Condition Assessment of Roads : Sangli District as a Case Study

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Abstract- *India is one of the fastest developing country in the world and India has 2nd largest road network in the world. Road network plays important role in transportation sector. This large network is deteriorating fast and needs to be maintained. This needs maintenance management system. For the preparation of Road maintenance management system distress analysis and condition assessment is required.*

This study deals with the measurement of distress quantity and distress severity to define the condition of road network in sangli district as a study area. By analyzing this distress data the priorities for the maintenance work for selected road network is defined and is developed maintenance system.

Keywords- CSTR- Distress analysis, Deterioration, Assessment

I. INTRODUCTION

Road network play important role in the transportation sector. India has the 2nd largest road network in world in which the part of rural road network is large. Population growth rate of country is high so the percentage of road users increases. So for the safe travelling there is need of well-maintained road network. So in preparation of road maintenance management system distress analysis and condition assessment plays an important role.

Distress type, distress severity and condition of road recommends maintenance and repair plan according to type and age of road section. This paper aim to detection of the distress, calculation of distress quantity, measurement of its severity and define the condition of the road network of sangli district

II. METHODOLOGY

The work undertaken for the study includes detection of distresses in asphalt pavement by physical inspection. The condition analysis of pavement is done by finding pavement condition index for the particular section of pavement. Overall condition assessment is done and rating is give to the pavement. Distress analysis and severity of the distress is measure according to American society of testing material (ASTM D 6433-07). [10]

A. Pavement distress:

Any indication of poor or unfavourable pavement performance or signs of impending failure; any unsatisfactory performance of a pavement short of failure .There are nineteen pavement distress obtained in pavement these are following 1) Alligator cracking 2) Bleeding 3) Block cracking 4) Bumps and sag 5) Corrugation 6) Depression 7) Edge cracking 8) Joint reflection crack 9) Lane/shoulder drop off 10) Long. And trans. Crack 11) Patching and utility cut 12) polished aggregate 13) Potholes 14) Railroad crossing 15) Rutting 16) Shoving 17) Swell 18) Slippage cracking 19) Revelling /Weathering

B. Distress analysis:

Distress analysis includes detection of distress in pavement and its measurement. Distress is detected by physical inspection method and the measurement of distress is done according to manual of American Society of Testing Material manual (ASTM).[10] Calculation of distress quantity and its severity is also part of distress analysis

C. Condition assessment:

Pavement condition assessment is done by calculating pavement condition index and rating will be give according to pavement condition index rating scale.

Pavement condition index is calculated according to the (ASTM D 6433-07) [10] manual and pavement condition rating scale is numerically divided in between 0-100. By using this scale the condition of road network is calculated

D. Total no of state highways in Sangli district = 19
E. Total no of MDR in sangli district = 75
F. Total no of State highways obtained by random sampling = 6

Sr. No.	Road Number	Chainage from	Chainage till	Chainage in sangli
1	SH-125	106	127.2	21.2
2	SH-150	1.12	84.4	83.28
3	SH-152	0	68.8	68.8
4	SH-155	0	130.3	130.35
5	SH-157	0	25.8	25.8
6	SH-161	0	40	40

G. Total no of MDR obtained by Random sampling

= 23

Sr.No.	Road Number	Chainage from	Chainage till	Chainage in sangli
1	MDR-1	0	33.2	33.2
2	MDR-3	0	12.6	12.6
3	MDR-4	0	21.82	21.82
4	MDR-6	0	18.9	18.9
5	MDR-10	0	17.52	17.52
6	MDR-13	0	16.9	16.9
7	MDR-15	0	22.6	22.6
8	MDR-19	0	49.5	49.5
9	MDR-23	0	54.8	54.8
10	MDR-27	0	6.4	6.4
11	MDR-30	0	37.9	37.9
12	MDR-37	0	6	6
13	MDR-45	0	33	33
14	MDR-46	0	19.2	19.2
15	MDR-47	0	17.48	17.48
16	MDR-52	0	7	7
17	MDR-54	0	22	22
18	MDR-55	0	12	12
19	MDR-61	0	25.5	25.5
20	MDR-75	0	11.2	11.2

H. Measurement of distress severity in flexible pavement:

Sr. No	Crack Type	Low	Medium	High	Unit of Measurement
1	Alligator cracking	Fine, longitudinal hairline cracks running parallel to each other.	Further development of alligator cracks into low severity.	Network or pattern cracking has progressed so that the pieces are well defined.	Alligator cracking is measured in square meters (square feet) of surface area.
2	Bleeding	In that case asphalt does not stick to shoes or vehicles	Bleeding has occurred to the extent that asphalt sticks to shoes and vehicles.	Asphalt sticks to shoes and vehicles during at least several weeks of the year	Bleeding is measured in square meters (square feet) of surface area.
3	Block cracking	Blocks are defined by low-severity cracks	Blocks are defined by medium-severity cracks	Blocks are defined by high-severity cracks	Block cracking is measured in square feet (square meter) of surface area.
4	Bumps and sag	Bump or sag causes low-severity ride quality	Bump or sag causes medium-severity ride quality	Bump or sag causes high-severity ride quality	Bumps or sags are measured in linear meters (feet).
5	Corrugation	Corrugation produces low-severity ride quality	Corrugation produces medium-severity ride quality	Corrugation produces high-severity ride quality	Corrugation is measured in square meters (square feet) of surface area.
6	Depression	13 to 25 mm (1⁄2 to 1 in.)	25 to 50 mm (1 to 2 in.)	More than 50 mm (2 in.)	Depressions are measured in square meters (square feet) of surface area.
7	Edge cracking	Low or medium cracking with no breakup or raveling	Medium cracks with some breakup and raveling	Considerable breakup or raveling along the edge	Edge cracking is measure in linear meters (feet).
8	Joint reflection crack	width is less than 10 mm (3⁄8 in.) or filled crack of any width.	Width is greater than or equal to 10 mm (3⁄8 in.) and less than 75 mm (3 in.)	Width is greater than 75 mm (3 in.).	Joint reflection cracking is measured in linear meters (feet).
9	Lane/shoulder drop off	the difference in elevation between the pavement edge and shoulder is > 25 mm (1 in.) and< 50 mm	The difference in elevation is > 50 mm (2 in.) and < 100 mm (4 in.)	The difference in elevation is > 100 mm (4 in.)	Lane/shoulder drop-off is measured in linear meters (feet).
10	Long and trans cracking	Width is less than 10 mm (3⁄8 in.)	Width is greater than or equal to 10 mm and less than 75 mm (3⁄8	Width is greater than 75 m (3 in.).	Longitudinal and transverse cracks are measured in linear meters (feet).

	g		to 3 in.).		
11	Patching and utility cut	Patch is in good condition and satisfactory.	Patch is moderately deteriorated.	Patch is badly deteriorated.	Patching is rated in square meter (square feet) of surface area.
12	Polished aggregate	No degrees of severity are defined.			Polished aggregate is measured in square meters (square feet) of surface area.
13	Potholes	The levels of severity for potholes less than 750 mm (30 in.) in diameter.	The depth is 25 mm (1 in.) or less, the holes are considered medium-severity	If the depth is more than 25 mm (1 in.), they are considered high-severity.	Potholes are measured by counting the number that are low, medium, and high severity and recording them separately.
14	Railroad crossing	Railroad crossing causes low-severity ride quality	Railroad crossing causes medium-severity ride quality	Railroad crossing causes high-severity ride quality	The area of the crossing is measured in square meters (square feet) of surface area.
15	Rutting	6 to 13 mm (1⁄4 to 1⁄2 in.)	>13 to 25 mm (>1⁄2 to 1 in.)	>25 mm (>1 in.)	Rutting is measured in square meters (square feet) of surface area.
16	Shoving	Shove causes low-severity ride quality	Shove causes medium-severity ride quality	Shove causes high-severity ride quality	Shoves are measured in square meters (feet) of surface area.
17	Swell	Swell causes low-severity ride quality.	Swell causes medium-severity ride quality.	Swell causes high-severity ride quality.	The surface area of the swell is measured in square meters (square feet).
18	Slippage cracking	Average crack width is < 10 mm (3⁄8 in.)	Crack width is 10 and < 40 mm (3⁄8 and<1-1⁄2 in.).	Crack width is > 40 mm (1-1⁄2 in.)	The area associated with a given slippage crack is measured in square meters (square feet).
19	Revelling and weathering	Aggregate or binder has started to wear away.	Aggregate or binder has worn away.	Aggregate or binder has been worn away considerably.	Weathering and raveling are measured in square meters (square feet) of surface area.

I. Pavement condition Index rating scale:

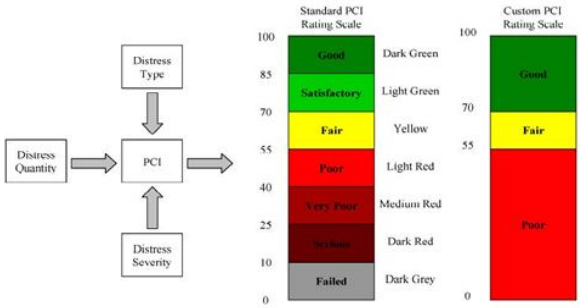

Fig.1 Pavement condition rating scale

J. Pavement condition index sample calculation

1) MDR-19

a) (1st patch between Bambwade and Balwadi fata):

$$\text{Pavement Condition Index} = \frac{\text{Total distress Area}}{\text{Total area of the patch}} \times 100$$

$$= \frac{2304.6}{5700.64} \times 100$$

$$= \mathbf{40.43}$$

b) (2nd patch between Balwadi fata and Vangi):

$$\text{Pavement Condition Index} = \frac{\text{Total distress Area}}{\text{Total area of the patch}} \times 100$$

$$= \frac{1822.27}{5809} \times 100$$

$$= \mathbf{31.37}$$

$$\text{Average pavement condition index} = \frac{40.43 + 31.37}{2}$$

$$= \mathbf{35.9}$$

II. RESULTS

Sr. No.	Road Name	Pavement Condition Index	Pavement Condition Rating
1	SH-125	5	Failed
2	SH-150	77.8	Satisfactory
3	SH-152	82.11	Satisfactory
4	SH-155	90	Good
5	SH-157	84.6	Satisfactory
6	SH-161	90	Good
7	MDR-1	11.19	Serious
8	MDR-3	90	Good
9	MDR-4	5	Failed
10	MDR-6	90	Good
11	MDR-10	28.44	Very poor
12	MDR-13	5	Failed
13	MDR-15	5	Failed
14	MDR-19	35.9	Very poor
15	MDR-23	90	Good
16	MDR-27	29.04	Very poor
17	MDR-30	21.76	Serious
18	MDR-37	90	Good
19	MDR-45	5	Failed
20	MDR-46	17.8	Serious
21	MDR-47	5	Failed
22	MDR-52	90	Good
23	MDR-54	5	Failed
24	MDR-55	29.1	Very poor
25	MDR-61	90	Good
26	MDR-75	5	Failed

III. CONCLUSION

From above research work following points are concluded:

Raveling or weathering is more severe problem in pavement as compared to other distress.

Out of 6 state highways 5 state highways are above satisfactory condition and out of 20 MDR 6 roads are above satisfaction condition and remaining 14 roads are in poor condition. About 60% roads are in poor condition so they are not fulfilling the safe driving condition.

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