Cold Planing/Milling Applications & Proper Technique

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Overview

Factors that affect the finished product

- Environment
- Operating Practices
- Machine Maintenance
- Machine Configuration
Grade and Slope Controls
Averaging Systems
GPS Control Systems

Mill to Grade based on Position

Only as accurate as the data
Control Points
Ground Man

- Ground Man is responsible for keeping the surface clean and avoiding obstructions
- All utilities have to be marked
- Each pass must match grade properly
- Ensure each cut entry and exit is executed properly
Clean Surface Required

Grade control sensors (both wire rope and sonic) will react to changes in grade caused by piles of material.

Surfaces must be kept clean in front of the machine, and material piles must be removed every time the machine is picked up.
Continuous Milling

Stops in the milling process cause the teeth to excessively cut the same spot, causing dips in the milled surface.

Difficult for the paving crew to correct these flaws.
Cutter Drums

Triple Wrap, Offset flighting.

Tooling is offset so that cutter bits rotate properly.

Standard spacing is 5/8"
Drum Tooling Components

- Base Block
- Holder or Sleeve
- Tooth
At Stage 3
Tool has lost 0.365 " [9.3 mm] of gage height
Advanced wear on holders will change how the tooth is seated in the drum.

This changes the surface pattern
Cutter Drum Maintenance

![Graph showing advance rate vs. milling depth for RX-900 new teeth and stage 4 teeth wear.](graph.png)

- **RX-900 New Teeth**
- **RX-900 Stage 4 Teeth Wear**
The Math of Milling

The 4 Main Factors Affecting Surface Texture
1. Line Spacing
2. Forward Speed
3. Drum RPM
4. Lacing Pattern
Advance Rate & Longitudinal Smoothness

As the machine reaches a certain ground speed, it begins to “out-run” the cut.

This creates the chevron pattern shown here.

Drum rpm must increase, or machine speed must decrease to maintain a smooth surface.
Advance = 30 fpm
Drum Dia = 46"
Drum RPM = 100
Drum Dia = 46”
Drum RPM = 100
Advance=120 fpm

Machine
Advance
14.4”

1.16”
Production Tradeoff

30 fpm vs. 120 fpm

2.3 miles in a day vs. 9.1 miles in a day
Double Hit Drums

Above
Double hit Quad wrap drum

Standard triple wrap drum
Below
Drum Lacings
Scroll Start Comparisons

Triple Wrap

Double Hit Quad Wrap
Pattern Comparisons

Single Hit
Triple Wrap

Double Hit
Quad Wrap
Pattern Comparison

5/8” Triple Wrap at 100 FPM

7/8” DHQW at 100 FPM
Line Spacing and Texture

Each cutter pattern is determined by the number of carbide teeth installed on the mandrel. More teeth produce fine patterns such as Profiling and Micro-Milling, but production rates remain low. Excavating and Traditional patterns allow for higher production rates but produce a coarser surface.

Milling Machine Cutter Drum Patterns
Standard drums are configured with 3 scrolls of teeth on each side (Triple Wrap)

In one revolution of the drum, each tooth should strike the surface once in lines spaced 5/8” apart
5/8” Spacing at 30 fpm
Micro-Mill Drums

Laced with 4 scrolls of teeth

0.2” Spacing

Must be built with weld-on tooling

Cut depths < 2”
2/10” Micro-Mill Pattern
Production & Cost Comparison

<table>
<thead>
<tr>
<th>Line Spacing</th>
<th># of Teeth</th>
<th>Cost of Teeth</th>
</tr>
</thead>
<tbody>
<tr>
<td>5/8” (16 mm)</td>
<td>268</td>
<td>$1340</td>
</tr>
<tr>
<td>3/8” (9 mm)</td>
<td>406</td>
<td>$2030</td>
</tr>
<tr>
<td>0.2” (5 mm)</td>
<td>770</td>
<td>$3850</td>
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</tbody>
</table>

Nearly 3 times the teeth
Nearly 5 times the cost
No quick change holders
Things we need to think about

Prior planning will help you do better work. Look at the job before you cut. Know what your machine is capable of doing. Make sure your machine is ready to cut. Keep up with the maintenance. Am I cutting shoulder and will I have a good reference. What is expected? smoothness or getting get in and get out...

Keep your job clean. Having a clean surface will help you start and make better transitions.