associated with measurement indicators. Various evaluation criteria's for RES were analyzed after which fuzzy maps were prepared for each criterion

3. SUGGESTED METHODOLOGY

After going through various literatures and their methodologies it is observed that for developing transportation network model and Road accidental analysis certain steps are to be followed.

3.1 Suggested methodology for developing Transportation network model

Most of the research papers in this context deals with optimum route computation in Transportation network, the ways in which accuracy of the results can be increased. This collected inventory will be useful in last stage of Trip assignment model in which a network representing all six zones of Khandwa is to be selected. The following steps will be performed:

- Home based, non home based and vehicle counting surveys are to be performed.
- Population, population growth and employment data is to be obtained from various government departments of Khandwa region.
- Computation of Trip generation, Trip distribution, Modal split and Trip assignment modals as per prescribed procedures mentioned in former literature reviews.
- Transportation network diagrams of final forecasted models.

3.2 Suggested methodology for Road accidental analysis

Most of the research papers in this context deals with quantifying accident data so that certain preventive actions during designing as well as in operational phase can be followed. The following steps will be performed:

- Accident data from Yatayat police station, R.T.O., statistics department Khandwa.

- Accident analysis based on age, type of vehicle, weather and location is to be performed.
- Black spot analysis using QGIS software.
- Accident severity Index calculation and field inspection of sites.

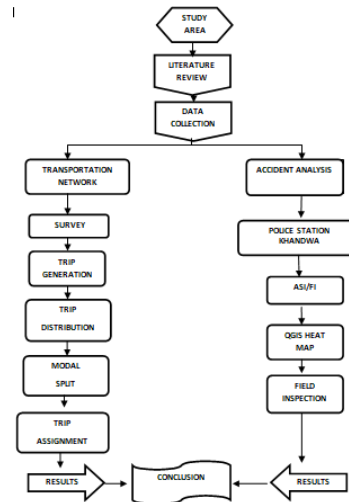


Fig -1: Methodology Chart

4. CONCLUSION

The study of Transportation network modeling will provide data for Travel forecast along different route links connecting all six zones. While Road network analysis will provide analysis and suggestions for minimizing Road accidents in new future. Interco relation between Transportation model and network analysis will be beneficial for developing integrated Transportation infrastructure and minimizing Traffic risks in near future.

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