Pavement Performance and Functional Evaluation for Selected Stretches

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Abstract— Transportation is a catalyst for development of any society. Road transportation is considered as veins and arteries of a nation, thus roads are constructed with variety of materials & specifications to mitigate the connectivity problems. Utmost care is taken in designing & developing the road ways, may it be in designing the network of roads or designing components of roads or in considering materials for construction. Hence it is very much essential to analyse a flexible pavement for its responses on application of vehicular loads. Due to repeated application of loads, the performance of the pavement deteriorates and hence damage assessment procedures are carried out to rectify the defects produced in flexible pavement to provide PCI by conducting tests and survey's like traffic volume count, distress survey, texture depth & rating survey.

Key words: PCI, Traffic Volume Count, Distress Survey, Rating Survey, Texture Depth

I. INTRODUCTION

Vehicle load get transmitted from the vehicle body through its suspension and tires to the pavement surfaces. Development of vehicle industries certainly leads to an increase in truck axle weights. As the truck axle load has been increased, the use of high pressure tires has become more predominant. Thus, increase in tire pressure and axle load affects the pavement performance, pavement serviceability, and maintenance cost. Increased tire pressure and axle load also affects the pavement structure underlying layers. India consumes about five million tons of viscosity graded paving bitumen per year and the quality of binder to be used in road construction is required to be in conformity to standard specified as IS: 73:2013. Along with structure it affects the functions of pavement which will results in causing of distresses on the road surface which will result in inferior raiding quality hence resulting in maintenance or relaying and patch work.

Many tests and surveys should be conducted for pavement performance and evaluation. Some of which are traffic counting, distress survey, texture depth using sand patch method rating survey etc on analyzing these we can give the condition and serviceability index for the pavement.

II. PAVEMENT PERFORMANCE

Pavement performance involves the thorough study of pavement and pavement components. The primary objective of pavement performance is to assess as to whether and to what extent the pavement fulfills the intended requirements.

There are two types of pavement performance analysis they are.

- Structural evaluation
- Functional evaluation

A. Structural Evaluation:

The structural evaluation of pavement is related to the structure of pavement such as sub grade support, pavement composition and its thickness, traffic loading etc. The studies therefore investigate the structural adequacy of pavements and also the requirements for providing safe and comfortable traffic operation.

B. Functional Evaluation:

The functional evaluation of pavement is the study related to the different functions of pavement which consist of following three things.

- Traffic volume count
- Distress survey
- Visual and rider ratings
- Skid resistance
- Pavement Unevenness
- Texture Depth
- Unconfined uni-axial repeated loading test
- Present serviceability Index

III. METHODOLOGY

The road transport system is considered to be the major component of infrastructure development in any country. It affects the development in economical and social activities. The flexible pavement is considered to be the major pavement material for road transportation in India. The road pavement continuously deteriorates under the combined action of traffic load and environment. Pavement performance evolution is a main task to be carried out based on its structural and functional adequacy parameters. Pavement structure layers and the properties of the asphalt binder play an important role to know the visco–elastic behavior and to evaluate modulus of elasticity.

This chapter briefs on the methodology adopted in order to determine the pavement performance parameters in terms of deflection and the critical strain. If flow chart representing the various studies viz., selection of study stretches, field study in the order of their occurrence is shown.

A. Scope of Present Study

For the present study, flexible arterial stretches from sir M. Visvesvaraya Circle to Bagalkot cross which is about 2km is selected. The selected stretch was further divided into various sections based on functional adequacy. The functional adequacy of selected stretch was evaluated by texture depth by sand patch method, traffic volume count, ratings survey in detail. Distress survey was carried out to classify pavement failures based on their type and severity. Rutting, potholes, depressions, cracks, raveling were some of the predominant failure present along the test sections.

Second data pertaining to selected stretches such as traffic volume is the number of vehicles crossing a section

of road per unit time at any selected period. Traffic volume is used as a quantity measure of flow; the commonly used units are vehicles per day and vehicles per hour. A complete traffic volume study may include the classified volume study by recording the volume of various types and the classes of traffic, the distribution by direction and turning on different lanes per unit time. Movements and the distribution.

Third data pertaining to the selected stretch such as failures according to IRC-37:2012. An attempt has been made to establish the correlation between different pavement failures considered include unevenness, rutting, cracking and patching the serviceability index was adopted based on the rating surveys conducted. The methodology as shown in the fig

IV. TRAFFIC VOLUME COUNT

Traffic volume is the number of vehicles crossing a section of road per unit time at any selected period. Traffic volume is used as a quantity measure of flow; the commonly used units are vehicles per day and vehicles per hour. A complete traffic volume study may include the classified volume study by recording the volume of various types and the classes of traffic, the distribution by direction and turning on different lanes per unit time.

S No.	Stretch Name	Weekly Traffic Volume
1	M. V. Circle to college circle	56,372
2	College circle to RTO circle	68,493
3	RTO Circle to PDJ high school	79,886
4	PDJ High school to Bagalkot cross	72,521
5	Bagalkot Cross to PDJ high school	64,327
6	PDJ high school to RTO Circle	67,456
7	RTO Circle to College circle	72,689
8	College circle to M.V. Circle	51,701

Table 1: Traffic Volume Count

V. TEXTURE DEPTH

pavement texture is defined as the deviation of pavement surface from a true planar surface. Macro texture aids for the development of hysteresis component of friction that is related to energy loss as the time deforms around the macro asperities and consequently increases pavement friction. Texture depth along the selected stretch is carried out by sand patch method as per ASTM e-965 which uses volumetric approach in measuring the pavement macro texture.

Stretch Name	Mean Texture Depth
M. V .Circle to college circle	1.077034204
College circle to RTO circle	0.955530895
RTO Circle to PDJ high school	0.614071079
PDJ High school to Bagalkot cross	0.663526606
Bagalkot Cross to PDJ high school	0.696032622
RTO Circle to College circle	0.686715215
College circle to M.V.Circle	0.86288747

Table 2: Texture Depth

VI. RATINGS SURVEY

Visual rating survey was conducted on the selected study stretches to determine the present serviceability index of each section. The raters were asked the pavements focused around the riding solace and visual appearance from zero to five scales, in which five is the best evaluated pavement and zero is the most noticeably bad one. The rating process that brings about an assessment of the pavement ride quality is a complex wonder. Analyzing it from a frame work view point, the procedure includes three subsystem: the vehicles, surface profile and the rater. The dynamic interaction between these subsystems is in charge of the yield reaction and qualities of the frame work. The panel constituting of three classes viz., highway panel, non-highway panel and mixed panel, each one panel comprising of six members each. An introductory introduction system was directed for raters for evaluating the asphalt by both ride rating and visual rating method. The raters were prepared to rate the asphalt surface for normal street extends. A standard mid-sized four wheeler vehicle (Tata sumo) was taken for the study and the over view ratings were taken during non peak hours as that the vehicle could be determined at a rate of 30 kmph

Stretch Name	Rider ratings		
	Highway	Non highway	Mixed
M. V .Circle to college circle	3.74	3.19	3.72
College circle to RTO circle	3.24	1.54	2.22
RTO Circle to PDJ high school	3.01	1.8	2.3
PDJ High school to Bagalkot cross	2.01	2.3	2.2
Bagalkot Cross to PDJ high school	3.3	3.12	3.05
PDJ High School to RTO Circle	4.32	4.17	4.27
RTO Circle to College circle	4	3.54	3.86
College circle to M.V.Circle	4.04	3.93	4.19

Table 3: Rating Survey

Stretch Name	Visual Ratings		
	Highway	Non Highway	Mixed
M. V. Circle to college circle	3.96	3.27	3.65
College circle to RTO circle	2.89	2.65	2.92
RTO Circle to PDJ high school	4.32	4.2	4.44
PDJ High school to Bagalkot cross	2.14	2.11	2.2
Bagalkot Cross to PDJ high school	1.9	2.73	2.29
PDJ High School to RTO Circle	4.32	4.06	4.22
RTO Circle to College circle	3.94	3.61	3.48
College circle to	3.89	3.91	3.85

M.V.Circle			

Table 4: Visual Rating Survey

VII. DISTRESS SURVEYS

This is the survey conducted to check or determine the different types of distress or deterioration and damages that have been occurred in the road infrastructure which reduces the comfort level of the pavement. Some of the different types of damages are deformation in soil sub grade, formation of ruts along wheel paths, total pavement failure due to improper compaction, failure of pavement due to shear failure in sub grade, failure due to frost heave, formation of pot holes, cracks etc.

Stretch Name	**Distress Survey**		
	CVD	**PCI**	**Maintenance**
M. V .Circle to college circle	42	58	More extensive dig-outs along with seal and micro surfacing treatments may required resurfacing
College circle to RTO circle	30	70	preventive maintenance such as slurry sealing, crack sealing and sealing
RTO Circle to PDJ high school	31	69	Dig –outs, slurry sealing and micro surfacing
PDJ High school to Bagalkot cross	47	53	More extensive dig-outs along with seal and micro surfacing treatments may required resurfacing
Bagalkot Cross to PDJ high school	46	54	More extensive dig-outs along with seal and micro surfacing treatments may required resurfacing
PDJ High School to RTO Circle	32	68	Dig –outs, slurry sealing and micro surfacing
RTO Circle to College circle	13	87	Little or no maintenance required may required crack sealing
College circle to M.V.Circle	32	68	Dig–outs, slurry sealing and micro surfacing

Table 5: Distress Survey

VIII. CONCLUSIONS

1) The minimum weekly traffic 51,701 is observed on College circle to M.V. Circle stretch and maximum 79,886 is observed on RTO Circle to PDJ high school stretch.
2) The maximum texture depth of 1.07 is observed at M. V .Circle to college circle and minimum 0.61 is found RTO Circle to PDJ high school.
3) The maximum PCI is found at stretch of RTO Circle to College circle i.e., 87 and minimum PCI was found at the stretch of PDJ High school to Bagalkot cross i.e. 53
4) Maintenance criteria for all the stretches have been listed in Table5 based on the pavement condition index values.

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