PLANNING OF TRANSPORT NETWORK OF NADIAD CITY USING GEO-INFORMATICS TECHNOLOGY

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Abstract - *Road network system is important for any city as it provides the means for people movement transportation of goods and other emergency services like ambulances. Inefficient road network system will disrupt the transportation movement, environment and affect human movement and quality of life. A good road network can improve and generate many things into improvements of town and its surroundings. Nadiad is a recently form district of Gujarat state requiring detailed network analysis for the development of communication system including roads connecting within the district and with other area adjacent to the Nadiad city with industries, hospitals, Education centers, airport, railway station and bus terminal et.. The area is generally flat occupied by mainly three types of soil alluvial, well-drained calcareous and coarse loam. Network analysis is being carried out to solve the problems pertaining to spatial networks including the most efficient travel route, generating travel directions, locating the closest facility, and defining service areas based on travel time and distance covered using geo-informatics technology.*

Key Words: **Network Analysis, Transport Planning, Geo-Informatics System (GIS)**

1. INTRODUCTION

Urban transportation planning is the process that leads to decisions on transportation policies and programs. In this part of process we have to identify to existing transport, highway facility, parking restrictions etc... The fundamental objective of transportation is to provide efficient and safe levels of mobility required to support a wide spectrum of human needs for a heterogeneous variety of societal groups. After all this process we can easily identifies a goal theirs needs on basis of study and set objectives' too. The important steps of the transportation planning process are as given below:

Step 1: Forecasting target year population and economic growth for the subject metropolitan area.

Step 2: Allocation of land bases on its use and its future growth on that basis.

Step 3: Specification of alternative transportation plans partly based on the result of Step 1 and Step 2.

Step 4: calculation in detail and of alternative also.

Step 5: Application of calibrated demand – forecasting models to predict target year equilibrium flows expected to use each alternative, given the land use and socio–economic projection of Step 2 and the characteristics of the transportation alternatives (Step 3).

Step 6: conversion of flows it can directly get benefits is saving of travel time and cost.

Step 7: Comparative evaluation and selection of the best of the alternatives analyzed based on estimated costs (Step 3) and benefits (Step 6).

This gathering data helps to take multi and alternative decisions

1.1 Solution Generation and Analysis:

Based on problem definition, transportation planners have to identify various alternatives and make choice about-

Various modes like roadway, railway, waterways or airways. The technological aspects like we can provide monorail, high speed rail and metro too and provide drivers information's too.

Traffic engineering aspect such as changing or improving flow pattern by making certain road one way, reducing delay on Arterial Street by improving signalization or grade separated intersection, disallowing certain

movement at intersection. Regulatory aspect such as reserving land for only high occupancy vehicles, disallowing high polluting vehicles, imposing speed limit.

2. Network and Network Analysis

A transport networks shows the flow ad permitted route and restrictions too that we can do in spatial analysis' and shows in network analysis' after setting network dataset of that particular areas.. Network is whole system that shows all its interconnects and its alternatives too. It include network of roads and streets, railways, pipes, aqueducts, and power lines.

Any method of solving traversability, movement, rate of flow, volume transfer is a type of network analysis.. It is used for identifying the most efficient routes or paths for allocation of services. Main objective of transport network is to understand the existing road network of the city in terms of connectivity and development and to develop a surface transport network system to reduce travel time, cost and alternatives routes for considering of city planner and authorities.

A good road network system can generate economic growth, physical transformation and improved system of maritime connections.

Traffic and transportation is a important part to provide network cause its shows the origin and destinations to for transport any kind of things.

Network is an interconnected set of points (nodes) and lines (edges) and it is Connectivity allows for analysis/problem solving. As example: Information networks, Social networks, Stream networks, and Transportation networks

Networks are all around us. Roads, railways, cables, pipelines, streams and even glaciers are phenomena that frequently need to be represented and analyzed as a network. Any network or transport network means divided and sharing or transferring or migrating goods, communications, in formations, freights and man too. A network is one of amongst 5 eternity types.

A network can be divided into research of flow. Nodes (the end points of lines) are used as origins and destinations, and links (lines) Travers from one node to the other.

A number of workers have given different classification of network. One of the classification widely used is of Laurini and Thompson (1992). They suggest there are four main types as below:
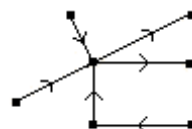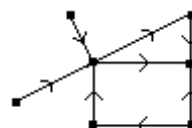
1) Unoriented
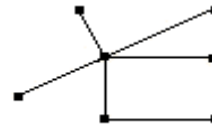
2) Unoriented with loops
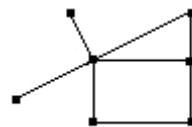
3) Oriented

4) Oriented with loops

3. STUDY AREA (NADIAD CITY)

Nadiad (22.7°N 72.87°E) is a part of kheda district in Gujarat state and having a total area of 45.16 km2. Population of Nadiad is 225,132 as per the census of 2011. It lies on the Western Indian Railways lines that connect Ahmedabad-Mumbai. The city lies in the center of Kheda district and is an important contributor in terms of business as well. This town of Nadiad falls in the border of the districts such as the Kheda and Anand, with 185 villages and 67 panchayats.

It has an average elevation of 35 meters (114 feet). The area is occupied by mainly three types of soil alluvial, well-drained calcareous and coarse loam.

Figure-1 shows the study area of the Nadiad city.

Fig -1: **Showing study area**

4. METHODOLOGY

For the network analysis of the Nadiad city methodology has been framed which includes following steps:

1) Data Sets:

A Google earth satellite imagery, which has geo-referenced in ArcGIS, has used for the network analysis of the Nadiad city. The data sets are prepared out of the collected data. These data are grouped based on the requirement to analyze the present condition of area. After analyzing it is forecasted to predict future growth. For data sets two types of methods are used for the network analysis of the Nadiad city.

4.1 Linear Referencing

The process of using a network for reference is termed linear referencing. Linear referencing help to find network based problems. it has been applying for finding black spot, incident locations and volumes that can shows in map by street views., and performing asset management functions such as the recording of pavement conditions or the location of street signs, bridges, exits, and many other traffic-related objects .there are following methods which we can use (Fletcher et al. 1998; Scarponcini 2001), methods (Noronha and Church 2002; Nyerges 1990), and data models (Curtin et al. 2001; Dueker and Butler 2000; Koncz and Adams 2002; Sutton and Wyman 2000; Vonderohe et al. 1997) available for implementation.

4.2 Routing Across Networks

Currently implemented network GIS tools are dominated by routing functions. Routing is the act of selecting a course of travel. The most common objective in routing across networks is to minimize the cost of the route. Cost can be a function of distance, time, or impedance in crossing the network. There are many methods to find out optimum route but widely used method is given by Edsgar Dijkstra (1959).shortest path the we can find out in network analysis.

These functions are:

- Finding a route between point locations;

- Determining the service area for a facility;

- Finding the closest facility across the network and

- Creating an origin–destination matrix.

2) Data processing and Analysis:

For the data processing following steps were taken:

-Geo-referencing of Nadiad city image

-Generation of Shape file of hospitals, schools, colleges and fire station

-Digitization of road network

-Generate topology

-Generating Network Geo-dataset

Methodology also includes gap finding, future scenario forecasting, image interpretation and natural topography marking of the area.

5. NETWORK PLANNING STUDY OF NADIAD CITY

Nadiad (22.7°N 72.87°E) is a part of kheda district in Gujarat state requiring detailed network analysis for the development of communication system including roads connecting within the district and with other area adjacent to the Nadiad city with industries, hospitals, Education centers, airport, railway station and bus terminal et..

Network analysis is being carried out to solve the problems pertaining to spatial networks including the most efficient travel route, generating travel directions, locating the closest facility, and defining service areas based on travel time and distance covered using geo-informatics technology.

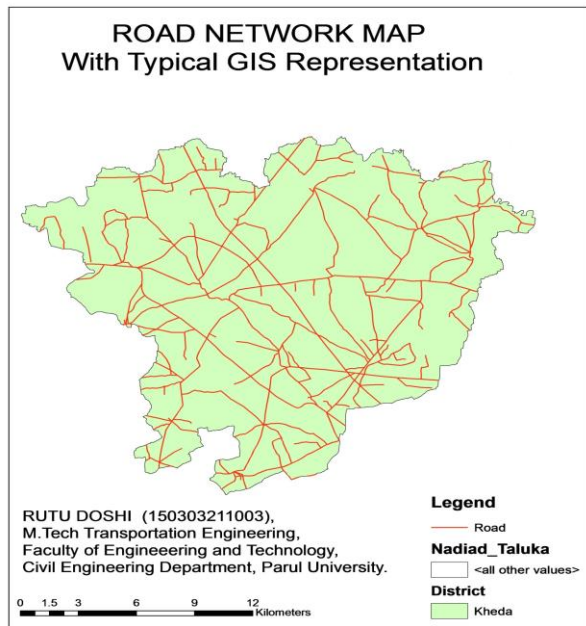Figure-2 shows the typical road network map with GIS representations.

Fig -2: **Typical road network GIS representations**

Gap analysis is essential for the future development of any city. Nadiad district is one of the fastest newly form district of Gujarat state and in future it may be developed as smart city. In this view gap analysis of transport network has been done and results have been summarized in the Table (1).

Table 1: Gap analysis of Transport Network of Nadiad City

Core features	As per Smart Cities Guideline, Government of India	Present condition of Nadiad City
Transport	↓ Maximum travel time of 30 minutes in small & medium size cities and 45 minutes in metropolitan areas ↓ Continuous unobstructed footpath of minimum 2m wide on either side of all street with RoW 12m or more ↓ Dedicated and physically segregated bicycle tracks with a width of 2m or more, one in each direction, should be provided on all streets with carriageway larger than 10m (not RoW) ↓ High quality and high frequency mass transport within 800m(10-15 minute walking distance) of all residences in areas over 175persons / ha of built area. ↓ Access to para-transit within	↓ Takes 45min to reach Vododara and 60 minutes to Ahmedabad. ↓ No footpath present. ↓ No segregated bicycle track. ↓ Transit system- No transit system to connect Ahmedabad, only GSRTC or private vehicle is the mode with bus at frequency

300m walking distance.	of every half hour running from Nadiad. - More congestion on road leading to Highways - Lack of street lighting leading to accidents. - No logistic park or route assigned.

Planning for the proposed transport network has been done considering population growth, industries and other need of the developing city. For this network data model has been adopted.

6. THE NETWORK DATA MODEL

The network data model is a special type of the node-arc-area data model that underlies many basic vector GIS databases – is built around two core entities: the Node (a zero-dimensional entity) and the Arc (a one dimensional entity).the current data model is showings of arcs and nodes in that area. The panning person needs to embedded the consent data of topographical.

Following are some of the thematic layers which have been considered in the network analysis for the future development of the city.

Figure-3 shows the Landuse map with typical GIS representations.

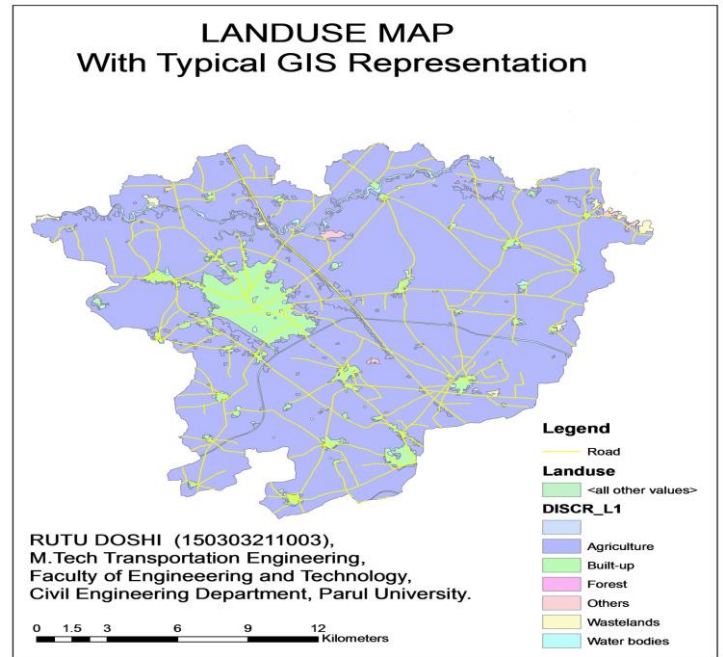Figure-4 shows the Drainage map with typical Gis representations.

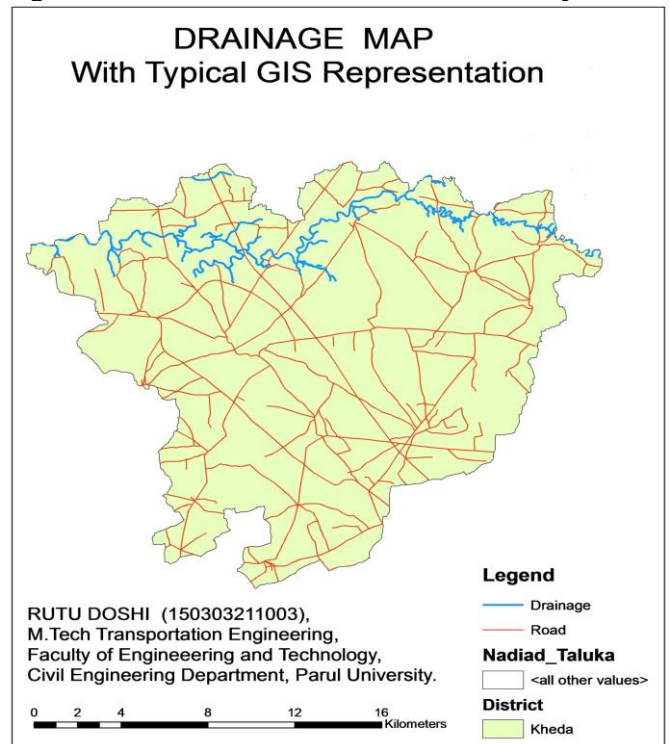**Fig -3**: **Road Network overlaid on land use map**

Fig -4: **Road Network overlaid on drainage map**

7. Discussion and Conclusion

Nadiad is an over densely populated city and its transport system is mainly road based with mostly non-motorized vehicles (predominantly rickshaw). Nadiad is experiencing lots of traffic congestion and a great lack of traffic management. Nadiad city is developing very fast requiring proper communication system for providing adequate and quick services to the industries, offices, hospitals and education institutes. Detailed study of the present transport network system of the Nadiad is being carried out for proper planning of the road network system considering future needs as a smart city. Gap analysis has also been done with the help of existing city maps and future master plan of the area. At present nearest airport connecting Nadiad is at Ahmedabad which is more than 68 km. appropriate airport site at Nadiad is being identified with the help of GIS study near the city. Different thematic maps have been generated and overlaid for the analysis to identify the locations of bridges, infrastructures, land use, hospitals, education institute etc. So this study tries to analyzing the use of various GIS tools for network analysis. Using network analysis tools number of things can be analyzed which are more relevant for different type of network analysis especially for transport planning we can create this type of analysis for different purposes like shortest path analysis, closest facility analysis, service area determined analysis and also for the best recourses allocation and for the creating of emergency route services. This type of analysis is very crucial especially for the transport based planning. The present study will help in transportation planning and for providing proper communication not only for Nadiad city but also for another developing city.

8. ACKNOWLEDGEMENT

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