

A STUDY OF TRANSPORTATION NEEDS IN RURAL AND SEMI-URBAN AREAS

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Abstract— Rural transport services are often inadequate. Passenger and goods transport needs improving to stimulate rural economies and reduce poverty. Understanding existing rural transport systems and constraining factors is a precondition for appropriate policy action to improve rural access and mobility in order to unlock the potential of poor people in rural areas. The purpose of the study was to develop and test a methodology for the rapid assessment of the provision of rural transport services in developing countries. In this context, rural transport services were defined to include both passenger and freight transport services operating in the range 5- 200 km. This allowed the study to concentrate on transport supply and demand for medium distance journeys within rural areas. The study did not include short-distance transport within villages or long-distance transport along national and international transport corridors. The aim was to develop a methodology that would allow transport planners to obtain, in a relatively short time, an understanding of the existing rural transport situation and provide information that could assist with policy formulation. The challenging task would involve obtaining estimates of the existing motorized and non-motorized services and their costs, the demand for transport services for economic requirement as well as for social, health, educational and community reasons. It would also involve assessing rapidly the regulatory situation and provide some suggestions of ways by which the various services could be improved.

highlight potential solutions. The promising strategies for responding effectively to support economic and community development and provide basic mobility include a diversity of geographic areas and many population sizes. While variations in cultural, geographic, and economic conditions make each area unique, smaller communities are increasingly recognizing that an integrated approach to community development is a key to long-term prosperity and quality of life.

The basic objective of economic policy to attain a higher standard of living and welfare for the people in a country can be achieved only through its rapid economic development. However, to be meaningful, such a development should be balanced, inter-regionally as well as intra regionally, in a large country like India. Experience of economic development in the developed countries in the past shows that economic development has been spotty over space, resulting in developed centres with underdeveloped hinterland. This is true in the case of India also where the bigger cities and industrial centres are found to be developed, though they have their own problems, while their surrounding areas are economically underdeveloped. Economic development of a country in general and of a region in particular, whether urban or rural, requires different types of infrastructural facilities. Even though the infrastructural facilities may not directly result in the production of anything, they are very essential for undertaking productive activities and also, they affect the basic functions of production, marketing and consumption.

1. INTRODUCTION

Nowhere is it more important to take a smarter and more strategic approach to transportation than in rural and small-town communities. The current system for planning, building, and maintaining transportation infrastructure in rural areas falls short of meeting the need for access within small cities and towns and their surrounding regions to jobs, shops, services, education, and healthcare. This paper, developed in consultation with numerous representatives of the interests of small cities, towns and rural areas, provides a discussion of these challenges and addresses the need to provide a more effective transportation system in rural and small-town America. The report identifies principles for improving mobility in these areas and profiles best practices that

2. LITERATURE SURVEY

Transport is the backbone of economic, cultural, social and industrial development of any country besides its two-dimensional role of creating time and space utilities. This sector has not received due consideration either of universities or academic institutions. A little attention is paid by the researchers in the past to evaluate the performance of transport sector. In the word of Alfred Marshall “The transport industry which undertakes nothing more than the mere movement of persons and things from one place to another, have constituted one of the most important activities of men in every stage of advanced civilization.” However recent Research and Development facilities provided by the Indian Universities in the Departments of social sciences, especially Economics, Commerce and Management Sciences and other Transport

related research institutes have shed light on problems and prospects of transport sector.

Tripp Alker. H examines the traffic problem in relate to road, rail, sea and air transport and suggested traffic control measures to reduce accidents and smooth running of the traffic.

Kitchin analyzed operational activities of bus transport irrespective of the size of the organization engaged in bus transport and observed that it should have three main sections viz., traffic, secretarial and engineering and each having clearly defined function.

Bonavia M.R highlighted the role and significance of transport system for the development of a country and suggested the utility of good transport system for industrial, political, social and cultural angles.

A study by Edwin Lowe on the development of transportation system in Japan portrays the transport and communication system during the Tokugawa Era (1600-1686) and explained the process of the development with certain features which ultimately helped the establishment of modern transport system in Japan.

An attempt made by Owen Wilfred on the problems and potentials of transport system by focusing on the mobility of people and goods. A study made by the Ministry of Transport Scottish Development Department emphasizes the free flow of traffic at reasonable speed requires planned improvement of urban road systems. The study also suggested constructing secondary means of access enable goods and service vehicles to load and unload at the stops.

Denys Munby opined that the cost of transport influences the size of cities, number of production units, choice of job in general and the quality of life of human beings in particular. Leeming J.J. examined the road accidents in Great Britain and observed that the behavior of drivers, their habits, carelessness and drunkard driving are responsible for accidents and also stated that they must be punished severely.

John Hibbs explained various approaches to study the concept of transport along with its control aspects. Gerald Kraft felt that economic development of a region will be influenced by the capacity of transport system it has. Insufficient capacity of transport system will create bottlenecks and may eventually retard the region's growth.

Bhatnagar, K.P. et.al., explained the role and significance of transport in India and abroad and examined critically the growth and development of various modes of transport in India and its effect on the economy of the country. Sharma.K.K. extensively studied the state of affairs, problems and prospects of Motor Transport in Rajasthan.

Patankar studied the Road Passenger Transport in different dimensions since 1950s and analyzed the urban transportation in detail with emphasis on operational

productivity and efficiency of STUs for the period 1973-74 to 1979-80. He opined that the future of road transport sector in India would brighten only with productivity-oriented planning and offers comprehensive solutions to urban mobility problems in the cities of developing countries.

Khan.R.R. presented a kaleidoscope of transport network and transport management system in India. Besides, continuing with systems approach, a model was framed for a comprehensive transport system and transport planning. He provides an analytical study of several vital areas along with the benchmark data for transport management.

Ali A. El-Mezawie studied the problems and prospects of 32 State Transport Undertakings in India during 1975-76 to 1979-80 and observed that the performance of company form of organization is better on almost all-important counts. He recommended the exchequer an immediate relief of at least 60% in tax, and provision for regular revision of fare at an interval of two years, failing which provision for subsidy.

Dev Arun evaluated the contributions of different modes of transport in civilized development especially the role of road transport in connecting the lifeline of the economy. Satyanarayana.J. intertwined the costs with revenues and relates losses with profit. Organizational set up, capital structure, financial and personal policies, Management Information Systems (MIS) of Andhra Pradesh State Road Transport Corporation (APSRTC) are discussed and observed that the cost of service of road transport solely rely on the size of the fleet, the vehicle condition and the length and road condition on the basis of the data collected from a reprehensive sample of motor vehicle operators in Andhra Pradesh. He found that the fundamental factor which influences the cost of operations of motor transport industry in Andhra Pradesh is the size of the motor transport unit.

Pandu Ranga Rao.D extensively studied the passenger and goods transport system in Visakhapatnam district of Andhra Pradesh and observed various trends and phases of transport system since its inception. Further, Jain. J.K. explored on macro- level transport operations before and after independence in India and analyzed the problems and prospects of road transport besides the socio-economic significance of road transport for bringing efficiency in all spheres.

3. RURAL PROFILE OF THE ANDHRA PRADESH

Andhra Pradesh is one of the 29 states of India, situated on the country's southeaster coast. Andhra Pradesh State, which was formed in 1956 is divided into two separate States, namely, Telangana and Andhra Pradesh with effect from 2.6.2014. In February 2014, the Andhra Pradesh Reorganisation Act, 2014 bill was passed by the Parliament of

India for the formation of Telangana state comprising ten districts. Hyderabad will remain as a joint capital for 10 years for both Andhra Pradesh and Telangana. The new capital of Andhra Pradesh is in Guntur District north of Guntur City and will be developed under a new Capital Region Development Authority. The state is the eighth largest state in India covering an area of 160,205 km² (61,855 sq. mi). According to 2011 census, the state is tenth largest by population with 49,386,799 inhabitants.

It is evident from the records that according to the 2011 Census, out of the total population in Andhra Pradesh, 70 per cent of them are living in rural areas. Srikakulam district is found to be having highest percentage of rural population (83.8 per cent), followed by Prakasam district (80.4 per cent), whereas lowest percentage of rural population are found in Visakhapatnam district (52.5 per cent).

4. DEVELOPMENT OF A NEED-BASED APPROACH FOR RURAL ROAD NETWORK PLANNING

Keeping in view the fact that connectivity has a catalytic effect on the economic and social development and poverty alleviation in rural areas, the Ministry of Rural Development, Government of India launched a mega rural roads development program in 2000, popularly known as Pradhan Mantri Gram Sadak Yojana (PMGSY) to improve all-weather road connectivity in Indian villages. The provision of the connectivity to a village was decided based on population. But mere connectivity does not ensure accessibility to basic needs. In this study an endeavor is made to build up a need-based approach for rural connectivity which would ensure accessibility to the basic facilities using GIS platform. The analysis has been done with the map of the year 2000, just before the PMGSY program launched.



Fig 1. Map of Guntur District

Ideally, a village should have easy access to basic facilities when connected to an all-weather road. The primary objective of this study was developing a need-based road network. This study analyses the accessibility to basic facilities such as primary school (PS), middle school (MS), high school

(HS), primary health centre (PHC) and local government (Panchayat) head quarter (PHQ). The district of Tonk has been taken for detailed study so as to develop a need based rural road network. The preliminary data, including the map of Guntur district is shown in Fig 7.1. It shows the existing road network with all categories of roads and highways, namely State Highway (SH), Major District Roads (MDR), Other District Roads (ODR) and location of villages with block boundaries in different colors.

Development of Need-Based Algorithm

The distance of travel to any facility should be within the acceptable limit as perceived by people. Hence, to determine the acceptable distance of travel, a village level informal survey was conducted in the study area with the help of local officials and NGOs. People were addressed about their tolerable and acceptable travel distance to different facilities. Accordingly, the acceptable distances to the facilities were decided as- primary school 5 km; middle school 8 km; high school 10 km; primary health centre 8km and Panchayat headquarters 15 km.

The flowchart for developing the need-based network is shown in Fig 7.5. Using the concept of graph theory, the existing network has been presented in terms of nodes and links. The villages are represented as nodes and the road segments connecting one village to another village or to a road intersection are shown as links. Hypothetical links were also created by connecting an unconnected village with the nearby connected village or to the nearest all-weather road, whichever was found to be the shortest.

To start with an unconnected habitation was identified and checked for the facilities available within. Facilities were checked one at a time. When any of the facility was not present in the village, it was necessary to traverse from the village, link-wise, either by maximum facility algorithm or shortest path algorithm, to search for the nearest facility. In the shortest path algorithm, the villager would travel to either the nearest node or link in search of the facility through shortest path, provided the distance was within the acceptable distance. However, if another village had the particular facility and a few additional facilities which the target village did not have, the target village was connected to that village even though it did not follow the shortest path. It was ensured that the village was within the respective acceptable distances of different facilities. The process was repeated for all other facilities and also for all the unconnected villages separately to develop a network.

Each facility was given a score depending on the level of importance of the facility. Also, a particular link could be used by more than one village. Depending on the number of purposes for which a particular link was used, it was assigned a cumulative score by adding up the number of purposes for which it was used.

Prioritization of Links

Once the network was developed based on need-based

approach, it was felt necessary to develop a methodology to prioritize them for construction. From Table 7.3 it has been observed that some of the links could serve a large number of populations, whereas some of them would have quite low demand. Similarly, the values vary widely on the scores given on the basis of the number of purposes for which the links were going to be used. All need-based links cannot be constructed simultaneously. The policy makers will need to develop a methodology for constructing the roads depending on budgetary allocation. However, a logical methodology has been suggested in this paper based on the data available for the study.

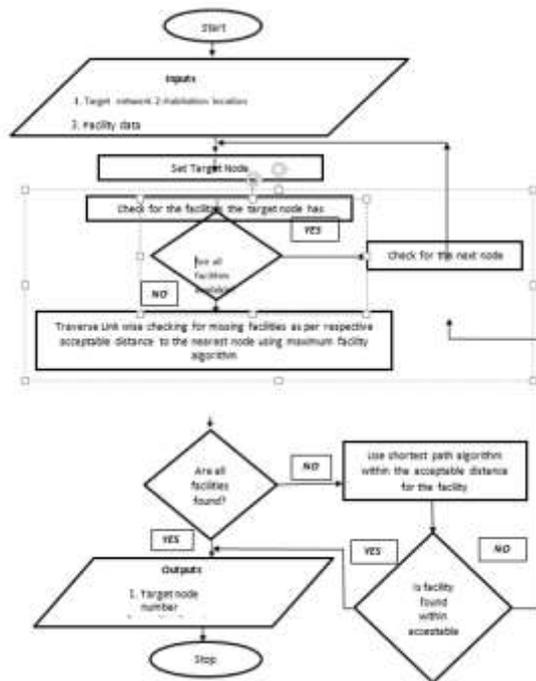


Fig 2. Flowchart for need-based network algorithm

Accordingly, 31 links were categorized as priority A. Once a link was in a particular priority list further prioritization was done based on the expected population using the link. As an example, priority order “A” is taken and shown in Table 7.7. The links in the same priority order are again prioritized, as A1, A2, etc. depending on population. The link with higher population is given higher priority. It might be seen in table 7 that link No. 340 has been given the first priority, A1, in spite of having a lesser score than many other links in the category because the highest number of populations is expected to get benefits through the link. It was felt during the study that all the links need not be constructed as a high-quality road such as blacktop or concrete. The links having lower values could be constructed as gravel or earth road as well. This might be decided based on the scores and the population. However, determination of the threshold values was not within the scope of this study.

Table: Ranking and priority order of the link

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Range	Range to score	Priority Order
Beyond $\mu+2\sigma$	>237	A
Between $\mu+2\sigma$ and $\mu+\sigma$	237-170	B
Between $\mu+\sigma$ and $\mu-\sigma$	170-103	C
Between $\mu-\sigma$ and $\mu-2\sigma$	103-36	D
Beyond $\mu-2\sigma$	<36	E

Table: Range and priority order

Link No.	Population	Score	Rank	Priority
340	7249	244	A	A1
601	5858	336	A	A2
470	5329	258	A	A3
467	4627	241	A	A4
685	4588	264	A	A5
7	4571	258	A	A6
239	4528	265	A	A7
1	4514	256	A	A8
328	4285	248	A	A9
576	4069	386	A	A10
577	4069	406	A	A11
578	4069	406	A	A12
722	3941	249	A	A13
500	3665	572	A	A14
238	3623	280	A	A15
703	3595	265	A	A16
135	3451	388	A	A17
313	3417	273	A	A18
270	3384	264	A	A19

5. CONCLUSION

Many of the developing countries such as India have failed to provide access to basic facilities in rural areas due to lack of adequate funds and the absence of focused goals for improving accessibility. In the PMGSY program launched in 2000, efforts have been made to improve accessibility in rural areas. However, keeping in view the sheer number of villages to be connected, there is a long way to go before total accessibility could be achieved. To identify the needs in different regions, a quantifying tool, RAI developed by IDA has been widely used in the developing countries.

In the present study, an attempt has been made to develop methodologies to quantify accessibility at different levels. Also a need based approach has been developed for rural road connectivity to improve access to basic facilities. Accordingly, a case study was conducted in five districts of

Rajasthan with varying population density. On the basis of the study the following conclusions have been drawn.

- The number of habitations with no accessibility increases significantly with the decrease in population density of the region. Also, the percentage increase in accessibility per kilometer of construction of the road is higher in densely populated areas.
- The construction of new roads based on population criteria as used in PMGSY program increases the overall accessibility in the region. However, the impact is more in areas with high population density.
- The method proposed in the study is able to quantify accessibility of health facilities with special reference to CHC quite satisfactorily as the results have been validated.
- While the fitting impedance function, it has been observed that sigmoidal functions like logistic power and MMF are more likely suitable for the high population density regions and also plain terrains. Though decline functions and rational models can be used for low population density regions and difficult desert or hilly areas.

6. FUTURE SCOPE

While concluding the study, it was found that certain aspect of the study needs further attention. Those are presented below.

- Accessibility to all the sectors to which rural individuals travel to meet their needs could not be quantified and a composite level of accessibility for each habitation separately.
- Indian rural health care Infrastructure system is developed as a three-tier system includes Sub center, Primary health care center and Community health care center. A composite accessibility for health sector may be determined.
- The threshold distance considered in this study is sensitive with respect to development and geographical characteristics of the region, therefore there is a scope to do sensitivity analysis.
- The need-based approach developed has been applied to the plain terrain area. There is scope to study the applicability of this method in hilly regions, to check its robustness.

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