Full-Depth Reclamation Symposium

The Missing Link in Pavement Management
October 24, 2015

Presented by:
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KERCHER ENGINEERING, INC.
Agenda

• Critical Pavement Management System Issues
• Pavement Condition Surveys (PCS)
• Pavement Management Software
• Summary
• Questions
Opening Questions

• Why are we here?
• What is the condition of your roadway network?
• Is it getting better?
• Is your pavement management program adequately funded?
• Are your current practices working?
• Are you selecting the right projects to maximize performance with the available resources?
Challenges/Problem Statement

1. Inadequate Roadway Funding
   - Does Council Fully Understand?
   - Are Other Departments Getting Funding?

2. Forced into “Worst-First” Project Selection
   - Spending a Lot of Money in a Small Area

3. Catching Up Is Impossible
   - Float a Bond?
Solution/Missing Link

1. Perform a Regular PCS
2. Predictive Modelling
   - Leveraging the PCS Data
   - Providing a Defensible Case
3. FHWA 3R’s
   - Repair Strategies (When, Where, What Type?)
   - Multi-Constraint Optimization
     • Doing things at the right time

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Pavement Condition Surveys (PCS)
Pavement Condition Surveys

- Measures the deterioration produced by use, environment and material aging
  - Data is Analyzed to Generate Decision-making Information
    - Condition → Repairs → Costs → Priorities
  - Collect only the Data that is required:
    - More Cost-effective
    - Higher Quality (less to focus on)

**Goal: Quality Data, Not Quantity!!!**
Pavement Condition Surveys

• A Good Evaluation requires a “SOLID” Understanding and Field Training

• Comprehensive Rating System
  – Must reasonably reflect the true level of deterioration
  – Distress Information:
    • Type
    • Severity
    • Extent

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PCS Methods

• Visual Surveys (Windshield)
  – LTPP
  – ITRE
  – Paser
  – Internal Rating System

• ASTM D6433 (Physical Measurement)

• Automated Data Collection (Van)
PCS Frequency

FHWA Recommends:

Every 2 to 3 Years
Why Is A Quality Pavement Management System So Critical?
Many Variables

- Functional Class
- Truck Traffic
- Speed Limits
- Pavement Types
- Soils
- Drainage
- Pavement Condition
- Repair Alternatives
Many Constraints/Challenges

Performance Goals

Needs (Backlog)

Other Assets

Funding Sources

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Timing is Very Critical!!!
Using The Right Mix of Fixes
Thin “Overlays”

NAPA Report - IS 135

• Range of Life – 4 years to 17 years
• Median Life Expectancy – 7 to 10 years

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Pavement Treatments
Utilize the Entire Tool Box

There is a most Cost-effective Treatment
for every combination of Distresses

Crack Sealing  Patching  Microsurfacing

Ultra-Thin Bonded Overlay  Cold In-Place Recycling  Full-Depth Reclamation

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Analytics Matter!!!

Maximize Your Infrastructure Investment

Doing More With Less
Pavement Management Software
Most Pavement Management Software

• Limited Flexibility
  – Generic Treatments
  – Generic Decision Trees
  – Generic Performance Models
  – Generic Reports

• Ranking Prioritization
  – Not Integer Optimization
  – 30% to 60% Less Effective than Optimization

• Single Composite Index (e.g. PCI)
What is the Most Cost-effective Treatment?

Crack Seal & Micro

Deep Patching

Thin Rehab

A Single Index would most likely Select a Surface Coat

3 Different Conditions with a PCI = 70-75

Transverse Cracks 30’ to 50’ c-c and Raveling

Localized Severe Alligator Cracks

Corrugations

Pavement Age

Very Good

Preservation

Rehab

Reconstruction

Very Poor

New

Old

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Structural Deterioration
Individual/Combined Indices & Treatment

Individual Index
- Alligator Cracking
- Edge Cracking
- Potholes/Patching

Combined Index
- Structural Index

Treatment
- Structural Repair

- No Maintenance
- Patching (IF MS/HS)
- Rehab
- Reconstruction/FDR/CIR

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Environmental Deterioration
Individual/Combined Indices & Treatment

**Individual Index**
- Transverse Cracking
- Block Cracking
- Raveling

**Combined Index**

**Treatment**
- No Maintenance
- Crack Seal (MS/HS)
- Preventive Maintenance
- Rehab
- Thick Rehab/CIR

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Pavement Management Software

AgileAssets Pavement Analyst
AgileAssets Pavement Analyst™ Software

- The Leading Pavement and Asset Management Software
- Predictive Modelling (“What If Scenarios”)
- Multi-Constraint Integer Optimization
- Tremendous Flexibility
  - VDOT> 57,000 centerline miles
  - Rehoboth Beach, DE - 19 centerline miles

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AgileAssets Pavement Analyst Software

- Flexibility
  - Inventory Data
  - Condition Data
  - Pavement Types
  - Treatment Types
  - Decision Trees
  - Performance Models
  - Integrate with other Assets
Optimization

Ensuring that the Utilization of Resources is Maximized to achieve Desired Goals
“Benefit” Calculation

Benefit of Applying Treatment = (A.B.C.) * Traffic Factor * ???

??? - Other Factors

Delaying Treatment

• Less “Real” Improvement
• Lower Performance
• Less Benefit!!!

Decreased Performance Created by “Delaying”
Goal Of Optimization
Provide the Maximum Amount of Benefit

- **Optimal Timing**
  - Excellent Rt. Maintenance
  - $150,000
  - Sweet Spot
  - Optimal Timing
- **Optimal Timing**
  - Good Preventive Maintenance
  - $480,000
  - Sweet Spot
  - Optimal Timing
- **Optimal Timing**
  - Fair Minor Rehabilitation
  - $30,000
  - Sweet Spot
  - Sweet Spot
- **Optimal Timing**
  - Poor Major Rehabilitation
  - $250,000
  - Sweet Spot
  - Sweet Spot
- **Optimal Timing**
  - Very Poor Reconstruction
  - $480,000
  - Sweet Spot
  - Optimal Timing

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Multi-Constraint Optimized Scenario Analysis

Objective: Minimize Cost

Minimize Cost

Network Overall PCI > 70

Constraint: Performance Measures (PCI)

Constraint No. 1
Network PCI

Constraint No. 2
Network Level SI
By Classification

Local
SI ≥ 65

Collectors
SI ≥ 68

Arterials
SI ≥ 75

Arterials
0% w/
PCI < 40

Collectors
10% w/
PCI < 40

Local
20% w/
PCI < 30

Collectors
10% w/
PCI < 40

Local
0% w/
PCI < 40

Arterials
20% w/
PCI < 40

Collectors
10% w/
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Examples
Buena Vista, VA
56 Miles of Streets

Comparison:
Worst First vs. Optimization
Investment Level: $600K/Year
Pavement Condition Index (PCI)

$600K/Year

PCI = 54

PCI = 46

Year

PCI

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Percent of Network Treated: Worst First

$600K/Year

Worst First %

Optimized 10 Year Treated Length = 27 Lane Miles
Percent of Network Treated: Optimized

$600K/Year

Optimized %

Optimized 10 Year Treated Length = 76 Lane Miles

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A Medium-Sized County
900 Miles of Streets

Comparison:
Reconstruction vs. FDR

Investment Level: $10M/Year
Many Subdivision Streets are 8-15 year age range and needing attention soon
Overall Condition Index (PCI)
The Same Annual Budget

PCI = 75.4
PCI = 72.3
Backlog - Utilizing Traditional Reconstruction vs. FDR
The Same Annual Budget

Traditional Reconstruction

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<th>Thin Rehab</th>
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FDR

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Backlog Cost Total Comparison
The Same Annual Budget

$35 Million
The Optimization Approach

• Why the Drastic Reduction in Backlog?
  
  – Optimization selects the most-cost effective (optimal) set of projects to meet the Objective subject to One or More Constraints!
  
  – Many more pavements are treated due to the software selecting the optimal mix of fixes!
The Missing Link

• Regular PCS (Every 2 to 3 Years)

• Predictive Modeling
  – Defensible Case

• Project Selection
  – Multi-Constraint Integer Optimization
    • FHWA 3R’s
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