METHODOLOGY FOR PLANNING AND EVALUATION OF RURAL ROAD NETWORK: AN INTEGRATED FUNCTIONAL ACCESSIBILITY APPROACH

by

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CERTIFICATE

Certified that **Mr. B. Kanagadurai**, was permitted to work for his Ph.D Degree in Economics at Indian Institute of Technology, Delhi on the problem entitled "**METHODOLOGY FOR PLANNING AND EVALUATION OF RURAL ROAD NETWORK: AN INTEGRATED FUNCTIONAL ACCESSIBILITY APPROACH".** He has faithfully carried out his study under our guidance and supervision and the accompanying thesis is his original work.

Mr. B. Kanagadurai has completed necessary course work and put in the required attendance in the Department of Humanities and Social Sciences.

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ABSTRACT

Rural roads contribute significantly in rural development by creating opportunities to access goods, services and other facilities located in nearby villages or major town/market centres. Rural roads are the tertiary road system which provides access to villages to the main roads and various centres of activities. In India, there are about 600,000 villages spread over an area of 3.2 million sq. kms. and about 50 percent of them are yet to be provided with an all-weather road access. Out of the total road length of 3.17 million km about 2.18 million km are categorised as rural roads. More than 50 per cent of the 2.18 million km of rural roads are unsurfaced, out of which 40 per cent are non-motorable. Several plans and programmes have been conceived for development of rural roads. The policies adopted for planning of road facilities in rural areas have been guided by population size of the villages and agricultural output of the area. Higher population size village gets higher priority for connectivity. This approach was based on the assumption that large-size villages generate more traffic and extend socio-economic benefit to more number of people. However, it ignored other factors such as availability of resources, settlement size distribution and its interactions, and other socio-economic aspects of the region.

Many rural areas in India are characterised by sparse distribution of population and low level of income. This combined with low level of vehicle ownership, made it difficult to plan and distribute resources needed to provide all-weather access roads to each and every village. Recently, Government of India decided to provide connectivity to all the villages in a phased manner under a dedicated fund created for this purpose through an additional cess on diesel. There is a need for further planned intervention for providing rural connectivity in an optimal way to achieve the objective of 100 per cent connectivity.

The major objectives of the study are:

- To review the rural road planning, appraisal methods and evaluation techniques adopted worldwide for selection and prioritizing of rural road investment interventions.
- To review the planning practices adopted for development of rural roads and their implications in India.
- To develop appropriate criteria for selection and prioritisation of villages as well as the link roads for connectivity based on its population levels, functional importance of roads and accessibility to various facilities centres.
- To evolve a methodology for selection of best link option for unconnected villages based on functional accessibility approach.
- To apply planning methodology through case studies using Geographic Information System (GIS) in a selected rural area in India.
- To conduct economic analysis of the selected links proposed through the functional accessibility approach for different construction options.
- To prioritise and rank the rural roads based on the accessibility benefits and economic rate of return.

The focus of the study is to evolve a methodology for planning rural road network in India. It reviews the existing policies, criteria, methodologies, planning process and project evaluation techniques adopted for selection and ranking of rural roads. At present, there is wide variation in rural road connectivity as well as regional imbalances in road development. In order to overcome the difficulties, the study proposes a methodology based on the integrated functional accessibility for planning of rural roads at block level. This approach is based on the hypothesis that the population of the unconnected villages will have to travel to the nearest major centres using the existing tracks or fair-weather roads to access the functions that are missing in their villages. The routes are identified based on the accessibility level it provides to the unconnected villages to the nearest major centre in a cost-effective manner. The accessibility benefit that is offered by the route will be directly proportional to the population size of the unconnected village or a cluster of villages and the relative functional importance of the major centre and indirectly related to the distance. A cluster of unconnected villages which falls within the range of the major centres can be provided a through route connecting these villages using shortest path like a spanning tree. The selected links/routes can be further evaluated using Access Benefit Cost Ratio (ABCR) by converting the actual length of the link into cost of construction for prioritisation. Accessibility criterion facilitates the measure the access provided to the rural population to various socio-economic facilities and employment opportunity and therefore, it is expected that it will reduce the incidence of poverty in rural areas. Further, economic evaluation of these selected routes can be conducted to determine the level of surfacing or investment needed for construction of each selected roads based on the cost-benefit analysis.

The methodology developed has been applied to provide connectivity for a Community Development Block (sub-district). Rajgarh Block of Churu district In Rajasthan State has been selected as the case study area for testing and application of the methodology. The Block has 205 villages out of which 109 are provided with all-weather road access while the remaining villages have some sort of tracks and fair-weather roads connecting the nearby villages. These links are considered for selection of optimal routes. In this block only 250 km having 49 route links are identified for providing all-weather road connectivity to all the unconnected villages. The Road Economic Decision (RED) model developed by the World Bank for economic analysis of rural roads has been used for selecting the required surface type for each link. The input data required for analysis were obtained from various sources and the traffic and its composition were also estimated for deriving the benefits. The internal rate of return is calculated for different surface types and the optimal surface type is determined from the available options. The analysis showed that 21 links with total length of 78.7 km can be selected as gravel roads, 12 links with total length of 74.3 km as water bound macadam (WBM) surfaced road with standard maintenance and 6 links with total length of 52.2 km black topped roads. The remaining 10 links with a total length of 38.8 km have to be earthen roads with minimum maintenance option. The ranking of the selected rural road projects have been carried out for both the weighted access-benefit cost ratio and the internal rate of return. Depending upon the level of development and criteria for rural road development the ranking can be carried out by combining the values of ABCR and IRR of the projects.

The integrated functional accessibility approach, suggested at block level, is useful for preparation of block level master plans for rural roads. The routes for connecting the unconnected villages are selected by maximising the benefits in terms of access to the major centre with minimum development cost. It takes care of the existing tracks and fair-weather roads and minimises the problems associated with land acquisition and other related issues. The functional accessibility approach will be highly useful in prioritising the villages and the routes which lack development because it represents the access to facilities and markets.

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