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PAVEMENT EVALUATION FOR RURAL ROADS IN RAMANAGARA DISTRICT

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Abstract - *Rural Connectivity becomes a major component in the socio-economic development of rural people by providing access to amenities like education, health, marketing etc. In India where rural population is higher, all weather roads were constructed for rural community. But Flexible pavements deteriorate even without traffic movement on the surface, due to climatic and environmental factors. MT Vihar Nano fiber Technology is one of the innovative techniques used in the construction of flexible pavement to reduce pavement deterioration. The main objective of the work is to carry out performance studies on existing pavements constructed using MT Vihar Nano Fiber Technology in Channapatna and Kanakapura Taluks of Ramanagara District in Karnataka. This work mainly focuses on carrying out the performance evaluation of flexible pavement i.e., functional and structural evaluations. Functional evaluation for the road stretch is found out by using instrument such as MERLIN. During pavement condition survey, detailed data of roads like severity of potholes, area of patching, % of raveling, rut depth and cracking of bituminous layer has been collected and measured to the Pavement Condition Index (PCI). All types of vehicles that used the road during the study is counted by conducting traffic survey for a day. To determine Vehicle Damage Factor (VDF), axial load survey is conducted. Details of vehicles passing through the road such as vehicle type, make, number of axles and load on each axle are recorded. The Benkelman beam deflection (BBD) test is used out to know the structural evaluation of pavement by recording the deflection values.*

Key Words: **Rural roads, Pavement Evaluation, MERLIN, MT Vihar Nano Fiber Technology (MTVNFT), Benkelman Beam Deflection (BBD).**

1. INTRODUCTION

Rural Roads are the tertiary road system in the total road network which give access to the outside world. From past five decades, the rural roads are being planned and implemented in the view of overall development of the rural area. An attempt is also being made to achieve the connectivity with all-weather roads. The funds for rural roads are allocated by Five Year Plans for the long term road development plans.

In India, rural roads forms a substantial portion of the road network constituting 70.23% of the total Indian road network. Most of the rural population are depending upon agriculture. The quality of life and ability of Indian farmers to transfer the post-harvest produce to market is affected by the poor condition of the rural roads. About thirty percent of post harvests is spoiled because of the poor infrastructure to transport them to the market.

Pradhan Mantri Gram Sadak Yojana (PMGSY) was launched for the development of rural roads in December 2000 by the Government of India with the vision of providing the connectivity to unconnected rural habitations. These roads are constructed and maintained by the Panchayat.

1.1 PRESENT CASE STUDY

The main task of this work is to evaluate the performance of roads constructed using the MT Vihar Nano Fiber technology as part of the demonstration project phase II of Namma Grama Namma Raste Yojane (NGNRY).
The study area extends from the Sasalapura to Honiganahalli road of Kanakapura Taluk. And Mallur to Kudlur road of Channapatna Taluk both are in Ramanagara District of Karnataka state. The above roads are classified as rural roads and are part of the NGNRY phase II demonstration project.

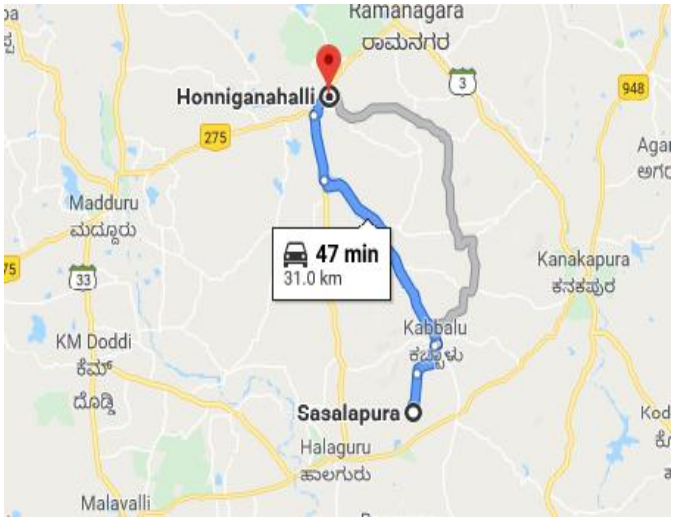

Fig -1: Honniganahalli – Sasalapura road stretch

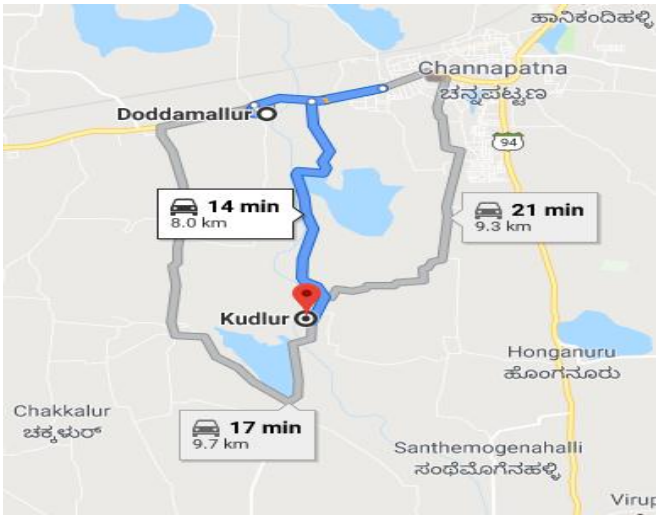

Fig -2: Mallur - Kudlur road stretch

1.2 MT VIHAR NANO FIBER TECHNOLOGY

In this technology, MT Vihar Nano Fiber mat or grille consists of a 10 x 10 mm carpet weighing approximately about 120 g / m^2 with Warp-700 and Weft-550 tensile strength. The carpet is superimposed over 300 mm longitudinally with using round head country nails of 150 mm length at an interval with a range of 1000 mm. The main purpose of using MT Vihar Nano fibers is to increase the tensile strength of the asphalt layer, allowing it to withstand more axle loads and more repetitions than the conventional one.

1.3 OBJECTIVES OF THE PRESENT CASE STUDY

- To evaluate the structural and functional parameters of the road stretches.
- To identify new technologies like MT Vihar Nano Fiber used roads over traditional asphalt pavement.
- To estimate the parameters required to measure the Pavement Condition Index (PCI) through structural and functional evaluation.
- Determine geotechnical parameters for road stretches and compare them with detailed project report (DPR).

2. METHODOLOGY

2.1 PAVEMENT PERFORMANCE EVALUATION

A wide range of pavement weakens with time without much application of vehicular loads and because of the impact of natural parameters. All parameters like introductory condition, traffic stacking, climatic conditions decides the rate of disintegration of pavement. By assessment it tends to be surveyed whether the pavement requires upkeep and restoration.

Table -1: TECHNOLOGY ADOPTED FOR PAVEMENT IN SASALAPURA TO HONNIGANAHALLI ROAD

Sl. No	Length (km)		Sub total (km)	Adopted Technology for pavement
	From	To		
1	0.00	1.02	1.02	MT Vihar Nano Fiber Technology
2	1.02	1.52	0.5	Conventional

Table -2: TECHNOLOGY ADOPTED FOR PAVEMENT IN MALLUR TO KUDLUR ROAD

Sl. No.	Length(km)		Sub total (km)	Adopted technology for pavement
	From	To		
1	0.00	1.20	1.20	MT Vihar Nano Fiber Technology
2	1.20	1.72	0.5	Conventional

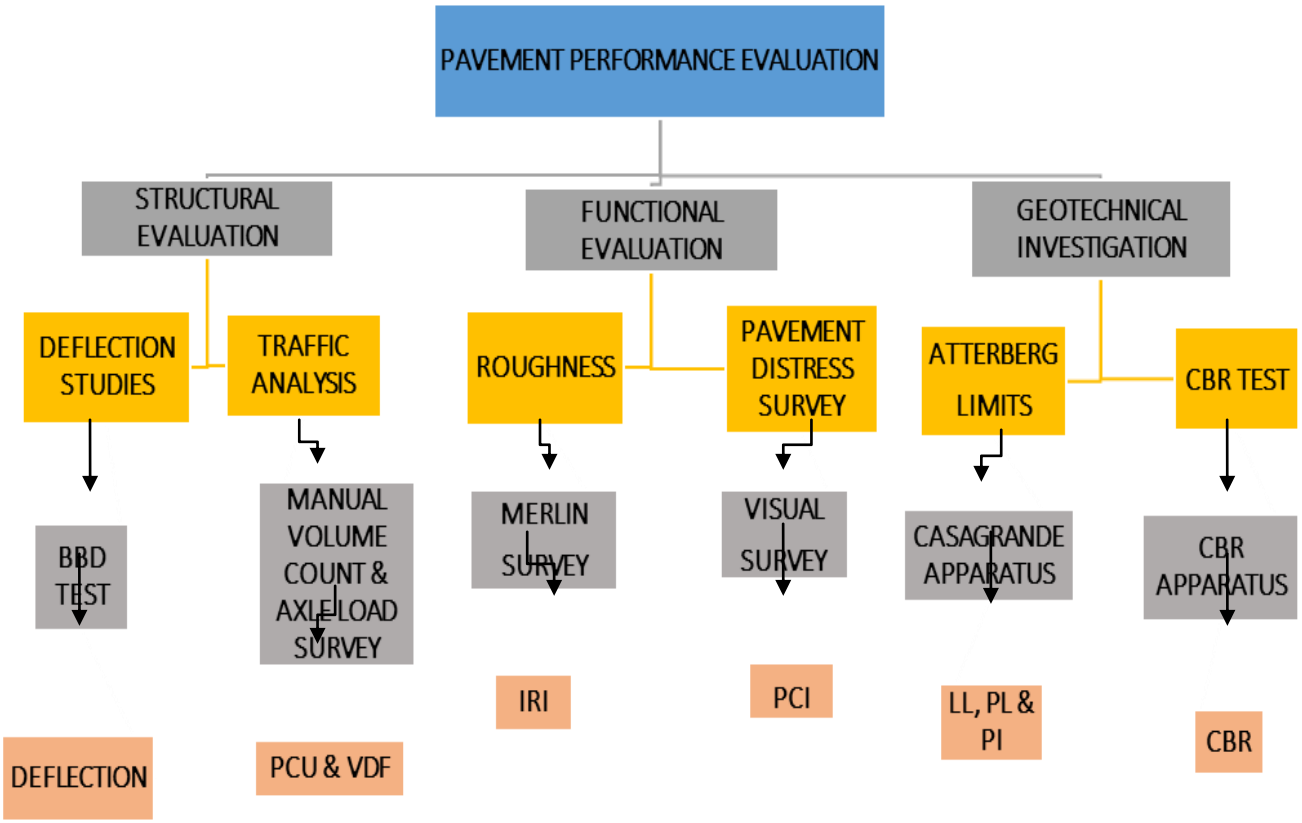

Chart -1: METHODOLOGY ADOPTED FOR THE STUDY

2.2 DATA ACCUMULATION

DATA ACCUMULATION FOR STRUCTURAL EVALUATION

- Classified volume count is carried out for a period of 3 days.
- Axle load study is completed by utilizing convenient weigh pads.
- Benkelman Beam Deflection test is conveyed at an interim of 50m separated and the focuses are taken in amazed position.

DATA ACCUMULATION FOR FUNCTIONAL EVALUATION

- MERLIN review is directed on both technology demonstrated pavement and conventional flexible pavement to get the unevenness of the pavement.
- Pavement condition review is done to decide Pavement Condition Index (PCI).

GEOTECHNICAL INVESTIGATION

- Atterberg limits is determined for a soil sample as per IS 2720 part IV.
- Laboratory density of a soil sample is determined out as per IS 2720 part VIII.
- CBR Test is conducted as per IS 2720 Part XVI.

3. RESULTS

3.1 AVERAGE DAILY TRAFFIC

The observed Average Daily Traffic and Vehicle Damage Factor obtained from survey done for a period of 12 hours are

Table -3: AVERAGE PCU AND VDF VALUES

CYCLE	STRETCH	AVERAGE DAILY TRAFFIC	VEHICLE DAMAGE FACTOR
1	SASALAPURA TO HONNIGANAHALLI	166	0.1
	MALLUR TO KUDLUR	306	0.1013
2	SASALAPURA TO HONNIGANAHALLI	202	0.045
	MALLUR TO KUDLUR	421	0.0599

3.2 BENKELMAN BEAM DEFLECTION TEST

The BBD studies were carried out as per IRC: 81-1997 to determine deflection.

Table-4: DEFLECTION VALUES

CYCLE	STRETCH	DEFLECTION (mm)	
		MT VIHAR NANO FIBER TECHNOLOGY	CONVENTIONAL
1	SASALAPURA TO HONNIGANAHALLI	1.013	0.539
	MALLUR TO KUDLUR	0.971	0.889
2	SASALAPURA TO HONNIGANAHALLI	1.763	1.383
	MALLUR TO KUDLUR	1.731	1.911

3.3 PAVEMENT CONDITION SURVEY

Table –5: PAVEMENT CONDITION INDEX (PCI) VALUES

CYCLE	STRETCH	PCI
1	SASALAPURA TO HONNIGANAHALLI	62
	MALLUR TO KUDLUR	52
2	SASALAPURA TO HONNIGANAHALLI	59
	MALLUR TO KUDLUR	49

A visual survey is conducted along the stretch to check the pavement condition. Rating scale is given in table 6 to suggest measures for maintenance of road.

Table -6: PCI RATING SCALE

PCI RANGE	RATING	MAINTENANCE MEASURES
86-100	Good	No maintenance required
71-85	Satisfactory	Little or no maintenance
56-70	Fair	Routine maintenance, crack sealing and minor patching
41-55	Poor	Preservative treatments (seal coating or thin nonstructural overlay 2" or more)
26-40	Very Poor	Needs patching and repair prior to major overlay Milling And removal of deterioration extends the life of overlay.
11-25	Serious	Needs reconstruction with extensive base repair
0-10	Failed	Total reconstruction

3.4 MERLIN SURVEY

Table- 7: INTERNATIONAL ROUGHNESS INDEX (IRI) VALUES

CYCLE	STRETCH	MT VIHAR NANO FIBER TECHNOLOGY	CONVENTIONAL
		IRI (m/km)	
1	SASALAPURA TO HONNIGANAHALLI	2.759	2.123
	MALLUR TO KUDLUR	2.64	2.47
2	SASALAPURA TO HONNIGANAHALLI	2.877	2.335
	MALLUR TO KUDLUR	2.71	2.54

4. CONCLUSIONS

- From Table 3, it can observed that the traffic census and axle load survey, very less commercial vehicles are plying on both the stretches, hence it is very difficult to draw the conclusion on the performance of MT Vihar Nano Fiber technology pavement over Conventional flexible pavement based on traffic conditions.

- From the Table 4, it can be observed that the characteristic deflection value of Experimental and Conventional flexible pavement stretch doesn't vary much and also characteristic deflection value is within safe limit, Hence it can be concluded that the relaying of the pavement is not warranted.

- The PCI value of the stretch from Sasalapura to Honniganahalli road for a cycle 1 and cycle 2 as shown in Table 5 are 62 and 59 respectively. Both the values lies in 56-70 range. It can be concluded that the stretches are fair and requires routine maintenance, crack sealing and minor patching.

- The PCI value of the stretch from Mallur to Kudlur road for cycle 1 and cycle 2 as shown in Table 5 are 52 and 49 respectively. Both the values lies in 41-55 range. It can be concluded that the stretches are poor and requires preservative treatments (seal coating or thin non structure overlay 2" or more).

- The IRI values as shown in table 7 obtained from MERLIN survey on both Experimental and Conventional flexible pavement stretches was found less than 3 m/km which has less significant on the vehicle operation cost (VOC).

- Since it is about two year old construction we need to wait for another 3 to 4 seasons and evaluation can be conducted to evaluate the performance of controlled stretch (MT Vihar Nano fiber Technology) in comparison with the uncontrolled stretch.

ANNEXURE

Fig -1: STARTING POINT OF SURVEY (SASALAPURA TO HONNIGANAHALLI)

Fig -2: PAVEMENT CONDITION SURVEY

Fig -3: CARRYING OUT MERLIN STUDY

Fig -4: AXLE LOAD SURVEY

Fig -5: CARRYING OUT BBD TEST

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