

DEVELOPMENT OF PAVEMENT MANAGEMENT SYSTEM ON URBAN ROAD NETWORK

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Abstract: --Pavements are major assets of urban infra-structure. Maintenance and rehabilitation of these pavements to the desired level of serviceability is one of the challenging problems faced by pavement engineers. The evaluation of pavement performance using pavement condition is a basic component of any Pavement Management system. (PMS) is a planning tool used to aid pavement management decisions, pavement deterioration due to traffic and weather, and recommend maintenance and repairs to the road's pavement based on the type and age of the pavement and various measures of existing pavement quality. It represents an effort in the similar direction, to develop a combined Overall pavement Condition Rating (OPCR) for the selected network of Hyderabad City Roads. The study area consists of urban road sections constituting 39.9 km of Hyderabad city. The methodology includes the identification of urban road sections, pavement distress data collection, Pavement condition Distress, Quality control analysis and finally developing Overall Pavement Condition Ratings (OPCR). The proposed rating is expected to be a good indicative of pavement condition and performance. The Ratings was used to select the maintenance strategy for the pavement section. It is far less expensive to keep a road in good condition than it is to repair it once it has deteriorated. This is why pavement management systems place the priority on preventive maintenance of roads in good

condition, rather than reconstructing roads in poor condition. In terms of life time cost and long term pavement conditions, this will result in better system performance

Keywords -- Pavement, PMS , OPCR, Overlay.

1. INTRODUCTION

India is said to be the fastest developing countries today. Although India is doing exceptionally well in industrialization there are still certain areas where the country is lagging behind. India's road network is gigantic. But one of the striking underlying facts is the condition of the roads. Since roads indirectly contribute to the economic growth of the country it is extremely essential that the roads are well laid out and strong. India is home to several bad roads be it the metropolitans, the cities or the villages. Bad road conditions are nothing new to India and the problem. Since India is a developing nation there is a constant demand for good quality infrastructure, transportation and services. But since India is a huge country with quite a sizable population this problem still has not been addressed in totality. In order to improve the conditions of roads efforts began way back in the 1980s. It is during this time that roads were built to link major highways, to expand the width of existing roads and to construct important bridges. India has a total of about 2 million kilometers of roads out of which 960,000 kilometers are surfaced roads and about 1 million kilometers of roads in India are the poorly constructed ones. India is also home to Fifty-three National highways which carry about 40 percent of the total road traffic. Although the figures look pretty impressive but the underlying fact is that 25 percent of villages in India still having poor road links. The other problems faced by the Indian roads are; bad riding quality, poor geometrics, and insufficient pavement thickness. In India the responsibilities for road building and maintenance lies with the Central and state government. The administration of the national highway system is vested with the Ministry of State for Surface Transport in India and other state roads are preserved by the state public works departments. As far as the minor roads in the country are concerned they are up kept by the various districts, municipalities, and villages

Need For Study

In India, due to the large scale industrialization and commercial activities, there has been an unprecedented traffic growth during the last four decades. The high volume of vehicular traffic and increasingly heavy axle loads witnessed on Indian highways have brought the existing arterial road network to such a crippling stage that heavy investments are needed for restoring it to a desired serviceability level. This is a particular difficult situation, because pavements often are deteriorating faster than they are being corrected. Effective management of pavements is essential in these challenging times. Therefore, there is a need to link together explicitly the activities of planning, design, construction and maintenance of pavements.

The Road User Cost Study in India has established that due to improper maintenance and poor surface condition of road pavements, there is a considerable economic loss to the country due to increase in vehicle operation costs. If the road pavements are maintained to the desired level at an appropriate time, it is possible to save the losses in road user cost. In view of the budgetary constraints and the need for judicious spending of available resources, the maintenance planning and budgeting are required to be done based on scientific methods.

Pavement management System

General

A pavement management system (PMS) is a planning tool used to aid pavement management decisions. PMS software programs model future pavement deterioration due to traffic and weather, and recommend maintenance and repairs to the road's pavement based on the type and age of the pavement and various measures of existing pavement quality.

Measurements can be made by persons on the ground, visually from a moving vehicle, or using automated sensors mounted to a vehicle. PMS software often helps the user create composite pavement quality rankings based on pavement quality measures on roads or road sections. Recommendations are usually biased towards preventive maintenance, rather than allowing a road to deteriorate until it needs more extensive reconstruction.

Pavement Deterioration- Pavements tend to deteriorate very slowly during the first few years after placement and very rapidly when they are aged. Even though pavement designs and materials varied widely, the deterioration of pavements followed a standard curve.

This curve, pavement condition vs. age, is shown in the figure 1.1



Pavement Deterioration Curve

Objective of Study:

The aim of this study is to suggest establishment of a new system of pavement management in Hyderabad City. The basic purpose of pavement management system is to achieve best value possible for the available public funds and to provide safe, comfortable and economic transportation. The function of management at all levels involves comparing alternatives, coordinating activities, making decisions and seeing that they are implemented in an efficient and economical manner.

The intent of this Thesis is to present the development of a PMS for use with Hyderabad city roads in the state of Telangana.

LITERATURE REVIEW

The present paper is an effort in the similar direction, to develop a combined Overall Pavement Condition Index (OPCI) [1] for the selected network of Noida urban roads. The study area consists of 10 urban road sections constituting 29.92 km of Noida city near New Delhi, capital of India. The condition indicator used to represent the pavement condition [2] of selected urban road sections is, combined Overall Pavement Condition Index (OPCI). These indices were developed individually and were then combined together to form an OPCI giving importance of each indicator. The pavement condition data was collected in the year 2012. All the individual condition indices and the combined index ranged from the value 0 to 100

[7] The pavement condition was rated based these values as 0-10: Failed; 10-25: Very Poor; 25-40: Poor; 40-55: Fair; 55-70: Good; 70-85: Very Good; 85-100: Excellent. [8] [9] [10]

The minimum and maximum range of various pavement performance indicators observed on the study sections

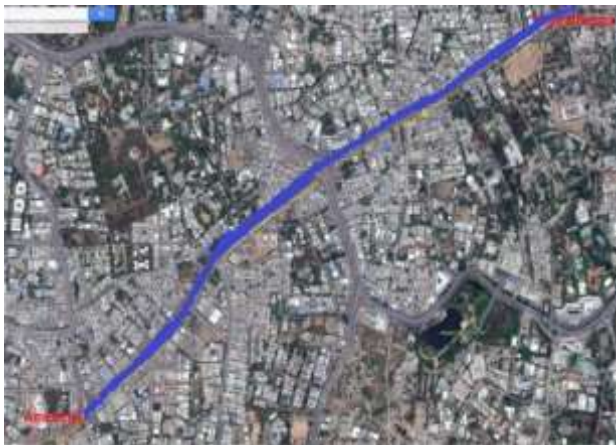
are: longitudinal cracking: 8.3% & 11.86%; transverse cracking: 2.23% & 6.61%; alligator cracking: 11.44% & 16.16%; patching: 4378% & 12.0%, raveling: 9.58% & 29.24%; potholes: 1 & 6 nos.; IRI: 2.08 m/km & 5.41 m/km; deflection: 1 mm to 1.82 mm & SRV: 48 & 75 respectively.

Primary Survey

In this identification of pavement stretch in HYDERABAD was done by conducting field trips in Hyderabad and Cyberabad regions. Field Trips means direct on-fields observations to find the distress problems in each place. For this survey the following data was utilized:



Hyderabad Road Plan



Data collection & Analysis

Visual Rating Survey & Distress Evaluation:

The form used for noting location, degree and extent of the distresses in this survey is given in the end in Annexure-2.

There were three types of distresses observed in the study area:

- Ravelling
- Rutting
- Pot-holes

Pavement Excavation



Shows cross section of Pavement-Ameerpet to Punjagutta

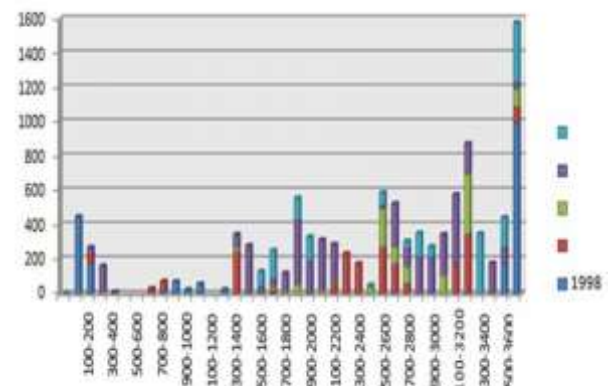
RESULTS

oad Inventory Data

Section	Carriageway Width		Shoulder Width		Median Width
	L.H.S	R.H.S	L.H.S	R.H.S	
Ameertpet	12.3m	10.62m	0.22m	0.33m	0.5m
Punjagutta	11.71m	11.69m	0.18m	0.27m	0.5m
Irrumanzil	8.1m	8.72m	0.1m	0.22m	0.5m
Khairathabad	14.81m	15.7m	0.31m	0.27m	0.5m

Visual Survey Raveling

As per the survey results the data is enclosed in the form of graph as shown below which reveals that severity levels verses chainage length of every 100.



Area of raveling of different severity levels Vs chainage

Cost of Repair works and Rehabilitation:

The cost of repair works is generally taken as 10% - 15% of the cost of new construction. As seen above, the expenditure required for repairing 1 Km road of width 7.5 m is Rs.8167750. Therefore the cost of repairing of 3.8 km long study area is about Rs 3103650. To sum up: Cost of reconstructing the study area: Rs. 26898300; and Cost of Repairing the study area: Rs. 3103650

Other than these direct costs, there are several indirect benefits, like vehicle maintenance costs, accident costs, etc. that are gained when the functional efficiency of road is improved. In order to optimize the funds, the MPI values should be followed to see which section needs to be repaired first. If these steps are followed carefully, we can get an efficient road network with optimum use of resources

5. CONCLUSIONS

- The minimum and maximum range of various pavement performance indicators are observed on the study sections are: longitudinal cracking: 8.3% & 11.86%; transverse cracking: 2.23% & 6.61%; alligator cracking: 11.44% & 16.16%; patching: 43.78% & 12.0%, Raveling: 9.58% & 29.24%, Deflection: 1mm to 1.82mm.
- Based on the survey Maintenance of pavements is not done regularly, overlays of pavements are going on without testing (i.e. Deflection testing). Continuous Overlays are done without reconstruction of Stretch.
- Quality reveals that Quality of materials also not up to the mark. Traffic growth is in high rate while design of overlays is not considering.
- Due to growth of traffic is more considerations are taking into account for overlays. Thickness of Overlays also neglected.
- For Stretch One OPCI/R Reconstruction should do, if not maintenance cost will be too high.
- Width of the road is also varying from place to place due to this vehicular load is more at particular stretch and causes deterioration, due to improper drainage facility water get staged on roads and causes damage to roads, In rainy seasons its effect is severe.
- Pavement structural strength was found to be a crucial pavement condition indicator for changing the pavement performance and deciding the M&R strategy for selected urban pavement sections.

RECOMMENDATIONS

- Proper supervision to be taken on Entire Hyderabad City Road Network

- Quality of Materials Used In the Pavement is not up to the mark, GHMC has to control the Quality related Issues as per MORTH.
- Required Testing's to be done as per IRC before going for Overlays of Pavement
- Road widening to be done to control the Heavy traffic as per Standards, As Hyderabad Roads Consists of Narrow Roads.
- After completion Of Overlays drainage lids to be brought into the same level of pavement, due to this traffic flow is obstructed.
- For further Extension of this project by maintaining the data in software to implement maintenance periodically, Skid resistance and roughness also plays an key role ,so we can apply this get a good result.

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