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Research Article

PAVEMENT CONDITION ASSESSMENT OF ASPHALT SURFACED NATIONAL HIGHWAY

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A B S T R A C T

Pavement Defect Assessment (PDA) is an important phenomenon in Pavement Management System (PMS). Generally, the pavement distresses can be investigated by either manual techniques or automated systems. In this present study, the surface images of asphalt pavements were acquired from the four cameras mounted on Hawkeye Network Survey Vehicle (NSV). The samples of surface images were taken for every 10m of stretch. The current research was aimed to assess the Pavement Condition Index (PCI) of Asphalt Surfaced National Highway-752 (NH-752) as per ASTM-D6433. A total of 2km stretch was considered for evaluating the pavement defects and ultimately PCI. Initially, the images were captured by 3 front cameras and 1 rear camera. Later, the defects were detected and quantified by the Hawkeye Processing Toolkit which is integrated to NSV. Finally, the value of PCI is estimated and subjectively the rating is given as per the ASTM-D6433. In overall, the asphalt surfaced NH-44 subjected to a greater amount of distresses with a low PCI of 66.2%.The presence of variation in PCI at different samples units, it can be recommended to adopt different and suitable Maintenance and Repair choices at particular location of distressed areas.

INTRODUCTION

Pavement Manage System (PMS) is a tool used to monitor the pavement condition after the construction and for timely response to adopt the proper and cost-effective maintenance solutions. It includes a system of designed methods for the data collection and storing it for the future action plans. An awareness of pavement conditions is necessary to programmed short, medium and long-term maintenance works withina systematic management system.PMS can handle the pavements at both project and network levels. At network level, PMS provides a basis for decision-making in-view of the long-term budgeting plans. It provides only the required information and support for decision making but, it doesn't make decisions.The PMS mainly composed of a) PCI-assessment, b) Evaluation of cost-effective solutions, c) Data Acquisition System and d) Data-Base Management. With this background, the present study aimed to focus on one of the components i.e., the evaluation of PCI. The evaluation of PCI is an important parameter helps in determining the type of maintenance works required at that particular time and particular location. (Figure 1)

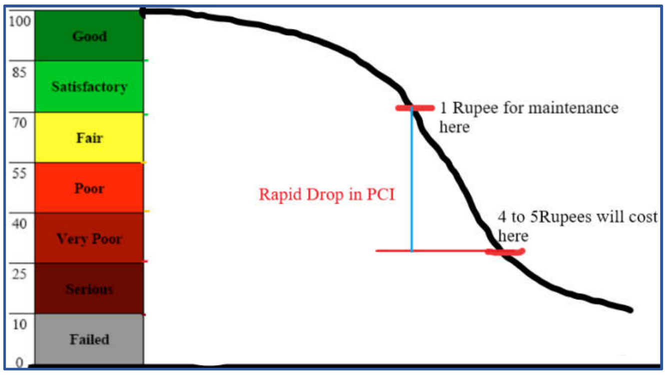

Figure 1 The effect of PCI on type and cost of maintenance works

Image Capturing and Data Acquisition System

In this study, Indian Road Survey and Management (IRSM) based Hawkeye 2000-Network Survey Vehicle (NSV) was utilized for capturing the asphalt pavement surfaces. Detecting, classifying and quantifying the pavement defects. The adopted NSV attached with Digital Cameras, Data Acquisition System, GPS/DGPS, GIPSI-Trac Geometry, Distance Measuring Instrument (DMI) and Digital Laser Profiler (DLP) as shown in figure 2. The attached DLP arranged with 11 lasers to cover a 3m road width and used for evaluating not only the rutting but also the macro texture of the asphalt surfaces.The in-built software for processing the digital images was considered for

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the detecting, classifying and quantifying the following distresses in the given stretch of pavement.

- Pot-holes
- Alligator Crackings
- Raveling
- Bleeding
- Rutting
- Shoving
- Corrugation

The pavement condition index (PCI) was evaluated based on the aforementioned pavement distresses for selected stretches of NH-572 nearer to the Gulbarga Ring Road.

Figure 2 The Hawkeye 2000 Network Survey Vehicle

METHODOLOGY

The methodology of current study consists of a set of sequential stages in order to determine the condition of selected pavement sections (figure 3). Firstly, the pavement images were captured by the aforementioned NSV for every 10m stretch. The each and every stretch was taken as one sample units. In this study, a total of 200 sample units were considered for 2km road-section. Secondly, the images were digitized and the pavement defects were detected, classified and quantified using the in-built software. Thirdly, the density of corresponding pavement distresses was determined. Later, the deduct values were determined for obtained densities and corresponding severity levels (as per ASTM-D6433). After determination of deduct values, the allowable number of deductions (AND) and maximum corrected deduct values (MCDV) were computed. Finally, the pavement condition index (PCI) for a given 10m stretch of highway was evaluated by subtracting the MCDV from 100%.

Allowable Number of Deductions (AND) $=1+\frac{9}{98}\times(100-MDV)$

Pavement Condition Index for a sample unit (PCI_i)=100-MCDV

Where, PCI_i = PCI for a given stretch "i"; MDV= Maximum Deduct value without correction; and MCDV= Maximum Corrected Deduct Value

After the evaluation of PCI_i, the number of sample units considered was checked with minimum number of sample units required as per ASTM-D6433. If it is satisfied, the average PCI will be determined for the entire section of 2km.

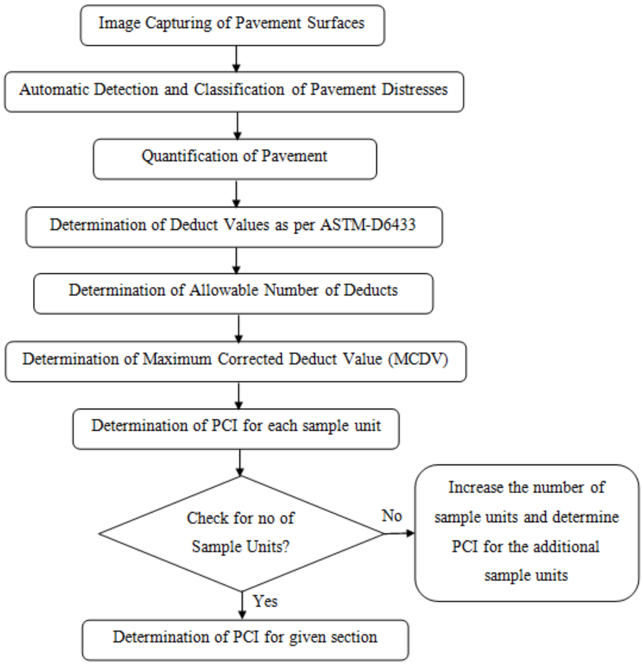

Figure 3 The study methodology for determination of PCI for given section

RESULTS AND DISCUSSIONS

The present study involved in evaluating the pavement distresses which were captured by the three front cameras mounted on NSV. The sample images of selected pavement surface are shown in following figure 4.

Figure 4 The different distresses of National Highway-752

The maximum deduct values for different distresses were extracted from ASTM-D6433 for given severity level and corresponding density. Later, the allowable number of deduct values were determined. Finally, the Corrected Deduct Values were computed in prior to evaluate the PCI. The statistical results of PCI values are listed in following table 1.

Table 1 The statistical Results of PCI at different sample units

Parameter	Value
Total Number of Samples Considered	200
Average PCI (%)	**66.2**
Standard Deviation (%)	6.46
Variance (%)	41.73
Minimum PCI (%)	48.2
Maximum PCI (%)	85.4
Minimum Required Sample Units	7

The results showed an average value of PCI as 66.2%, in addition to that the standard deviation of PCI was observed as 6.46%. The calculated minimum required number of sample units is 7 which is far less than the actual number of samples considered for this study. Hence, the average value 66.2% is considered as PCI of given stretch of NH-572. Finally, it can be concluded that the condition of pavement subjectively classified as fair conditioned pavement.In addition to the PCI assessment, the severity levels of different distresses at different locations were reordered to select the proper Maintenance and Rehabilitation choice

CONCLUSIONS

The following conclusions were made from the current study.

1. As the standard deviation of PCI values is 6.46%. the condition of pavement is taken as non-uniform along the stretch of 2km
2. Due to the variation in PCI, the pavement can be subjected to different Maintenance and Rehabilitation choices like crack seal, surface dressing and patches.
3. In overall, the pavement condition index of entire stretch can be taken as 66.2% and subjectively the pavement condition can be taken as fairly conditioned pavement as per ASTM-D6433.

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