Accepting Change for the Better
What’s new for your Streets

Thomas J. Wood
MnDOT Office of Materials & Road Research
Topics

• Stripping under chip seals
• Fog sealing
• Micro surfacing
• Joint sealing
• Overlay
• Forgotten pavements
• Resources
Stripping Under Chip Seals
The Issues

• Some streets develop potholes 2 to 3 years after chip seal is applied
• Starts as small blisters
• Grows to ½” to 1” deep potholes size of pie pans or larger
• The wearing course seems to be destroyed
• Mainly on curb and gutter streets
Why?

- Observed variable density in cores taken from streets
- As high as 15% air voids after 12 yrs. of traffic
- Theory that high air voids makes mix more prone to stripping
- Made pucks up at 3 voids level, 7, 10, & 14%
  - All testing methods showed that as air voids increase, the susceptibility to water damage also increases
Recommendations for Preventing Stripping

• Stripping is caused by high air voids
• Streets seem to have high degree of variability of density
• MnDOT see same issues on longitudinal construction joints
  – Air voids from 10 to 16%
Recommendations for Preventing Stripping

• On new construction or re-paving
  – Recommend switching from ordinary compaction to specified density
  – Does not appear to increase cost of paving
  – May increase cost of inspection
  – Reserve right to pick coring locations
Recommendations for Preventing Stripping

• Existing Streets
  – Nuclear density testing will determine variability quickly
  – Recommend chip sealing streets with less than 6 lbs. variability
  – Chip sealing early in streets life seems to help
  – Fog sealing may be an options in place of chip seal
    • Seal water out but allows water vapors to move out of pavement
Fog Seal

• Lite uniformly applied layer of asphalt
• Normal Css-1h or Css-1 diluted 1 part emulsion to 1 part water
• Slows or reduces oxidation
• Why fog seal instead of chip seal
  – Chip seal is just a very heavy fog seal with layer of rock to protect seal and furnish friction
  – No loose rock
  – Less costly
Current Uses

- Cul-De-Sacs
- Recreational trails
- Parking lots
- Shoulders
- Over chip seals
Fog Seal

• Strengths
  – Easy to apply
  – Low cost
  – No loose rock
  – Does great job stopping water infiltration
    • Still allows water vapors to escape
  – Makes streets look new
Fog Seal

• Weakness
  – Slow curing time
  – Low friction characteristics
  – Grays out in 2 to 3 years
    • Leads to belief that only works for a couple years
Css-1h Fog Seal Performance

Permeability (in/day)

- **B/W Cells 19-18 (0.10)**
  - *K₀ taken as 18-17

- **B/W Cells 18-17 (0.15)**

- **B/W Cells 17-16 (0.20)**

Legend:
- **k Before**
- **k After**
- **k, 2 Yrs After**
Needs

• Fog Sealing
  – Faster curing emulsions
  – Methods to make stay black longer
    • Possible polymer modification
Un Broken Emulsion 100 X
Micro Surfacing
What is Micro Surfacing

- Homogenous mixture of aggregate, asphalt emulsion, mineral filler, and water
  - Like a Dairy Queen Blizzard
- Chemical cure
- Used for Surface treatments
- Rut filling
- Ride improvement
- Improve Friction
- Used both on concrete and HMA
Uses

• Arterial Streets
  – High traffic areas that would be hard to chip seal
  – Able to work at night
• Rut filling
• Leveling cupped transverse cracks and depressions
• Surface treatments for PM
• Parking lots
Strengths of Micro Surfacing

- Chemical cure
  - Able to fill ruts up 3” deep
- Carry rolling traffic in 1 hour or less
- No loose rock
- Minimum height increase
- Black surface
Weakness

- Prone to reflective cracking
- Can be noisy
  - Recommend using MnDOT Type 1 or 2
- Rough surface
  - Pedestrians' may not like surface
**Research Efforts**

- Can we use micro surfacing in place of 1½” M&O
- Softer base AC
  - PG 49-34 instead of PG 64-22
  - Less reflective cracking
- SBS polymer instead of SBR post added latex
Cell 1 after Micro Surfacing
## Results

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
<th>Driving Lane IRI (in/mi)</th>
<th>% Improvement</th>
<th>Passing Lane IRI (in/mi)</th>
<th>% Improvement</th>
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</thead>
<tbody>
<tr>
<td>1994</td>
<td>New construction</td>
<td>50</td>
<td></td>
<td>50</td>
<td></td>
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<tr>
<td>2006 before</td>
<td>Mill and fill (1.5”)</td>
<td>205</td>
<td></td>
<td>140</td>
<td></td>
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<tr>
<td>2006 after</td>
<td>Mill and fill (1.5”)</td>
<td>80</td>
<td>61%</td>
<td>140</td>
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<tr>
<td>2012 before</td>
<td>Micro Surfacing</td>
<td>137</td>
<td></td>
<td>175</td>
<td></td>
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<tr>
<td>2012 after</td>
<td>Micro Surfacing</td>
<td>92</td>
<td>33%</td>
<td>92</td>
<td>48%</td>
</tr>
</tbody>
</table>
Tack
The Issue

• "Poor bond of the HMA layers may be reducing pavement life by 25% in 1/3 to ½ of our pavements" – Erland Lukanen, P.E.

• Tack has become incidental to paving
  – Over looked
  – Believe tack does not have value
Good vs. Bad

Application rate 0.10 g/y² of Cς-1h diluted
Tack needs to be properly applied

- Css-1h diluted at place of manufacture
- Proper size nozzles
- Enough ground speed
- Clean surface
New LRRB Study on Tack

• Starting summer 2013
• Task 1: coring & testing of existing pavement
• Task 2: coring & testing new pavement based on observation during construction
  – Good, bad, and ugly
• Task 3: build test sections
  – Different emulsions, rates, coverage, and etc.
  – To determine what strengths we can receive
New LRRB Study on Tack

• Develop requirement for minimum bond strength
  – Looking at ratio of tack strength to strength of HMA
• Will use information to develop specifications
• Training for Agency and Contractors employees
Use proper binder

• -34 should be used on all streets
• Residential 52-34
• Arterial 58-34 or 64-34 if enough ESALS
• Saw and Seal intersections and man holes
SAW and SEAL
Typical Saw Cut Dimensions

- Reservoir
- Bond Breaker Tape
- Crack Sealant
- Depth of Saw Cut Shall Be 75% of Total Thickness of New Asphalt Overlay

\[ \frac{1}{2}'' \quad \frac{5}{8}'' \quad \frac{1}{6}'' \]
Recommend Layout for S & S Manholes

Saw & Seal
Seal Joint between Street and Curb

- MnRoad research shows 85% reduction in water infiltration when sealing joint between pavement and shoulder
- Clean & Seal
  - 3719 or 3723
- With paving
  - Mastic
  - Joint Adhesives
No Seal
Seal with Mastic
Alternate method for reconstruction of streets
Emulsion Stabilized FDR
Why?

- Residential streets have low truck loadings
  - Option for reconstruction of recreational trails
- Less expense than mill off and replace
- Uses 100% of in place materials
- Lower assessments to property owners
- Less greenhouse gases
Other Surfacing options

- Single 1 ½” lift of HMA
  - Requires removing some of the in place HMA
- Ultra Thin Bonding Wearing Course
- Micro Surfacing
90 laps per day at 80K
• Two localized areas of failure easily patched
• 24000 ESAL
• Comment for Staff “seem to improve with time and traffic”
Forgotten Pavements:

• Cities have many more HMA pavements than just streets:
  – Recreational trails
  – Parking lots
  – Driveways
  – Fire lanes
  – Storage yards
PM for Parking Lots

— Fog Seal
  • Css-1h diluted newer pavements
  • Crs-2pd older pavements

— Chip sealing parking lots
  • Crs-2p
  • ⅛” chips
  • Fog seal to reduce turning damage
Value of PM

Surface Rating vs. Age

- Chip Sealed
- No Chip Seal

6 year life extension
New Product

- Realistic expectations
- Need to have honest evaluation method
- Meaningful specifications
  - Not trust me spec
- True costs
Resources

• Office of Materials & Road Research
• Help with project selection
• Forensic
• Training for new processes
  – Formal training
    • Chip Seal
    • Micro Surfacing
  – Informal training
    • On site
    • Tailored to your needed
Thank You!