

A review on Performance of Rural Roads in India

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Abstract: This paper addresses a key aspect regarding to Rural Roads Development. The Govt. of India is funding various project associated with village road development consistently. PMGSY project is one of them. The aim behind the rural road development is to provide sustainable and efficient rural connectivity for rural community but the present strategies and practice will in general suggest innovation, but troublesome and distance away they might be, which generally outcome in higher cost of construction. There are a few aspects which actually should be tended to in the planning procedure of low volume road. The various material constituents are directly affected on strength parameters of each layer. The design charts dependent on various values of California Bearing Ratio should be estimated thickness of all layer of the pavement. An ideal design proportion can be acquired by assessing the pavement layer for difference in thicknesses. As such considering significant factors like construction and maintenance cost, appropriate design for serviceable life can be recommended for various values of CBR. A more thorough investigation and improvement of such scientific device will support for a more sensible way to deal with the plan of village road. It is seen that significant improvement has been made according to the utilization of simulation model dependent on exacting pavement condition. GIS (Geographic Information System) and HDM 4(Highway Development and Maintenance Management System) software are truly reliable and useful for development of current pavement performance as well as maintenance practice.

Index Terms – Rural roads, pavement performance, GIS, HDM-4.

I. INTRODUCTION

Rural roads contribute around 70% of the entire road network in Nation. Village roads in Indian structure a considerable portion of the National Road system. However, their availability isn't to the specified level. The Central and State committees, complete various projects, about 50% of habitations within the village portion unit still not linked by roads. The rural road condition is anticipated to encouraging effects on all parameters of rural development. In this decade the Indian govt. launched the nationwide program called PMGSY to supply connectivity, maintenance and upgradation of existing roads to all the communities in a phased manner. PMGSY III it is improved phased with the objective of like upgradation of existing Through Routes and providing rural connectivity, the Government of India had launched the PMGSY-III (Now rename the program MMMGS) on OCTOBER, 2019, [9], thus it is required to focus on performance of Rural Road in India.

India is distinguished for its geographical diversities there exists a huge series the subgrade soil types, rainfall, traffic condition and availability of construction materials. There for pavement condition assessment is important to supply the correct material at place in right time with optimum price. These natural barriers produce issues for developing a regular uniform technique to serve the requirements at all the site condition. This needs to adoption of various technologies for sustainable growth of village community.

II. LITERATURE SURVEY

2.1 Research study on pavement condition analysis

S.kumar (2016)[13] In this examination paper directed a video realistic study and picture was investigated by using image processor method. All out selected quantities of pavement were reviewed. The streets are separated into a quantity of km for the pavement condition index determination, hence complete number of segments become 37. Deficiencies like potholes and ravelling is normal for every of the flexible pavements & after pavement condition survey all selected quantities of pavement is categorise in percentage based on surface condition. It was noted that around 68% roads have oldness around 04 years while 32.43% roads have oldness more than 04 years. Since, serviceable life for rural roads is fifteen years however they will not in serviceable condition once four years. It means that economic burden for treatment of such roads shall increase.

2.2 Sub soil condition improvement techniques

There are several mechanisms for enhancing the property of subgrade soil. Several investigations have been done so some geotechnologists and investigator have placed their efforts come to a solution with their concepts.

Hussain S. (2016) [12] presented an associate investigation on adjustment of various soils utilizing nano-synthetics. Organosilane nano chemical & Nano polymer which has been examined at study site is a nano technology-based product manufactured by Zydex Industries. Nano chemicals are nano-technology-based Product which provides solution for moisture presence problems in asphalts. Expansion of nanoparticles as an external issue to soil can cause regulate the property of soil, it impacts the strength, and obstruction things of soil. Nano - technology is a renovated mode which can report the rising worry of low-quality pavement. This paper presents a context-oriented examination of an asphalt part of 1 km long on the Sector 19, Gandhinagar, Gujarat and 800 m in Kuruvilakam street in Pothencode has been built by consolidating the current granular street base utilizing organosilane nanomaterial and cement stabilization.

Table -1 Experimental Result

Subgrade properties	Without additive	With Cement 3%	With OS 0.75 kg/m ³ +polymer 0.75 kg/m ³ + Cement 3%
CBR	7	67	152
UCS (Unconfirmed Compressive Strength)	0.27	1.02	2.43

Table 1 show the improvement in the engineering property after utilized additive in subgrade soil [12]

This implies that such soil consolidating process upgrade the expected enhancements to strength of pavement establishment subsequently expanding the conveying limit of flexible pavement from economy perspective advantage related with the usage of organosilane nanomaterials with cement is appealing and upholds the supportable advancement in pavement development. It will assist with giving modest and economic road network to the close by rural community.

2.3 Investigation on subgrade Soil Condition

de Rezende et al. (2015) [3] conducted lab. and on-site experiment to find the utilization of non-conventional materials as an alternative for naturally accessible granular material to be Performance analysis of Low Volume Rural Roads. In this paper, research facility considers were led with conventional and non- conventional materials available in the area, for example, shallow fine soil found in bounty, crushed stone, quarry dust, lime and coarse aggregate. With the combinations that presented outcomes in the lab. an exploratory black-top asphalt was developed to assess the exhibition of the construction with various materials. During development and following 02 years, the asphalt Pavement was observed by site experiment.

Table -2 Experiment Result

	With Cement lime	With gravel	With quarry waste
DCP (Reduction of PR Valur in mm /below)	4.8	4.7	7
Plate-bearing load test (maximum displacement in mm)	1.70	1.05	2.24
Benkelman beam test (maximum deflection)	40 × 10 ⁻² mm	70 × 10 ⁻² mm	60 × 10 ⁻²

Table 2 show the rate of improvement the engineering property of after utilized additive in subgrade soil [3].

The outcomes presented that the considered combinations current viability and also utilized in replacement for materials generally utilized.

2.4 Analyses of Subsoil condition:

Gupta et al. (2010) [5] examined the bearing capacity of the subsoil of asphalt road. Broad site experiment like field dry thickness, DCPT & CBR were completed on selected road from the territories of Uttarakhand and Uttar Pradesh, India. This paper presents the outcomes of a broad field and research facility examination of fourteen low volume street segments in the province of U.P(India). DCP tests, CBR tests, FDD tests were performed to consider the bearing capacity of the subgrade layer of rural road

Table -3 Analysis of Results

	MSN	R2
DCP – MSN RELATIONSHIP	2.3539 e ^{-0.038 (DCP)}	0.8357
CBR – MSN RELATIONSHIP	1.264 CBR ^{0.2606}	0.8383

Table 3 show the relationship of MSN with DCP & CBR and give result field test is give correct results compare to lab. Test [5]. The work shown in this, focused on investigating the relationships between the outcomes acquired utilizing the DCP and the outcomes got utilizing the CBR strategy for subgrade soils at different areas of Northern Districts of Uttar Pradesh and Uttarakhand, India. A relationship between the altered modified structural number (MSN) of subgrade and DCP entrance record and CBR values were additionally settled. Relapse models were created as a feature of this examination to empower the expectation of CBR strength dependent on the average penetration-rates of DCPs performed for field thickness and field-water content.

2.5 Pavement performance evaluation

The presentation of a road is assessed regularly for improve its quality improvement and also prepare schedule for maintenance of pavement. Pavement Management System (PMS) is a technique that can support decision makers for selecting economical approaches for provided that, assessing, and maintaining pavement in a operational condition.[14]

Tanuj chopraa (2017) [7] used Pavement Maintenance Management System (P.M.M.S) for four segments areas of metropolitan road organization (Patiala, Punjab, India) utilizing H.D.M-4 model. The H.D.M-4 gives a methodology in information info and interaction information of existing pavement situation, traffic capacity and also asphalt creation to foresee street disintegration according to the metropolitan street conditions regarding I.R.I. This investigation offering the utilization of H.D.M.-04 model for the calculation of ideal Repairs and Recovery such as Maintenance & Rehabilitation methodology for every roadway area and relative investigation of planned and state reactive M.& R. systems.

Table -5 Description of Maintenance & Rehabilitation works with total costs

M&R Alternative	M&R	Applicable	Frequency of Application	Total Costs in Million Rupees
Scheduled Overlay Condition	B.C 25 mm	20-17, 22, 27 year	03	5.81
Responsive Overlay	B.C 25 mm	20-22 year	01	1.93

Table 5 Description of Maintenance & Rehabilitation works with total costs [7]

The consequences of current investigation will be valuable for acquiring improved help for leaders for sufficient and convenient asset portions for protection of the all type of pavement.

Javedali m jalegara (2017) [2] examined an all-inclusive endeavor to create Geographic Information System (GIS) based country street created under PMGSY Scheme data set with the goal that organizers, chiefs, analysts and other diverse level experts in the rustic street area will be profited by the last yield. The examination region is situated in Sangareddy Region, Telangana in our Nation. The investigation likewise expected to choose the most brief and elective ways from various towns towards development focuses. Organization investigation has been led to choose most brief way regarding travel time between two areas in the examination territory.

C. Makendran, (2015) [11] developed a simulation method for low traffic road in nation are created to assess the movement of various kinds of deficiencies like roughness, cracking, and potholes. Even however the Administration is putting away tremendous quantum of cash on street development consistently, helpless command over the nature of pavement construction and its ensuing maintenance is prompting the quicker pavement weakening. In such manner, it is fundamental that logical maintenance systems are to be developed based on performance of village road having low traffic. Pavement performance prediction model used in this research for evaluation of deficiencies of existing pavement. Distress data were collected from the village road covering around 170 sections spread across Tamil Nadu in Nation and all the outcomes of the survey is utilized for prediction model with help of statistical analysis. After validation the model it become valuable devices for the practicing engineers maintaining flexible pavements on rural roads.

III. SUMMARY AND CONCLUSION

- Pavement Management System (PMS) need to improvement with involves Pavement Prediction model and statistical analyses of pavement based on pavement condition for rural road construction.
- The subgrade soil improvement technique is very effective to enhance the stability of pavement and also it gives cost saving solution in pavement construction.
- This needs a scientific procedure that predicts economical maintenance ways that may facilitate to place maintenance activities with restricted financial condition in case of low volume roads. Thus, GIS is become very effective for finding ideal alignment as well improving the existing connectivity of village road.
- Construction of road network involves substantial investment and therefore correct maintenance of those assets is of predominate importance. HDM 4 software have been used to predict selections with relation to maintenance management of Rural roads.

IV. FUTURE RESEARCH POTENTIAL

Course Considering the existing literature study for low volume village road under develop by PMGSY and other governing organization concern with enhancing rural transport condition. it is seen that significant advancement has been made in the pavement performance as well as maintenance several aspects which is required focus on that it was overlooked in past design practice

REFERENCES

- [1] Bhatore, A., Tare, V.: Performance models for rural roads. Indian Highw. 42(2), 82–88 (2014)
- [2] c. S. b. Javedali m jalegara, "rural road network planning by using gis methodolog," international journal of engineering research & technology (IJERT),2017
- [3] de Rezende, L.R., Marques, M.O., da Cunha, N.L.: The use of nonconventional materials in asphalt pavements base. Road Mater. Pavement Des. 16(4), 799–814 (2015). <https://doi.org/10.1080/14680629.2015.1055334>
- [4] Durai, B, K., Rao, A, M., Jain, P.K., and Sikdar, P.K. "Geographical Information System for Planning and Management of Rural Roads." annual conference Map India, New Delhi 2004.
- [5] Gupta, A., Kumar, P., Rastogi, R.: Field and laboratory investigations on subgrade layer of low volume roads. In: Indian Geotechnical Conference, pp. 1019–1022 (2010)
- [6] Kumar, S., Nazish Akhtar, E.: Use of locally available non-conventional materials in the construction of rural road pavements. Indian Highw. 44(9) (2016). ISSN 0376-7556
- [7] m. p., n. k., j. m. Tanuj chopraa*, "development of pavement maintenance management system (pmms) of urban road network using hdm-4 mode," international journal of engineering & applied sciences (IJEAS), 2017.
- [8] M. o. r. t. a. highways, Ministry of road transport and highways, Ministry of road transport and highways, 2021.
- [9] Programme guidelines (PMGSY-III), Programme guidelines (PMGSY-III), Programme guidelines (PMGSY-III), 2019.
- [10] Piyush G. Chandak, Ravindra P. Patil, Anand Tapase (&), Abdurashid C. Attar, and Sabir S. Sayyed "Performance Evaluation of Low Volume Rural Roads- A State-of-the-Art Review" 5th GeoChina International Conference 2018 – Civil Infrastructures Confronting Severe Weathers and Climate Changes.

- [11] r. M. a. s. V. C. Makendran, "performance prediction modelling for flexible pavement on low volume roads using multiple linear regression analysis," journal of applied mathematics, 2015.
- [12] S. hussain, "soil stabilization using nano-materials for rural roads—a case study", international journal of innovative research in science, engg. & tech., 2016.
- [13] S. s. a. a. kumar yadav, "evaluation of pavement condition of rural roads under pmgsy for maintenance at patna", international journal of recent scientific research, 2018.
- [14] Sumesh Rajan, Saranya Zacharia, "Development of GIS Integrated Pavement Management System (PMS) for Rural Roads" International Journal of Engineering Science and Computing, June 2017
- [15] Tawalare, A., Raju, K.V.: Pavement performance index for Indian rural roads. Perspect. Sci. (2016).

