PERFORMANCE OF LOUISIANA’S CHIP SEAL AND MICRO-SURFACING PROJECTS

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Background
- Chip Seals
- Micro-Surfacing

Objective

Scope

Research

Summary and Conclusions
Chip Seals

- What is a Chip Seal?
  - Single layer of asphalt binder covered by embedded aggregate one rock thick.
- Dates back to the 1920’s.
  - Used primarily as wearing course for low volume roads.
- Evolved into maintenance treatments for low and high volume roadways.
- Popularity is a result of low initial cost in comparison to thin asphalt overlays.
Chip Seals

- NCHRP Synthesis 35-02, Chip Seal Best Practices.
  - States and municipalities reporting excellent chip seal programs.
- Use Chips Seals as preventative maintenance.
  - Apply to roads before distress levels are classified as moderate.
  - Chip Seals scheduled every 5 years with life expectancy of chip seals being 6 years.
Micro-Surfacing

What is Micro-Surfacing?

- Type of Slurry Seal
- Mixture of dense-graded aggregate, asphalt emulsion, water, and mineral fillers.

Applied with specialized paver which carries and mixes all components.

Surface is initially dark brown and then changes to black.

Cures in 1 hour.
Micro-surfacing
Chip seals and micro-surfacing are two of the commonly used techniques to preserve or extend pavement life.

These techniques can be classified according to their purpose or function as either corrective or preventive.

Should only be considered for structurally sound pavements.
Critical Decisions for Pavement Preservation

- Timing of application
- Selection of an appropriate technique
Time of Application

Effectiveness of Maintenance Operations
Which Application?

- Chip Seal
  - Seal Surface
  - Seal low intensity fatigue and block cracking
  - Restore Surface Friction

- Micro-Surfacing
  - For Asphalt Pavements
    - Rut Filling
    - Texturing/Sealing
  - For Concrete Pavements
    - Texturing
Objective

- Evaluate the effectiveness of LADOTD’s chip seal and micro-surfacing program in terms of their performance and cost.
Scope

– Limited to the evaluation of performance relative to age and traffic factors and not factors associated with materials and/or construction.
Project Factorial

- **Single layer Chip Seals**
  - 40 projects

- **Micro-Surfacing**
  - 24 projects
General Location of Preventive Maintenance Projects

CS = Chip Seal
MS = Micro Surface
Pavement Evaluation Process

- Ride each entire project.
  - Rate roughness

- Select a representative test section from each project.
  - 500 to 700 foot test section

- Survey same section every 12 – 24 months.

- Conduct a minimum of four surveys.
Test Section Evaluation

- Conduct a walking survey.
- Rate Severity and Extent of Pavement Distresses.
- Photograph each test section.
Rating Distresses:

- Rutting
- Roughness
Rating Distresses: Cracking

Alligator

Longitudinal/Transverse

Edge (Widening)
Rating Distresses:

Patch/ Pothole

Bleeding

Aggregate Loss
Field Evaluation Rating Procedure

- Subjectively rate each distress in terms of:
  - Severity
    - Degree of deterioration
  - Extent
    - Frequency of occurrence
- Assign weight to each pavement distress
- Record the rating on the rating form
### PAVEMENT CONDITION RATING FORM

**Project No:** 424-08-0023  
**District:** 02  
**Name:** Overpass - Jet LA 3199  
**Project Begin:** US 90 @ the Overpass @ LA 308; thence North to  
**Project End:** its intersection with LA 3199  
**Route:** US 90  
**Seal Type:** MicroSurface  
**Project Length:** 3.60  
**Date Constructed:** 2/97(75)  
**Date Surveyed:** 4.15.03  
**Surveyed By:** SCS  
**Test Section Begin:** Sheriff’s Bldg  
**Test Section End:** Insp Lane: NB, SB, EB, WB

<table>
<thead>
<tr>
<th>Distress</th>
<th>Weight Factor</th>
<th>None</th>
<th>Low</th>
<th>Med</th>
<th>High</th>
<th>None</th>
<th>Occ</th>
<th>Freq</th>
<th>Ext</th>
<th>Deduct Points</th>
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<tbody>
<tr>
<td>Long/Trans Cracking</td>
<td>20</td>
<td>None</td>
<td>&lt;1/4</td>
<td>1/4</td>
<td>&gt;1/4</td>
<td>None</td>
<td>&lt;10%</td>
<td>10-30</td>
<td>&gt;30%</td>
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<tr>
<td>Alligator Cracking</td>
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<td>0.1</td>
<td>0.2</td>
<td>0.6</td>
<td>1.0</td>
<td>0.1</td>
<td>0.4</td>
<td>0.8</td>
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<tr>
<td>Edge Cracking</td>
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<td>None</td>
<td>&lt;1&quot;</td>
<td>1/2&quot;</td>
<td>&gt;1&quot;</td>
<td>None</td>
<td>&lt;10%</td>
<td>10-30</td>
<td>&gt;30%</td>
<td></td>
</tr>
<tr>
<td>Patch/Pothole</td>
<td>10</td>
<td>0.1</td>
<td>0.2</td>
<td>0.6</td>
<td>1.0</td>
<td>0.1</td>
<td>0.4</td>
<td>0.8</td>
<td>1.0</td>
<td></td>
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<tr>
<td>Rutting</td>
<td>10</td>
<td>&lt;1/4&quot;</td>
<td>1/4-1/2</td>
<td>1/2-1&quot;</td>
<td>&gt;1&quot;</td>
<td>0.1</td>
<td>0.3</td>
<td>0.7</td>
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<tr>
<td>Aggregate Loss</td>
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<td>None</td>
<td>slight</td>
<td>Mod</td>
<td>Severe</td>
<td>None</td>
<td>&lt;10%</td>
<td>10-30</td>
<td>&gt;30%</td>
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</tr>
<tr>
<td>Bleeding</td>
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<td>0.3</td>
<td>0.6</td>
<td>1.0</td>
<td>0.1</td>
<td>0.5</td>
<td>0.8</td>
<td>1.0</td>
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<tr>
<td>Roughness</td>
<td>15</td>
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<td>Poor</td>
<td></td>
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<td>0.6</td>
<td>0.8</td>
<td>1.0</td>
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Deduct Points = Distress Weight Factor x Severity Weight Factor x Extent Weight Factor

Total Deduct Points (TDP) =

Pavement Condition Rating, PCI = (100 - TDP)
PCI Computation

- Compute deduct points for each distress (Wt Factor) \times (Severity Factor) \times (Extent Factor)
  - Maximum Deduct Factors
    - Cracking – 45 Points
    - Patch/Potholes – 10 Points
    - Rutting – 10 Points
    - Aggregate Loss – 10 Points
    - Bleeding – 10 Points
    - Roughness – 15 Points
PCI Computation

- **Determine Total Deduct Points**
  - Sum all deduct points for each distress

- **Compute the Pavement Condition Index (PCI)**
  - \( PCI = (100 - \text{Total Deduct Points}) \)

- PCI range from 0 to 100
  - 0 = Poor
  - 100 = Excellent
**Generalized PCI Rating Scale**

<table>
<thead>
<tr>
<th>PCI</th>
<th>Rating</th>
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<tbody>
<tr>
<td>86 – 100</td>
<td>Excellent</td>
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<tr>
<td>71 – 85</td>
<td>Very Good</td>
</tr>
<tr>
<td>56 – 70</td>
<td>Good</td>
</tr>
<tr>
<td>41 – 55</td>
<td>Fair</td>
</tr>
<tr>
<td>26 – 40</td>
<td>Poor</td>
</tr>
<tr>
<td>11 – 25</td>
<td>Very Poor</td>
</tr>
<tr>
<td>0 – 10</td>
<td>Failed</td>
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</table>
Pavement Condition Index – PCI

Chip Seals

PCI

Months

LTRC
Chip Seal PCI Deterioration Curve

Year

PCI

80
75
70
65
60
55
50
45

Very Good

Good Rating

Poor

0 2 4 6 8

LTRC
LA 4 Chip Seal

November 1998

February 2001
LA 999 Chip Seal

December 1998  February 2001
Pavement Condition Index – PCI

Micro Surfacing

Months

PCI
Initial & final average AGE-PCI charts for micro-surface projects

- **Age (initial)**
- **Age (final)**
- **PCI (initial)**
- **PCI (final)**
- **N (initial)**
- **N (final)**

<table>
<thead>
<tr>
<th>District</th>
<th>Age (initial)</th>
<th>Age (final)</th>
<th>PCI (initial)</th>
<th>PCI (final)</th>
<th>N (initial)</th>
<th>N (final)</th>
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<tr>
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<td>2</td>
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<tr>
<td>D04</td>
<td>94</td>
<td>70</td>
<td>82</td>
<td>82</td>
<td>2</td>
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<td>D07</td>
<td>95</td>
<td>88</td>
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<td>81</td>
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<td>D08</td>
<td>93</td>
<td>86</td>
<td>64</td>
<td>80</td>
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<td>92</td>
<td>88</td>
<td>74</td>
<td>80</td>
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<tr>
<td>D10</td>
<td>91</td>
<td>87</td>
<td>74</td>
<td>80</td>
<td>2</td>
<td>2</td>
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</tbody>
</table>

**Districts**

**Note:** The numbers represent the percentage values for each category.
Micro-Surfacing PCI Deterioration Curve

- Excellent
- Very Good
- Good

Year

PCI

0 2 4 6 8 10

LTRC
Cost Effectiveness

Expressed as Equivalent Annual Cost (EAC)

- \[ EAC = \frac{\text{Unit Cost of Treatment}}{\text{Expected Life of Treatment}} \]

- Unit Cost = Construction Cost plus Maintenance Costs
Cost Effectiveness

- **Average Unit Cost of Chip Seal**
  - $1.67/sq. yd
- **Average Unit Cost of Micro-Surfacing**
  - $3.20/sq.yd.

\[ EAC_{\text{Chip Seal}} = \left( \frac{$1.67/\text{sq. yd.}}{6\text{years}} \right) \]
- $0.28/sq.yd./year for average expected life.
- $0.33/sq.yd./year for preventative maintenance cycle of 5 years.

\[ EAC_{\text{Micro-Surfacing}} = \left( \frac{$3.20/\text{sq. yd.}}{7\text{years}} \right) \]
- $0.46/sq.yd./year for expected life.
Summary and Conclusions

Chip Seals

- 30 percent of projects have been rehabilitated.
- Remaining 70 percent have a median PCI of 68 (Good Rating) after 7 years of service.
- Based on PCI Deterioration Curves
  - 5-7 year life expectancy
  - 5 year preventative maintenance (PM) cycle
- Equivalent Annual Cost (EAC)
  - $0.33/sq.yd./year for PM cycle.
  - $0.28/sq.yd./year for average expected life
Summary and Conclusions

Micro-Surfacing

- 33 percent of the projects have been rehabilitated.
- Remaining 67 percent have a median PCI of 78 after 8 years of service.
- Based on PCI Deterioration Curves
  - 7 year life expectancy
- Equivalent Annual Cost (EAC) of about $0.46/sq.yd./year.
Summary and Conclusions

Two major distresses affecting performance
- Cracking
- Followed by roughness

Surface treatment techniques considered only for structurally sound pavements.
Summary and Conclusions

Timing of application

- Louisiana evaluation shows nothing to refute NCHRP 35-02, Chip Seals Best Practice, findings.
- May be possible to extend preventative maintenance cycle for individual roadways depending on historical data, distress rating and rate of deterioration.
- Principle Investigator, Shashikant Shah, developing guidelines.
Summary and Conclusions

- Selection of an appropriate technique.
  - Galehouse, L., Moulthrop, J.S., Hicks, R.G.
    “Place the right treatment, on the right road, at the right time”
  - Abadie, Chris
    “Place any preventative maintenance treatment, on all roads, at the right time”
Thank You!