ASSESSMENT AND PLANNING OF SURFACE TRANSPORT NETWORK OF KAPADWANJ CITY USING GEO-INFORMATICS TECHNOLOGY

[1]Aatish Patel, [2]Smit Bhatt, [3]Srinath Karli

[1]Student, [2]Professor, [3]Assisant Professor

[1]Department of Civil Engineering,

[1]Hasmukh Goswami College of Engineering, Vahelal, Ahmedabad, India

Abstract: Rural population faces pull-push by the metro for their employment which further tress out on developed region in terms of infrastructure requirement. The unexpected population rise will not meet the planned supply of the basic services. On the other hand, people choice for the residential will also depend on independent choice and create many issues with the planner parameter of the region. This can be tackled using planning an area which is regionally balanced. 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. Networks are used to move people, transport goods, communicate information and control the flow of matter and energy. It is not surprising then that techniques have been developed to analyze these most geographical phenomena. 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 system can generate economic growth, physical transformation and improved system of strategic connections. The main objective of this study is to develop a surface transport network system to reduce travel time and cost. Existing routes of Kapadwanj City have been studied and alternative routes have been suggested for proper planning of road network system using GIS. 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: Kapadwanj City, Surface Transport System, Transport Planning, Network Analysis, Geo-Informatics System (GIS).

I. INTRODUCTION

1.1 GENERAL

Indian states are becoming more and more urban and has witnessed urbanization rate of 32% in the year 2011. This increase in the population put burden on demand and supply of the primary infrastructure in urban areas. Also at the same time changing lifestyle of the urbanisms stressed on basic infrastructure. On the other side, under developed or undeveloped rural, small and medium town's population try to push themselves in search of employment and better infrastructure which tends to end up as the migrants of developed urban areas. The villages or towns neighboring to the metros may rely on that metros for their needs, but in absence of such metros in regional context, they are migrating to the other developed region. The migrated population, due to the industrialization and more urbanized region, try to settle in the developed region which results into the requirement of more infrastructure provision. This unexpected migration will create false estimation of demand in cities after 20-30 years down the line. In the above context, it is also observed that the areas/region developed as the industrial area in absence of basic amenities and lack of infrastructure are not accepted by the workers or employees as the residential location choice and hence they select residential area in nearby metros.

As an urban planner, it is difficult to measure the demand and supply due to the unexpected growth of migration and is also difficult to predict the choice behavior of the workers or employees. These challenges are taken up by developing better regional balanced area planning. Second issue in the small and medium towns, urbanization scenario changes as we go from core city to outer peripheral area. These changes are observed in land use, density, economic activity, etc. because of the time gap in implementation of the plans. In order to propose the development plan of an area, it is essential to study its existing condition and its future need which was lacking in the past plans along with the time frame of its completion.

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.

TO DATE, MOST development theory and practice have focused on either "urban" or "rural" issues with little consideration of the interrelations between the two. By contrast, several empirical studies show that the linkages between urban centers and the countryside, including movement of people, goods, capital and other social transactions, play an important role in processes of rural and urban change. Within the economic sphere, many urban enterprises rely on demand from rural consumers, and access to urban markets and services is often crucial for agricultural producers. In addition, a large number of households in both urban and rural areas rely on the combination of agricultural and non-agricultural income sources for their livelihoods.

II. LITERATURE REVIEW

2.1 Ministry of Urban Development, India. 2015 : In this report, the government of India specifies the areas which are of target to develop a city as smart city. Based on the areas, the innovative smart solutions are also listed down which any city can follow to become smart. The framework of the entire process of development is briefly discussed so that implementation can be done in the limited span of time.

From this document, the parameters upon. which any city can start with are clearly mentioned irrespective of the status of the city. The development can take place in four form: Redevelopment, Rejuvenation, Regeneration and PAN city project in which the different areas of the city will be targeted to improve services to its citizen.

2.2 Allbino V, Berardi U &Dangelico R, 2015. : The term Smart city was first coined in 1990 which focused more on new ICT for modern infrastructure. But later, as this is technical oriented, this approach was criticized and converted to governance oriented. Smart city means interconnected, instrumented and intelligent city. Another definition is it is the center for higher education, better educated people and skilled workforces known as knowledge city.

"Dimensions of smart city upon which the city should be designed are different for different authors viz. education, economy, infrastructure, quality of life, technology, mobility, citizen, governance, and environment. Various approaches are done in smart city direction by various cities but they all focus on one direction only. So if integration of all this takes places then a real fully operational smart city can be made"

2.3 Birmingham Smart City Commission. 2014. : "Smart city is an inclusive city that values and supports its communities to solve the problem. Smart Birmingham implies a concentration of dynamic, innovative young businesses providing all sort of services and solutions. To make Birmingham smart, the strategy adopted is to benchmark other cities and project management.

They create smart city eco-system to work together and create environment. In this paper, Roadmap covers three sections: technology & place, people and economy" This paper gives clear solution for each sections with the action framework that can be followed.

2.4 Stratigea A, Papadopoulou C &Panagiotopoulou M, 2015. : The goal behind smart city development is sustainable urban development. The paper shows why e-participation is important where various actors are involved and how ICT played a major role in it. Various smart city definitions are given focusing commonly on means of communication, networking & goal pursued but the definition adopted is: "smart city is multi-dimensional. It shows strategic development relating internet, technology and people."
Methodological framework is given in which various stages are discussed-

1. Gathering smart city experience: Referring the literature related to global experience.
2. Tools and technology: Data to be collected and stored. And the technology to be used to gather them as well as used by other countries.
3. Smart city planning framework: Learning in-depth about the city, evaluation (Codesign& co-deciding) & action step.
4. Web-platform development: Integrating data and technology with the goal to plan the city.

III. STUDY AREA

3.1 Strategic Location:

Kapadvanj is a Municipality city in district of Kheda, Gujarat. The Kapadvanj city is divided into 9 wards for which elections are held every 5 years. The Kapadvanj Municipality has population of 49,308 of which 25,436 are males while 23,872 are females as per report released by Census India 2011.

Population of Children with age of 0-6 is 5506 which is 11.17 % of total population of Kapadvanj (M). In Kapadvanj Municipality, Female Sex Ratio is of 939 against state average of 919. Moreover Child Sex Ratio in Kapadvanj is around 875 compared to Gujarat state average of 890. Literacy rate of Kapadvanj city is 87.59 % higher than state average of 78.03 %. In

Kapadvanj, Male literacy is around 91.71 % while female literacy rate is 83.24 %.

Kapadvanj Municipality has total administration over 9,973 houses to which it supplies basic amenities like water and sewerage. It is also authorize to build roads within Municipality limits and impose taxes on properties coming under its jurisdiction.

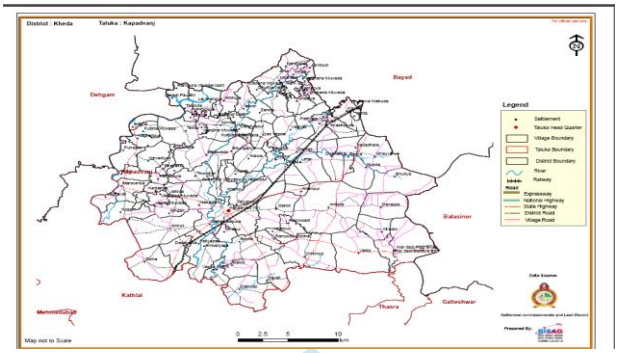


Fig.3.1. Index Map of Kapadwanj

"Kheda district is situated on Southern part of Gujarat State having area of 634.48 sq.kms. Geographically it lies on the Kapadvanj is located at 23°01′N 73°04′E / 23.02°N 73.07°E / 23.02; 73.07. It has an average elevation of 69 metres (226 feet). Kheda is surrounded by common boundaries with four other districts of Gujarat State namely Ahmedabad, Panchmahal, Sabarkantha and Vadodara. On the Southern part, Khambhat Tehsil of Anand district has natural boundary of the Gulf of Cambay with Kheda district. Total geographical area of the taluka kapadwanj is 634.48 sq. km, which amounts to 2.02 percent of the total geographical area of the State. The district is divided into 10 talukas and 617 inhabited villages and 8 inhabited town"

"Kapadwanj lies in the center of Kheda district in Gujarat and is conveniently connected by road and rail network. It is a railway Junction of Gujarat and lies on the Western Railway lines of Nadiad-Kapadvanj and Kapadwanj-Modasa routes. There are plenty of local and express trains that run daily from Nadiad and go via Kapadwanj. The connectivity by Air, Rail and road is very convenient and accessible. The nearest airport to Kapadwanj is at Modasa which is just 63 kms from the city. The praiseworthy highways and road networks connect Kapadwanj to other parts of Gujarat and India"

An important city with history that can be traced to a prosperous past, Kapadwanj has always progressed with time. It is an important city in Gujarat and Kheda district which is developing with every passing day and contributing to the growth story of developed Gujarat.

IV. DATA COLLECTION

4.1 GENERAL:

The present study aims at generating the future forecast scenario which is useful for deciding the demand of future public transportation. So, data was collected in terms of population, density, census, Geo-spatial data, satellite images, public demand survey, O-D survey and remote sensing images which are used for forecasting the population and demand which will be needed in 2021. The type of data collected are as follows:

1. Primary data

Site visit, Observations and Informal Questioning to the head of authorities.

2. Secondary data

This includes data collected in the form of existing reports, census data, annual progress reports, case study and city development plan.

3. GIS data

This involves collection of RS images, maps and other related GIS data useful for the analysis purpose.

4.2 Site visit and observations:

Kapadvanj Municipality, with population of about 49 thousand is Kapadvanj sub district's only municipality located in Kapadvanj sub district of Kheda district in the state Gujarat in India. Total geographical area of Kapadvanj municipality is 19 km2. Population density of the city is 2567 persons per km2. There are 9 wards in the city, among them Kapadvanj Ward No 06 is the most populous ward with population of 8165 and Kapadvanj Ward No 04 is the least populous ward with population of 3579.

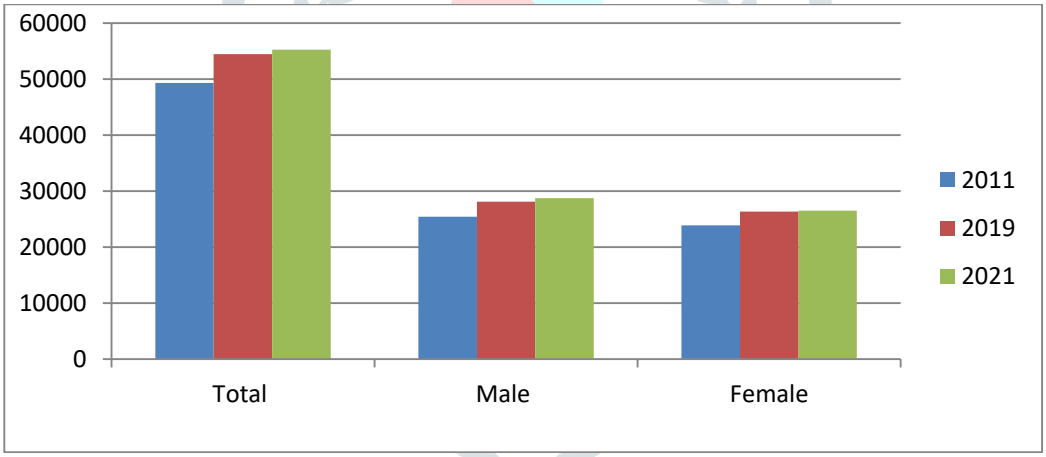
Nearest railway station is Kapadvanj which is within the city. Kapadvanj is the sub district head quarter of the city. District head quarter of the city is Nadiad which is 44 km away. Gandhinagar is the state head quarter of the city and is 70 km far from here. Yearly average rainfall of the city is 960 mm. Maximum temperature here reaches up to 42°C and minimum temperature goes down to 12°C.

Kapadvanj, station code KVNJ, is a railway station in Kheda district of the Indian state of Gujarat, India. It is under the administrative control of the Vadodara Division of the Western Railway zone of the Indian Railways. Find seat availability, train schedule, trains passing through Kapadvanj.

4.3 Demographics

The city is home to about 53 thousand people, among them about 25 thousand (52%) are male and about 24 thousand (48%) are female. 90% of the whole population are from general caste, 5% are from schedule caste and 4% are schedule tribes. Child (aged under 6 years) population of Kapadvanj municipality is 11%, among them 53% are boys and 47% are girls. There are 9973 households in the city and an average 5 persons live in every family.

Fig:4.1 male female population – Kapadvanj



As of 2011 census there are 939 females per 1000 male in the city. Sex ratio in general caste is 938, in schedule caste is 925 and in schedule tribe is 957. There are 875 girls under 6 years of age per 1000 boys of the same age in the city. Overall sex ratio in the city has decreased by 0 females per 1000 male during the years from 2001 to 2011. Child sex ratio here has decreased by 35 girls per 1000 boys during the same time.

TABLE:4.1 : male female population

	2011	2019	2021
Total	49308	54436	55234
Male	25436	28081	28750
Female	23872	26355	26484

VI. CONCLUSION

"Kapadwanj is an over densely populated city and its transport system is mainly road based with mostly non-motorized vehicles (predominantly rickshaw). Kapadwanj is experiencing lots of traffic congestion and a great lack of traffic management. Kapadwanj 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 Kapadwanj 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. 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 Kapadwanj city but also for another developing city.

GIS based models for infrastructure provision will provide benchmark for the urban planners and decision makers to plan for the future needs. GIS, RS can be proved as helping hand for urban planner in decision making of policy. The development mechanism can be used for the similar city/town.'The use of GIS and remote sensing is done for the present work which has proved to be the important tool which can integrate all the maps. The base map of Sanand is used to propose infrastructure by using the operations like georeferencing, spatial adjustment, spatial join, merge, supervised classification, buffer, selection criteria, etc. Usage of GIS tools has proved to be very useful to satisfy multiple criteria selection. This is used in selection of site selection"

"Hence, the analysis of an area is must before publishing any policy. The role of planner is not only in providing route and landuse but is also in making an area most likely for people. The action plan of an area can be made based on the detailed study of area and demand of its people. The parameter upon which to emphasize is also dependent on the socio-economic condition of its people. The integration of all this is somewhere still missing in practice which is covered in this thesis work"

REFERENCES

- **Papers**

1) "Sreelekha.M.G.,Krishnamurthy.K., Anjaneyulu. M.V.L.R.c "Interaction between Road Network Connectivity and Spatial Pattern" Procedia Technology 24 (2016) 131 – 139"

2) "Parveen Kumar and Dinesh Kumar "Network Analysis using GIS Techniques: A Case of Chandigarh City""

3) Facility, Closest, and Service Area Analysis. "ArcGIS Network Analyst."

4) Fang, Kun, Polygon Based Model, and XuYiqin. "Gis Network Analysis in Rescue of Coal Mine." (2001)

- **Books**

[1] Kadyali, L. R. and Lal, N. B. 2007, Traffic Engineering and Transport Planning, Khanna Publishers, New Delhi-110006
[2] S. K. Khanna, C. E. G. Justo, A. Veeraragavan, Highway Engineering, Nem Chand & Bros., Roorkee 247667, India, ISBN 978-81-85240-80-0