RUBBLIZATION: A COST-EFFECTIVE OPTION

Innovations in Pavement Recycling Session
CTS Conference
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www.asphaltisbest.com
HMA Overlay to rehab pcc

- HMA overlay, or
- HMA overlay with fractured slab
  - Crack/Seat (JPCP)
  - Break/Seat (JRCP)
  - Rubblization (JPCP, JRCP, CRCP)
Fractured Slab Design Thickness

- Rubblization
- Effective (i.e. CSAH, TH, etc.)
  - Reduces reflective cracking
- Can be done rapidly
- Minimize delays
- Researchers & agencies have concluded that rubblization is technically sound
- CD/BMP/Design Available
  - See www.asphaltisbest.com & www.asphaltalliance.com
Concrete pavement in need of rehabilitation
Obliterating existing pavement distresses & joints
Grid roller
Pneumatic & smooth drum vibratory rollers
High performance, long lasting HMA over rubblized concrete
<table>
<thead>
<tr>
<th>Year</th>
<th>Contractor</th>
<th>Location</th>
<th>Thickness</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1999</td>
<td>Ulland Bros</td>
<td>TH 53 SB, s/o Eveleth, Saint Louis County, MN</td>
<td>08&quot;</td>
<td>34,891 S/Y</td>
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<tr>
<td>2000</td>
<td>Northland</td>
<td>Superior St., Duluth, Saint Louis County, MN</td>
<td>08&quot;</td>
<td>21,940 S/Y</td>
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<td>2001</td>
<td>Ulland Bros</td>
<td>CSAH 45, Geneva, Freeborn County, MN</td>
<td>09-7-9&quot;</td>
<td>42,200 S/Y</td>
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<td>2001</td>
<td>Northwest Asphalt</td>
<td>Harrison St., Shakopee, Scott County, MN</td>
<td>07&quot;</td>
<td>2,667 S/Y</td>
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<td>2002</td>
<td>Ulland Bros</td>
<td>TH 169, Chisholm - Virginia, St. Louis Co., MN</td>
<td>08&quot;</td>
<td>168,559 S/Y</td>
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<td>2004</td>
<td>Mark S&amp;G</td>
<td>CSAH 88, Carlisle, Otter Tail County, MN</td>
<td>08&quot;</td>
<td>54,395 S/Y</td>
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<td>2004</td>
<td>Dunn Blacktop</td>
<td>CSAH 32, Winona, Winona County, MN</td>
<td>09&quot;</td>
<td>20,868 S/Y</td>
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<td>2004</td>
<td>Ulland Bros</td>
<td>CSAH 16, Faribault County, MN</td>
<td>09-7-9&quot;</td>
<td>80,239 S/Y</td>
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<td>2004</td>
<td>Tower Asphalt</td>
<td>TH 5, Lake Elmo, Washington County, MN</td>
<td>09-7-9&quot;</td>
<td>1,333 S/Y</td>
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<td>2006</td>
<td>Buffalo Bituminous</td>
<td>CSAH 4, CSAH 6 - CSAH 11, Rock County, MN</td>
<td>09-7-9&quot;</td>
<td>49,084 S/Y</td>
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<td>2007</td>
<td>Hardrives</td>
<td>CSAH 88 (New Brighton Blvd), Ramsey County, MN</td>
<td>08&quot;</td>
<td>26,889 S/Y</td>
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<tr>
<td>2009</td>
<td>Rochester S &amp; G</td>
<td>16th Ave NE, Austin, Mower County, MN</td>
<td>08&quot;</td>
<td>2,267 S/Y</td>
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<td></td>
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<td></td>
<td></td>
<td><strong>Total:</strong> 505,332 S/Y</td>
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</table>
Design Procedures
Most Common Sources

- AASHTO Design Procedures (SN)
- AI - Manual Series (MS) 17
- AI Computer Program (CP) 4
- NAPA Information Series (IS) 117 & 132
- Several State Agency Procedures
NAPA Guidelines ▶ HMA Overlay Thickness

- 3 Levels of design
  1. Tables
  2. Nomographs
  3. FWD and M-E Analysis
Fracture Modulus vs Reflective Cracking

Probability of Failure

Low                                    PCC Modulus                                       High
Small                          Nominal Fragment Size                              Large

Structural Failure

Reflective Cracking

Target Zone

NAPA IS-117
What Are The Economics of Rubblization?

- **Variables are:**
  - Rehab alternatives
  - Time associated with construction
    - User delay
  - Design life (ex. 20 years vs. perpetual)
  - Rubblization characteristics
  - Drainage system
  - Type of HMA overlay
Traffic Control

- Cross overs
- Single lane construction zone
- Both have benefits
Case Example: Freeborn County
Rubblization Project
- Install Edge Drain
- Replace Centerline Culverts
- Remove Bituminous Surface
- Rubblize & Widen Driving Surface
- Pave Surface with Hot-Mix Asphalt
Old Surface Condition

20\text{pcc} with 4\text{Bituminous}
Many Benefits

✓ Cost savings.
✓ No new r.o.w. needed, thus no impact to wetlands.
✓ Resurfaced road without having to re-grade meant shorter time that traffic is delayed.
✓ Used the deteriorated concrete for base without having the hauling & material costs.
✓ Reused existing resources rather than wasting them.
## COST COMPARISON

<table>
<thead>
<tr>
<th>Description</th>
<th>Year</th>
<th>Length</th>
<th>Details</th>
<th>BID Price</th>
<th>Cost/Mile</th>
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<tbody>
<tr>
<td>RUBBLIZING &amp; BITUMINOUS SURFACING (2001)</td>
<td>2001</td>
<td>4.0 MI</td>
<td>7 - 9&quot; RUBBLIZED CONCRETE</td>
<td>$1,268,774.18</td>
<td>$317,193.55</td>
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<td></td>
<td></td>
<td>L</td>
<td>6&quot; AGGREGATE BASE</td>
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<td></td>
<td></td>
<td>3.5&quot; BITUMINOUS BASE</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>1.5&quot; BINDER</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>1.5&quot; WEAR</td>
<td></td>
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<tr>
<td>GRADING &amp; BITUMINOUS SURFACING (1997)</td>
<td>1997</td>
<td>3.5 MI</td>
<td>2 - 8&quot; CRUSHED CONCRETE</td>
<td>$1,702,822.25</td>
<td>$486,520.64</td>
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<tr>
<td></td>
<td></td>
<td>L</td>
<td>(Hauled to pit and crushed)</td>
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<td></td>
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<td>6&quot; AGGREGATE BASE</td>
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<td></td>
<td>3.5&quot; BITUMINOUS BASE</td>
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<td>1.5&quot; INTERIM WEAR (1996)</td>
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<td>1.5&quot; LEVEL (1997)</td>
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<td></td>
<td>1.5&quot; WEAR (1997)</td>
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</tbody>
</table>
Milled off Bit. Surface
Widened road with crushed rock.
Rubbled old concrete surface.
Paving

Finished Product
Faribault County Project

- CSAH 16, east of Blue Earth, 8-mile project
- Heavy Traffic
- Road widened
  - Edge drains
  - New CL culverts
- Grade corrections
- Over 80,000 SY of pcc rubblized in 7 days
Rubblizing while meeting additional challenges.

Rubblizing near homes.
Rubblizing while meeting additional challenges.

Rubblizing near commercial buildings.
Rubblizing while meeting additional challenges.

Rubblizing adjacent to heavy traffic.
Rubblizing while meeting additional challenges.

Rubblizing over and near utilities.
Rubblizing while meeting additional challenges.

Rubblizing over a weak subgrade.
Rubblizing while meeting additional challenges.

Rubblizing while maintaining existing curb and gutter.
Square Yards of Rubblization by Project Type (from Antigo)
Asphalt Paving Design Guide
Summary of MN Research Findings
Raveling of HMA
HMA is the Top Choice for Airport Runway Pavements
Fast Facts
Caring For and Maintaining Your Asphalt Driveway
Pavement Distress
Slippage Cracks
Storm Water Treatment
Asphalt Calculator

BMP & Spec for Rubblizing Concrete Pavement
Total Asphalt vs. Granular Base
Perpetual Pavement: Time Has Come
Hot Mix Asphalt (HMA) as Surface Treatment
Repair of Potholes with Hot Mix Asphalt (HMA)
32 Links to Transportation Related Web Sites
More
Acknowledgement

- Thank you CTS for acceptance of abstract
- Thank you Antigo
Questions? Thank you.

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  651-636-4666

All roads lead to Rome.

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