

# Quality Management Practices in Milling

by Justin Grusing





# Discussion Topics

- What it can/can't do
- Safety Concerns
- Specifications

# What Milling Can Do

- Correct Slope
- Remove undesirable asphalt
- Create reveal at curb for flush seam
- Remove Rutting
- Microtexture Surface Preparation
- Bump Removal
- Butt Joints/Inlays
- Save Money
- Conserve Resources



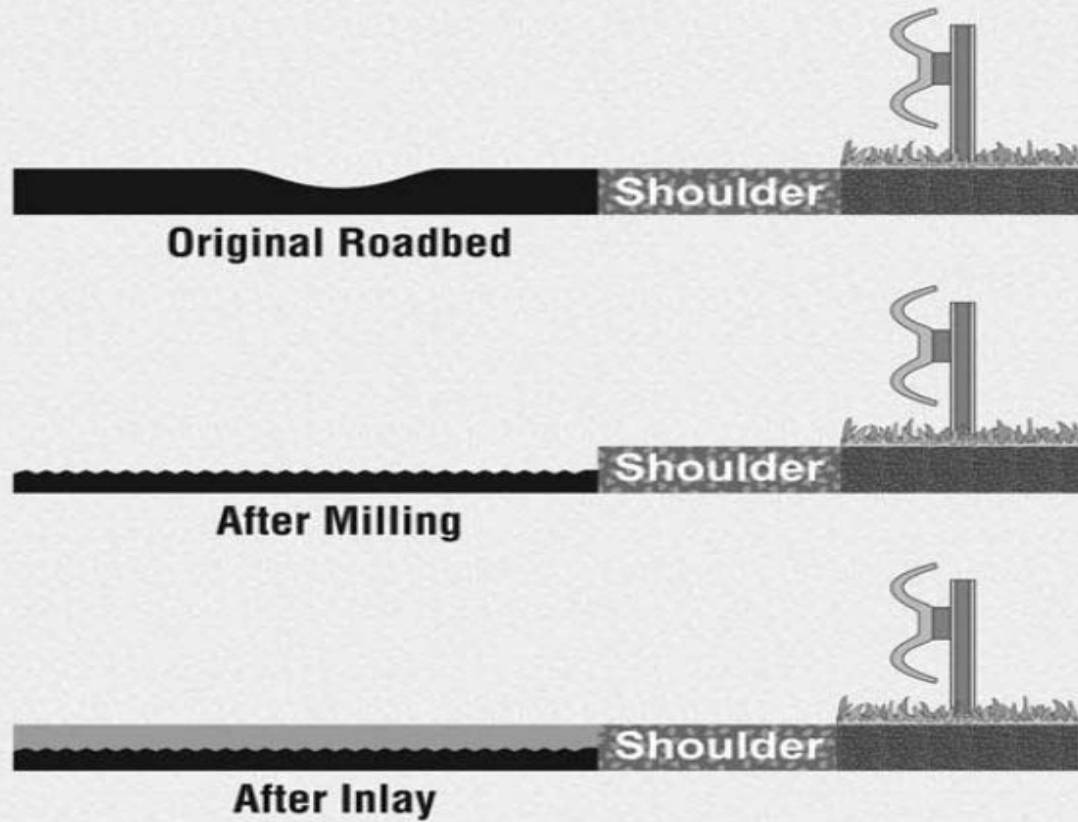
**Typical 2" Ruts in Driving Lanes**



**2" Overlay on Over Ruts**



1/2" Ruts Due to Compacting Variable Depths  
(based on 1/4" compaction per inch depth)



**Mill and Fill Process Eliminates Need for Shoulder and Guardrail Changes**

*Image courtesy of Astec, Inc.*

***Positive proof of global warming.***



**18th  
Century**

**1900**

**1950**

**1970**

**1980**

**1990**

## FHWA SUPPORTS THE USE OF RECYCLED MATERIALS

The Federal Highway Administration (FHWA) has developed policy guidance on the use of recycled materials.

1. Recycling and reuse can offer engineering, economic and environmental benefits.
2. Recycled materials should get first consideration in materials selection.
3. Determination of the use of recycled materials should include an initial review of engineering and environmental suitability.
4. An assessment of economic benefits should follow in the selection process.
5. Restrictions that prohibit the use of recycled materials without technical basis should be removed from specifications.



# What Milling Cannot Do

- Maintain Grade on both sides and slope
- Guarantee Sizing
- Mill through Rebar
- Wire Mesh and Fabric Can be Problematic

# Some things can't work





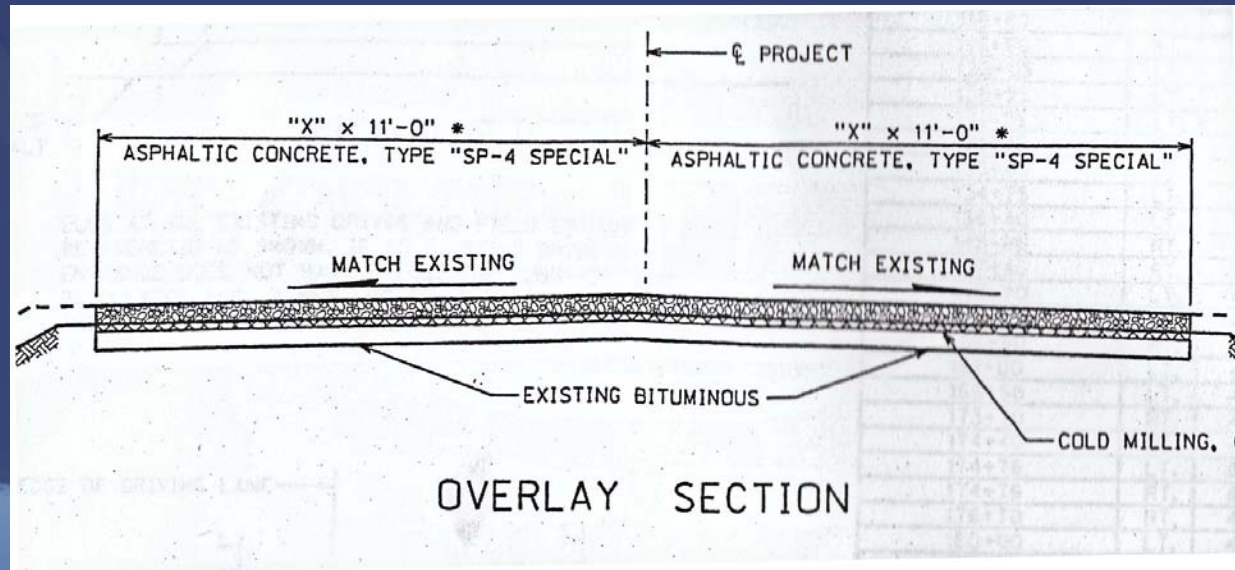
Eskimo Barbecues



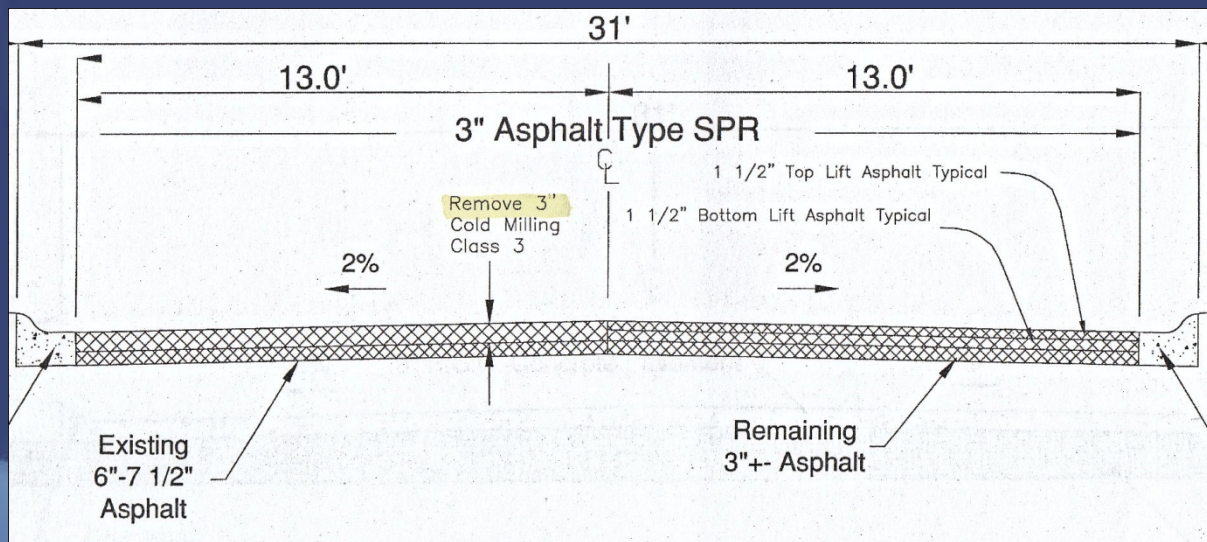




# Match Existing



# 2% Slope





# Which of these is not like the others?



# Typical Quality Issues

- Worn or Irregular Teeth
- Unmaintained Drum
- Ground Speed
- Overzealous Groundsman
- Dips from stopping between trucks

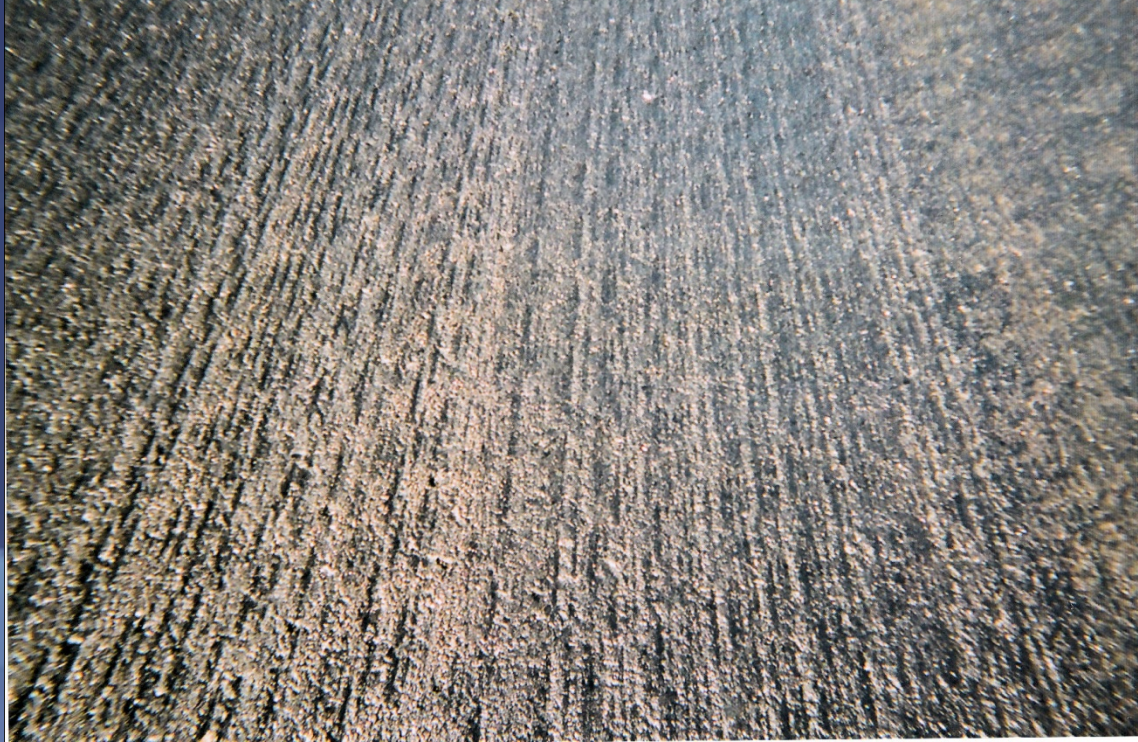
# Irregular Teeth



# Irregular Teeth



# Irregular Teeth & Speed



# Ground Speed Too Fast



# Ripples

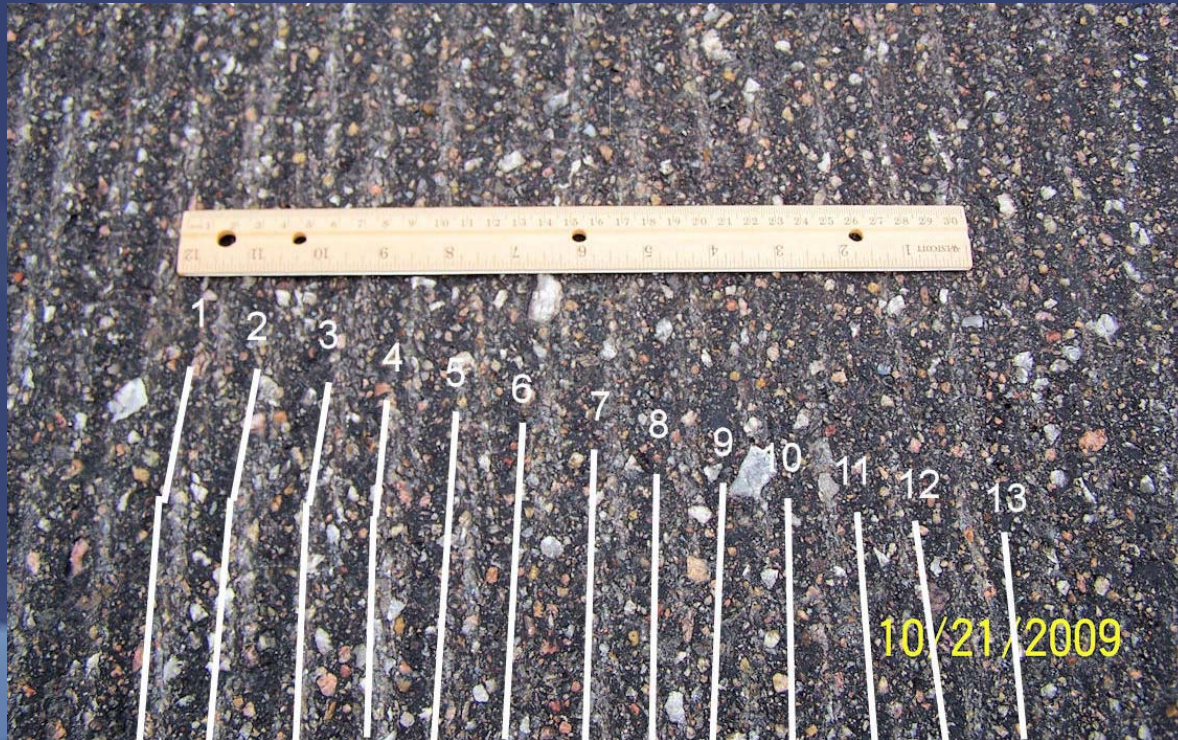


# Classic V Pattern





# Effective Spacing $\approx 1''$



# Easy Does It



# Creep Between Trucks



# Safety Concerns

- Longitudinal Vertical Edges
- Transverse Vertical Edges
- Milling Debris
- Drainage Problems
- Unstable Base

# Vertical Edges



# Debris Issues



# Excess Dust



# Proper Sweeping





# Drainage Solutions

- Daylighting out shoulder
- Weep Holes

# Weep Hole



# Unstable Base

- Undermined Streets
- Soft Underlying Base

# Undermined Streets





# Unstable Base



# Method Based Examples

- Gradation of millings from mill
- Travel speed/Drum speed
- Tooth Spacing
- Pick-up Broom must be used after miling

# Performance Based Examples

- Profilograph/Inertia Profiler
- Macrotexture Sand Test
- Gradation of RAP entering mix
- Roadway must be free of loose debris



# % Improvement IRI



# Glass Bead Test



# Gradation Spec

Cold milled asphalt concrete material shall be milled to provide a nominal one inch (25 mm) maximum size. A tolerance of five percent in material retained on a one inch (25 mm) sieve will be permitted, provided all material passes a 1-1/2 inch (37.5 mm) sieve.

# ND Gradation Spec

- **Processing Salvaged Material.**  
**Salvaged bituminous material shall be processed with minimal waste to the maximum size specified before introduction into the recycling plant.**

# Broom Economics 101



# Keep Your Eye on the Target



# What is the Target?

- Is slope or depth more important?
- Is material going to be used as RAP soon?
- Is the texture important?

# The Secret Ingredients

- Common Sense
- Coordination
- Collaboration
- Keep plenty of tools in your toolbox





*Cold milling – Creating RAP*



*Hot In-place Recycling*



*Full Depth Recycling*



*Cold In-place Recycling*



# Questions?

