Columbus Pavement Management System:
Using Network-Level, Long-Range Planning to Preserve Pavements

Presented by
Alan P. Moran, P.E.
Joshua R. LeVan, E.I.
Objective

Discuss how Columbus has developed a multi-year pavement preservation program using network level pavement condition data, field review data, routine maintenance, preventive maintenance strategies, and minor rehabilitation activities.
Outline

• Overview of Columbus Roadway Network
• Challenges with Maintaining the Roadway Network
• Solution to Effectively Maintaining Pavement
• City of Columbus: Pavement Preservation Program
• Multi-Year Pavement Preservation Program
• Conclusion/Summary
OVERVIEW OF COLUMBUS ROADWAY NETWORK
City of Columbus

• Capital of the State of Ohio

• Largest city in Ohio
  – 228 square miles of area (2014)

• 15th largest city in the United States
  – Population: Over 800,000
City of Columbus-Roadway Network

• Approximate centerline miles: 2,100
• Approximate Lane-Miles (11-foot): 6,400
  – Asphalt: 6,100 LM (96%)
  – Concrete: 175 LM (3%)
  – Brick: 80 LM (1%)

• Los Angeles to New York City (2-lane Rdwy)
  – 5550 LM
CHALLENGES WITH MAINTAINING THE ROADWAY NETWORK
• To resurface a street once every 10-15 years
  – Approximately 488 Lane-Miles need to be resurfaced each year

• Between 2010 and 2015, an average of 200 Lane-Miles were resurfaced each year.
  – This rate would require 30 years to resurface all streets
Resurfacing Summary

• 1990-1999:
  – $47.5m
  – 1692 Lane-Miles (28% of Network)
  – Average 169 LM/year

• 2000-2009
  – $82.7m
  – 1009 Lane-Miles (17% of Network)
  – Average 101 LM/year

• 2010-2015
  – $158.5m
  – 1205 Lane-Miles (20% of Network)
  – Average 200 LM/year
Resurfacing Lane Mile and Funding History Since 1985

**11-Foot Lane Miles**

- 1985: 170
- 1990: 140
- 1995: 180
- 2000: 220
- 2005: 190
- 2010: 300
- 2015: 290

**Resurfacing Program Total Dollars (Mil)**

- 1985: $10
- 1990: $20
- 1995: $30
- 2000: $40
- 2005: $35
- 2010: $25
- 2015: $30

*Graph showing the resurfacing of lane miles and total funding from 1985 to 2015.*
2014 Resurfacing Program Cost Breakdown

- Pavement: 59%
- ADA Ramps: 16%
- Curb: 9%
- Bike: 3%
- Inspection: 8%
- Contingency: 5%
- Pavement Markings: 3%
SOLUTION TO EFFECTIVELY MAINTAINING ROADWAY NETWORK
How does the City of Columbus Effectively Maintain its Pavement?
Pavement Preservation Program

“a program employing a network level, long-term strategy that enhances pavement performance by using integrated, cost-effective set of practices that extend pavement life, improve safety and meeting motorist expectations”

(FHWA-9/12/2005 Memorandum)
Pavement Preservation Program

• Proactive Maintenance Approach
  – Incorporates **planned** Preventive Maintenance and **Minor** Rehabilitation
Pavement Preservation Program

Consists of 3 Primary Components

- **Minor Rehabilitation**(non-structural)
  - Milling and asphalt overlay (1.25”-3”) with some pavement repairs

- **Preventive Maintenance**
  - Crack sealing, Slurry Sealing, Micro-surfacing, etc.
  - ODOT’s Pavement Preventive Maintenance Program Guide

- **Routine Maintenance activities (Reactive)**
  - Pothole repairs, etc.
Timing of Preservation Maintenance Activities

- **Preventive Maintenance:** Crack Seal/Slurry Seal
  - **Very Poor** or Better
  - **Excellent**

**Graph:**
- **Time** on the x-axis
- **Pavement Condition** on the y-axis
  - Very Poor
  - Excellent
  - Very Good or Better
Timing of Preservation Maintenance Activities

MINOR REHABILITATION: RESURFACING

VERY-GOOD OR BETTER

EXCELLENT

PAVEMENT CONDITION

TIME

VERY POOR
Timing of Preservation Maintenance Activities

- No maintenance activities performed
- Very-good or better
- Major rehabilitation or complete reconstruction

Maye

Excellent

Very poor

Time
Benefits of Timely Preservation Maintenance Activities

- Crack Seal
- Slurry Seal
- Resurfacing

Graph showing the pavement condition index over time with various maintenance activities such as preventive maintenance, rehabilitation, and construction projects like reconstruction.
Benefits of Timely Preservation Maintenance Activities

There is a general industry agreement that for every $1 currently invested in preservation, there is an approximate $6 return in extended service life

(Associated Construction Publication-2/15/2009)
CITY OF COLUMBUS: PAVEMENT PRESERVATION PROGRAM
City of Columbus: Pavement Preservation Program

Consists of 3 Primary Components

- **Minor Rehabilitation (non-structural)**
  - Milling and asphalt overlay (1.25”-3”) with some pavement repairs

- **Preventive Maintenance**
  - Crack sealing, Slurry Sealing, Micro-surfacing, etc.

- **Routine Maintenance activities (Reactive)**
  - Pothole repairs, etc.
City of Columbus: Minor Rehabilitation

- Resurfacing Program
Factors Considered When Selecting Streets for Resurfacing

• Pavement Condition
• Traffic Volume
• Street Maintenance Input
• Public Input/311 Call Center
• When the roadway was last maintained
• Distributing the effort around the City
• Other Projects
• Funding Levels
Factors Considered When Selecting Streets for Resurfacing

• PAVEMENT CONDITION
  – Automated data collecting equipment (Lasers)
    • Continuous
    • Objective
    • Accurate
  – Deflection Testing (Arterial Streets)
  – Comprehensive pavement management system integrated with GIS
  – Field Verification
Factors Considered When Selecting Streets for Resurfacing

- **PAVEMENT CONDITION**

<table>
<thead>
<tr>
<th>Pavement Rating</th>
<th>Pavement Condition Number (PCN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>85-100</td>
</tr>
<tr>
<td>Very-Good</td>
<td>80-84</td>
</tr>
<tr>
<td>Good</td>
<td>70-79</td>
</tr>
<tr>
<td>Fair</td>
<td>60-69</td>
</tr>
<tr>
<td>Poor</td>
<td>40-59</td>
</tr>
<tr>
<td>Very-Poor</td>
<td>10-39</td>
</tr>
</tbody>
</table>
Factors Considered When Selecting Streets for Resurfacing

• TRAFFIC VOLUMES
  – Arterial Streets
  – Residential Collectors
  – Residential Streets

• Attempt to distribute resurfacing funds 50-50 for arterial and residential roadways
Factors Considered When Selecting Streets for Resurfacing

• STREET MAINTENANCE INPUT
  – Pothole patching and routine maintenance becomes an issue for Street Maintenance
  – Areas of concern for Design
  – Roadway deteriorates faster than models
  – Street Maintenance Investigators
    • Areas to be considered in design
      – Pavement failures, water ponding, etc.
    • Provide streets recommended for resurfacing
Factors Considered When Selecting Streets for Resurfacing

• PUBLIC INPUT/311 CALL CENTER
  – Constituent submits concerns or questions using the City’s 311 Call Center
    • www.columbus.gov
    • 645-3111
    • Mobile App
  – Service Request is created
  – Street Maintenance Investigator
Factors Considered When Selecting Streets for Resurfacing

• WHEN THE ROADWAY WAS LAST RESURFACED
Factors Considered When Selecting Streets for Resurfacing

• DISTRIBUTING THE RESURFACING EFFORTS AROUND THE CITY
Factors Considered When Selecting Streets for Resurfacing

• OTHER PROJECTS/COORDINATION
  – City Projects
    • Public Service
    • Public Utilities
    • Recreation and Parks
    • Development
  – Private Utilities
  – Other government agencies
Factors Considered When Selecting Streets for Resurfacing

• FUNDING LEVELS
  – Annual Capital Improvement Budget
    • Typically approved each year around February
City of Columbus: Preventive Maintenance Program

- Crack Seal
- Slurry Seal
- Micro-Surfacing
City of Columbus:
Preventive Maintenance Program
City of Columbus: Preventive Maintenance Program

• Crack Seal
  – Performed approx. 6-8 years after resurfacing/built
    • Timing is important
City of Columbus: Preventive Maintenance Program

- Crack Seal – Performed approx. 6-8 years after resurfacing/built
- Right time • Too much?
- Structurally Sound Pavement • Groups of Streets

BAD EXAMPLE
City of Columbus: Preventive Maintenance Program

• Crack Seal
  – Performed approx. 6-8 year after resurfacing/built
    • Timing is important
City of Columbus: Preventive Maintenance Program

• Crack Seal
  – Performed approx. 6-8 year after resurfacing/built
    • Timing is important
  – Structurally Sound Pavement
  – Groups of Streets
City of Columbus: Preventive Maintenance Program

• Slurry Seal/Micro-Surfacing
  – Performed after Crack Sealing (Typ. 2 year after)
  – May need re-crack sealed or few pavement repairs, but overall the roadway still needs to be structurally sound
  – Residential Areas: Slurry Seal
  – Arterial/Commercial: Micro-Surfacing
  – Expected Service Life: 5 to 8 years
  – Actual Service Life Observed: 10+ years
Slurry Seal Example:
Matthias Dr. and Evaline Dr.

- Built: 1958
- Resurfaced: ???
- Slurry Sealed: 1985
- Resurfaced: 2004
- Crack Sealed: 2011
- Slurry Sealed: 2013

19 YEARS!
28 YEARS!
Slurry Seal Example: Matthias Dr. (2008) Before Crack Seal
Slurry Seal Example: Matthias Dr. (2014) After Slurry Seal
Slurry Seal Example: Matthias Dr. (2015) After Slurry Seal
Slurry Seal Example: Matthias Dr. (2014) After Slurry Seal
Slurry Seal Example: Evaline Dr. (2009) Before Crack Seal
Slurry Seal Example: Evaline Dr. (2011) Before Crack Seal
Slurry Seal Example: Evaline Dr. (2014) After Slurry Seal
Slurry Seal Example: Evaline Dr. (2015) After Slurry Seal
Slurry Seal Example: Pierce Ave

- Built: 1959
- Resurfaced: ???
- Slurry Sealed: 1985
- Resurfaced: 1998
- Crack Sealed: 2010
- Slurry Sealed: 2013

13 YEARS!
28 YEARS!
Slurry Seal Example: Pierce Ave. (2013) After CS
Slurry Seal Example: Pierce Ave. (2014) After Slurry Seal
Slurry Seal Example: Worthington Green

- Built: 1986/1987
- Crack Sealed: ???
- Slurry Sealed: 2000
- Resurfaced: 2015

29 YEARS!
15 YEARS!
Slurry Seal Example: Watertower Dr. (2014) 14 Year Old Slurry Seal
Slurry Seal Example: Gardenstone Dr. (2014) 14 Year Old Slurry Seal
*Higher Traffic
Slurry Seal Example: Hightower Dr (2015) 15 year old Slurry Seal

COPPLE YEARS LEFT!
City of Columbus:
Preventive Maintenance Program
6,100 LANE MILES OF ASPHALT STREETS

• To resurface a street once every 10-15 years
  – Approximately 488 Lane-Miles need to be resurfaced each year

• Between 2010 and 2015, an average of 200 Lane-Miles were resurfaced each year.
  – This rate would require 30 years to resurface all streets
City of Columbus: Preventive Maintenance Program

- Matthias Dr. & Evaline Dr.
  - 28 YEARS
- Pierce Ave
  - 28 YEARS
- Gardenstone/Hightower/Watertower
  - 29+ YEARS

Preventive Maintenance is CRITICAL to preserving pavement condition.

- And a key aspect of the Pavement Management Program.
City of Columbus: Routine Maintenance

• Day-to-day maintenance activities performed by City of Columbus personnel
  – Maintaining the condition of the roadway network at an acceptable level of service
  – Pothole Patching
  – Isolated Pavement Repairs
  – Pavement Markings
  – Roadside Grading

• Street Maintenance Investigators

• Public: City’s 311 Call Center
  • [www.columbus.gov](http://www.columbus.gov)
  • 645-3111
  • Mobile App
MULTI-YEAR PAVEMENT PRESERVATION PROGRAM
City of Columbus: Resurfacing Program
Resurfacing
2000-2009
Resurfacing
2010
Resurfacing
2010-2011
Resurfacing
2010-2012
Resurfacing
2010-2013
Resurfacing
2010-2014
Resurfacing
2010-2015
Resurfacing
2010-2017

2010-2015
Proposed 2016
Proposed 2017
City of Columbus: Resurfacing Program through 2015. Overall Average PCN = 76

Percentage Area

- Excellent (100-85): 31.0%
- Very-Good (84-80): 16.7%
- Good (79-70): 17.5%
- Fair (69-60): 13.5%
- Poor (59-40): 20.0%
- Very-Poor (39-0): 1.3%
City of Columbus: Resurfacing Program through 2015. Arterial Average PCN = 75

(Percentage Area)
- Excellent (100-85): 37.5%
- Very-Good (84-80): 19.9%
- Good (79-70): 18.7%
- Fair (69-60): 9.5%
- Poor (59-40): 11.9%
- Very-Poor (39-0): 2.6%

(Percentage Area)
City of Columbus: Resurfacing Program through 2015. Residential Average PCN = 76

- Excellent (100-85): 27.2%
- Very-Good (84-80): 14.8%
- Good (79-70): 14.4%
- Fair (69-60): 20.7%
- Poor (59-40): 0.5%
- Very-Poor (39-0): 14.4%
City of Columbus:
Preventive Maintenance Program
Crack Seal
2004-2013
Slurry Seal
2004-2013
Preventive Maintenance 2004-2013

Crack Seal

Slurry Seal
Preventive Maintenance
2004-2016

2004-2013 CS
2004-2013 SS

Proposed CS
Proposed SS
CONCLUSION/summary
Conclusion/Summary

• Based on the many factors involved with selecting streets, a maintenance program involves more than pressing run on a PMS.
• Effectively maintaining large roadway networks is possible when performing the appropriate preventive maintenance at the right time.
• Preventive maintenance treatments are lasting longer than anticipated.
QUESTIONS/COMMENTS

Columbus Pavement Management System

Presented by
Alan P. Moran, P.E.
Joshua R. LeVan, E.I.