Use of Fine Milling (Carbide Grinding) To Stretch Highway Maintenance Budgets

Gary Condon
Manager, Technical Cutting Systems
August, 2010

KENNAMETAL

Overview

- Cost effective pavement preservation strategies are more important than ever in today's tough economic climate.
- One means of extending pavement life at significantly reduced cost compared to traditional mill & fill, is to resurface with thin hot-mix asphalt (HMA) overlays – a case study will be presented.
- Thin HMA overlays require smoother fine milled or carbide ground surfaces so that the peaks and valleys of the milled surface do not reflect through the new thin overlay paved surface.
- Fine milling or carbide grinding utilizing 0.20 inch (5 mm) tooth spacing effectively removes distressed pavement and eliminates the need for multiple layers (scratch and/or leveling) and allows the option of thin-lift resurfacing that is not feasible under regular milling methods.

Highway maintenance budgets are tighter than ever – What should be done?

Why Fine Milling? What Can it Do?

KENNAMETAL

- Restore safe skid resistance to worn, slippery pavement surfaces
- Remove wheel ruts or uneven pavement surfaces
- Roughen pavement surface to improve adhesion of thin wearing course or seal coat applications
- Allow milling crew to operate independently from paving due to surface texture that allows opening to traffic.
- Cost savings related to the reduced amount of material needed.
- Potential to use surface as milled over extended periods.

Fine Milling addresses above conditions at lower cost than traditional mill & fill.

Why Fine Milling? What Can it Do?

KENNAMETAL

- Reduce – Material Removed
- Reduce – New Material Required
- Reduce – Haul Trucks
- Reduce – Time tied to Mill & Fill
- Reduce – Overall Contractor Costs
- Reduce – Overall Cost of Project
- Increase – The mileage of road to be paved

Fine Milling addresses above conditions at lower cost than traditional mill & fill.

Fine Milling Advantages

KENNAMETAL

- Scarify to a level below the over roll created by traffic.
- Maintain a considerable layer of original wearing surface.
- Restore surface with cover coat or sealer coat of choice.
- Utilize smaller aggregate in cover coat.
- Use super compacted area in high traffic zone as a base to bring road surface back to an "as new" condition.

Fine Milling addresses above conditions at lower cost than traditional mill & fill.

Case Study: I-75 in Georgia

KENNAMETAL

Project Background

- Georgia Department of Transportation (GDOT) project to remove open graded friction coarse (OGFC) and replace it with a thin layer of porous European mix (PEM) on 15.6 miles of I-75
- The OGFC was in service for 10 years and was distressed
- The dense graded surface mix layer under the OGFC still good shape.
- However, normal practice involved milling the underlying surface layer as well due to following concerns:
  - Potential exists for a conventional milled surface to reflect through the thin layer of the Porous European mix
  - Surface water would flow through the porous surface layer and become trapped in the valleys of the milled surface. Conventional milled surface peak to valley height is 5/16 –inch or greater.
- The fine surface texture created by fine milling allowed the thin OG course layer to be placed directly on the ground surface of the dense graded base layer, eliminating the need for a scratch or leveling course.

Reduce the amount of material needing milled and reduce new asphalt required.

Source: National Center for Asphalt Technology – Asphalt Technology News Spring 2010, Volume 22, Number 1, Page 5

Case Study: I-75 in Georgia

KENNAMETAL

Project Controls and Specifications

- Control milling depth within 1/16 inch (1.6mm) accuracy
- Control peak to valley height to 1/8 inch (3.2mm) or less
- Target smoothness of 825 mm / km, not to exceed 900 mm / km

Project Measurement Methods

- National Center for Asphalt Technology (NCAT) assisted in using Circular Track Meter (CTM) and Ultra Light Inertial Profiler (ULIP) to measure surface texture depth
- Laser Road Profiler (LRP) used to measure smoothness.

Controlling the quality of the milled surface texture is critical to success

Case Study: I-75 in Georgia

KENNAMETAL

Project Results:

- Savings of $58,000 per lane mile, or approximately $5.4 million for the project.

Traditional 5/8" Spacing

0.2" (Micro) Spacing

Micro milling enabled significant savings

Other Means of Measuring Surface Texture

KENNAMETAL

"Sand Test" or "Glass Bead Test" (Colorado DOT), Maryland (DOT)

- Pre-measured volume (200 ml) of glass beads used for retroreflectivity in lane striping, is poured onto the milled surface from a height not to exceed 4 inches.
- Pile of glass beads is then distributed evenly on the milled surface using a slow circular motion with a plastic disk, until the disk rests on the peaks of the milled surface.
- To pass the test, the glass beads must spread out to cover minimum area of 9.5 inch diameter circle. Anything less means the surface is too rough.

Source: "Better Roads" October 2009 Pgs 16-23

How Does the Milling Contractor Meet Texture Spec?

KENNAMETAL

Milled surface texture is affected by:

- Drum design (bit spacing, wrap angle, bits per line)
- Drum RPM (faster RPM = smoother texture)
- Machine advance speed (faster machine speed = rougher texture)
- Drum Condition (Holders, teeth)
- Track pad condition
- Water system condition (tooth rotation)

How Ground Speed Affects Texture

KENNAMETAL

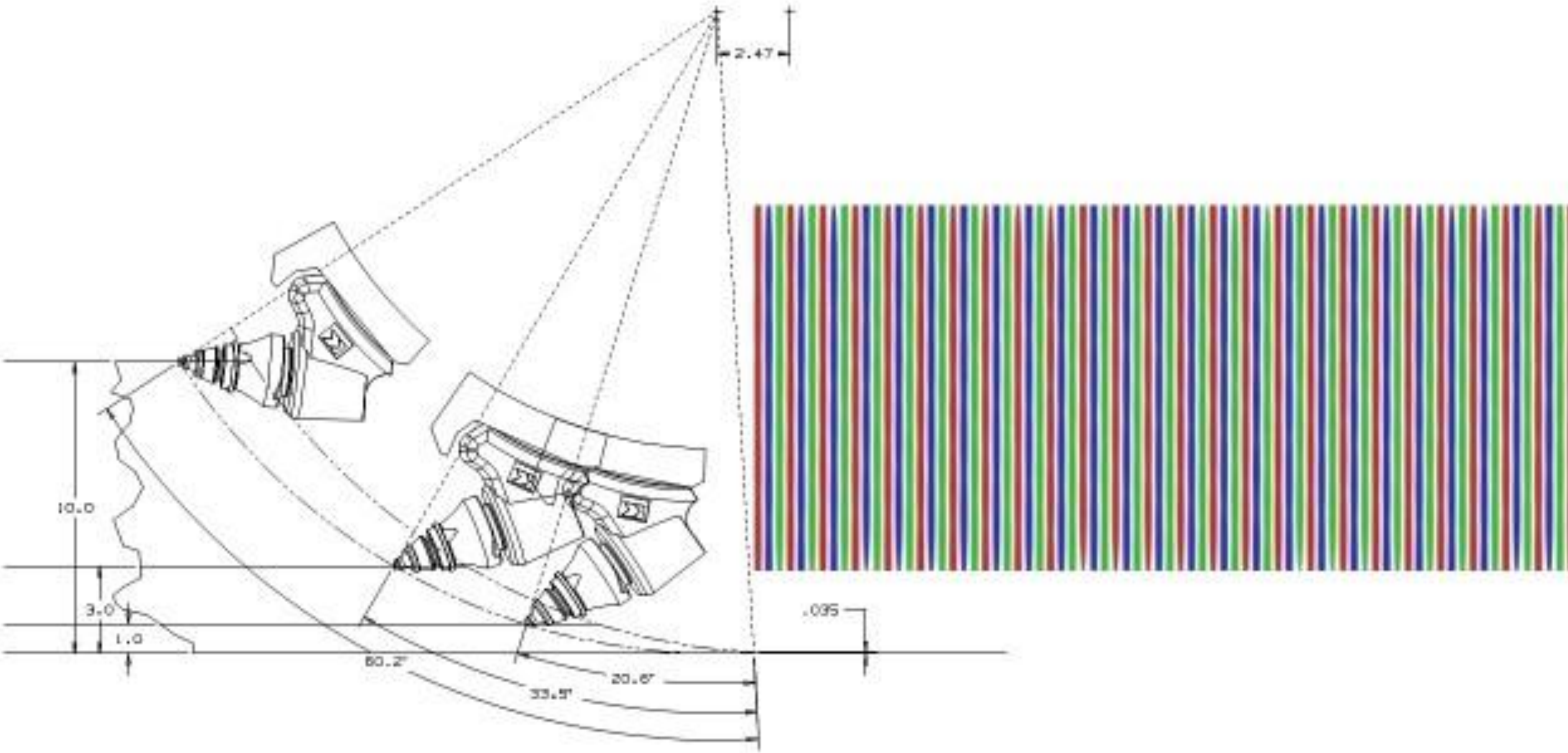
ENGAGEMENT LENGTH, ANGLE, AND TIME CALCULATIONS

RPM=	97								
CUTTING RAD=	21								
DEPTH=	1								
		SUMP(IN./REV.)	PEAK HEIGHT(IN.)	SL(IN.)	ENGAGEMENT LENGTH (IN.)	ENGAGEMENT ANGLE (DEG.)	TOOLS ENGAGED(153 BITS)	TIME IN CUT(SEC.)	
ADVANCE=	20	2.47	0.0365	6.403	7.64	21.1	9.0	0.0363	
	40	4.95	0.1463	6.403	8.88	24.5	10.4	0.0421	16%
	60	7.42	0.3306	6.403	10.11	27.9	11.9	0.0480	32%
	80	9.90	0.5914	6.403	11.35	31.4	13.3	0.0539	49%
	100	12.37	0.9316	6.403	12.59	34.9	14.8	0.0599	65%

RPM=	97								
CUTTING RAD=	21								
DEPTH=	3								
		SUMP(IN./REV.)	PEAK HEIGHT(IN.)	SL(IN.)	ENGAGEMENT LENGTH (IN.)	ENGAGEMENT ANGLE (DEG.)	TOOLS ENGAGED (153 BITS)	TIME IN CUT(SEC.)	
ADVANCE=	20	2.47	0.0365	10.817	12.05	34.4	14.6	0.0591	
	40	4.95	0.1463	10.817	13.29	37.8	16.1	0.0649	10%
	60	7.42	0.3306	10.817	14.53	41.2	17.5	0.0708	20%
	80	9.90	0.5914	10.817	15.77	44.6	19.0	0.0767	30%
	100	12.37	0.9316	10.817	17.00	48.1	20.5	0.0827	40%

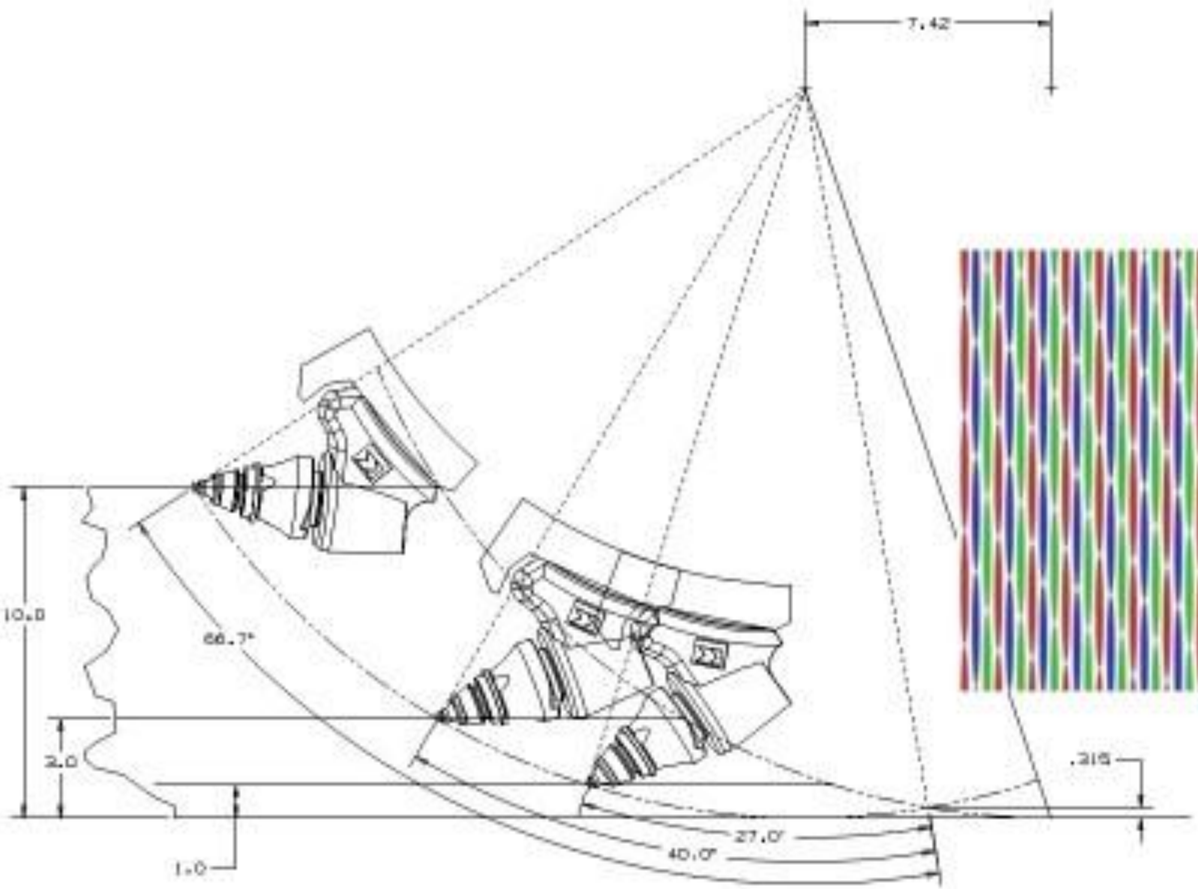
RPM=	97								
CUTTING RAD=	21								
DEPTH=	10								
		SUMP(IN./REV.)	PEAK HEIGHT(IN.)	SL(IN.)	ENGAGEMENT LENGTH (IN.)	ENGAGEMENT ANGLE (DEG.)	TOOLS ENGAGED(153 BITS)	TIME IN CUT(SEC.)	
ADVANCE=	20	2.47	0.0365	17.889	19.13	61.8	26.3	0.1062	
	40	4.95	0.1463	17.889	20.36	65.2	27.7	0.1120	5%
	60	7.42	0.3306	17.889	21.60	68.6	29.2	0.1179	11%
	80	9.90	0.5914	17.889	22.84	72.0	30.6	0.1238	17%
	100	12.37	0.9316	17.889	24.07	75.5	32.1	0.1298	22%

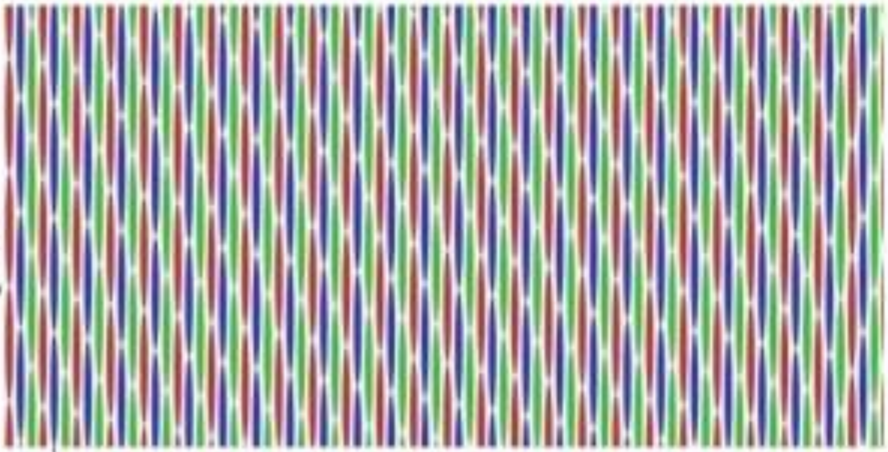
20 Feet per Minute Advance Rate
Standard Spaced Drum



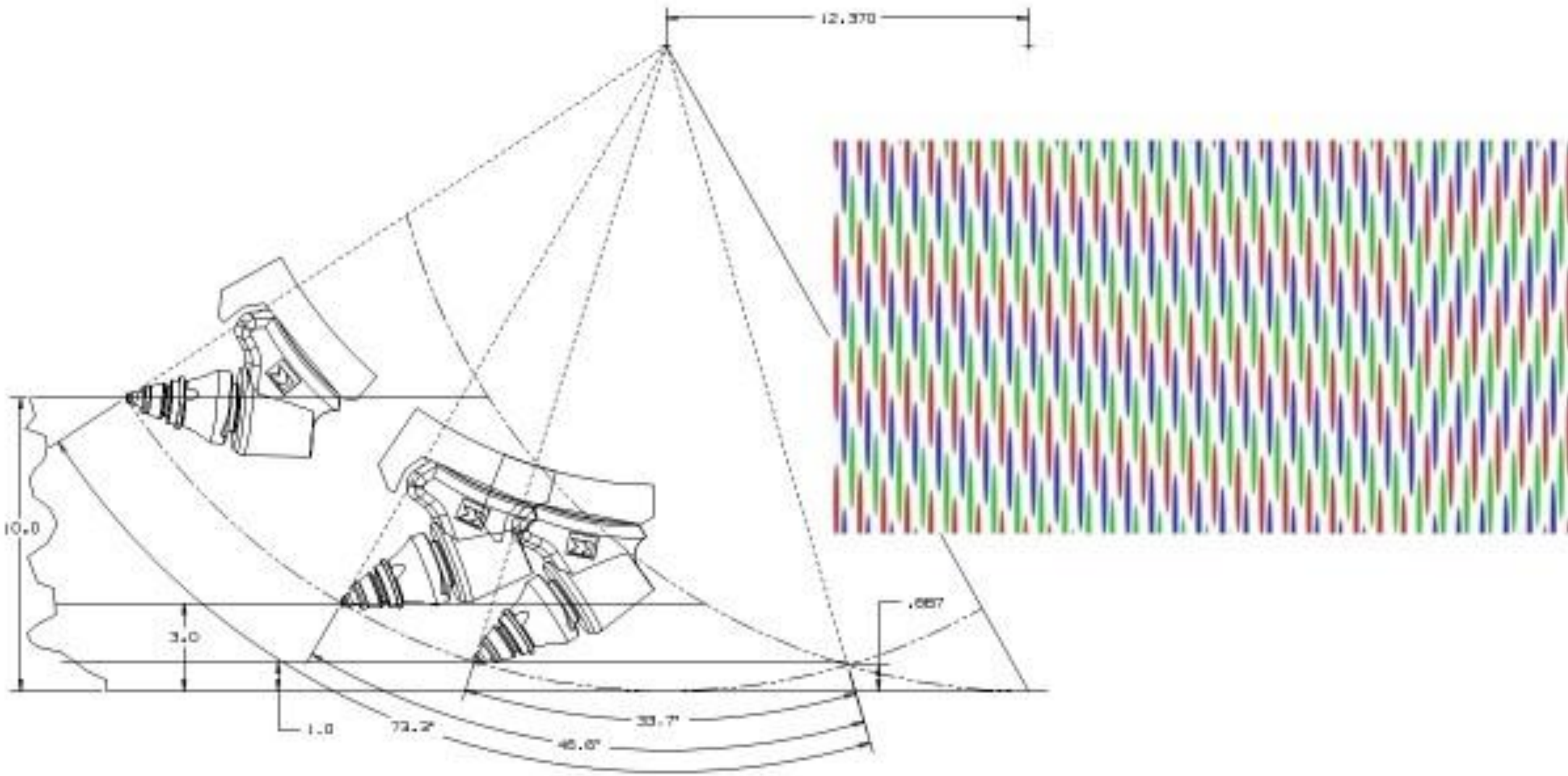
60 Feet per Minute Advance Rate
Standard Space Drum

KENNAMETAL



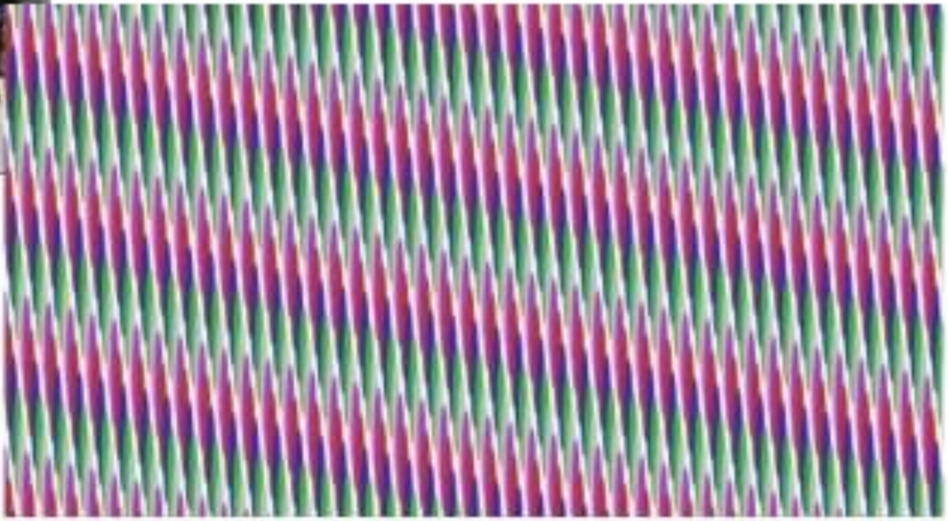


100 Feet per Minute Advance Rate
Standard Space Drum



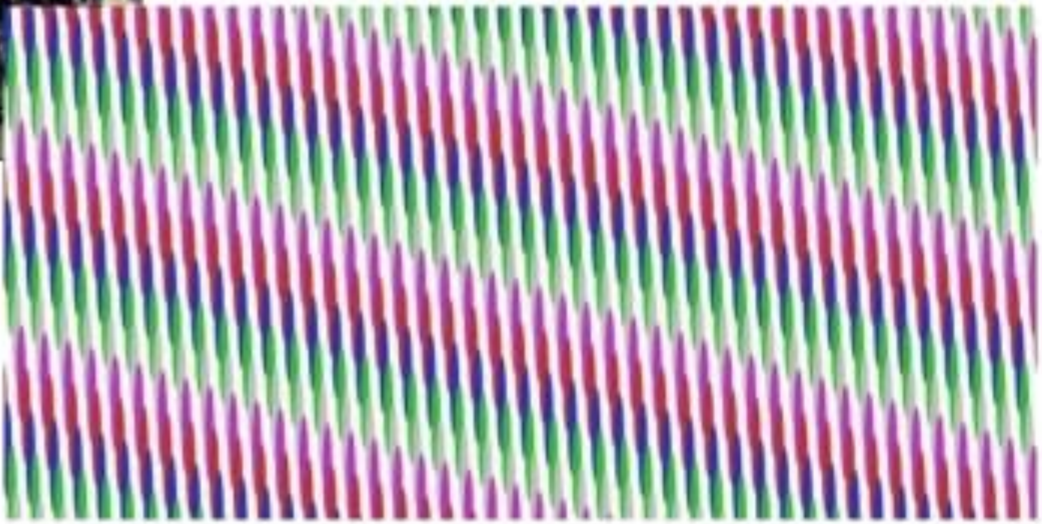
60 Feet per Minute Advance Rate Fine Milling 0.20” Drum

- Micro 0.20” (5mm) spacing



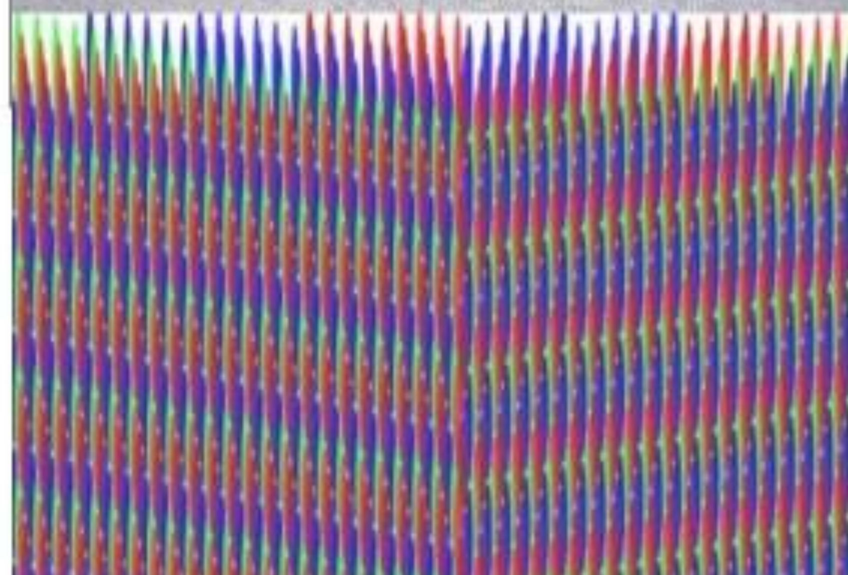
100 Feet per Minute Advance Rate Fine milling 0.20" Drum

- Micro 0.20" (5mm) spacing



Fine Milling Road Milling

- Micro 0.20" (5mm) spacing



Fine Milling Surface Finish

KENNAMETAL

Fine Milling Surface Finish

KENNAMETAL

Thank You