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Development Of Systematic Approach For Upgradation Of Rural Road Network Considering Agricultural Growth

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ABSTRACT: As per the 2011 census, rural areas account for 69 % of India's total population. Therefore, improved connectivity and accessibility to rural areas will provide a vital impetus to the country's economic growth. It is estimated that 20-30% of the agricultural, horticultural and forest produce gets wasted because of either inadequate rural road network or poor condition of roads, which creates an impedance for transporting such commodities for the user needs. Rural road accounts for 60% of the total road length in India. Statistics shows that the importance given to the development of rural roads as part of the overall development of the country. Studies on rural road development in several countries reported rise in agricultural wages and aggregate crop indices (Bangladesh), increase in the availability of food, the completion rates of primary school and the wages of agricultural workers (Vietnam), etc. However, studies on Indian rural roads are almost non-existent. Against this backdrop, the present study analyses some past trends and present practices related to rural transport in India. In present work efforts are made to develop a new methodology for the upgradation of rural road considering agricultural growth.

KeyWords: Rural Road, Upgradation, Pripority.

I. INTRODUCTION

As roads are the only means of transport available to most of the rural settlements, it plays a predominant role in the comprehensive development of a society. It acts as the lifeline of the rural economy and society hence it is required to upgrade the existing roads by passage of time based on their agricultural growth rate every triennium ending. PMGSY(Pradhan Mantri Gram Sadak Yojna) envisages only single connectivity if a habitation is already connected to another habitation by all-weather road ,then no further work can be taken up under PMGSY. Network planning mainly aims to improve flexibility of travel and reduce the circuity. Construction of rural roads inevitably leads to increase in agricultural production and productivity by bringing in new land into cultivation or by intensifying existing land use to take advantage of expanded market opportunities. In addition to facilitating agricultural commercialization and diversification, rural infrastructure, particularly roads, consolidates the links between agricultural and non-agricultural activities within rural areas and between rural and urban areas (IFAD, 1995) .The agricultural sector is one of the most important components of Indian Economy. Agriculture continues to be a main stay of life for majority of the population. Which contributes around 17.5 per cent (Economic survey 2015-16) of the GVA; About 68.84% people are living in rural areas (Census 2011) and are still dependent on Agriculture. About 43% of India's geographical area is used for agricultural activity and employs 50 per cent of the workforce in the country. Therefore the responsibility of providing infrastructure is with the state which aims at rapid growth of agricultural production for attaining developmental goals such as attaining food security, promote industrial development, relieving unemployment, and poverty alleviation etc,. The agricultural sector in our country has prosperous over the years because of government's constant thrust on increasing agricultural production. Still the benefits are not percolating down to the farming community. Indian agriculture is characterized by lack of proper infrastructure facilities.

Rural Roads and Their Importance

The necessity of a proper road network for the socioeconomic development of rural India and consequently the whole country was understood quite early in India. The first road development plan of 1943-61, popularly known as Nagpur Plan, looked at the road needs of the country on a long-term basis, and for the first time classified the road system into a functional hierarchy comprising National Highways (NH), State Highways (SH), Major district roads (MDR), Other District roads (ODR) and Village roads (VR). The last two classes of roads form the rural road system in the country.

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The third road development plan known as Lucknow Plan (1981-2001), estimated rural road requirement for the country and had spelt out various measures to develop rural roads. This plan suggested several approaches for rural road development. These approaches include preparation of long-term master plan for rural roads; stage construction in view of the low level of traffic in the initial stage of development of a rural road; integration of rural road development plan with the other rural development programs During all the road development plans the rural roads have received significant attention and emphasis. A number of programs were launched under several employment generation and poverty alleviation programmes of the Central and State Governments to achieve the goal of rural connectivity such as the Minimum Needs Program (MNP), National Rural Employment Program (NREP), Rural Landless Employment Guarantee Programme (RLEGP), Jawahar Rozgar Yojana (JRY) etc.; but these programmes failed to achieve their desired goals. A pragmatic analysis of the past schemes reveals many deficiencies in the whole process from planning to implementation and monitoring to evaluation. There was largely a misconception that rural roads being the lowest category of roads need no elaborate design and engineering. The Ninth Five Year Plan acknowledges that several thousand kilometers of such roads were constructed in the past without proper design and engineering and hardly commensurate with the resources that were allocated to the effort. As a result, rural roads had poor geometrics, inadequate compaction of embankment and inadequate drainage, so the roads that were built were hardly all weather roads. Consequently, these roads did not last long.

II. PMGSY

In order to create durable and permanent assets, an adequate provision for drainage and protection works as well as quality control during construction and maintenance of assets, Government of India launched the Pradhan Mantri Gram Sadak Yojana (PMGSY) on 25th December, 2000 as a Centrally Sponsored Scheme to assist the States. The primary objective of PMGSY is to provide connectivity by way of an All-Weather road (with necessary culverts and cross-drainage structures, which is operable throughout the year), to the eligible unconnected habitations as per Core-Network with a population of 500 persons (as per 2001 Census) and above in plain areas. The current source of funds for PMGSY works is cess on High Speed Diesel (Rs. 0.75 / litre), budgetary support, ADB funding, World Bank funding and NABARD loan. Table 1 details the release of funds from 2000-2001 to 2013-14. A total amount of Rs. 1,11,368 have already been spent under this program including funding from World Bank and Asian Development Bank. It is increasingly essential to ensure that roads already created are systematically maintained and yield services as originally envisaged before going on undertaking more such assets. Keeping in view the asset value of the road network, PMGSY-II has been launched. The programme was conceived on sharing basis to consolidate existing rural road network by upgradation, renewal and maintenance of the vast network already created. It would cover up-gradation of existing selected rural roads based on a criterion to make the road-network vibrant. The selection of routes would be with the objective of identification of rural growth centre and other critical rural hubs, rural places of importance (connectivity to other growth poles, market, rural hub, tourist places etc.). Development of Rural Hubs & Growth Centre is crucial to the overall strategy of facilitating poverty reduction through creating rural infrastructures. Growth centre / rural hubs provide markets, banking and other service facilities enabling and enhancing self employment and livelihood facilities. It is proposed to cover during the 12th Five Year Plan period, overall 50,000 km road length by up-gradation to consolidate the rural road Network under the PMGSY-II programme at an estimated cost of Rs. 33,030 crore (at 2012-13 prices), including administrative and management cost of Rs. 530 crore. The cost will be shared between the Centre and States/Uts on 75:25 basis for the plain areas and 90:10 basis for the special areas. The Central share would be Rs. 27,022 crore (at 2012-13 prices), including administrative and management cost of Rs.530 crore.

III. OBJECTIVE OF STUDY

- To develop a new methodology to develop rural road Network.
- To develop a new methodology to upgrade the existing rural road network.
- To connect the rural habitation to the market, society and basic needs.

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Amount Released as Project Cost	No. Of Road Works Completed	Percentage of Road Works	Length of Road works Completed	Percentage Road Length Completed
1,09,589	1,01,999	71	3,99,911	73
			Rs. In Crore, Length in Km.	

Table 1-1: Physical Progress of PMGSY upto March 2014 (PMGSY I, II and ADB/WB)

IV. LITERATURE SURVEY

There are many approaches to rural road planning. Prioritizing settlements based on their population and socioeconomic characteristics and connecting them with shortest road link are the simplest approach to rural road planning. Methods based on minimal spanning tree concept, inter settlement interaction approach, accessibility criteria etc are more rational and scientific approaches to rural road planning. In India, the rural road planning at national level were guided by the long term Twenty Year Road Development Plans, which provided guidelines to prioritise settlement connectivity on the basis of their population and to achieve certain road density as a result of road development in the region (Road Development Plan of India 1981-2001 1984). There were many shortcomings in adopting these guidelines as the basis for rural road planning. The road mileage targets fixed in the plan were based on certain empirical formulae. Instead of formulating the road development plans at local or regional level, pre-calculated road mileage were assigned by the plan and states and districts were required to reconcile their needs with the overall target thus assigned, without considering for the actual accessibility needs of a region (Mahendru et al. 1983). The master plans prepared for rural road development, based on these guidelines, result in direct connectivity of settlements of qualifying population range with the nearest connected settlement or to the nearby existing roads. Network thus developed was suboptimal and not efficient to cater the functional requirements of settlement. Also, there are no guidelines to decide inter settlement connectivity. This approach of rural road planning thus led to the development of inefficient network and poor utilization of scarcely available resources.

International Research

Kim and Chung (2001) proposed measuring accessibility in terms of disutility index for spatial location - allocation of multiple centre villages using rural roads. The location allocation method optimizes some functions of access to the facilities but it does not provide accurate information needed for improving or ranking the road linkages between settlements. Mellor's (1976) outline for the future economic development of India places infrastructural development as one of the top priorities. Mellor indicates that infrastructure plays a strategic role in producing large multiplier effects in the economy with agricultural growth. As agricultural incomes grow, consumption expenditures increase in rural areas, creating increased demand for urban goods-the multiplier effect. Limao and Venebles (1999) in a study of transportation costs in sub Saharan Africa showed that roads are significant determinants of transportation cost, and that when a region is land locked, transportation cost increased by 50percent. They reported that most of Africa's poor trade performance was the result of weak infrastructure.

National Research

Swaminathan et al. (1982) used the concept of minimum spanning tree for connecting the settlements to existing nearby roads or to the nearest market. In this method, it was claimed that the network generated is optimal but no analysis for optimality was carried out. Kumar and Tilloston (1985) proposed the rural road network planning methodology based on minimization of total cost, which consisted construction and travel costs.. The method suggested does not consider an integrated area development approach and, therefore, its overall functional utility is questionable. Mahendru et al. (1983, 1985, 1988, 1989) used the concept of settlement interaction, link efficiency, route efficiency and network efficiency to generate, analyse and evaluate alternative rural road linkage pattern. Integrated area development approach was considered to develop the road network so that it serves the area in a balanced way. Gravity hypothesis was used to quantify the inter-settlement interaction, based on level of socioeconomic development, population and spatial separation between settlements.. The existing primary and secondary road systems were not taken as the framework in planning the rural roads and therefore, the possibility of connecting the settlements directly to these roads was completely ignored. Binswanger, Deininger and Feder (1993) in a study of 13 states in India, found that investments in rural infrastructure lowered transportation costs, increased farmers' access to markets, and led to substantial agricultural expansion. The Road Development Plan Vision: 2021

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(IRC 2001) proposes the long term strategy for planning rural roads in India. It emphasizes preparation of master plans for rural road network in each district and building up from block level-needs. Ministry of Rural Development (MORD) in India (MORD 2002) and World Bank (World Bank RT-4 2000) have suggested master planning rural roads based on the identification of core network, which ensures minimum connectivity for each village to a nearby main road or market center. The core network was identified through a rural road master planning process based on guidelines for preparation of „District Rural Road Plan". This procedure is also adopted for planning and selection of through routes and link roads (Rao et al. 2007) under the Prime Minister's rural roads program (MORD 2002) in India. The drawback of this method is that core network is identified based on judgment on accessibility of settlements. NITI Aayog (2015) says agriculture remains the largest sector in Indian Economy while its output share fell from 28.3% in 1993-94 to 14.4% in 2011-12. The paper identifies many important aspects of agriculture that need immediate attention to bring economic advantages to millions of farm families out of which major aspect includes low and faulty input uses ,poor access to modern technology no real technological breakthrough in recent times.

V. PROPOSED METHODOLOGY

The proposed methodology includes following steps;

1. Selection of the study Area
2. Selection of Villages
3. Preparation of Distance Matrix and Road Inventory
4. Preparation of Village wise population
5. Development of priority list based on agricultural growth.

Need of Master Plan

Connecting rural habitations through good quality all weather roads, which provide access to services and also opportunities for the rural population to increase their income, is an important part of the socio-economic development process. For sustainable development through rural roads, it is necessary that a proper Study area os selected and prepared in order that all activities relating to rural roads such as Construction, Upgradation and Maintenance can be taken up systematically within the frame work of this study Area .

Selection of Villages

The District Rural Roads Plan is a compendium of the existing and proposed road network system in the District which clearly identifies the proposed roads for connecting the yet Unconnected Habitations to already connected Habitations/ All-weather roads, in an economic and efficient way. The District Rural Roads Plan shall be prepared at two levels – the Block and the District. Keeping in view the convenience from the point of view of Map preparation and Data collection, the work would primarily be done at the Block level. For the present work 50 Villages of Mhasala Taluka were selected.

Preparation of Distance Matrix

Road Inventory

A comprehensive inventory of all Rural Roads including Other Districts Roads (ODR) and Village Roads (VR) and any other existing earthen roads having a Land Width of 5m or more is to be prepared at block level.

Primary and Secondary Road Data

The National Highways (NH), State Highways (SH) and Major District Roads (MDR), which form the primary and secondary road network in a region, will also be required for analyzing connectivity of habitations.

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Table:1 Sample Matrix of Ten Villages

Name of Village	ADI THAKUR	ADIMAHAD	AGARWADA	AMBET	BANDWADI	BANOTI	BHABAT	BHEKRYACH AKOND	CHICHONDE	CHIKHALAP
ADI THAKUR	0	39	16	22.5	42	15	19.9	26	26	28
ADIMAHAD	39	0	34	14	25	24	28	28	23.1	23
AGARWADA	22	27	0	26	29	2.6	17	14	28	9.2
AMBET	22.3	24	33	0	22	35	30	30	27	32
BANDWADI	19.8	24	28	27	0	27	12	15	20	35
BANOTI	23	25	1.7	35	27	0	15	12	11	18
BHABAT	30	28	17	30	12	15	0	3.1	12	15
BHEKRYACH AKOND	26	28	14	29.7	15	12	3.1	0	9	4.5
CHICHONDE	26	32	28	27	20	11	12	9	0	28
CHIKHALAP	28	23	9.2	32	35	18	15	28	27	0

Preparation of Village wise population

Population of selected village was computed as per the census of 2011.

All the 50 villages were tabulated as there preparation

Development of priority list based on agricultural growth.

For the Present Work priority lists were developed by taking the common agricultural productivity for all the links of different villages

To calculate the Agricultural productivity link wise given formula were used

Agriculture productivity value per km	=	Total Crop Produced along that road/ length of the road.

Further this agricultural productivity is multiplied by the population weightage to get the productivity value for that link.

The population weightage is calculated for the per 100 person.

Weightage of population is calculated for the per 100 person =	Total population of all habitation benefited by the road /150

Finally the utility value of each link was calculated for each and every link using following formula

Utility value per km	Total weightage of road x Agricultural productivity per km length of the road

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VI. DATA ANALYSIS

The agricultural productivity was calculated for all 50 to calculate these value common agricultural growth was villages and tabulated. Considered that is 100 kg/hectare.

Table: 3 calculation of agricultural productivity per kilometer

Link Wise Productivity	ADI THAKUR	ADIMAHAD	AGARWADA	AMBET	BANDWADI	BANOTI	BHABAT	BHEKRYACH A KOND
ADI THAKUR		2.564	6.250	4.444	2.381	6.667	5.025	3.846
ADIMAHAD	2.564		2.941	7.143	4.000	4.167	3.571	3.571
AGARWADA	4.545	3.704		3.846	3.448	38.462	5.882	7.143
AMBET	4.484	4.167	3.030		4.545	2.857	3.333	3.333
BANDWADI	5.051	4.167	3.571	3.704		3.704	8.333	6.667
BANOTI	4.348	4.000	58.824	2.857	3.704		6.667	8.333
BHABAT	3.333	3.571	5.882	3.333	8.333	6.667		32.258
BHEKRYACHA KOND	3.84	3.571	7.142	3.363	6.666	8.3333	32.256	

Table: 4 Population Weightage

Village	Population Weightage	Village	Population Weightage	Village	Population Weightage
Adi Thakur	1.44	Dhoraje	4.59	Kole	2.69
Adimahad Khadi	4.91	Gadadav	1.45	Kolvat	1.64
Agarwada	6.02	Ganeshnagar	3.21	Konzari	3.39
Ambet	14.61	Gaulwadi	2.47	Krishnanagar	1.2
Bandwadi	7.23	Ghonse	7.29	Kudgaon	3.7
Banoti	7.38	Ghum	2.29	Kudtudi	4.74
Bhabat	2.38	Gondghar	14.74	Lep	2.75
Bhekryacha Kond	4.55	Jambhul	3.52	Lipni	2.09
Chichonde	8.34	Kalsuri	7.03	Mahammad Khanikhar	11.76
Chikhalap	7.35	Kandalwada	13.53	Mandathane	7.73
Chirgaon	4.09	Kanghar	4.55	Maryamkhar	7.1
Dagadghoom	2.47	Kelte	6.81	Mendadi	19.33
Dehen	2.73	Khamgaon	9.85	Mendadikond	13.06
Deoghar	2.3	Khanloshi	0.33	Morvane	1.56
Deoghar kond	7.06	Khargaon Bk	6.69	Newarul	2.49
Kokbal	2.79	Khargaon Kh	7.6	Nigadi	7.19
Kharsai	26.49	Pabhare	36.32		

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TABLE:5UTILITY VALUE PER KILO METER

Name of Link	ADI THAKUR	ADIMAHAD	AGARWADA	AMBET	BANDWADI	BANOTI	BHABAT	BHEKRYACHA KOND
ADI THAKUR		8.14	23.31	35.67	10.32	29.40	9.60	11.52
ADIMAHAD	8.14		16.07	69.71	24.28	25.60	13.02	16.89
AGARWADA	16.95	20.24		39.67	22.84	257.69	24.71	37.75
AMBET	35.99	40.67	31.26		49.64	31.41	28.32	31.93
BANDWADI	21.89	25.29	23.66	40.44		27.06	40.04	39.27
BANOTI	19.17	24.58	**394.12**	31.41	27.06		32.53	49.71
BHABAT	6.37	13.02	24.71	28.32	40.04	32.53		111.77
BHEKRYACHA KOND	11.52	16.89	37.75	32.26	39.27	49.71	111.77	

VII. RESULT AND CONCLUSION

1)The utility values were find out for each link and the maximum utility value was 872.35, which means these link will be upgraded at first priority.
2)Likewise utility values were find out for each link and on basis of utility value priority will be decided.
3)For this paper a matrix of 8 villages is shown in above table and this 64 links were compared
4)The maximum utility value is 394.12 which banoti to agarwada means this link will be upgraded at first priority.
5)Further all the links can be compared and priority list decided.

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