

# Chapter 5

## Diamond Grinding and Grooving

From... Maintenance Technical  
Advisory Guide (MTAG)

# Learning Objectives

1. List benefits of diamond grinding and grooving
2. Describe recommended diamond grinding/grooving dimensions
3. Describe recommended construction procedures
4. List important quality control activities
5. Describe potential construction and performance problems
6. Identify troubleshooting solutions

# Presentation Outline

- Introduction
- Design considerations
- Construction
- Quality control
- Troubleshooting

# Diamond Grinding



# Diamond Grinding

## Benefits

- Restored smoothness
- Improved friction
- Improved cross slope
- Reduction in noise
- Improved cross slope for reducing splash and spray

# Diamond Grinding

## Effect on Roughness

### Percent decrease in IRI

Test Area	Lane 1	Lane 2	Lane 3
1	59%	56%	NA
2	NA	NA	53%
3	64%	60%	NA
4	NA	NA	55%

NA = Not applicable

# Diamond Grinding

## Effect on Friction

### Percent increase in friction

Test Area	Lane 1	Lane 2	Lane 3
1	25%	15%	NA
2	NA	NA	18%
3	41%	35%	NA
4	NA	NA	26%

NA = Not applicable

# Diamond Grinding

## Project Selection

- Consider effectiveness and limitations
- IGGA and ACPA recommendations
  - Present serviceability index (PSI) range of 3.8 to 4.0
  - Before critical faulting level
- Used with other CPR activities

# Diamond Grinding

## Project Selection

Measure	Traffic, ADT		
	>10,000	3,000 to 10,000	< 3,000
IRI, m/km (in/mi)	1.0 (63)	1.2 (76)	1.4 (89)
PSR	3.8	3.6	3.4
CA Profilograph, m/km (in/mi)	12	15	18

# Diamond Grinding

## Project Selection

<b>Ave. Faulting, mm (in)</b>	<b>Comment</b>
0.8 (1/32)	No roughness
1.6 (1/16)	Minor Faulting
2.4 (3/32)	Grinding Project
3.2 (1/8)	Expedite Project
4.8 (3/16)	Discomfort Begins
6.4 (1/4)	Grind Immediately

# Diamond Grinding

## Limitations

- Does not address structural or durability problems
- Hardness of aggregate affects costs
- Roughness will return if causes are not addressed
- Allowable work hours for the job can affect the cost

# Diamond Grinding

## Following Load Transfer Restoration



# Diamond Grooving



# Diamond Grooving

- Cutting parallel grooves into the pavement using diamond saw blades
- Longitudinal vs. transverse
- Benefits
  - Improved wet weather friction
  - Reduction in splash and spray

# Diamond Grooving

## Project Selection

- Historical crash rate, friction number, or macrotexture depth data
- Potential locations for wet weather crashes
- Pavements should be structurally and functionally sound

# Diamond Grooving

## Longitudinal Grooving

- Advantages

- Restored surface friction
- Decreased hydroplaning potential
- Improved curve tracking
- Easier to conduct under traffic

- Disadvantages

- Perception poor handling for motorcycles and light cars

# Transverse Diamond Grooving



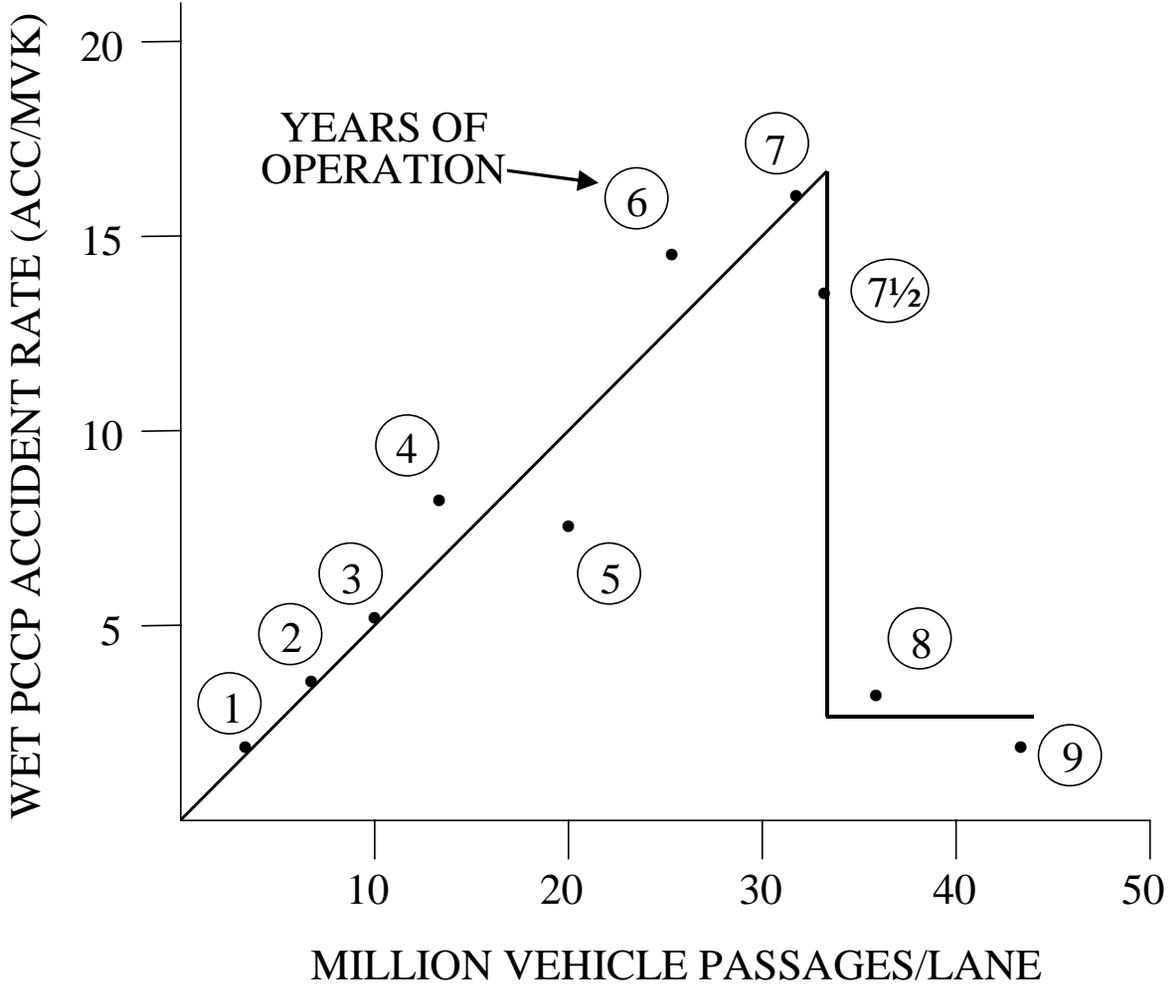
# Diamond Grooving

## Transverse Grooving

- Advantages
  - Most direct channel for water drainage
  - Introduces a surface that provides significant braking traction
- Disadvantages
  - Maintaining adjacent traffic
  - Excessive noise
  - Productivity

# Diamond Grooving

## Effect on Friction



# Module 5-1

## Design, Materials & Specifications

From... Maintenance Technical  
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# Presentation Outline

- Introduction
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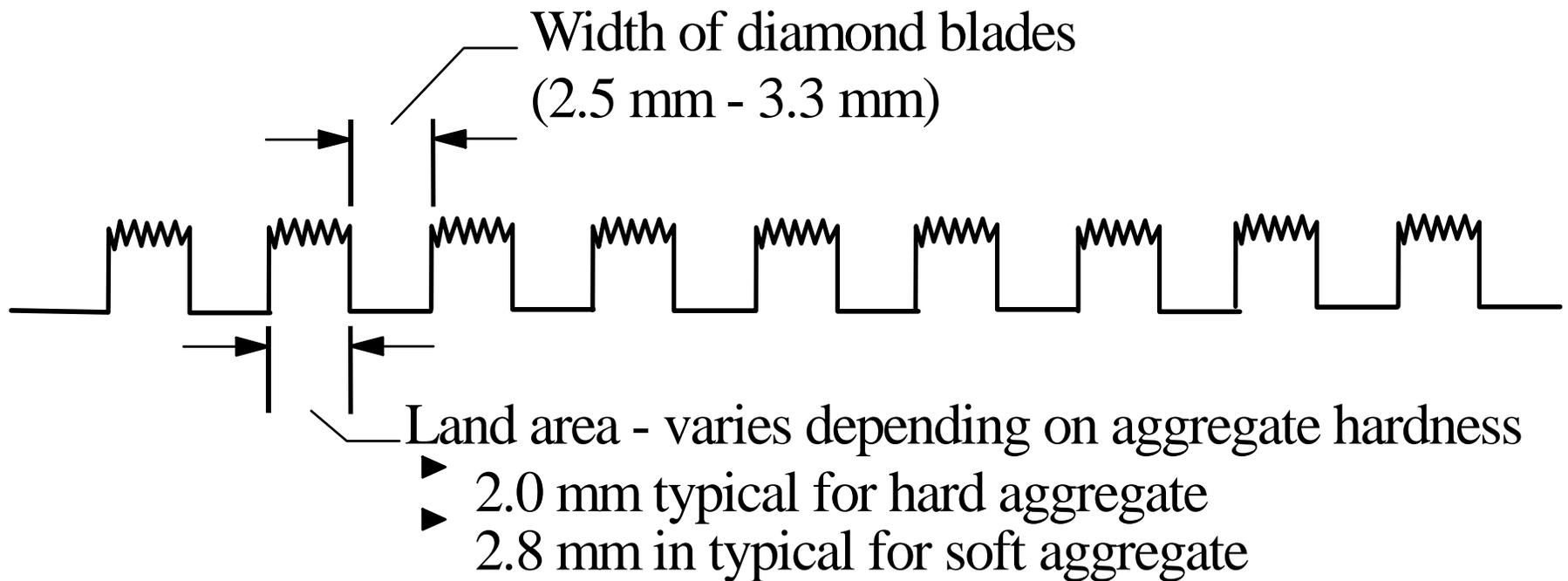
# Diamond Grinding

## Design Considerations

- Degree of faulting
- Review past corrective efforts
- Design specifications
  - Concurrent preservation techniques
  - Blade spacing
  - Transverse slope
  - Grinding limits and transitions

# Diamond Grinding

## Dimensions

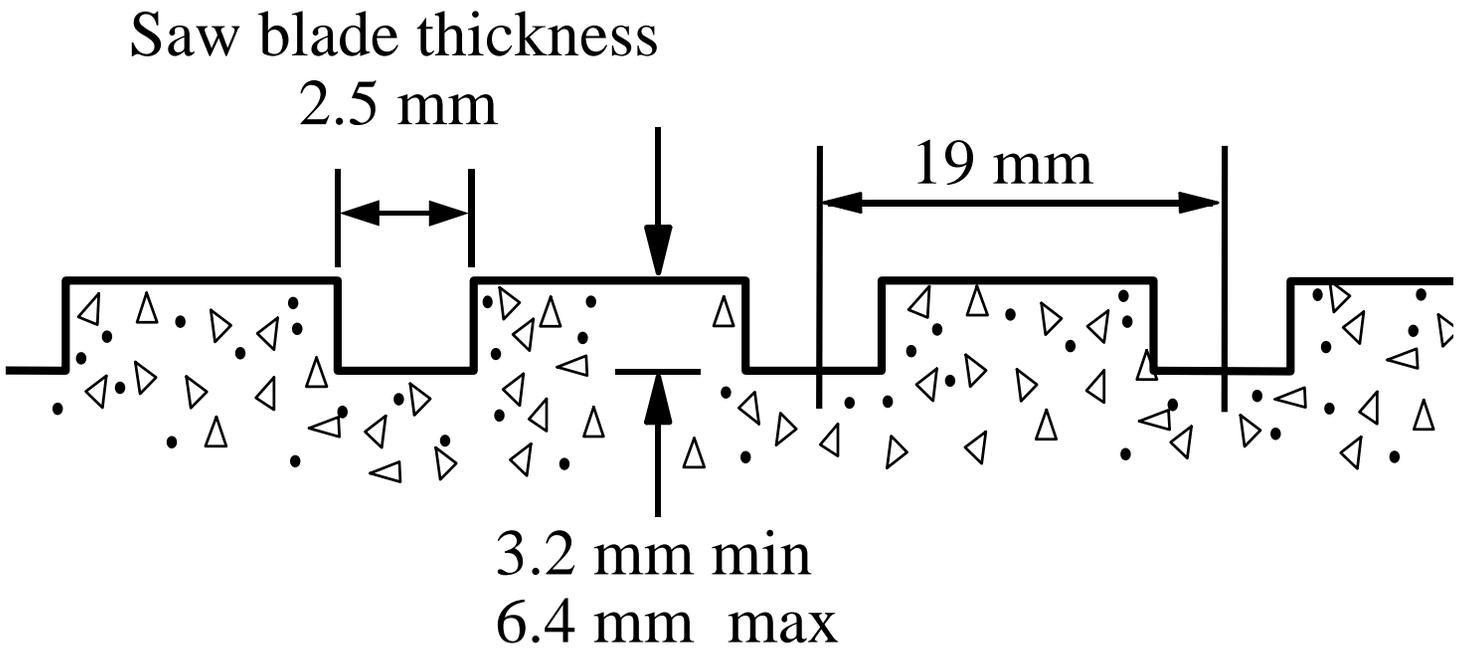


# Diamond Grooving

## Design Considerations

- Groove entire lane area
- Allowances for small areas with surface irregularities
- Use recommended blade spacing

# Diamond Grooving Dimensions



# Typical Item Codes

Item Code	Description
066145	Remove pavement markers
074017	Prepare water pollution control program
074020	Water pollution control
074042	Temporary concrete washout (portable)
120090	Construction area signs
120100	Traffic control system
128650	Portable changeable message sign
413111	Repair spalled joints
420201	Grind existing concrete pavement
420102	Groove existing concrete pavement
413114	Replace joint seal (existing concrete pavement)

# Module 5-2

## Construction and Inspection

From... Maintenance Technical  
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# Presentation Outline

- Introduction
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# Diamond Grinding

## Construction Considerations

- Grinding sequence and pattern
- Continuous operation
- Begin and end perpendicular to centerline
- Maximum overlap of 50 mm (2 in)
- Disposal of slurry

# Diamond Grinding

## Cutting Head Specifications

- Diamond blades mounted in series on cutting head
- Cutting head width from 48 to 50 in
- Spacing of 56 to 61 blades per ft

# Diamond Grinding Cutting Head



# Diamond Grinding

## Construction Procedures

- Single lane closure
- Conduct grinding parallel to centerline
- Multiple passes per lane
- Slurry removal

# Diamond Grinding Grinding Machine



# Diamond Grinding Grinding Machine



# Diamond Grinding Trucks Collecting Slurry



# Diamond Grinding

## Grinding Process



# Diamond Grinding

## Front of Grinding Head



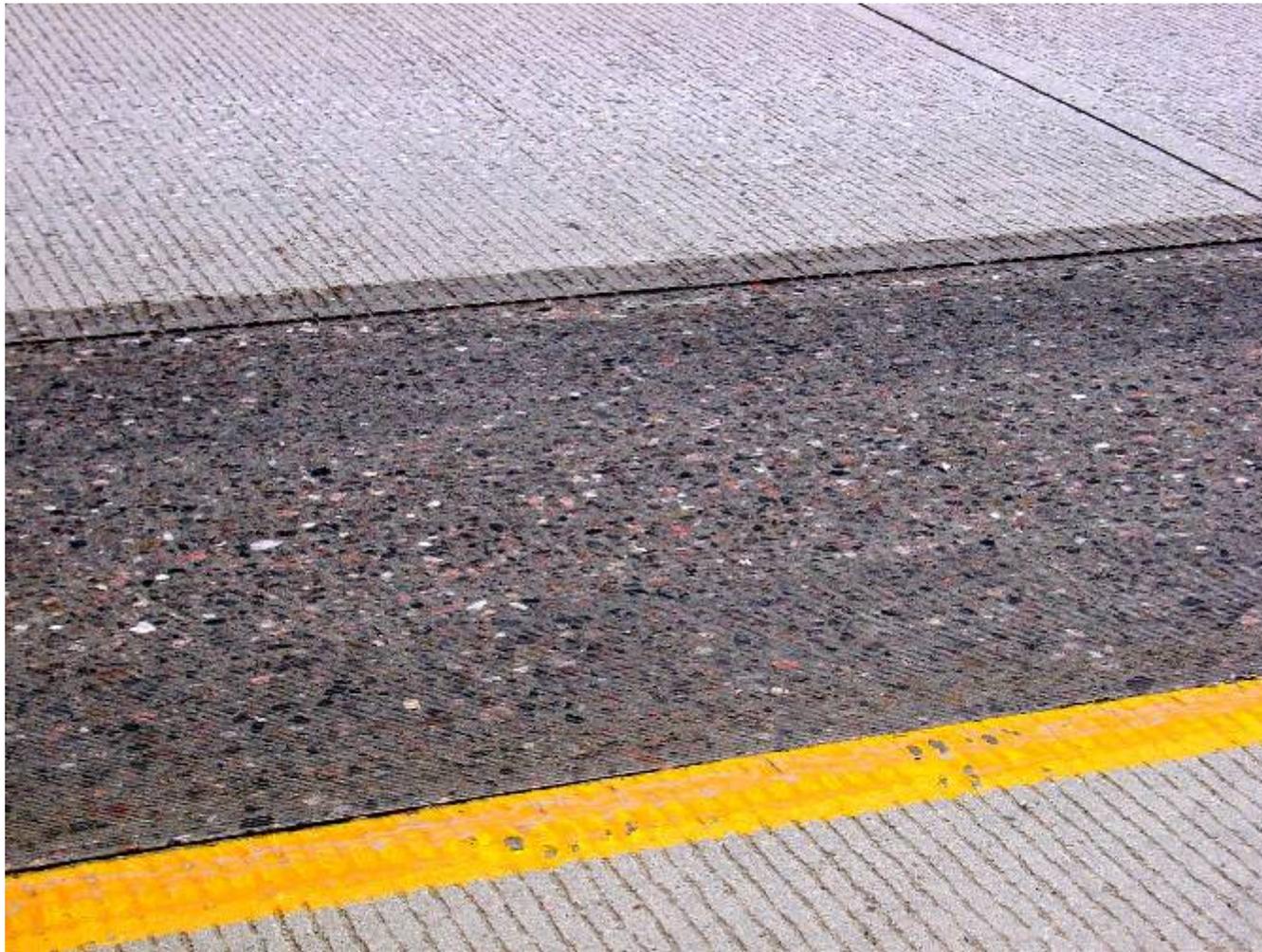
# Diamond Grinding

## Behind the Grinding Head



# Diamond Grinding

## After First Pass of Grinding Machine



# Diamond Grinding Finished Product



# Diamond Grooving

## Construction Considerations

- Groove dimensions
- Direction of grooving
- Disposal of slurry
- Procedures similar to diamond grinding

# Diamond Grooving Equipment

- Head width: 1 to 6 ft
- Longitudinal blade spacing of 3/4 inch
- Vacuum system employed to collect slurry

# Presentation Outline

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# Diamond Grinding

## Quality Control

- Profile
  - Pavement roughness
  - Need acceptance standards
- Skid resistance
  - Standard smooth tire
  - Improvement may be temporary if aggregate is susceptible to polishing

# Diamond Grooving

## Quality Control

- Quality assessed through friction
- Values prior to grooving compared with post-grooving values
- Direct measurement of surface texture can also be used

# Project Checklist

- Preliminary Responsibilities
  - Document Review
  - Project Review
- Equipment Inspections
  - Diamond-Grinding Machine
  - Profilograph or Profiler
- Others
  - Weather Requirements
  - Traffic Control

# Project Checklist

- Project Inspection Responsibilities
  - Alignment
  - Texture
  - Residues

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# Troubleshooting

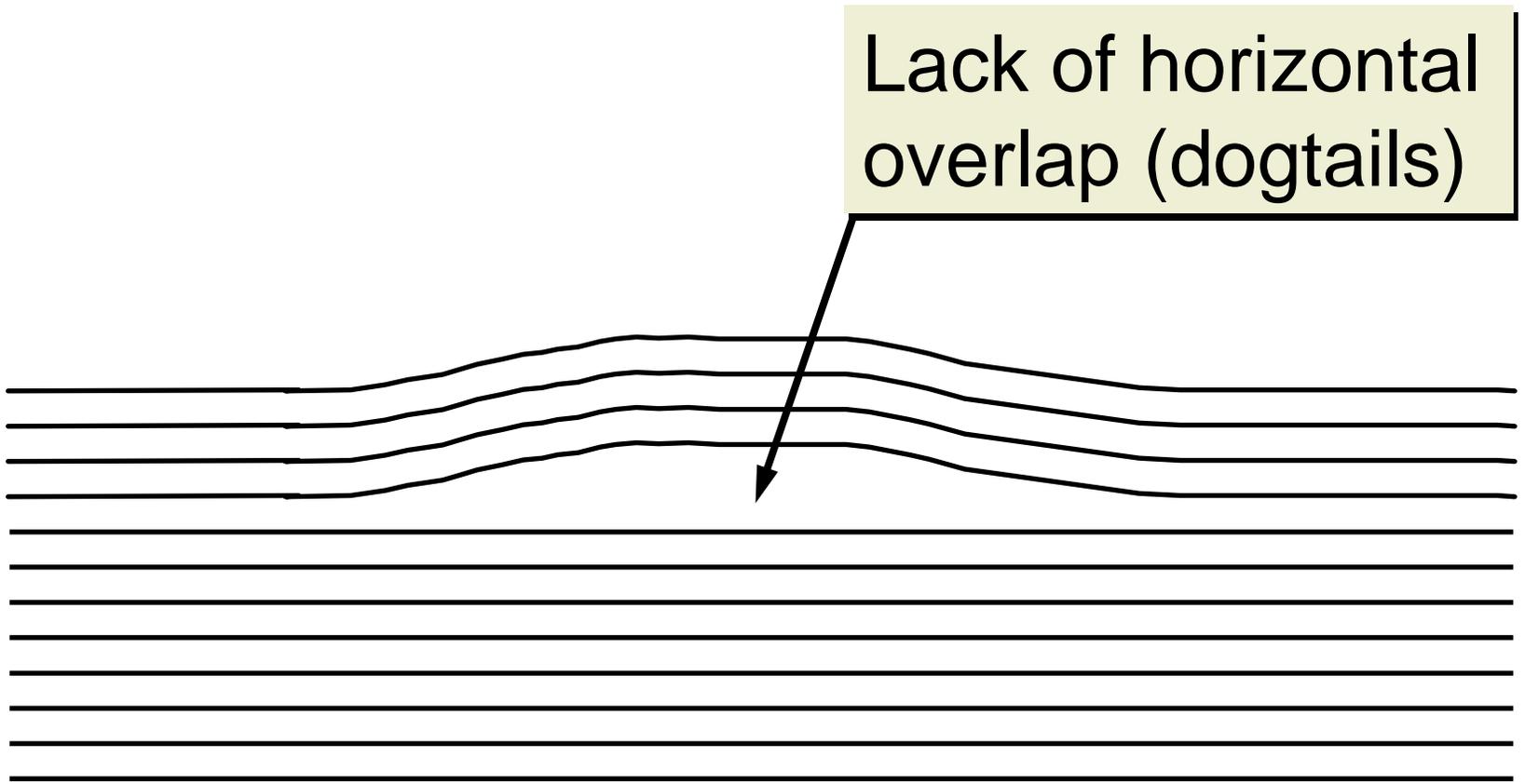
- Construction quality and performance problems
- Approach:



# Troubleshooting—Grinding

## Possible Construction Problems

Lack of horizontal overlap (dogtails)



# Troubleshooting—Grinding

What is wrong here?



Unground areas (holidays)

# Troubleshooting—Grinding

What is wrong here?



Poor vertical match between passes

# Troubleshooting—Grinding

## Possible Construction Problems

- Problem:  
*Uneven material removal due to spalled or broken pavement*
- Potential causes?

# Troubleshooting—Grinding

## Possible Construction Problems

- Problem:  
*Remaining fins do not break easily*
- Potential causes?

# Troubleshooting—Grooving

## Possible Construction Problems

- Problem:  
*Unground areas from low spots*
- Potential causes?

# Troubleshooting—Grooving

## Possible Construction Problems

- Problem:  
*Non-uniform groove depths*
- Potential causes?

# Troubleshooting Guide – Causes and Solution

- “Dogtails”
- “Holidays”
- Poor vertical match between passes.
- The fins that remain after grinding do not quickly break free.
- Large amounts of slurry on the pavement during grinding.

# Troubleshooting Guide – Causes and Solution

- Lack of horizontal overlap.
- Isolated areas with inconsistent groove depth.
- Inconsistent groove depth near joints.
- Large amounts of slurry on the pavement during grooving.
- Light vehicles and motorcycles experience vehicle tracking.

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# Thank You

## Questions?