Lessons Learned from Research in Innovative Resurfacing and Pavement Preservation Techniques on Roadways in Metro Nashville – Davidson County

Using The Right Treatment - At The Right Place - At The Right Time

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This Presentation Covers 3 Main Topics

- Why Do Agencies Need a Paving & Pavement Preservation Program
- The Benefits of a Strategic Plan & Pavement Management System
- Nashville’s Perspective of Various Pavement Preservation Products & Resurfacing Techniques Tested on Nashville Roadways
Why Do Agencies Need a Paving & Pavement Preservation Program
Historical Paving Program

- Identify roads in poor condition.

- Pave what you can until the budget runs out.

- Does not take into account the various pavement distresses in the roadway network.

- Does not incorporate pavement preservation techniques.

- Does not address roads that need attention but may not need paving at that time.
Paving & Pavement Preservation Program

- Paving only is not the most cost effective application to address the various roadway distresses.

- Paving only became an issue when the cost of asphalt increased drastically in 2005.

- Increasing the life of the road through pavement preservation is a good use of tax payers dollars.
The Benefits of a Strategic Plan & Pavement Management System
Strategic Plan

- A Strategic Plan is a good road map to a Pavement Preservation Program.
- Includes Data Collection Process, Pavement Management System, and Detail of Various Treatments based upon Roadway Condition.
- Provides Support for Pavement Management Decision made.
Pavement Condition Data

- Pavement Condition Data On Your Roadway Network is the Key to Pavement Management.

- Pavement Condition Data is Needed to Define Your Paving & Pavement Preservation Program.

- Data Needed; Longitudinal and Transverse Cracking, Raveling, Fatigue & Block Cracking etc.
Data Collection Process

• There are Several Processes used to collect Pavement Distress.

• Vehicle Road Profiler, Wind Shield Survey, Random Survey, & Walking Survey.

• A Pavement Distress Protocol Needs to be Selected.
Weathering/Raveling

- Raveling is a good Distress for Pavement Preservation Projects.

- Raveling is the loss of fines and aggregates in the pavement.

- Exclude Raveling on roads paved within the last five years.

- Pavement Preservation Projects were selected on roads with Low to Medium Raveling and no cracking.
Pavement Management System

- Metro’s Pavement Management System
  
  - Pavement View contains the inventory data such as current conditions and physical attributes.
  
  - Pavement View Plus is the segment analysis model that generates paving plan for Metro’s pavement network.
Distress Information

Distress: AC Fatigue (alligator) Cra
Pavement Class: AC Asphalt Concrete

Description:
Category: Cracking
Alligator or fatigue cracking is a series of interconnecting cracks caused by fatigue failure of the pavement.

Do Severities Apply?: Yes

Low Severity | Moderate Severity | High Severity
--- | --- | ---

Fine, longitudinal hairline cracks running parallel to each other with no, or only a interconnecting crack(s). The cracks are not spalled (crack spalling is a breakdown of the material along the cracks).
Pick a Setting

This form allows you to set the parameters PAVEMENTview Plus uses for its calculations. The initial settings reflect CartéGraph’s experience and judgment, but you can make adjustments based on your own research.

- **Activities:**
  The Activities Library is used to specify maintenance, rehabilitation, and reconstruction (MR&R) activities and the associated cost information.
  ![View Report](image)

- **Conditions & Impacts:**
  Opens the Condition Category Library. This library describes characteristics of a segment and the weight assigned to each characteristic used when calculating OCI. Impacts and Rankings are child recordsets for this library.
  ![View Report](image)

- **Performance:**
  The Performance Library contains pavement deterioration data used to predict the future OCI as well as the remaining life of the segment.
  ![View Report](image)

- **Model Scopes:**
  The Segment Model Scopes Library constrains the analysis by storing filter statements that identify which segments are selected for the analysis.
  ![View Report](image)

- **Budget Plans:**
  The Budget Plan Library stores annual budget figures, and includes the capability of tracking various multi-year budget plans.
  ![View Report](image)

- **MR&R Protocols:**
  Stores the MR&R decision matrix as well as the activity selection hierarchy. You can tie the MR&R protocol to each analysis scenario that you run.
  ![View Report](image)

- **Network Priority Rating (NPR):**
  The Network Priority Rating (NPR) establishes the overall priority of each segment to be considered for MR&R each year. The NPR calculation combines the OCI value with many other factors to come up with an inclusive index of maintenance priorities. The library contains filters used to select records based on functional class, pavement class, priority ranking, ADT, OCI and detour length.
  ![View Report](image)
Pavement Management System

• Ability to generate reports for GASB requirements.

• Report for Maintaining CAPR:
  – It is the policy of the Government to maintain at least 70% of its road and street system at a good or better condition
CURRENT CONDITION OF NETWORK
(BY % AREA)
The Use of GIS for Planning & Scheduling

- Pavement Distress Data is used to plan and schedule activities.

- Type of activity (i.e. fog seal, crack seal, paving, rejuvenating) is represented by symbol.

- The Activities Scheduled Year is represented by different Colors.
Do I Need a Pavement Management System?

• No, a simple pavement management process will work.

• Must determine a rating system for the condition of the road.

• Must have place to store data.

• For more information check out: http://mpw.nashville.gov/Row/Paving/
Results of New Pavement Preservation & Resurfacing Techniques on Nashville Streets & Roads
Metro Public Works underwent a performance audit by Maximus in May 2002.

Auditors said traditional paving is old-school; use slurry seal to increase pavement life.

Auditors were forward-thinking, but slurry seal is not a cure-all.

Luckily, we had official sources of relevant research (LTPP, SHRP, FP²) to learn from.
### Product Tested in Nashville, Tn.

<table>
<thead>
<tr>
<th>Product Tested</th>
<th>Technology Applied</th>
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</thead>
<tbody>
<tr>
<td>Reclamite</td>
<td>Crack Seal</td>
</tr>
<tr>
<td>GSB 88</td>
<td>GSB-Restore</td>
</tr>
<tr>
<td>Rejuvaseal</td>
<td>Slurry/Micro</td>
</tr>
<tr>
<td>PASS</td>
<td>Joint Bond</td>
</tr>
<tr>
<td>Re-Play (Soy)</td>
<td>Infrared Patching</td>
</tr>
<tr>
<td>NovaChip</td>
<td>Warm Mix</td>
</tr>
<tr>
<td>Liquid Road</td>
<td>Aspen</td>
</tr>
<tr>
<td>Geogrid</td>
<td>Polymer-Modified Asphalt</td>
</tr>
<tr>
<td>Road New</td>
<td></td>
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</tbody>
</table>
Innovative Pavement Preservation Techniques
RECLAMITE –

- Made from the same light oils and resins used in making asphalt.

- A one-step method for restoring plasticity and durability of the asphalt binder.

- Used on newly constructed pavements (0-3 years) to improve durability of the mix, while providing an in-depth seal to reduce permeability.
RECLAMITE –
Our Experience

- Pink surface while curing; color fades away within 24 hours.

- Requires aggregate (sand or slag) to be spread to retain skid resistance. This material coating can affect the visual appearance of the road.

- Nashville has adopted the use of pavement rejuvenators like Reclamite to protect pavement that is 3-5 years old.

- Average Cost: $0.65 Per Square Yd
CRACK SEALING

Crack sealing is the most common maintenance option used to help protect the pavement structure.

First, the cracks are cleaned and dried using a hot compressed air heat lance. Then, the cracks are filled with hot poured rubberized joint and crack sealant.

It is often placed in advance of overlays and surface treatments to improve performance.
Joint separation is biggest failure on roadway.

Crack sealant does just what its name implies.

Nashville has adopted crack sealing.

Average Cost: $1.70 per pound
GSB 88 –

- GSB Rejuvenating Sealant Binder is a low cost method to keep pavements in good condition longer by slowing the oxidation/deterioration process of your roads.

- GSB stands for Gilsonite, Sealer, and Binder

- Army Corp of Engineers found it to be four times more effective in holding a pavement's surface together than the leading saturate oil rejuvenator.
GSB 88 – Our Experience

- Very tacky. Cure time not conducive to quick traffic-readiness.

- Thin material composition – high water content in emulsion.

- Metro Nashville pursuing alternative methods more aggressively.

- Average Cost: $0.75 per Square Yard
GSB-RESTORE –

- Use on asphalt pavements within the first few years of their existence.
- Effective in solving specific pavement problems such as raveling and oxidation.
GSB-RESTORE – Our Experience

• Greater material composition than GSB-88. Less watery.

• Penetrates better than GSB-88.

• Asphalt “clogs” were left on our on finished surface during our test section.

• Outperforms GSB-88, but Metro still undecided on its use within Nashville.

• Average Cost: $0.75 per Square Yard
REJUVASEAL –

- Seals, protects, and revitalizes asphalt pavement.
- Penetrates the surface of asphalt; becomes integral part of the binder.
- Reduces viscosity and brittleness in the top 3/8” of asphalt while significantly increasing ductility and flexibility.
- Asphalt surfaces treated with RejuvaSeal are fuel, water, and chemical resistant.
REJUVASEAL –
Our Experience

• Strong coal-tar smell calls attention to itself, caused unfavorable public perception.

• Nashville’s opinion is that the smell is too strong for application on residential streets.

• Average Cost: $0.75 per Square Yard
SLURRY / MICRO-SURFACE – The Marketing Blurb

- Slurry seal is a mixture of emulsified asphalt oil, rock, water, and additives such as aluminum sulfate, Portland cement, lime, latex or carbon black.

- **Micro-Surface = Slurry Seal + Additional Aggregate** to increase skid resistance, color contrast, surface restoration, and service life to high-speed, heavy-traffic roadways.
MICRO-SURFACE –
More Marketing

- Micro-Surfacing creates a thin, restorative surface course that does not alter drainage.

- Applied to roads or runways to eliminate hydroplaning problems that occur during periods of rain.

- Micro-Surfacing creates a new, stable surface that is resistant to rutting and shoving in summer and to cracking in winter.
MICRO-SURFACE –
Our Experience

- A step up from slurry seal.
- Finish looks rough; highly textured.
- Finished surface is thin and brittle.
- Reflective cracking soon comes through.
- Average Cost: $1.50 per Square Yard
• Polymer-modified Asphalt Surface Sealer, a type of fog seal.

• Rejuvenates and seals worn asphalt.

• Fills cracks; adds durable membrane to resist reflective cracking.

• It’s got substance: 50% asphalt; 20% rejuvenator; 3% polymer. (Remaining composition is emulsifier + water.)
PASS –
Our Experience

• Cures to black appearance in 2-3 hours, allowing traffic back onto roadway.

• Little impact on residents:
  – Requires no aggregate coating
  – Little or no odor

• PASS works well to stop raveling, seal out water, fill small cracks, and extend the lifetime of roadways that were last paved 7-10 years ago.
• Requires re-striping.

• Metro Nashville has adopted the use of polymer-modified asphalt surface sealants like PASS.

• Using PASS lets Metro Nashville extend a roadway’s lifetime by about 5 years before resurfacing is needed.

• Average Cost: $0.70 Per Square Yard
## PASS – Relative Costs

Applying PASS to these 10 example streets costs around 1/8 the cost of traditional resurfacing.

**PASS = $139K where MILL & FILL = $1.1M**

<table>
<thead>
<tr>
<th>ROAD NAME</th>
<th>ACTUAL SQ YDS</th>
<th>LAST PAVED DATE</th>
<th>FOG SEAL COST</th>
<th>OVERLAY COST</th>
<th>MILLING COST</th>
<th>SAVINGS: FOG SEAL vs MILL &amp; FILL</th>
</tr>
</thead>
<tbody>
<tr>
<td>SHERIDAN RD</td>
<td>6443</td>
<td>1994</td>
<td>$3,801.37</td>
<td>$31,167.37</td>
<td>$10,147.73</td>
<td>$37,513.72</td>
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<tr>
<td>AUTUMNRIDGE DR</td>
<td>7251</td>
<td>1995</td>
<td>$4,278.09</td>
<td>$35,075.99</td>
<td>$11,420.33</td>
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<tr>
<td>HINKLE DR</td>
<td>7336</td>
<td>1992</td>
<td>$4,328.24</td>
<td>$35,487.17</td>
<td>$11,554.20</td>
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<tr>
<td>GWYNNWOOD DR</td>
<td>7768</td>
<td>1993</td>
<td>$4,583.12</td>
<td>$37,576.92</td>
<td>$12,234.60</td>
<td>$45,228.40</td>
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<tr>
<td>CHESAPEAKE DR</td>
<td>10232</td>
<td>1992</td>
<td>$6,036.88</td>
<td>$49,496.28</td>
<td>$16,115.40</td>
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<tr>
<td>IVY POINT</td>
<td>27646</td>
<td>1995</td>
<td>$16,311.14</td>
<td>$133,734.76</td>
<td>$117,423.62</td>
<td>$137,144.30</td>
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<tr>
<td>RIDGEWOOD RD</td>
<td>32289</td>
<td>1992</td>
<td>$19,050.51</td>
<td>$156,194.81</td>
<td>$137,144.30</td>
<td>$143,179.85</td>
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<tr>
<td>GREENBRIER RD</td>
<td>33710</td>
<td>1994</td>
<td>$19,888.90</td>
<td>$163,068.75</td>
<td>$143,179.85</td>
<td>$154,486.43</td>
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<tr>
<td>OLD HICKORY BLVD</td>
<td>36372</td>
<td>1995</td>
<td>$21,459.48</td>
<td>$175,945.91</td>
<td>$154,486.43</td>
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<td>GREER ROAD</td>
<td>66186</td>
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<td>$39,049.74</td>
<td>$320,168.16</td>
<td>$281,118.42</td>
<td>$1,060,600.89</td>
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</tbody>
</table>

Total Costs:
- **FOG SEAL** = $138,787.47
- **OVERLAY** = $1,137,916.11
- **MILLING** = $61,472.25
- **SAVINGS** = $1,060,600.89
JOINT BOND –

• To be applied just after resurfacing, while the pavement is new.

• Forms a strong construction joint if applied prior to initial separation.

• Prevents water from penetrating construction joints.
JOINT BOND – Our Experience

• Tested on 1, 2, and 3 year-old roadways.

• Determined it should be used on roads 1 to 2 years old.

• Sooner the Better; Joint starts opening up around 3rd Year.

• Average Cost: $0.65 per Linear Foot
RE-PLAY –

- Soy-based sealant product.
- Light odor; not unpleasant.
- More environmentally friendly than most options.
RE-PLAY –
Our Experience

• Currently under testing.

• Not enough experience with it yet to gauge its value to our program.
Infrared Repair

- Infrared heat is used to heat the existing asphalt.
- Is designed to repair asphalt defects such as pot holes, surface defects and old utility cuts.
- Average Cost $4.70 per square foot.
Aspen –

- Clay-stabilized asphalt emulsion; a type of fog seal.
- Replenishes the binder lost through oxidation, weathering, and aging;
- Fills cracks; adds durable membrane to resist reflective cracking.
- It’s got substance: 40% liquid asphalt; 30% clay fillers; 2% pigment. (Remaining composition is water.)
Aspen –
Our Experience

• Cures to black appearance in 2-3 hours, allowing traffic back onto roadway.

• Little impact on residents:
  – Requires no aggregate coating
  – Little or no odor

• Aspen works well to stop raveling, seal out water, fill small cracks, and extend the lifetime of roadways that were last paved 7-10 years ago.
Aspen –
Our Experience (cont’d)

• Requires re-striping.

• Metro Nashville is still testing and evaluating Aspen.

• Average Cost: $1.85 per Gallon
PASS VS. ASPEN

• Herman St
  – Collector
  – Raveled
  – Road Condition was Fair

• Side by Side Comparison
Liquid Road –

- Polymer modified, fiber reinforced asphalt emulsion coating.
- Job mixed with special graded aggregate.
- Fills cracks; adds durable membrane to resist reflective cracking.
- Contains: 25% liquid asphalt; 23% mineral fillers; 50% water; 2% pigment. (4 lbs of aggregate added for every gallon of liquid road.)
Liquid Road—Our Experience

- Appears to be a slow construction process.
- Cannot let traffic drive on it until fully cured.
- Major issue if gotten on concrete or aggregate driveways.
- Durable Product; excellent for sealing open construction joints or pop-outs.
- Average Cost: $2.65 Per Gallon
Combo Test Project – Our Experience

• Infrared Repair + Liquid Asphalt + Aspen

• Centerline Popping Out

• Overall Road Condition: Fair
OUR PLAN TO CONTINUE PRESERVING PAVEMENT

- Pave streets that need it.
- Reclamite streets 0-3 years old.
- Use products like PASS on streets 7-10 years old, that are severely raveled and have little or no cracking.
- Crack seal streets that have construction joint separation.
- Continue to researching and test products on roadways.
Nashville is actively researching ways to effectively manage the pavement on its roadways, and it is paying off.

We are doing our homework to ensure we are USING THE RIGHT TREATMENT AT THE RIGHT PLACE AT THE RIGHT TIME.

QUESTIONS?

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