Achieving Smoothness with Milling

2016 OTEC
October 25-26, 2016
Agenda

- Asphalt milling
  - Overview & Applications
- Supplemental Spec 897
  - Detail & Objective
  - Fundamentals
  - Intended use
  - Control
- Milling for smoothness
  - Procedure
  - Objective
  - How-to
Asphalt Milling is...

the controlled surface removal of existing pavement to a desired depth, often used to restore a specified grade and cross-slope
Conventional Milling

- Most common milling process
- 5/8” – 3/4” spacing
- 6’7” milling head = 144 teeth

Several Advantages
- Highly productive
- Cost efficient
- Powerful removal
- Capable of increased depths

Applications & Capabilities
- HMA overlay
- Mass removal of deteriorated pavement
- Increase or maintain curb reveal & vertical clearances
- Provide transitions to existing pavements and approaches
Surface Preparation
- Tighter textured surface
- 5/16” – 1/2” spacing
- 6’7” head = 260 teeth
- Increases the productivity and efficiency of paving operation
- Primarily used with thin-lift overlay
- No upward reflection unlike conventional milling

Applications & Capabilities
- Economical and Productive
  - 1,500 - 2,000 sy/hr. (7 mm spacing)
- 1/2” - 2” removal
- Establishes profile and slope
- Milled surface cleans well
- Reduction in RAP processing costs
Applications & Capabilities

- 3/16” spacing
- 450 teeth (67” head)
- Least amount of removal possible
- Eliminates wheel rutting
- Improves skid resistance
- Bump removal
- Profile correction
- Corrects drainage problems
- Epoxy overlay & striping removal
- Alternative to Diamond Grinding
- Meets most DOT’s specifications
- Maintenance/corrective option
- Highly productive compared to DG
- Final riding surface
- Most difficult form of milling
Failed Milling
Quality Milling

- Machine Maintenance
- Pattern Control
- Proper Speed
- Suitable Grade Systems
- Knowledgeable Personnel
• Topic was brought to Spec Committee

• Research & Testing
  • Other states/agencies using fine and micro milling
  • Ohio Turnpike Commission
    • Micro planing for smoothness correction

• Pilot Projects
  • Micro Planing- District 12 Cuyahoga County
  • Fine Planing- District 2 Lucas County US 20A
Pilot Project

ODOT District 2
Lucas County- US Highway 20A
• Shoulders lacking
  • 3” - 4” Thick
  • Visually appeared low

• Centerline Distress

• Varying cross slopes
<table>
<thead>
<tr>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Opportunity to improve cross slope</td>
<td>• New process for ODOT</td>
</tr>
<tr>
<td>• Provides textured surface for overlay</td>
<td>• Not always fun being first</td>
</tr>
<tr>
<td>• Improved opportunity for smoothness</td>
<td>• What if it all goes wrong</td>
</tr>
<tr>
<td>• Pilot Project for alternate milling</td>
<td></td>
</tr>
</tbody>
</table>
384 (13) Fine Milling Note

- Requirements
  - ½” removal at center of road
  - Preferred pavement slope of ¼” per foot
    - Uniform coverage of milled surface NOT required
  - Maximum of 10 days open to traffic
  - Smoothness required on milled surface
  - Quality control on milled surface
  - 1” thin asphalt overlay applied
Combining multiple sensors to establish an average measurement of existing surface.
- IRI improved
  - Overall improvement with milling
  - Due to slope, had some \( \frac{1}{4} \)" in 10’ violations WB

<table>
<thead>
<tr>
<th></th>
<th>EB</th>
<th>WB</th>
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</thead>
<tbody>
<tr>
<td>Existing</td>
<td>97</td>
<td>105</td>
</tr>
<tr>
<td>After Fine Milling</td>
<td>75</td>
<td>91</td>
</tr>
<tr>
<td>Project Completion</td>
<td>52</td>
<td>55</td>
</tr>
<tr>
<td>1.75” Mill/Fill</td>
<td>73</td>
<td></td>
</tr>
<tr>
<td>3.25” Mill/Fill</td>
<td>79</td>
<td></td>
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</table>

(avg. combined)
## Productivity

<table>
<thead>
<tr>
<th>Activity</th>
<th>Quantity</th>
<th>Time</th>
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<tbody>
<tr>
<td>1.75”</td>
<td>41,500 sy</td>
<td>3 days</td>
</tr>
<tr>
<td>3.25”</td>
<td>24,500 sy</td>
<td>2 days</td>
</tr>
<tr>
<td>Fine Milling</td>
<td>105,471 sy</td>
<td>5 days</td>
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</table>
Class A: Fine Planing

Class B: Micro Planing
Class A: Fine Planing

- 5/16” (8mm) spacing
- To be used with an overlay
- Item 254 similarities
- Remove irregularities
- Clean surface
Class B: Micro Planing

- 0.2” (5mm) spacing
- Remove Irregularities
- Texture pavement
- Minimum 6’ cutterhead
- 95-100% coverage
SS-897: Smoothness Requirements

• With an overlay
  • 1/4” in 10’ tolerance
  • Fine Planing
  • Removal depths between ½” - 2”

• Without an overlay
  • 1/8” in 10’ tolerance
  • Micro Planing
How to Control SS-897?
Quality Control...In Planing???

- Control/Inspection tool for ODOT
- Looking for uniform texture
- Measure the macrotexture
  - ASTM E-965
- Minimum diameter required per Class
1. Inspect test area
   • Homogenous, free of localized imperfections

2. Clean test area

3. Protect area from wind

4. Hold container with 200 ml of beads a maximum of 4" above pavement

5. Pour volume of material on pavement (conical pile)

6. Place spreader on pile (do not compact)
6. Move hockey puck in slow circular motion
7. Continue until filler is well dispersed and spreader rides on top of milled surface
8. Measure diameter four times at 45° intervals through the center of the circle to nearest ¼"
9. Calculate average reading and compliance with
   • 9"
   • 12"
• Fine Planing
• Micro Planing
Utilizing SS-897
Ashtabula Co. I-90 #625 (12)
#625 (12) Project Overview

- Reconstruction of I-90 – $68 million
  - 4 year project – 10/31/2016 Completion
  - 7.31 miles (90% cement stabilized)
  - Rehab/Replacement of 6 bridges
  - Realignment of two SR-11 Ramps
  - Reconstruction of .13 miles of SR-11
  - New construction of Carson Rd.
Intermediate MRI Summary

Section 1 EBPL (Start of job to the mainline bridge)

![Graph showing data over distance](image)
Section 2 EBDL (Mainline bridge to phase transverse construction joint)
Proposed Corrective Action Plan

- Smoothness correction
  - Repair heaved areas to IRI levels similar to original data
- Fine mill with diamond tipped teeth
  - Averaging system to control removal
- NO removal of consistent depth
  - Avg. removal = 3/8” or less
  - Structural integrity maintained
- “Daylight” milling process to shoulders
# 625-12 (I-90) EBDL MRI Comparison

<table>
<thead>
<tr>
<th>Date Profiled</th>
<th>Average MRI (in./mi.)</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>10/24/14</td>
<td>7.73 to 11.24</td>
<td>Initial</td>
</tr>
<tr>
<td>3/19/15</td>
<td>7.56 to 11.24</td>
<td>161%</td>
</tr>
<tr>
<td>5/27/15</td>
<td>7.56 to 11.24</td>
<td>6%</td>
</tr>
<tr>
<td>3/17/16</td>
<td>7.56 to 11.24</td>
<td>2%</td>
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<tr>
<td>N/A</td>
<td>Milled Prediction</td>
<td>49%</td>
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<tr>
<td>9/2/16</td>
<td>Actual Post Mill</td>
<td>44%</td>
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# Timeline of Events

## 625-12 (I-90) EBPL MRI Comparison

<table>
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<tr>
<th>Date Profiled</th>
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<th>% Change Initial</th>
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</thead>
<tbody>
<tr>
<td>10/24/14</td>
<td>7.56 to 11.24</td>
<td>65.2</td>
</tr>
<tr>
<td>3/19/15</td>
<td>7.56 to 11.24</td>
<td>126.9</td>
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<tr>
<td>5/27/15</td>
<td>7.56 to 11.24</td>
<td>122.6</td>
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<tr>
<td>3/17/16</td>
<td>7.56 to 11.24</td>
<td>124.7</td>
</tr>
<tr>
<td>N/A</td>
<td>Milled Prediction</td>
<td>69.4</td>
</tr>
<tr>
<td>9/2/16</td>
<td>Actual Post Mill</td>
<td>69.8</td>
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N/A: Not Available
## Timeline of Events

### 625-12 (I-90) WBDL MRI Comparison

<table>
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<tr>
<th>Date Profiled</th>
<th>Average MRI (in./mi.)</th>
<th>% Change Initial</th>
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<tbody>
<tr>
<td>12/18/13</td>
<td>11.24 to 7.56</td>
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</tr>
<tr>
<td>3/19/15</td>
<td>129.6</td>
<td>81%</td>
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<tr>
<td>5/27/15</td>
<td>122.4</td>
<td>6%</td>
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<tr>
<td>3/17/16</td>
<td>126.2</td>
<td>3%</td>
</tr>
<tr>
<td>N/A</td>
<td>Milled Prediction</td>
<td>42%</td>
</tr>
<tr>
<td>6/24/16</td>
<td>Actual Post Mill</td>
<td>37%</td>
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</table>
## 625-12 (I-90) WBPL MRI Comparison

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<th>Date Profiled</th>
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<th>% Change</th>
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<tbody>
<tr>
<td>12/18/13</td>
<td>11.24 to 7.56</td>
<td>73.1</td>
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<tr>
<td>3/19/15</td>
<td>11.24 to 7.56</td>
<td>119.6</td>
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<tr>
<td>5/27/15</td>
<td>11.24 to 7.56</td>
<td>113.6</td>
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<tr>
<td>3/17/16</td>
<td>11.24 to 7.56</td>
<td>112.8</td>
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<tr>
<td>N/A</td>
<td>Milled Prediction</td>
<td>63.1</td>
</tr>
<tr>
<td>6/28/16</td>
<td>Actual Post Mill</td>
<td>81.2</td>
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Conclusion

• Old Man Winter
  • End results are quantifiable

• Milling can / should be a tool
  • Proponent to quality paving
    • Conventional Mill/Fill???
    • Longitudinal & Transverse smoothness
  • Increase quality and durability of new pavement
  • Corrective Action
Thank You

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