

Development of Strategy for Up Gradation of Existing Rural Road Links of Aravalli District

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Abstract: The present study developed Maintenance Priority Index (MPI) for the road links of the Aravalli District using certain factors affecting pavement maintenance. The factors considered in this study were pavement condition, Riding quality, traffic characteristics, land use characteristics of the pavement. A simple priority ranking module provides a systematic procedure to prioritize road pavement sections for improvement and selection of suitable maintenance strategies. The priority ranking methodology is based on priority index concept, which makes use of overall distress index model and traffic adjustment factors. It involves a process of expert opinion through a series of questionnaires and the derivation of weighted average condition measure.

Keywords: *Pavement Management System, Maintenance priority Index.*

I. INTRODUCTION

General

The importance of roads in connecting the vast rural areas of India to form the national market and economy cannot be overstated. Connectivity provided by roads is perhaps the single most important determinant for the well-being and the quality of life of people living in an urban area. The efficiency of the innumerable government programs aimed at rural development, employment generation, and local industrialization is, to a large extent, determined by the connectivity provided by roads. There is a considerable body of evidence that demonstrates the links between rural road investment, decline in poverty, and improvement in the quality of life in India. Improvements in rural roads are positively correlated with decline in poverty.

Objective of the Study

- To collect information of existing condition of road / road links.
- To get the overview of existing traffic flow, surface condition, geometry etc.
- To get the idea of connected and not connected habitations with the existing road / road links.
- To determine the existing and future demand of traffic flow.
- To obtain opinion from experts of the different field like R&B department, academicians, state transport officers (GSRTC), politicians / leaders of the region and statistical officers.
- Improvement in geometry features.

- To prepare a decision matrix by giving suitable proper weightage to different factors for preparing priority list.
- To develop a model for deciding the priority

Scope of the study

- This study is limited to rural road links of aravalli district. Important road link with heavy traffic of the district.
- This study can give an idea to prepare a priority list according to considering the main factors with proper weightage.
- Improvement with respect to decided priority list may reduce the accident potential, increase socio-economic development and proper utilization of fund.

II. REVIEW OF LITERATURE

Reddy et. al (2001) developed a priority ranking model for managing flexible pavements at network level. In this paper a priority ranking module that provides a systematic procedure to prioritize road pavement sections for improvement and selection of suitable maintenance strategies depending upon the budget is developed.

Sathyakumar et. al (2004) has represented a methodology for priority ranking of highway pavements for maintenance based on composite criteria. Questionnaire survey was used capture expert opinion and user opinion followed by functional evaluation to determine the crack area, percentage of potholes and present serviceability index.

Jain et al. (2011) have studied the study aims to evaluate road safety audit of a section of four-lane national highway (NH)-58 and will focus on evaluating the benefits of the proposed actions that have emanated from deficiencies identified through the audit process. After conducting RSA, it is found that trucks are parked on highway which reduces the effective width of carriageway and creating traffic hazards to high speed moving traffics. Unauthorized median openings were found which should be immediately closed. Missing road and median markings to be done and speed signs should match with speed. Access and service lanes are also deficient which requires immediate improvement. The most vulnerable road user (VRU) i.e. Pedestrians and cyclists facilities near habitation are lacking and needs to be facilitated on priority.

III. METHODOLOGY

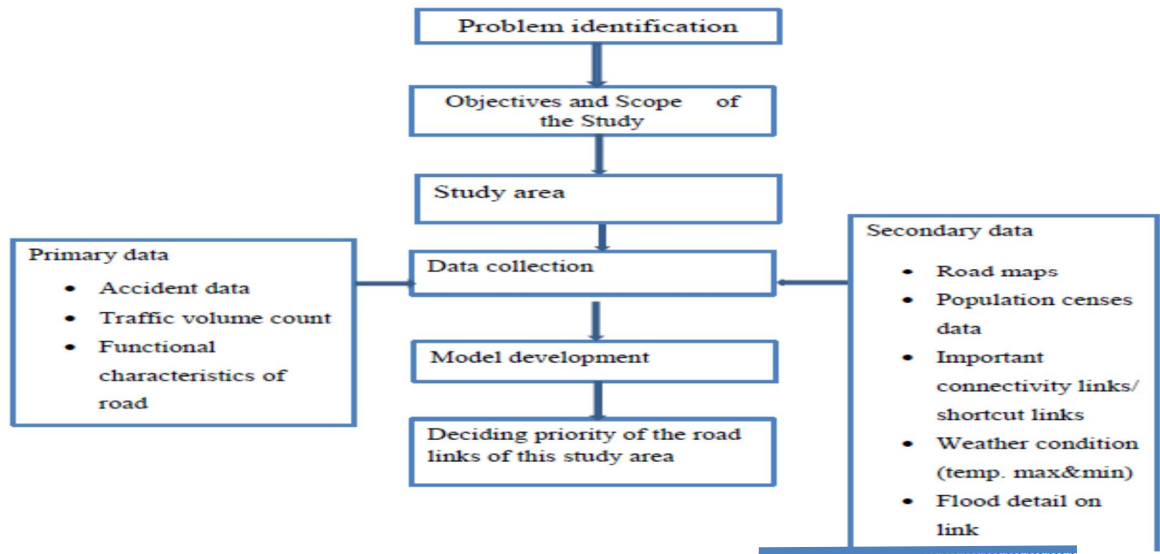


Fig. 1. Methodology Flow Chart

IV. STUDY AREA AND DATA COLLECTION

➤ Data Collection in the Study Area

• Reconnaissance survey

Condition survey: Detail condition survey will be conducted to collect the information regarding the type of road surface, rut depth, crack type and extent, pot holes, raveling, shoulder failure etc. Inventory and condition data culvert and bridge will also be collected.

Traffic survey: By manually traffic volume count method. Manual counts require simply counting of every vehicle seen to pass fix point on road.

Preparation of improvement proposals: Based on the existing road condition and traffic, improvement proposals will be prepared the improvement may include immediate repair, widening, strengthening and geometry corrections.

Aravalli district is a district in the state of Gujarat in India that came into being on August 15, 2013, lies at 24.0283° N, 73.0414° E in western India becoming the 29th district at 197 metres (646 feet) above sea level on the banks of the Mazum river, in north Gujarat state. The district has been carved out of the Sabarkantha district. The district headquarters at Modasa. Figure 4.1 shows the location of Aravalli district in the map of Gujarat.

The district consists of Modasa, Malpur, Dhansura, Meghraj, Bhiloda and Bayad talukas of former Sabarkantha district. Of these, Meghraj, Malpur and Bhiloda are tribal dominated talukas. The district includes 676 villages and 306 village panchayats with a total population of 1.27 million and is the most literate (74%) tribal district in Gujarat.

Roads in Aravalli district are selected as study area

Table 1. Study Area Detail

SR. NO.	APPROACH NAME	LENGTH (KM)	WIDTH (M)	AREA (SQU. MET.)	ROAD TYPE
1	MALPUR TO PAHADIA	18.0	5.50	99000	ODR
2	GALIYADANTI TO PANAVADA	10.0	5.00	50000	ODR
3	DODIA TO MEVDA	12.0	5.50	66000	ODR
4	JARDA TO ITAVA	12.0	5.50	66000	ODR
5	GODHA TO MOTIPANDULI	23.0	5.00	115000	ODR
6	LIMBHOI TO ADAPUR	12.0	5.50	66000	ODR
7	MEDHASAN TO AMRATPURA	15.0	5.00	75000	ODR
8	KAU TO AMALAI	4.50	5.50	24750	ODR
9	MODASA TO KAU	10.12	7.00	70840	MDR
10	DUGARVADA TO ANIYOR	8.00	7.50	60000	MDR
11	KUNOL TO ISARI	11.0	7.50	82500	MDR
12	PANCHAL TO JAMGADHA	10.0	7.50	75000	MDR
13	MEGHRAJ TO KALIYAKUVA	17.0	7.50	127500	MDR
14	MODASA TO MEGHRAJ	24.0	7.50	180000	SH
15	MODASA TO RAJENDRANAGAR	23.9	7.50	179250	SH
16	MEDHSAN TO JIVANPUR	13.0	7.50	97500	SH
17	TINTOI TO MEGHRAJ	31.4	5.50	172425	SH
	TOTAL			1606765	



Fig. 2. Road map of aravalli district

Table 2. Summary of Traffic volume Details

SR. NO.	APPROACH NAME	TRAFFIC VOLUME (PCU PER SQ.M.)
1	MALPUR TO PAHADIA	438
2	GALIYADANTI TO PANA VADA	399
3	DODIA TO MEVDA	493
4	JARDA TO ITAVA	430.5
5	GODHA TO MOTIPANDULI	422
6	LIMBHOI TO ADAPUR	433.5
7	MEDHASAN TO AMRATPURA	602.5
8	KAU TO AMALAI	331.5
9	MODASA TO KAU	768
10	DUGARVADA TO ANIYOR	606.5
11	KUNOL TO ISARI	541
12	PANCHAL TO JAMGADHA	513
13	MEGHRAJ TO KALIYAKUVA	589
14	MODASA TO MEGHRAJ	3917.5
15	MODASA TO RAJENDRANAGAR	4744.5
16	MEDHSAN TO JIVANPUR	768
17	TINTOI TO MEGHRAJ	1005.5

Table 3. Details of Visual Condition Surveys

SR. NO.	APPROACH NAME	LENGTH (KM)	WIDTH (M)	Total AREA (SQ.M.)	CRACK AREA (SQ.M.)	ROUGHNESS AREA (SQ.M.)	POTHOLES AREA (SQ.M.)	BENIFITED VILLAGE ON ROAD LINK
1	MALPUR TO PAHADIA	18.0	5.50	99000	39.57	67320	149.518	7
2	GALIYADANTI TO PANA VADA	10.0	5.00	50000	40.89	21500	171.552	8
3	DODIA TO MEVDA	12.0	5.50	66000	33.65	3960	159.349	3
4	JARDA TO ITAVA	12.0	5.50	66000	28.62	40260	126.281	6
5	GODHA TO MOTIPANDULI	23.0	5.00	115000	33.18	63250	204.764	11
6	LIMBHOI TO ADAPUR	12.0	5.50	66000	29.92	36300	170.910	7
7	MEDHASAN TO AMRATPURA	15.0	5.00	75000	24.87	43500	198.184	4
8	KAU TO AMALAI	4.50	5.50	24750	35.11	16335	171.220	3
9	MODASA TO KAU	10.12	7.00	70840	35.69	34003	236.391	7
10	DUGARVADA TO ANIYOR	8.00	7.50	60000	36.23	28200	206.431	5
11	KUNOL TO ISARI	11.0	7.50	82500	22.19	40425	177.267	7
12	PANCHAL TO JAMGADHA	10.0	7.50	75000	27.63	43500	162.767	5
13	MEGHRAJ TO KALIYAKUVA	17.0	7.50	127500	30.27	82875	199.789	12
14	MODASA TO MEGHRAJ	24.0	7.50	180000	31.69	115200	232.229	13
15	MODASA TO RAJENDRANAGAR	23.9	7.50	179250	28.31	100380	206.194	17
16	MEDHSAN TO JIVANPUR	13.0	7.50	97500	27.94	56550	168.933	9
17	TINTOI TO MEGHRAJ	31.4	5.50	172425	29.18	81040	205.473	30

➤ *Maintenance priority Ranking*

Maintenance priority value is calculated by multiplying each priority factor value by its weightage and summing the products as follows:

$$MPV = \sum_{i=1}^n V_i * W_i$$

Where, V_i = priority factor value

W_i = priority factor weightage of importance to priority ranking

V. CALCULATION

For, Kau to Amlai link

(1) *For, Traffic*

(a). Total area of road link = 24750 sq. m.

(b). Measured Traffic Volume (PCU per sq.m.) for 12 hours = 331.5

Assumed in night (12 hours) = 17%

Over all PCU = 331.57 + (0.17 * 331.6)

ADT = 387.855

©. Traffic Volume PCU per 1000 sq.m.

24750 ➡ 1000

387.855 ➡ ?

=15.671

(d). Weightage factor for Traffic = 28.69 (As per table no. 4.8)

MPV for Traffic = 28.69 * 15.671 = **449.60**

(2) *For, Crack*

(a). Total area of road link = 24750 sq.m.

(b). Measured Crack Area = 35.11 sq.m.

(c). Crack in Percentage (%)

24750 (area) 100

35.11 (area) ?

=0.14

(d). Weightage factor for Crack = 3.60 (As per table no. 4.8)

MPV for Crack = 3.60 * 0.14 = **0.511**

(3) *For, Roughness*

(a). Total area of road link = 24750 sq.m.

(b). Measured Roughness Area = 16335 sq.m.

©. Roughness in Percentage (%)

24750 (area) 100

16335 (area) ?

=66

d. Weightage factor for Roughness = 21.02 (As per table no. 4.8)

MPV for Roughness = 21.02 * 66 = **1387.32**

(4) *For, Potholes*

(a). Total area of road link = 24750 sq.m.

(b). Measured Potholes Area = 171.220 sq.m.

(c). Potholes in Percentage (%)

24750 (area) 100

171.220 (area) ?

= 0.69

(d). Weightage factor for Potholes = 23.76 (As per table no. 4.8)

MPV for Potholes = 23.76 * 0.69 = **16.437**

(5) *For, Benefited Village on Road,*

(a). Total Length of road link = 4.50 Km

(b). No. of Village connected Road link = 3

©. Benefited village on road link per Km

4.50 (Km) 3

1 (Km) ?

=0.667

(d). Weightage factor for connected benefited Village = 22.93 (As per table no. 4.8)

MPV for Potholes = 22.93 * 0.667

= **15.287**

Total MPV = 449.60 + 0.511 + 1387.32 + 16.437 + 15.287
= **1869.15**

Table 4. Priority Rank for selected road links

SR. NO.	APPROACH NAME	TRAFFIC	CRACK	ROUGHNESS	POTHLES	BENEFITED VILLAGE	MPV	PRIORITY RANK
		WEIGHTAGE 28.69	WEIGHTAGE 3.60	WEIGHTAGE 21.02	WEIGHTAGE 2.76	WEIGHTAGE 22.93		
1	MALPUR TO PAHADIA	139.62	0.144	1429.36	3.588	1.62	1574.34	4
2	GALIYADANTI TO PANAVADA	256.42	0.294	903.86	8.152	3.67	1172.40	16
3	DODIA TO MEVDA	233.59	0.184	126.12	5.737	1.04	366.68	17
4	JARDA TO ITAVA	213.34	0.156	1282.22	4.546	2.08	1502.34	6
5	GODHA TO MOTIPANDULI	116.97	0.104	1156.1	4.231	2.19	1279.59	13
6	LIMBHOI TO ADAPUR	211.05	0.163	1156.1	6.153	2.43	1375.90	11
7	MEDHASAN TO AMRATPURA	260.44	0.119	1219.16	6.278	1.22	1487.22	8
8	KAU TO AMALAI	449.60	0.511	1387.32	16.437	2.78	1856.65	3
9	MODASA TO KAU	357.69	0.181	1008.96	7.929	2.27	1377.03	10
10	DUGARVADA TO ANIYOR	321.91	0.217	987.94	8.175	1.91	1320.15	12
11	KUNOL TO ISARI	205.07	0.097	1029.98	5.105	1.95	1242.20	14
12	PANCHAL TO JAMGADHA	215.86	0.133	1219.16	5.156	1.53	1441.84	9
13	MEGHRAJ TO KALIYAKUVA	148.44	0.085	1366.3	3.723	2.16	1520.71	5
14	MODASA TO MEGHRAJ	736.80	0.063	1345.28	3.065	1.66	2086.86	2
15	MODASA TO RAJENDRANAGAR	949.23	0.057	1177.12	2.733	2.17	2131.32	1
16	MEDHSAN TO JIVANPUR	264.41	0.103	1219.16	4.117	2.12	1489.90	7
17	TINTOI TO MEGHRAJ	185.71	0.061	987.94	2.831	3.99	1180.53	15

VI. CONCLUSION

This study realise that the MPV value of selected road links deciding the priority based on their priority index. For finding MPV value the selected parameter gives proper weightage by expert opinion survey .priority is depends on MPV value thus, MPV value is more than improvement of road link is must prior.

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