

Panchayatraj Institutions and Rural Road Maintenance Management System

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Abstract- Rural roads consist of Village roads and other district roads. India has a vast rural road network. It comprises about 85 percent of the total road network. Rural roads are the last links in the transport network. However they are more important in terms of providing access to social and economic services to the rural population. Rural roads are means to promote and sustain agricultural growth, improve primary health and connect to market centers, hospitals, education hubs etc. This in turn expands rural growth opportunities and real income through which poverty can be reduced. However, these benefits would reduce substantially due to poor maintenance. Thus, to achieve the benefits of created road assets it is essential to maintain the rural road network. The emphasis of the paper is on assessment of the rural road maintenance problem and to provide some suggestions on how the situation can be improved.

This study comprises surveying the existing condition of rural road network in Mangaon Taluka of Raigad district. Survey includes assessing pavement condition Index by a most simple and economical method and collecting all relevant road inventory data of Bridges, culverts and cross drainage works. Road condition survey of 57 Km of Other district roads and 318 Km of Village roads is carried out. The study identifies required maintenance cost of each type of pavement condition index, existing resources like labour, funds and machinery. This study attempts to highlights some basic maintenance issues such as community participation through Panchayatraj Institutions and suggests a model of allocation of maintenance responsibility. The findings of this study will be useful to preserve the benefits of huge rural road assets created in Maharashtra as well as in India.

Keywords- Panchayatraj Institutions, PCI, Pavement maintenance, PMGSY, Road maintenance, Rural roads.

I. INTRODUCTION

A large rural road asset has been created in India since the first Road Development plan (1943-61) popularly known as Nagpur Plan. With the advent of Pradhanmantri Gram Sadak Yojana in the year 2000 rural road connectivity programme has got a boost. PMGSY aimed to join the habitation of population more than 250. PMGSY is a first centrally funded and fully dedicated Scheme for Rural road

construction, run by Ministry of Rural development Government of India.

We concentrate on the new construction but the maintenance is often neglected. Maintenance of road means to keep the road in its original condition as it was constructed or renewed and fit for motorized traffic. Proper routine maintenance prevents the fast deterioration of road surface, which may lead to the periodic maintenance. Cost of routine maintenance is much less than and equal to the fraction of the periodic repairs, we may call the routine maintenance as a preventive measure and it is so easy and requires no expertise to carry out. Maintenance should begin as soon as road construction or improvement works are completed. Regular and timely maintenance increase the life of the road, prolonging date at which it needs to be reconstructed. This has many benefits, mainly it stretches the period over which the benefits of the investment made are available and therefore provides a higher rate of return on investment.

II. OBJECTIVE OF MAINTENANCE

The objective of maintenance is to ensure that the road remains serviceable throughout its design life. Maintenance is important because,

- (i) It keeps the road open for traffic and contributes to more reliable transport services.
- (ii) It reduces the maintenance cost of operating vehicles on the road by providing a smooth riding surface.
- (iii) It prolongs the life of the road by reducing the rate of deterioration, thereby safeguarding previous investments.
- (iv) It sustains social and economic benefits of improved road access.

III. CLASSIFICATION OF RURAL ROAD MAINTENANCE

A. Classification depending on location

Rural road maintenance activities are commonly divided in two distinct groups, depending on the location of the actual works.

a. off-carriageway Maintenance work

Off-carriageway works are mainly related to maintaining the drainage works, and repairing any damages to the road components outside the road surface. This means that the side slopes, all drains and cross drainage structures are kept in a good condition that permits the free but controlled run-off of water away from the road.

b. Road Surface maintenance work

The second group of maintenance activities relate to road surface repairs or Pavement maintenance. This work mainly consists of maintaining a good riding surface on the road, free from any obstructions and damage and with the necessary cross-slope to secure proper drainage of the surface.

B. Classification depending on Timing of Maintenance

Inputs

Routine maintenance is a recurrent activity. Careful timing of work inputs forms an important part of an efficient maintenance program. The prime objective when scheduling maintenance works is to ensure that the works are carried out as preventive measures, at an early stage when the road deterioration and damage are still limited. The works are therefore scheduled at strategic intervals when it is expected that the need for action is essential.

a. Routine Maintenance

The timing of regular, or routine maintenance works are often related to the time of the year when rainfalls occur. The most common work activities are:

- (i) Clearing of drains to allow free passage of water;
- (ii) Controlling erosion on shoulders and slopes;
- (iii) Clearing of culverts and other waterways;
- (iv) Minor repairs to culverts and retaining structures;
- (v) Repairing rain cuts;
- (vi) Repair, fill and compact potholes and ruts;
- (vii) Grass and bush clearing;
- (viii) Repairs of road signs.

Routine maintenance of rural roads is a much dispersed activity, requiring small resource inputs over a large number of geographically dispersed locations. For this reason, this operation is very well suited for labour-based work methods thereby relying to a high extent only on locally available resources.

b. Periodic Maintenance

Along with the routine maintenance carried out each year, the road will need a more extensive overhaul after a certain number of years. This periodic maintenance involves more comprehensive and costly activities such as reshaping of the road surface, re-surfacing and major repair or reconstruction of cross-drainage structures. Depending on the quality of the road, and the level of wear and tear, the periodic maintenance works would be scheduled at intervals of 3 to 7 years.

Periodic maintenance includes activities such as:

- i) Reshaping prior to resurfacing.
- ii) Regraveling / resurfacing of entire road.
- iii) Major repairs to structures.
- iv) Construction of new culverts.

c. Emergency Maintenance

Along with regular maintenance activities, road maintenance authorities need to make provisions for the occurrence of unforeseen damage to the road network. This could be caused by major floods or rains, landslides, or other freak conditions.

Emergency maintenance cannot be forecasted and therefore does not figure in annual work program. It is, however, possible to reserve a certain amount of funds for this purpose. The road organizations need to establish contingency plans for such incidences, thus allowing them to react in a timely fashion, in order to reopen access on the road and limit the extent of the damages.

Emergency maintenance involves activities as under:

- (i) Repair or reconstruction of damaged road sections due to wash-outs, erosion, or floods,
- (ii) Repair or reconstruction of damaged cross-drainage structures due to floods or over-weight vehicles,
- (iii) Clearing of landslides, trees or boulders from the road carriageway.
- (iv) Repair or reconstruction of damages to erosion protection, resulting from excessive flows of water or landslides.

IV. PRIORITY OF RURAL ROAD MAINTENANCE

An organization responsible for road maintenance faces the challenge that available funds are never sufficient. It is therefore necessary to assess the importance of the various work interventions to ensure that available resources are utilized in the most effective way.

The emergency maintenance is the most important as it relates directly to keeping the roads open to traffic. In terms of non-emergency related works, experience clearly show that it is the regular or routine maintenance activities related to preserving the drainage system which have the most significant effect in terms of extending the lifetime of a road. These works do not involve any sophisticated technology or skills. They can be carried out using manual labour and simple hand tools and are inexpensive. Despite this, they still require a sound management organization to ensure that works are carried out at the right place and time.

V. CASE STUDY AND DATA COLLECTION

1. Study region

Rural road network in Mangaon Taluka is studied. Mangaon Block (Taluka) is in Raigad district of Maharashtra state. The block is situated in "Western Ghats" region of Sahyadri mountain ranges of "Konkan". Mangaon Block area is a completely notified hilly region. This area is a high rainfall area. The main features of Mangaon block are shown in the table I below.

Table I: Main Features of Mangaon Block

1.	Name of block	Mangaon
2	District	Raigad
3	Total Area of Block	670.39 Sq.Km
4	Total population of Block(2011)	169541
5	Number of Villages in Block	186
6	Number of Gram Panchayats in Block	75
7	Average Rainfall	3573 mm
8	Temperature variation	Maximum =42° C Minimum =12° C
9	Education Centre	Mangaon, Nizampur, Lonere, Goregaon, Nandavi
10	Market Centers	Mangaon, Nizampur, Talashet, Goregaon, Lonere
11	Primary health centers & Govt. Hospitals	Mangaon, Nizampur, Talashet, Goregaon, Lonere, Sai, Nandavi, Shirawali.

2. Study Methodology

- i) Collection of data regarding road inventory such as cross drainage works, Culverts, Bridges.

- ii) Collection of surface type data such as bituminous surface, W.B.M. surface, murum surface, Concrete surface.
- iii) Surface Condition of road by way of Pavement condition Index.

There are many sophisticated methods for measurement of pavement condition of roads with automated equipments like Bump Integrator, roughometer, etc. These are very accurate but expensive methods. For Rural Roads, simple and low cost methods can be used to initiate a pavement management system.

A simple method of measurement of pavement condition of Rural Roads to be adopted by field Engineers of Zilla parishad is given as follow.

PCI based on comfortable driving speed

The driver is instructed to drive jeep or car at most comfortable & safe speed possible on the road. The PCI thus assessed for each kilometer based on normal driving speed, is shown in table No. II

Table II: PCI based on safe driving speed

Sr.No.	Normal driving speed	PCI	Surface Condition
1	Over 40 Km/Hrs	5	Very good
2	Between 30-40 Km/Hrs	4	Good
3	Between 20-.430Km/Hrs	3	Fair
4	Between 20-10 Km/Hrs	2	Poor
5	Below 10 Km/Hrs	1	Very poor

Photographs of Road surface in different PCI state are shown in Annexure I.

- iv) Collection of data Regarding Education centre, Primary Health Centre, Market Centre.
- v) Fixing Priority for Road maintenance according to available data.
- vi) Assessment of requirement and availability of Funds.

3. Data acquisition

- i) The Rural roads comprise of Other district roads (ODR) and Village roads (VR). As per 2001-21 Road Development Plan total road length in Mangaon Taluka is shown in Table III as under and Graphically Shown in fig.1;

Table III: Total Rural Road length in Mangaon Taluka

Sr. No.	Type of road	Total number of Road	Road Length as per 2001-21 Plan (Km)	Road length in existence (Km)	Surface type			
					B.T.	W.B.M.	Murum	Concrete
1	O.D.R.	9	57.32	57.32	57.32	--	--	--
2	V.R.	289	498.77	318.37	246.67	36.66	25.69	9.52
Total		298	556.09	375.69	303.99	36.66	25.69	9.52

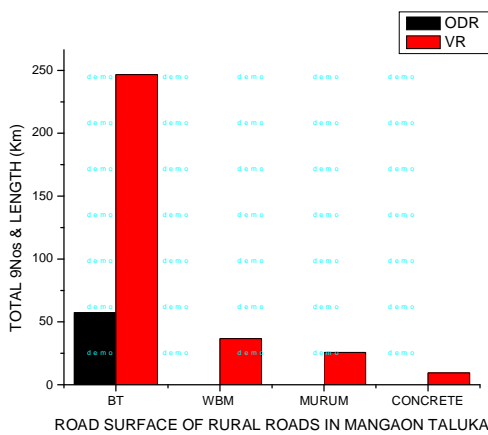


Fig.1 Total Rural Road length in Mangaon Block

ii) The data collected of bridges is shown in Table IV below,

Table IV :Bridges in Mangaon block

Description	O.D.R.	V.R.	Total
Major Bridges (Length more than 30m)	0	8	8
Minor Bridge (Length 7-30m)	10	69	79
Culverts(Length up to 6m)	7	60	67
Total	17	137	154

iii) The data collected of RCC Pipe Cross Drainage Works is shown in Table V below,

Table V: Pipe C.D. works in Mangaon Block.

Description	O.D.R.	V.R.	Total
C.D.Work with headwall	207	282	489
C.D.Work without Headwall	22	397	419
Total	229	679	908

iv) The data collected of Pavement condition Index wise Road length is shown in Table VI below and Graphically Shown in fig.2;

Table VI: Pavement condition Index wise Road length in Mangaon block

PCI	VR(Length in Km)	ODR(length in Km)
1	7.50	13.10
2	53.95	5.00
3	117.11	6.00
4	101.19	14.42
5	13.10	18.60
Total	292.85	57.32

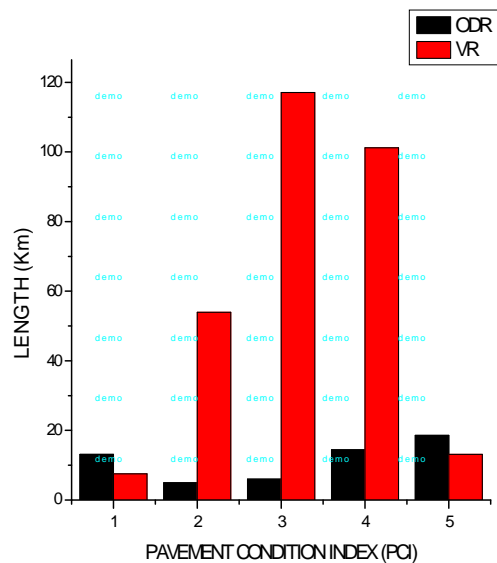


Fig.2 Pavement Condition Index & corresponding Length of rural roads in Mangaon Taluka (Dec.2014)

v) The data collected regarding General construction Practice to construct new rural road by PWD Maharashtra State is shown in Table VII below,

Table No. VII
General Construction Practice to construct new rural road by PWD Maharashtra State

Name of layer	Metal Size	Layer Thickness	Percentage of screening materials
Blanketing	Hard murum having PI<6	150-600mm to achieve sub grade CBR 15	Nil
WBM(over size)	60-80mm	150mm	Hard murum 33% of metal
WBM(Normal Size)	40mm	75mm	Soft murum 25% of Metal
MPM	40mm & 12mm	75mm	Bitumen 2Kg/Smt
Carpet	12mm	20mm	Bitumen 1.59Kg/Smt.
Seal coat	6mm	Nil	Bitumen 0.98Kg/Smt

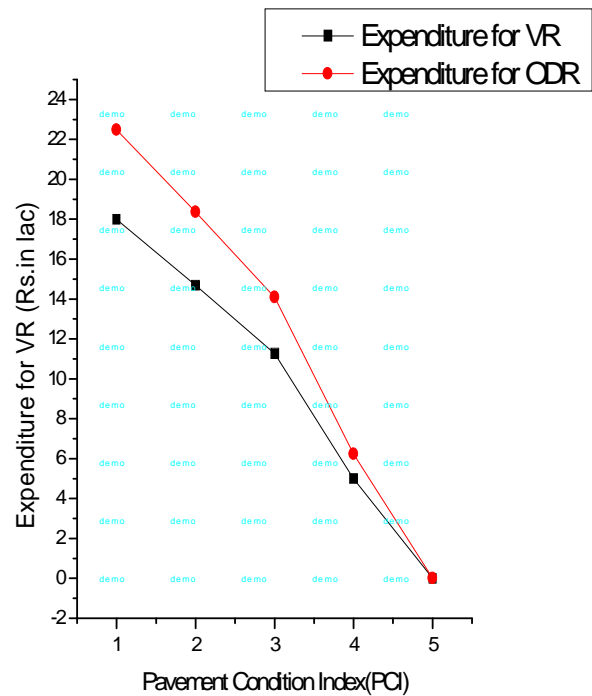


Fig.3 Expenditure required per Km length of each PCI

vi) The expenditure required per Km length of each PCI is shown in the Table VIII below,

vii) The current expenditure required for total length of each PCI in Mangaon block is shown in the Table IX below,

Table No. VIII
Expenditure required per Km length of each PCI

PCI	Cost of Repairs in Rs., (figures in bracket shows % area of the Treatment required)				Total Cost in Rs.	
	WBM40mm @Rs. 1108/mt.	MPM50mm @ Rs. 2288/mt	carpet 20mm @Rs. 190.55 /Smt	Sealcoat @Rs. 70.958/mt.	For VR(3.0m Carriageway)	For ODR(3.75m Carriageway)
1	330000 (100%)	684000 (100%)	571650 (100%)	212850 (100%)	1798500	2248125
2	0 (0%)	684000 (100%)	571650 (100%)	212850 (100%)	1468500	1835625
3	0 (0%)	342000 (50%)	571650 (100%)	212850 (100%)	1126500	1408125
4	0 (0%)	0 (0%)	285825 (50%)	212850 (100%)	498675	623344
5	0	0	0	0	0	0

Graphically it is shown as,

Table IX
Current expenditure required for total length of each PCI in Mangaon block

PCI	VR		ODR	
	Length in Km	Cost of repair Rs.	Length in Km	Cost of repair Rs.
1	7.50	13488750	13.10	29450437.50
2	53.95	79225575	5.00	9178125.00
3	117.11	131924415	6.00	8448750.00
4	101.19	50460923.25	14.42	8988616.88
5	13.10	0	18.60	0
Total	292.85	275099663.3	57.32	56065929.38
Total cost required for ODR+VR				331165592.60

Graphically Shown as,

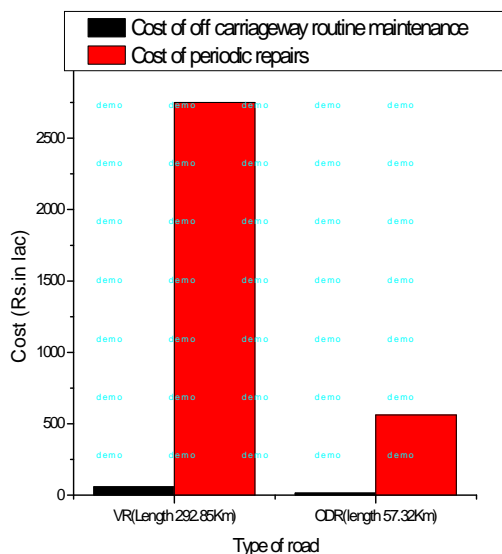


Fig.4: Expenditure required for routine maintenance & Periodic repairs.

viii) Annual Fund availability for maintenance & Repairs of Rural roads under the head 3054 for last Two years for the Raigad District is as under,

2012-13 = Rs. 335.00 lac

2013-14= Rs. 309.52 lac

ix) Departmental maintenance labour available

Only four permanent labours are available for maintenance of @ 375 km length of rural road. Department has no authority to engage labour on daily wages.

x) Maintenance machinery available with Department.

Neither machinery nor any material is available with the Department for road maintenance work.

4. Sources of Funds:

- i) 3054 Roads & bridges fund (local sector)- Implemented by Zilla parishad
- ii) 5054Roads & bridges fund (State sector - State budget) - Implemented by Public works Department.
- iii) Mineral development fund (Implemented by both Zilla parishad as well as Public works Department.)
- iv) Finance commission Funds (Fund from Central Government for Improvements of ODR)

5. Existing Model of Maintenance responsibility:

At present in Maharashtra state, the responsibility of Rural road maintenance is of concerned Zilla parishad. Raigad Zilla parishad have one Works Sub-Division for two blocks and with the available few permanent labours road maintenance activities are being carried out. Periodical maintenance is carried out by engaging contractors. Although the rural road maintenance responsibility is assigned to Zilla parishad, Public Works Department is also carrying out the periodical repair works.

6. Suggested model of Maintenance responsibility based on Community Participation:

As there is not clear policy of maintenance responsibility often confusion occurs. To overcome this difficulty all the funds should be entrusted to Zilla parishad and also the maintenance responsibility should be decentralized among the three tier panchayat raj System. The three tier panchayat raj System prevailing in Maharashtra is shown in Annexure II. The formation of MGs (Maintenance Gangs) with four or five able-bodied villagers to be selected from the village itself and imparted training on simple maintenance activities. The suggested model of allocation of maintenance responsibility is shown in Table X:

Table X:
The suggested model of allocation of maintenance responsibility

Administration / Organization Unit	Extent of Road length(Km)	Responsibility
District(Zilla Parishad)	1500-3000	Planning and assessment of maintenance needs regularly; rehabilitation and renewal works periodically every 5-7 years.
Block (Panchayat Samiti)	200-400	Procurement of materials and equipment/implements & distribution to central village gang (CVG).
Central village gang for a group of villages (Gram Panchayat)	5-10	Collection of materials and equipment/implements from Block HQ and storing for distribution to MG.
Maintenance Gang of Village(Village)	1-5	Execution of routine maintenance by the MG of the Village.

Normal agricultural/household hand tools used by villagers would be used for carrying out maintenance works. A specially made push-cart will be used by the MG for transporting materials and implements to the sites for maintenance works. A calibrated small metal container of

known volume can be used for batching of the mix and a normal rammer will be used for manual compaction of the repaired pot hole, patchwork, shoulder, side slope and side drain.

VI. CONCLUSION

- 1) Only four permanent labours are available for maintenance of @ 375 km of rural road length under the study, which is highly impossible to maintain such a big length. The policy of government is not to employ the labours further more after the existing retires. Then it is so difficult to go through the little routine maintenance activities, such as removing rainwater from road surface, which is only to get cut from side shoulder. This small activity if neglected it will lead to serious road deterioration problem.
- 2) Considering the available data average fund availability for maintenance & Repairs of Rural roads per K.M. is Rs 10000 /Km only. This is most insufficient. For only off-carriageway routine maintenance Rs.20,000/km/year expenditure is expected. This cost does not include the cost of surface repair.
- 3) A small maintenance at early stages can check the further fast deterioration and big expenditures. Hence considering the scarcity of funds the priority of maintenance should be changed .The priority must be given to early stages maintenance instead of going for rehabilitation and restoration of roads in very poor condition. There should be a good tuning between Zilla parishad and Maharashtra rural road Agency which is aimed to carry out PMGSY works. The roads requiring complete rehabilitation must be improved at a glance under PMGSY so that the scarcely available fund can be used for early stages maintenance work.
- 4) For the timely Maintenance of rural road assets a dedicated Road Fund should be created.
- 5) The formation of MGs (Maintenance Gangs) will be more convenient because of the Local labour will do the maintenance work with the feeling that this road is my own village road.
- 6) We can survey the PCI every year after monsoon in a fast manner by the suggested method, and with a small exercise the priority of repairs may be decided.
- 7) 7)The cost of determining PCI by Suggested method as per Raigad district Schedule of Rates for the year 2014-15 is Rs.15/Km which is very small as compared to roughometer method Rs.560/Km.

A. Limitations

The PCI determination is based on safe driving speed of car, for roads in hilly region having high gradient it may

affect the speed. To overcome this difficulty Surveyor's visual judgment is also required to rate the PCI. Large and varied data is required to be stored and updated periodically.

B. Future Scope

GIS based data storage and logical analysis system can tackle this large data storage and assessment problem.

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