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Decision on Maintenance Strategy of Pavement Condition for Existing Roads in Pimpri Region

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Abstract

Pavement condition assessment is one of the important components of pavement management system .The level of repair and rehabilitation carried on the roads depends on the physical condition of the road at a particular time. Pavement condition index (PCI) is a numerical indicator that rates the surface condition of a pavement or road. The PCI is based on the results of the visual condition survey in which distress type, severity, and quantity are identified. The distresses are measured and compiled. Based on the distress values pavement condition rating has been done by using pavement condition index. The pavement rating and condition assessment method is described in Indian Road Congress (IRC) 82-2015. In this research work condition assessment of road pavements in Pimpri , Pune region has been carried out by adopting PCI and IRC 82 methods. The maintenance strategy is also discussed in detail. It has been observed that both the methods can be used meritoriously for the road condition assessment.

Index Terms—About Condition Assessment, Condition Rating Pavement, Maintenance strategy, Pavement condition index

I.INTRODUCTION

India, a developing country, is seeing a dramatic increase in demand for infrastructure related to transportation. It directly aids in economic expansion and raises people's standards of living. The foundation of each nation is its transportation infrastructure. The current transportation system consists of air, land, and sea travel. The pavements of the highway system are undoubtedly the main structural load-bearing components.

The level of repair and rehabilitation carried on the roads depends on the physical condition of the road at a particular time in relation to its acceptable and operable condition. Thus, the condition of pavements is monitored regularly and this is known as pavement condition monitoring. These condition monitoring surveys play a vital role in pavement management since it provides valuable information that forms the basis of repair and rehabilitation activities.

Pavement evaluations are conducted to determine functional and structural conditions of pavements either for purposes of routine monitoring or planned corrective action.
Many methods have been employed by prior studies to evaluate the performance of pavements. The most basic method of assessing the performance of a pavement is to use several indexes. The International Road Roughness
Experiment, conducted in Brazil in 1982, provided the data for the 1986 development of the international roughness index [1]. AASHTO, an organization of American Association of State Highway and Transportation Officials, created the Present Serviceability Index (PSI). [2]. The American Army Corps of Engineers is the organization that created the Pavement Condition Index (PCI) [3]. In the Indian Road Congress (IRC-82) 2015 version, the distress-based assessment for urban pavement is provided [4]. In this research work, an effort has been made to analyze the pavement condition of urban roadways using PCI and the IRC -82 approach as PCI is a regularly used pavement condition evaluation tool for global pavement condition and IRC methodology is precisely used for Indian road condition.
The previous study work has been carefully examined, and part of it is described here.
Sabir Javaid et al. evaluate the distress of flexible pavement and determined the type and severity of failure by evaluating pavement performance using the Pavement Condition Index (PCI) [5]. Dr Fareed M.A et al. evaluates the pavement condition in terms of the surface distresses existing at the time of the field evaluation [6]. The PCI method was used in this study because it most comprehensively addresses the issue of pavement failure detection and is based on a robust statistical testing method [6]. This study attempted to visually assess a large heavy traffic road corridor connecting the city of Aden (the commercial capital of Yemen) with the northern region of the country, namely parts of the Al-Fiush road. Mohammed A. et al. assesses the condition of flexible pavement by visual surveys using the Pavement Condition Index (PCI) method and provides a simple way to calculate PCI from GIS data using Micro PAVER software 5.2 [7]. Ashpaq Majeed Naik et al. evaluates the of existing flexible pavement conditions through visual inspection includes the failures and selects the most and effective treatments and maintenance types . As a case study, of Ambala Cantt to Saha road was selected for evaluation and inspection purposes [8]. B. Subramanyam et al. assess the condition of selected road surface on Highway 99 from Budalur to Pudupattin as per the IRC: 82 - 2015 criteria. The pavement is in acceptable condition, and the proportion of problem areas varies between 10-20% of the surface. This indicates that proper maintenance is required in the near future [9].

II.**METHODOLOGY**

The scope of work is divided into the following steps:

- Identification of study sections
- Visual examination at specific locations.
- Analysis of data
- The condition Assessment of Roads and decide maintenance strategy

A. Identification of study sections

Three roads have been identified for the present study in the Sant Tukaram Nagar, Pimrpi Pune. Road 1 is Sant gadge baba path, Road 2 is Gaikwad Haraibha Vinayan road and Road 3 is Yashwantrao Chavan Road.

B. Visual Inspection

It is a preliminary assessment that can be carried out along the pavement's degraded sections. The pavements primarily had Cracks, Patches, Potholes, and Ruts, according to the visual evaluation. Data is collected in respect of distresses such as Cracking. Raveling, Patching, Potholes, etc.

C. Analysis of data

In this study, the distresses are measured and compile Based on the distresses values pavement condition rating has been done by using pavement condition index and The methodology adopted is as per the IRC rating System described in IRC 82-2015 and PCI defined by ASTM D6433 . The comparison of both the method has been done and maintenance measures are decided.

Road no.	Rating	Condition	Maintenance Strategy
1	2.00	Fair to Good	Routine
2	1.98	Fair	Routine
3	2.45	Good	Preventive

D. IRC rating System

The distress based assessment for urban pavement is given in the IRC 82-2015, as illustrated in Table1. For the purpose of assessment, major distresses such as cracking, raveling, potholes, settlement, and rut depth are taken into account and shown in Table 2. In Table 3 , appropriate weights for each parameter rating value are given. The weighted rating value is calculated by multiplying each parameter rating by its weight. The final rating value is the average of the weighted rating values of all parameters. Routine, preventive, and periodic maintenance are the three forms of maintenance covered by IRC82-2015. Filling potholes, repairing cracks, and patchwork are all part of routine maintenance. When the pavement surface is in Regular maintenance operations, such as applying a renewal coat, are included in periodic maintenance. Preventive maintenance is performed on urban roads before the pavement rating drops to 2, and periodic renewal is allowed at a serviceability level of 2.

Table1: Pavement Distress Based Rating for Urban Roads

Road no.	Rating	Condition	Maintenance Strategy
1	2.00	Fair to Good	Routine
2	1.98	Fair	Routine
3	2.45	Good	Preventive

Table 2: Fixed Weightage

Defects	Range of Defects		
Cracking, %	>15	5-15	<5
Raveling, %	>10	5-10	<5
Potholes, %	>0.5	<0.5	NA
Settlement, %	>5	1-5	<1
Rut Depth (mm)	>10	5-10	<5
Rating	1	1.1-2	2.1-3
Condition	Poor	Fair	Good

Source: IRC 82

From the measured defects and by using IRC rating method the rating and condition assessment of roads are shown in the table

Table3: Rating and condition assessment of Roads

E. **Pavement Condition Assessment (PCI)**

The Pavement Condition Index (PCI) is a numerical indicator that rates the general surface condition of a pavement or road. It is a statistical measure which requires manual/visual inspection and survey of the required roads, and was developed by the United States Army Corps of Engineers. The PCI is a numerical Index, ranging from 0 for a failed pavement to 100 for a pavement in perfect condition. Calculation of the PCI is based on the results of a visual condition

survey in which distress type, severity, and quantity are identified. The degree of pavement deterioration is a function of distress type, distress severity, and amount or density of distress. Producing one index that would take into account all three factors was a considerable challenge. To overcome this challenge, "deduct values were introduced as a type of weighing factor to indicate the degree of effect that each combination of distress type. Severity level, and distress density has on pavement condition. The sum of the deduct values is corrected based on the number and value of the deducts and the corrected sum is subtracted from 100 to obtain the PCI. The ASTM divides the PCI into seven classes as follows, but in practice a PCI lower than 40 is almost impossible, so the custom PCI rating scale in Table 4

Table 4: Condition of Road based on PCI value by custom PCI rating scale

PCI	PCI	Condition of Road
0-55	0-55	Poor
55-70	55-70	Fair
70-100	70-100	Good

Steps to determine PCI is given in following
figure 1

Density of the distresses, measured in square meters (m2) or square feet (ft2), is calculated as follows: Density = (Distress amount in m^2/ Sample unit area in m^2) ×100
Density of distresses measured in linear feet or meters (bumps, edge cracking, joint reflection cracking, lane/ shoulder drop-off as well as longitudinal and transverse cracks) is calculated as follows:
Density = (Distress amount in linear m/ Sample unit area in m^2) ×100
Density of distresses, as measured by the number of potholes, is calculated as follows:
Density = (Number of potholes/ Sample unit area in m^2) ×100
The pavement condition rating for the different roads under observation are as follows in Table 5 and Table 6

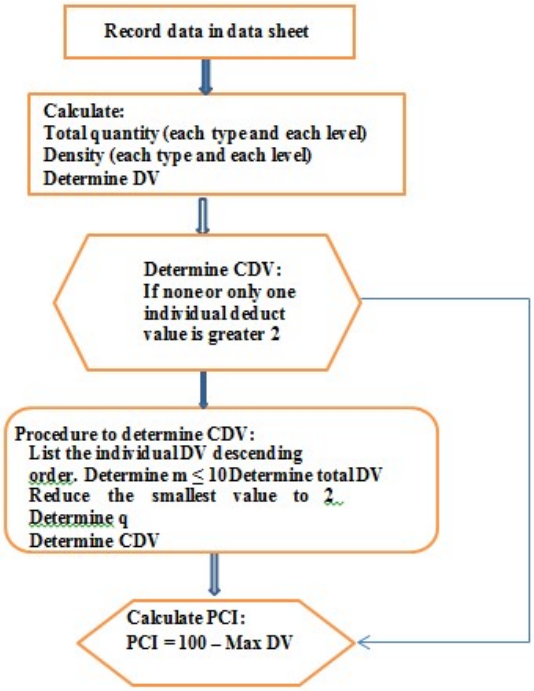

Figure 1: Steps to determine PCI

Table 5: Rating and condition assessment of Roads As per IRC

Road no.	Rating	Condition
1	2.00	Good
2	1.98	Fair
3	2.45	Good

Table 6: Rating and condition assessment of Roads As per PCI

Road no.	Rating	Condition
1	2.00	Good
2	1.98	Fair
3	2.45	Good

From tables it is observed that by both the methods condition of roads comes as similar. Based on condition assessment maintenance strategy for roads are suggested which is shown in Table 7

Table 7: Maintenance Strategy for Roads

Road no.	Rating	Condition
1	2.00	Good
2	1.98	Fair
3	2.45	Good

III. CONCLUSION

In the present study rating and condition assessment of three roads in the Sant Tukaram Nagar, Pimrpi Pune has been carried out. PCI and IRC methods has used. The rating of according to IRC method comes as Road 1 , Sant gadge baba path is 2.00 , Road 2 , Gaikwad Haraibha Vinayan road is 1.98 and Road 3, Yashwantrao Chavan Road is 2.45. PCI values obtained for all the roads are 87, 68 and 80 respectively. From both the methods road 1 and 3 are good and road 2 is fair. Road 1 and 3 required routine maintenance which consists of filling potholes, repairing cracks, and patchwork. Road 2 required preventive maintenance.

From the analysis it is observed that the results of both the methods are similar. It is concluded that both the methods can be used effectively for the road condition assessment.

IV. REFRENCES

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