Annual AirTAP Fall Forum
September 27, 2012
Mankato, MN

CONCRETE PAVEMENT REHABILITATION

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Executive Director
Early 1980s
Concrete Rehab
Meeting
Why the group was started.....
If they would have only saw the signs
Decision Tree
Rehabilitation Selection Process

- Pavement History
- Core Project
- What is the goal
  - Ride, Noise, Maintenance issues
- Determine the cause of distress
  - Material, Structural, Drainage.
- What is length of expected repair
It’s all about the Dollars!!

Start with your best pavements and work toward your worst!
CITY OF DULUTH
CONCRETE PAVEMENT REHABILITATION
THE COST OF "TIMELY" MAINTENANCE

75% OF TIME

12% OF TIME

40% QUALITY DROP

POOR

VERYY POOR

TOTAL FAILURE

Pavement Life Cycle

EACH $1.00 OF MAINTENANCE & REHABILITATION HERE WILL COST $4.00 TO $5.00 FOR RECONSTRUCTION IF DELAYED TO HERE

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Purpose of CPR

- Used early when pavement has little deterioration.
  - Repairs isolated areas of distress.
  - Repairs some construction defects.
  - Manage the Rate of Deterioration.
<table>
<thead>
<tr>
<th>STREET NAME</th>
<th>YEAR BUILT</th>
<th>REHAB COST PER SQFT</th>
</tr>
</thead>
<tbody>
<tr>
<td>24th AVE EAST</td>
<td>1952</td>
<td>2.53</td>
</tr>
<tr>
<td>14th AVE EAST</td>
<td>1965</td>
<td>2.38</td>
</tr>
<tr>
<td>COLLEGE ST</td>
<td>1967</td>
<td>2.38</td>
</tr>
<tr>
<td>10th AVE EAST</td>
<td>1950</td>
<td>2.14</td>
</tr>
<tr>
<td>27th AVE WEST</td>
<td>1982</td>
<td>2.09</td>
</tr>
<tr>
<td>HARBOR DRIVE</td>
<td>1966</td>
<td>1.62</td>
</tr>
<tr>
<td>4th STREET</td>
<td>1977</td>
<td>1.36</td>
</tr>
<tr>
<td>VERMILLION</td>
<td>1983</td>
<td>1.19</td>
</tr>
<tr>
<td>TRUCK CENTER</td>
<td>1977</td>
<td>1.05</td>
</tr>
<tr>
<td>19th AVE EAST</td>
<td>1985</td>
<td>0.88</td>
</tr>
<tr>
<td>30.5 AVE WEST</td>
<td>1977</td>
<td>0.85</td>
</tr>
<tr>
<td>63rd WEST</td>
<td>1982</td>
<td>0.81</td>
</tr>
<tr>
<td>24th WEST</td>
<td>1982</td>
<td>0.68</td>
</tr>
<tr>
<td>46th AVE WEST</td>
<td>1984</td>
<td>0.51</td>
</tr>
</tbody>
</table>

RECONSTRUCT CONCRETE= $8.00/SQFT ASPHALT= $5.75/SQFT
MnDOT REPAIR TYPES

TYPE A – JOINT & CRACK SEALING
TYPE B – PARTIAL DEPTH REPAIR
TYPE C – FULL DEPTH REPAIR
  high volume and low volume
DOWEL BAR RETROFIT
CROSS STICTING
DIAMOND GRINDING
MISC. REPAIRS
Type A Repairs

**Type A1** - saw and seal  
$ 3.49LF

**Type A2** - clean and seal  
$ 2.34LF
Joint/Crack Sealing-Type A Repair

Crack Sealing

Joint Sealing
Partial Depth Repairs

spalling, surface defects, joint re-establishment

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Area to Be Removed</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA</td>
<td>Partial Depth Repair (Type BA)</td>
<td>10&quot; to 6'</td>
<td>$21.84 SF</td>
</tr>
<tr>
<td>B3</td>
<td>Partial Depth Repair (Type B3)</td>
<td>Greater than 6'</td>
<td>$13.67 SF</td>
</tr>
<tr>
<td>BE</td>
<td>Partial Depth Repair Special (Type BE)</td>
<td>Lower half of BA or B3</td>
<td>$30.14 SF</td>
</tr>
</tbody>
</table>
Finding Unsound Concrete
Typical Removal Method outside MnDOT

- Diamond blade sawing
- Chipping with light hammer 15 lb
MnDOT Method - Milling Machines

- Weight – 9 Tons
- Less dust
- Removal rate 8 ft. / minute
- 60,000 sq/ft 5 days
- Skid Steers weigh about 8000 pounds and can have removal rates of 2-3 feet per minute.
Milled Crack and Joint
Before Proceeding....

Check removal by sounding with hammer or chain
Sandblasting Partial Depth
Placement of Isolation Material
Compressible Insert

3 in. min.

Spall

Patch

Compressible insert

1 in.
Bonding Grout Recipe

- 2 Parts Type I Cement
- 1 Part Water
- 1 Part Sand

Mixed to the consistency of thick cream

Placement immediately before concrete.
Bonding Grout
Partial Depth Mix-3U18

- Small Aggregate 100% passing 3/8” sieve
- 850 lbs Type I Cement
- 6.5% - liquid air
- Maximum 1 inch slump
- Can’t get out of Ready Mix
- Cure time of 12 hours
Vibrate the 3U18

Grout the Edges
Type C Repairs MnDOT

Type CD-HV $63.88 LF
Type CX - $76.83 SY
Full Depth Removal Process
Full Depth Removal Process
Full Depth Joint Repair
CX - Repair
Placing and Finishing
Dowel Bar Retrofit

$35.91 each / Grinding $3.68 SY
Slot Saw
Bar Assembly & Caulking
Blasting, Placing and Finishing
Cross-stitching longitudinal cracks

**STITCHING LONGITUDINAL PAVEMENT CRACKS**

**DESCRIPTION:** Retro fit tie bars to maintain aggregate interlock and to prevent vertical or horizontal slab movement.

- **PLAN VIEW:**
  - Intersection Joints
  - Construction Joints

- **Table A:**
  - Slab Thickness (in):
    - 2: 6.57, 8.60, 10.77, 12.95
    - 4: 6.57, 8.60, 10.77, 12.95
    - 6: 6.57, 8.60, 10.77, 12.95

**Notes:**
- Not recommended for cracks that are greater than 3/4" in width. Contact the Concrete Engineering Unit for recommendations.
- For pavement 7" or less contact the Concrete Engineering unit for further recommendations.

**WORK TO BE DONE**

1. Determine the appropriate tie bar diameter, length and drill angle from Table A. Drill the diameter of the hole not less than 1/8" nor 3/16" greater than the over all diameter of the tie bar. Drill the hole at the corresponding angle shown on Table A. Use a jig that controls the starting point of the hole and the angle of the drill bit is required. Drill hole to a depth that ensures 1" of cover over the top of the tie bar.

2. Air blast the holes to remove dust and debris. Apply a compressed air spray of a diameter and length to reach the bottom of the drill hole. Ensure all debris is removed prior to epoxy injection.

3. Inject an approved epoxy into hole, leaving some volume for the tie bar to occupy the hole.

4. Insert tie bar into hole to 1" below the pavement surface. Rotate tie bar during installation.

5. Remove or add epoxy as flush with pavement surface.
Examples of 10 to 15 year old CPR work in Minnesota
Full Depth Joint Repair

Partial Depth Joint Repair
Older Longitudinal and Transverse Partial Depth Repairs
Older Longitudinal and Transverse Partial Depth Repairs
Partial Depth Longitudinal Crack Repair
Deteriorated Areas were not Repaired in Original Work

(Joint and Crack had received a Partial Depth Repair on either side of Deteriorated Areas)
Questions?