FLAT TOOTH MILLING

Bob Chapin MDOT
Andy Moran MDOT
Jerry Byrne Kent CRC
Precise Depth Control
Variable Cutting Widths: 1"-49"
100% Surface Coverage

Corrective Grind—III improvement
- Precisely levels bumps and other irregularities, acts as a profilograph and bump grinder in one
- Utilizes Keystone Engineering’s patented Flat Tooth Cutting Technology
- 100% surface coverage, unlike diamond blades and other traditional carbide conical bits and flail cutters
- Minimal surface damage seen when comparing to traditional carbide bits and water blasting equipment
- Equipped with Keystone’s Internal Water System for dust control

FL MODEL ILLUSTRATION

FL MODEL SPECIFICATIONS

<table>
<thead>
<tr>
<th>FL MODEL SPECIFICATIONS</th>
<th>FL24</th>
<th>FL36</th>
<th>FL48</th>
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</thead>
<tbody>
<tr>
<td>Grinding Width</td>
<td>0-25&quot;</td>
<td>0-37&quot;</td>
<td>0-49&quot;</td>
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<tr>
<td>Grinding Depth</td>
<td>0-1.5&quot;</td>
<td>0-1.5&quot;</td>
<td>0-1.5&quot;</td>
</tr>
<tr>
<td>Number of Bits</td>
<td>72</td>
<td>106</td>
<td>140</td>
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<tr>
<td>Hydraulic Horsepower (HP) Requirement</td>
<td>45</td>
<td>60</td>
<td>70</td>
</tr>
<tr>
<td>Operating Weight (lbs)</td>
<td>3200</td>
<td>3000</td>
<td>3400</td>
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</tbody>
</table>

Ensuring accurate pavement depth at Chicago’s Midway Airport
Flatlined Surface
Pavement Markings and Coatings Removal

Flat Tooth Drum System—Variable Width Design
Flat Tooth CarbidePCD Cutter
Full Round PCD Cutter
Twin PCD Cutter

WWW.KEYSTONECUTTER.COM
THE FLATLINER
BUMP GRINDING ATTACHMENT

• Profiograph and bump grinder in one
• Precise Depth Control
• Variable cutting widths
• Works on any high-flow skid steer
THE FLATLINER IS IDEAL FOR:

- **International Roughness Index (IRI) Improvement**
- **Maintenance Work-Bump Grinding**
- **Coatings/Membrane Removal**
- **Pavement Markings Removal**
REMOVAL OF FROST HEAVES AND
EXPANSION JOINTS
MAINTENANCE GRINDING - AFTER
MAINTENANCE GRINDING
AFTER
GRINDING CAPABILITY UP TO 2”
SMOOTHING AFTER UTILITY OR UNDERDRAIN REPAIR
CORRECTIONAL GRIND ON NEW PAVEMENT TAKE-OFF JOINT
PAVEMENT MARKINGS REMOVAL
SURFACE PREP AND COATINGS REMOVAL

• VARIABLE CUTTING WIDTHS: 2” - 49”

• PRECISE DEPTH CONTROL

• ANTI-SKID INSTALLATION AND REMOVAL
NEW PAVEMENT CORRECTION

- Economical alternative to diamond grinding
- No water required
- A green alternative
BRIDGE DECK COATING REMOVAL
SURFACE COURSE GRINDING ON TALLADEGA SPEEDWAY
SURFACE TEXTURE COMPARISON
PAVEMENT MARKINGS REMOVAL

- 100% SURFACE COVERAGE
- MINIMAL SURFACE DAMAGE WHEN COMPARING TO CARBIDE CONICAL TOOLS OR FLAIL CUTTERS
- NO WATER REQUIRED
SURFACE PREP

- Only remove what is needed
- Save money on material
- Increase the life cycle of the treatment

Bump Grinding and Surface Prep for Seal Coats
WHEN CONICAL DOESN'T “CUT” IT

Ultra-Precise Flat Bits:

• Shears the Surface
• 100% Surface Coverage
• Smooth and Uniform Surface Pattern
FLAT TOOTH GRINDING DRUM
HOW LONG WILL THE CARBIDE TEETH LAST?

According to Keystone Engineering

“Bit wear will vary from job to job and will be determined by the scope of the job and the material that is being cut.

For example... DOT bump grinding applications primarily in limestone surface course mixes got over 300 hours on a set of bits.”
MILLING HEAD WITH KEYSSTONE’S FLAT TOOTH SYSTEM
KEystone Engineering

https://www.keystonecutter.com/flatliner-attachment.aspx
https://youtu.be/GfVKDQ-nNlU
317.319.7639
The Flatliner has brushes that mechanically clean away spoils and debris from in front of the wheels to help maintain a smooth grinding surface.

The Flatliner has two pivot points on which it articulates (fore and aft and side to side) this allows a consistent finished surface (rise-fall and crown).
The wheels on the flatliner are easily adjusted to ensure that the mill head is at the proper height.

There is minimal airborne debris, however a wet grind water attachment is available to further reduce the number of airborne particulates.
Spoils are easily removed from the site or swept on to existing gravel shoulders.

Prior to milling, position the skid steer so that the bump is between the mill and the front ski.
With a 4’ machine a 12’ lane can be done in 3 passes. Depending on the severity of the bump, additional passes may be required to achieve complete removal. 1-1/2”-2” of material can be removed per pass.

It took two passes over the entire surface to achieve the desired smoothness, requiring about 15 minutes. Compared to conventional grinding, the Flatliner is approximately 3X faster, easier to operate and leaves a superior surface smoothness.
IN CONCLUSION

From a highway maintenance perspective, the FlatLiner is an excellent solution to many scenarios encountered on our road systems. It is a great alternative to conventional bump grinding equipment, offering more capabilities and increased production, as well as providing better ride quality and a superior surface smoothness.
Kent County Examples

- Sealcoat Program
- Joint bidding
- Pavement repairs
- Shared Asphalt Roller/Tack Distributor
- Shared Asphalt Paver Rental
- Summer/Winter Staff Share
- Monthly agencies meeting
Joint venture with
Barry, Montcalm, Muskegon, Kalamazoo & Ottawa County Road Commissions
Equipment & crews are intertwined

1. Sealcoat Program
4. Sharing Asphalt Equipment

Asphalt roller, tack distributor, and emulsion storage tank shared among cities of Grand Rapids, Kentwood, & Walker, KCRC, Newaygo CRC, and Ottawa CRC.

**DAILY EMULSION USAGE**
CITY OF GRAND RAPIDS TANK

<table>
<thead>
<tr>
<th>DATE</th>
<th>CHARGE</th>
<th>GALLONS</th>
<th>EMPLOYEE (PRINT NAME)</th>
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</table>

** Please fax to Kris every Monday morning – 242-6983 **
5. Sharing Asphalt Equipment

KCRC & City of Walker share rental of asphalt paver and coordinate scheduling of paving operations.
6. Sharing Maintenance Staff

Summer: 1 KCRC mechanic & 4 drivers join MDOT crews
Winter: 5 MDOT employees work for KCRC
Winter Maintenance

- MDOT’s Seamless Corridor Maintenance Initiative
- Coordinating Snow Removal at County Lines
- Adjusting “County Lines” to Address Problems
Winter Maintenance

- Developing Mutual Aid Agreements
- How Do We Get Paid?
- How Do We Communicate?
Communication with Neighbors
Winter Maintenance

- Short-term solution – Share frequencies
  - Adjacent counties
  - Non-adjacent counties
Engineering Services

• Weighmaster
• Traffic Signals (City of Grand Rapids)
• KCRC/NCRC Experience
  • Newaygo CRC Salt Storage
  • Newaygo CRC Fuel Facility