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Review Paper on Road Maintenance Strategies and Road Pavement Performance Case Study of Developing Countries

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Abstract: ***One of the most critical aspects of the management of road infrastructure is the type and scale of maintenance systems adopted and the consequences of them in adequacy. The performance of road maintenance system scan be assessed by a number of important indicators such as: cost, safety, environmental impact, and level of complaints by users. A review of practice reveals that insufficient level of expenditure or poor management of the road network often has serious consequences for the economic and social life of a country in terms of vehicle operating costs (VOC), travel time costs, accident costs and environmental impact. Despite an increase in the attention paid by global road agencies to the environmental and the road users' satisfaction, the overwhelming evidence from the available literature agrees on the lack of similar levels of attention for the two factors in many developing countries. While many sources agree that the road maintenance backlog is caused by either the shortage of expenditures or lack of proper management or both, it appears that managing the available assets particularly in the developing countries is the main issue.***

Keywords: Performance based contract, periodic maintenance routine maintenance, emergency maintenance, road performance

1. Introduction

Pavement maintenance is a very crucial component of any highway agency's operation. Highway agencies try to maintain their existing highway network in a state that provides a safe and smooth ride to the travelling public through the application of maintenance strategies. Research has been conducted at the national level to determine the value of maintenance to encourage highway agencies to adopt sound maintenance practices (preventive maintenance) and understand the benefits of maintaining the highway network. Individual highway agencies need to carry this research further to determine the impact of their own maintenance practices on the condition of their highway network. The results can be incorporated into a pavement management system to conduct resource allocation and project selection. This paper discusses procedures used to determine the impact of several maintenance strategies on pavement condition for the Iowa Department of Transportation (Iowa DOT). The research described goes through the process of obtaining the data, assessing the impact, and finally determining the benefits of each individual treatment strategy or a combination of strategies. The paper is divided into three major sections. The first section describes the methodology used to acquire the necessary data, maintenance activity identification, data review and validation, and then data integration using a dynamically

2. Literature Review

Highway pavement maintenance [1] literature highlights the importance of preventative maintenance in extending pavement lifespan and minimizing costs. Pavement Management Systems (PMS) are widely used for rational pavement network management and identifying cost-effective maintenance strategies. Research explores various maintenance techniques, including preventive maintenance, rehabilitation, and reconstruction, with a focus on optimizing treatment types and timing.

Key Themes in Highway Pavement Maintenance Literature:

a) Preventative Maintenance:
Research emphasizes the economic benefits of preventative maintenance, which aims to prevent or delay deterioration by addressing minor issues before they escalate.

b) Pavement Management Systems (PMS):
PMS are crucial for analyzing pavement condition, predicting future performance, and prioritizing maintenance activities.

c) Treatment Types:
Literature covers various maintenance treatments, including patching, overlays, resurfacing, grinding, and reconstruction, each suited for different types and severities of pavement distress.

d) Cost-Effectiveness:
Studies explore cost-effective maintenance strategies, considering factors like material selection, treatment duration, and labor costs.

e) Sustainability:
Recent research focuses on integrating sustainability into pavement maintenance practices, considering environmental impacts and life cycle costs.

f) Condition Assessment:
Various methods for assessing pavement condition, including visual inspection, non-destructive testing, and distress surveys, are discussed.

g) Performance Prediction:
Models and algorithms are used to predict pavement performance and determine the appropriate timing for maintenance interventions.

h) Prioritization:
Literature explores methods for prioritizing maintenance activities based on factors like pavement condition, traffic volume, and budget constraints.

i) Materials:
Different pavement materials, including asphalt, concrete, and recycled materials, are examined in terms of their performance and durability.

j) Research Trends:
Studies indicate that research on pavement maintenance is evolving towards more sophisticated models, data-driven approaches, and sustainable practices.

3. Recommendations

The influence of other factors such as poor drainage courses, level of groundwater table, variation of Geologic materials along the road route and poor construction materials should be thoroughly addressed before beginning rehabilitation the road section in the future.

Detail investigation should be carried out on project areas; also the properties of material and method of construction should be done according to the design specification of project in order to serve the design period of a project in order to avoid the pavement failure. Adequate longitudinal drainage, cross drainages and other drainage facilities should be provided in order to control the drainage problem. Seal coats shall be applied to prevent infiltration of water through cracked surfaces.

For future research, it is recommended that detailed in-depth investigation should be carried out on related project; compliance with quality of materials and construction methods in accordance with ERA Standard Specifications in order to avoid future failure.

Types of failures [3]
1) Alligator cracking
2) Consolidation of pavement layer.
3) Share failure cracking
4) Longitudinal cracking
5) Potholes and slippage
6) Bleeding
7) Pumping

4. Suggested Maintenance Methods

Continuous periodic inspection of roads [2]. Fill the cracks and repair minor defects on the road surface.

Construct the shoulders and Repair Edge Cracking of the road.

The well design camber should be provided.

Three layers of coats or finishes are provided that are seal coat, tack coat, prime coat Construct a water drainage system.

Surface coats should be water tight against surface water infiltration.

Base coarse is constructed with hard and durable aggregate which may either stabilizer or granular or both. The sub grade is weak then minimum 100mm thick sub-base coarse to be provided. Periodic cleaning of the road.

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