MAINTENANCE STRATEGY SUGGESTION OF FLEXIBLE PAVEMENT USING PAVEMENT CONDITION INDEX

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Abstract-*Pavements are major assets of highway infrastructure. Maintenance and rehabilitation of these pavements to the desired level of serviceability is one of the challenging problems faced by pavement engineers and administration in the highway sector. The evaluation of pavement performance using pavement condition indicators is a basic component of any Pavement Management System. Various indicators like Surface Condition Index (PCI), Present Serviceability Rating (PSR),Roughness Index (RI), etc. have been commonly used to assign a maintenance strategy for the existing pavements. The present study is an effort in the similar direction, to develop a combined Pavement Condition Rating Index (PCRI) for the selected roads to select maintenance strategy using PCRI.*

Introduction-Roads plays important role in economic growth and development of country. The road transport is the oldest and perhaps the most widely adopted mode of transport of mankind. Roads have not infinite life span. In other words, all structures are designed to fail at some point but the life of structure is extended by the maintenance and rehabilitation activities. Type of treatment selected for the maintenance of road is called maintenance strategy. Different type of maintenance strategies are Patching, Pothole filling, Crack sealing Chip Seal, Micro-Surfacing, Thin Overlays, Fog Seal Thick overlays, Mill & Overlays, Full depth patching, Premix Carpet Cold in-place recycling, Full depth reconstruction, Full depth reclamation.Most of the cost effective maintenance and rehabilitation (M&R) strategies developed using Pavement Management System (PMS) is due to accurate pavement evaluation. The condition indicator used to represent the pavement condition of selected urban road sections is, combined Overall Pavement Condition Index (OPCI).

Objectives
a) To evatuate pavement.
b) To give rating of pavement.
c) To suggest maintenance using pavement condition index.

Study area's details
Location : Valsad,Gujarat,India
State highway no 67
From Dharampur crossing to Ronvel village of 10km of stretches.
Two lane bituminous concrete highway with width of 7.5m.
Sholder of 1m each side.

ANALYSIS OF DATA
1.ALLIGATOR CRACKING INDEX
Ac index$= 100 - 40 * [(\%LOW / 70) + (\%MED / 30) + (\%HI / 10)]$
The values *%LOW*, *%MED* and *%HI* report the percentage of the observed pavement(0.02 mile, primary lane) that contains alligator cracking within the respective severities. These values range from ≥ 0 to ≤ 100.
%LOW = Percent of total area (primary lane, 0.02 in length), low severity
%MED = Percent of total area (primary lane, 0.02 in length), medium severity
%HI = Percent of total area (primary lane, 0.02 in length), high severity
Percent of total area is computed as: square foot area of alligator crack severity/0.02 mile * lane width
In AC_INDEX, the denominators 70, 30, and 10 are the Maximum Allowable Extents (MAE) for each severity. In other words, we will allow up to 70% of low severity alligator cracking for a 0.02 interval before failure, 30% for medium severity, and so on.
As you can see, if any single severity reaches MAE the resulting index value is 60, or failure.

2.LONGITUDIONAL CRACKING INDEX
Lc index$= 100 - 40 * [(\%LOW / 350) + (\%MED / 200) + (\%HI / 75)]$
Where:

The values *%LOW*, *%MED*, and *%HI* report the length of longitudinal cracking within each severity as a percent of the section length (0.02 mile, primary lane).

These values are ≥ 0 and can exceed 100.

%LOW = Percent of interval length (primary lane, 0.02 in length), low severity

%MED = Percent of interval length (primary lane, 0.02 in length), medium severity

%HI = Percent of interval length (primary lane, 0.02 in length), high severity

Percent of interval length is computed as: length of respective longitudinal cracking/0.02 mile (105.6 feet)

In LC_INDEX, the denominators 350, 200, and 75 are the Maximum Allowable Extents (MAE) for each severity. In other words, we will allow up to 350% of low severity Longitudinal cracking for a 0.02 interval before failure, 200% for medium severity, and so on.As you can see, if any single severity reaches MAE the resulting index value is 60, or failure.

3.TRANSVERS CRACKING INDEX

Tc index= $100 - \{[20 * ((LOW / 15.1) + (MED / 7.5))] + [40 * (HI / 1.9)]\}$

Where:

The values *LOW*, *MED* and *HI* report a count of the total number of transverse cracks (reported to three decimals) within each severity level, where one transverse crack is equal to the lane width. These values are ≥ 0.

LOW = Number of cracks in interval (primary lane, 0.02 in length), low severity

MED = Number of cracks in interval (primary lane, 0.02 in length), medium severity

HI = Number of cracks in interval (primary lane, 0.02 in length), high severity

Number of cracks is computed as:Total length of transverse cracks/Lane width

In TC_INDEX, the denominators 15.1, 7.5, and 1.9 are the Maximum Allowable Extents

(MAE) for each severity. In other words, we will allow up to 15.0 low severity

transverse cracks for a 0.02 interval before failure, 7.5 cracks for medium severity, and so on. As you can see, if any single severity reaches MAE the resulting index value is 60, orfailure.

4.POTHOLE INDEX

Pothole index= $100 - 40 * (\%Pothole / 80)$

Where:

The value *%Pothole*reports the percentage of the observed pavement (0.02 mile, primary lane) that contains patching/potholes. This value ranges from ≥ 0 to ≤ 100.

%Pothole = Percent of total area (primary lane, 0.02 in length)

Percent of total area is computed as: square foot area of patching/potholes 0.02 mile * lane width

There are no severity levels for patching. It either exists or does not.

In POTHOLE INDEX, the denominator 80 is the Maximum Allowable Extent (MAE) for each severity. In other words, we will allow up to 80% pothole for a 0.02 interval before failure. As you can see, if patching/potholes reaches MAE the resulting index value is 60, or failure.

5.RUTTING INDEX

Rut index= $100 - 40 * [(\%LOW / 160) + (\%MED / 80) + (\%HI / 40)]$

Where:

10 ARAN rut depth measurements are taken per 0.02 interval for each of 2 wheel paths (left and right), resulting in a total of 20 measurements taken for both wheel paths. The values *%LOW*, *%MED* and *%HI* report the percentage of the 20 measurements within that severity. These values range from ≥ 0 to ≤ 200.

%LOW = Percent of ARAN-measured ruts in both wheelpaths (20) within a single wheel path, low severity

%MED = Percent of ARAN-measured ruts in both wheelpaths (20) within a single wheel path, medium severity

 %HI = (Percent of ARAN-measured ruts in both wheelpaths (20) within a single wheel path, high severity

Percent of rut measurements within each severity is computed as:Number of ruts within each severity/10 * 100

In RUT_INDEX, the denominators 160, 80, and 40 are the Maximum Allowable Extents for each severity. In other words, we will allow up to 160% low severity ruts for a 0.02 interval before failure. As you can see, if any single severity reaches MAE the resulting index value is 60, or failure.

6. ROUGHNESS INDEX

RCI= $32 * [5 * (2.718282 \wedge (-0.0041 * AVG\ IRI))]$

Where:

The value *AVG IRI* reports the average value of the Left IRI and Right IRI measurements for the interval (0.02 mile, primary lane). This value can range from approximately 40 to over 1000. Unit of roughness is m/km,mm/m.

Average IRI is computed as:Left wheelpath IRI + Right wheelpath IRI/2

SCR= 100 - [(100 –AC index) + (100 – LC index) + (100 – TC index) + (100 –Pothole index) + (100 – Rut index)]

PCR = (0.60 * SCR) + (0.40 * RCI)

SELECTION OF MAINTENANCE STRATEGY

PCI Value	Pavement Condition Rating	M&R Strategy	Suggested Maintenance Alternatives
85-100	Excellent	Routine Maintenance	Patching, Pothole filling, Crack sealing Chip Seal, Micro-Surfacing, Thin Overlays, Fog Seal
70-85	Very Good	Preventive Maintenance	
55-70S	Good	Rehabilitation	Thick overlays, Mill & Overlays, Full depth patching, Premix Carpet
40-55	Fair	Rehabilitation	
25-40	Poor	Reconstruction	Cold in-place recycling, Full depth reconstruction, 0-10 Failed Full depth reclamation
10-25	Very Poor	Reconstruction	
0-10	Failed	Reconstruction	

CONCLUSION

The study was primarily aimed to use the outputs of different pavement condition index of flexible pavementin deciding the M&R requirements. The combined PCRI was evaluated by considering the effects of two main pavement performance indicators viz. distresses and roughnes for selected road sections of state highway no 67 . Following are the main conclusions drawn from the study.

The minimum and maximum range of various pavement performance indicators observed on the study sections are: longitudinal cracking: 0.3%; transverse cracking: 0% & 0%; alligator cracking: 0%, potholes: 1 & 2 nos in 30m , IRI: 4 m/km & 12 m/km.

The average PCRIDistress+Roughness, values of selected roadsections were found to be in a range of 80 (very good pavement condition).

It was observed that 46% of pavement sections in upward lane under PCRI of 85-100, 53% of pavement sections in downward lane under PCRI of 75-85 and 0.3% of pavement sections in downward lane under PCRI of 55-70%.

And in downward lane It was observed that 43% of pavement section under PCRI of 85-100, 55% of pavement sections under PCRI of 75-85 and 2% of pavement sections under PCRI of 55-70%.

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