Diamond Grinding in NC
Recent Projects

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North Carolina Concrete Pavement Conference

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# Diamond Grinding – Items

<table>
<thead>
<tr>
<th>Year</th>
<th># of Projects</th>
<th>Dia. Grinding (SY)</th>
<th>Dia. Grinding ($)</th>
<th>Average ($/SY)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>5</td>
<td>1,726,964</td>
<td>$8,902,400</td>
<td>$5.15/SY</td>
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<tr>
<td>2017</td>
<td>6</td>
<td>1,424,803</td>
<td>$6,078,819</td>
<td>$4.27/SY</td>
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<tr>
<td>Totals</td>
<td>11</td>
<td>3,151,767</td>
<td>$14,981,219</td>
<td>$4.75/SY</td>
</tr>
<tr>
<td>2018 (est.)</td>
<td>3</td>
<td>1,427,626</td>
<td></td>
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2016 & 2017 – Top 10 state agency, and possibly top 5 in use of Diamond Grinding
So......
What kind of diamond grinding jobs are being built in NC?
Very active...Charlotte to Mt. Airy to Winston Salem to Greensboro to Raleigh-Durham and beyond!

Several categories:
Concrete Pavement Preservation
Concrete Pavement Rehabilitation, Moderate
Concrete Pavement Rehabilitation, Severe
Newly Constructed PCC Pavement

Briefly discuss: Slurry Roadside Disposal Research

Briefly Discuss: Diamond Grinding PPC Deck Overlays
Concrete Pavement Preservation

• Typically 15-25 year old pavement
  • Relatively new, relatively smooth surface
  • Minor amount of pavement repairs
  • Projects away from urban hubs are easier
  • Relaxed MPT restrictions
  • Lower prices, faster completion
Case in Point

• I-40, Johnston Co
Project Spotlight
I-40 Johnston Co.
TIP# I-5781
Division 4

- 16-mile JPCP
- 40,000 VPD / 2,500 Trucks
- $10.2M / $3.49M CPR
- 28 Years and 1st Treatment
- 525,000 SY of Diamond Grinding
- $6.64 / SY (Preservation)
Light Traffic, Longer Allowable Lane Closures
Joints straight, narrow and functional
Aggregates readily identifiable
Minimal Rutting
This will be the first major rehab work on this section of I-40 since it was built in the mid-1980s, said NCDOT spokesman Andrew Barksdale. “The original concrete construction of this section of I-40 has held up really well,” he said.
2nd Case in Point, I74/I-77 Surry Co., Three Projects Similar to Johnston Co
Slurry Disposal

• Johnston Co...has substantial slopes within the ROW for land application;
• Surry Co...material hauled and disposed of off of State ROW.
Concrete Pavement Rehabilitation, Moderate

• Rehabilitation/Restoration project
• Pavement deterioration at more advanced level than preservation treatment
• More slab and spall repairs
Case in Point, I-85 Mecklenburg Co

• Rough Pavement, Rutting, Lanes Added-on through the Years
• Urban/Suburban Setting...longer haul distanced for slurry disposal
Mid-Panel Longitudinal Joint, probably used to accommodate MPT during widening
Uneven Transverse Joints
High Traffic Volumes
shorter work hours
costlier MPT
Concrete Pavement Rehabilitation, Severe

• Pavement deterioration at much more advanced level
• Numerous panel repair/replacements, spall repairs
• Difficult MPT
• No shoulders, at-grade intersections
• Business and residential areas...noise is an issue
Case in Point: University Parkway, Winston-Salem

- Older pavement
- Rutting
- Exposed Aggregate (paste worn away)
- Castings in Pavement
Joint deterioration is prevalent
Evidence of High Steel
Slurry Trucked Off-Site
Newly constructed PCCP

• Smoothest and, usually, easiest to grind
• Often placed full width w/ slip-form paver
• Traffic conditions may require lane-by-lane construction
Case in Point 1: Western Wake Freeway, New Alignment
Diamond Grinding is Uniform in Texture and Depth of Removal
Slurry Disposal

• No picture

• GC used settling basins with weirs to separate the water and solids: solids loaded and hauled to landfill
Case in Point 2: I-85 PCCP Overlay

• Note Uniform Coverage of Grind, Minimal Removal Depth
Slurry Disposal into Baker Tanks; Settle and Separate
Case in Point 3, I-40 Rapid Repair

- Targeted, Lane Specific PCCP Replacement
- Followed by full pavement diamond grind and joint resealing
Diamond Grinding Provides Uniformity in Existing and Replaced Pavement;
IRI reduced from 153 to 65; Slurry taken to lined pond for settlement and separation of water and solids.
Question from industry about diamond grinding Spec. Prov.

• “...passes shall be parallel to each other with no variation. Completely lap adjacent passes with no unground surface remaining between passes and no overlap of more than 1½ inches (35 mm). Adjacent passes shall be within 1/8 inch (10 mm) of the same height as measured...”

• Commercially manufactured equipment is built with 2” overlap...a 3’ grinding head is actually 38” long; likewise, a 4’ grinding head is 50” long.
Disposal of Residual Slurry

Diamond grinding slurry disposal shall be in accordance with the Statewide Permit for Land Application of Diamond Grinding Slurry (DGS), Permit No. WQ0035749 dated June 3, 2014. Submit a slurry disposal plan to the Engineer detailing method of handling and disposing of slurry from the diamond grinding operation a minimum of 60 days prior to beginning the diamond grinding operation. Engineer shall review the slurry disposal plan. Plan must be accepted prior to beginning the diamond grinding operation. DGS may also be transported beyond the project limits to an approved permitted site. No additional payment will be made for transporting this slurry material for disposal.
Roadside Slurry Disposal Study

• I-85 SB, Vance/Granville Co., 2016

• Pilot Study on Direct Discharge of Concrete Grinding Residuals to Roadside Shoulders: Part 2 (TAR 2017-2&3)

• NC State University, Biological and Agricultural Engineering Dept.

• The purpose of the Technical Assistance Requests (TAR 2017-2&3) was to conduct a preliminary assessment of the environmental impacts of direct discharge of concrete grinding residuals from the grinding machine to highway shoulders
Study Conclusions

• “the data from the three pilot sites show that direct application of DGS to the I-85 shoulder had a minimal effect on the vegetation, soil, and surface water quality, but that the potential for a much greater effect at less optimal sites is significant.”
Roadside, October 2018
PPC Corrective Grinding

• Polyester Polymerized Concrete
• Bridge Deck Overlay Product
• Bridge on I-95 in Wilson
Problem with Using PCCP Grinding Spec on PPC:
Blade spacing too wide for brittle overlay material
Shallow cut OK, but deeper cut leaves high ‘fins’; ‘fins’ break off under traffic, eventually
Recommended change

Thinner spacers will provide more blades for a cleaner cut over the surface of PPC overlays by reducing the land area between the grooves. 70-75 blades per foot is suggested (existing PCC grinding spec is ~55 blades per foot).

Recommend that transverse or longitudinal deck grooving be used in conjunction with this process.