Lecture #7:

◎ Pavement Management Systems Workshop

Handouts:

Zimmerman, K. A., “Pavement Management Systems Workshop,” 1996 International Road Federation Asia-Pacific Regional Meeting, Nov. 17-22, 1996, Taipei, pp. 57-92.

I. Introduction

Growing Backlog of Rehab Needs
Major Components of a PMS
Forecast Future Conditions
Identify Optimal Timing for Pavement Rehab
(Figure 1- Impact of Rehab Timing on Cost)

II. Pavement Management & PMS Components

2.1 Introduction

Various PMS Definitions:

APWA: “... A systematic method for routinely collecting, storing, and retrieving the kind of decision-making

information needed to make use of limited maintenance (and construction) dollars."

AASHTO: "... to improve the efficiency of decision making, expand its scope, provide feedback on the consequences of decisions, facilitate the coordination of activities within the agency, and ensure the consistency of decisions made at different management levels within the same organization."

[... Most Recommendations from a PMS are Made at the Network Level, ...]

2.2 Components of a PMS (Figure 2)
Network Inventory, Condition Assessment, Database, Model Development, Data Analysis, System Outputs & Feedback

2.3 Network Inventory
Pavement Length & Width, Location Reference Identifiers, As-Built Materials & Thickness, Traffic Data, Surface Type, Non-Destructive/Destructive Test Results, and Maintenance Histories

[Guidelines: The Data Should be Fairly Easy to Obtain ..., Should Serve a Purpose]

2.4 Condition Assessment

Evaluate Current Pavement Condition
An Objective & Repeatable Procedure
Network Level for Airports: PCI
Project Level: PCI & NDT Results
Entire State Highway Network: PCI is Impractical; Automatically Collect Roughness, Profile, and Rutting at Traffic Speeds
Video Inspection Van (Figure 3)
Distress Identification Workstation (Figure 4)
NCHRP Synthesis 203: Data Collection

- Most Agencies Collecting Distress & Roughness as part of their PMS
- Many Agencies Collecting Friction Data, but do not incorporate it into their PMS Decisions (=> Used for Wet Weather Accident Reduction Programs)
- Half Agencies Collecting Deflection Information Only for

Project-Level Designs, Not Network Level Planning

2.4.1 Distress

Common Distress Types: Cracking, Rutting, Joint Deterioration, Durability Cracking, Punchouts, etc. => To Generate a Distress Index, PSI, Priority Rating, Other Indices

2.4.2 Roughness

Roughness, or Ride Quality Ratings

International Roughness Index (IRI)

World Bank: Four Classes

Precision Profile, Other Profilometer Methods, IRI Estimates from Correlation Equations, Subjective Ratings and Uncalibrated Measures

South Dakota Profiler (Class II): most commonly used equipment in U.S.

2.4.3 Uses of Condition Data

A Distress Index, or Individual Distress Thresholds for Each Distress Type

Decision Tree for Individual Distress (Fig.5)

2.5 Database

2.5.1 Database Content and Structure

Decisions Supported by a PMS Database (Table 1)

PMS Database: Inventory Data, Traffic Data, Construction/Maintenance Histories, Condition Information

Dynamic Segmentation (Fig. 6)

2.5.2 Importance of Data in a PMS

Performance Modeling
Project and Treatment Selection
Network Trade-off and Impact Analysis
Maintenance Program Development
Design Inputs

2.5.3 Data Integrity and Database Maintenance

2.6 Model Development

2.6.1 Performance Modeling

Predict future Pavement Condition, Analyze Pavement Life Cycle Costs, Estimate the Type and Timing of Maintenance & Rehab Needs, Provide Feedback

1. Deterministic Models
2. Probabilistic Models: Based on Markovian Theory (Table 2)
3. Individual Segment Models & Family Models (Figure 8)
4. Expert Models
5. Regression Models Supplemented with Expert Opinion

3. Optimization

2.7.3 Single-Year vs. Multi-Year Prioritization
Advantages & Disadvantages

2.7.4 Components of Multi-Year Prioritization
1. Pavement Performance Analysis
2. Pavement Preservation Strategies and Treatments
3. Investment Analysis
4. Project Selection Process

2.7.5 Data and Analysis Requirements of Multi-Year Prioritization

2.7.6 Other Factors That Influence the Analysis Process

2.8 System Outputs & Feedback
Reports and Other Outputs: Reports, Graphics, Maps, CAD, GIS
Feedback Loop

III. Benefits to Using Pavement Management
1. Provide An Automated Procedure
2. Improve Long-Term Effectiveness
3. Understand the Impact of Project Timing or Treatment Selection
4. Improve Forecasting Future Needs

5. Provide timely & Accurate Information
6. Provide a Quantifiable Assessment of Network Condition
7. Evaluating Various Rehab Strategies & Option Trade-offs
8. Analyze the Consequences of Various Funding Levels
9. Provide a Sound Basis for Allocating Resources
10. Provide Objective Info to Balance Political and Other Subjective Inputs
11. Enhances Agency's Credibility
12. Provide Valuable Feedback
13. Improve Communications
14. Allow to Answer "What-if" Questions

etc...

IV. Summary