ASPHALT

THE SMOOTH QUIET RIDE

ASPHALT 100% RECYCLABLE

2018 Local Roads Workshop

Pavement Repair Options

March 2018

ASPHALT PAVEMENT ASSOCIATION OF MICHIGAN

MICHIGAN RIDES ON US

Asphalt.

Presentation Outline

- **Overlay Prep**
- Composite Pavements
- Preventive Maintenance

Objectives

To describe the typical procedures for

- Crack sealing operations in HMA
- Patching HMA

Introduction

- Crack sealing is applied to
  - Extend the service life of the existing HMA
  - Preparation of existing pavement prior to construction of a HMA overlay

Purpose & Application

- Cracks allow moisture and debris to enter the pavement
  - Contribute to stripping, spalling, cupping, lipping, delaminating, etc.
  - Reduce pavement & base stiffness which contributes to further load related cracking
- There is a general consensus among states experience that supports sealing cracks as a cost effective rehabilitation or maintenance treatment

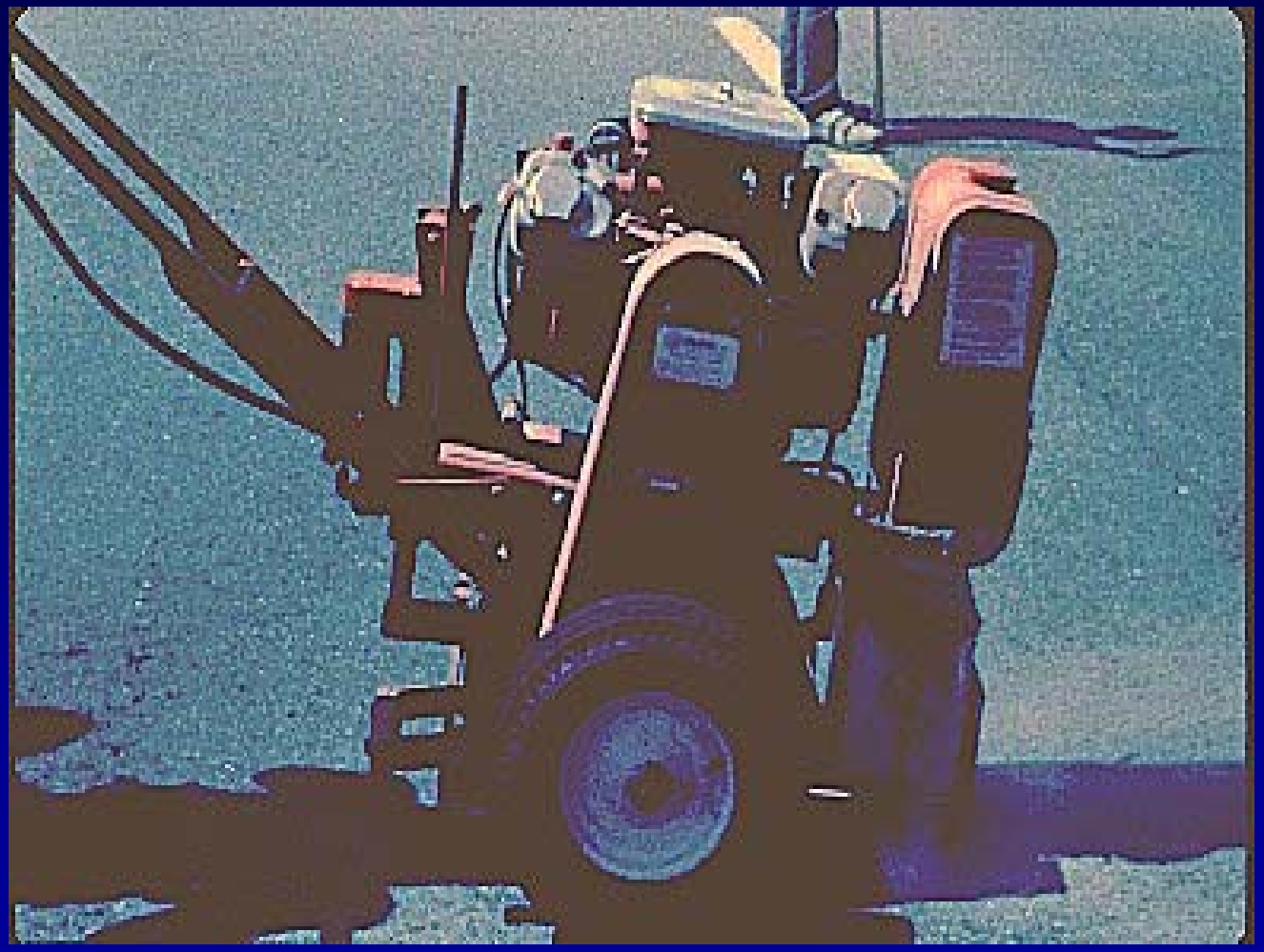
Sealant Materials

- Thermoplastic
  - Hot Applied
  - Cold Applied
- Thermosetting
  - Chemically cured
  - Solvent release

Crack sealing steps

- Steps in sealing of HMA cracks are:
  - Refacing
  - Cleaning
  - Sealant installation

Vertical Spindle Router



Rotary Impact Router

Airblasting

Hot Air Lance

Squeegeed Sealant

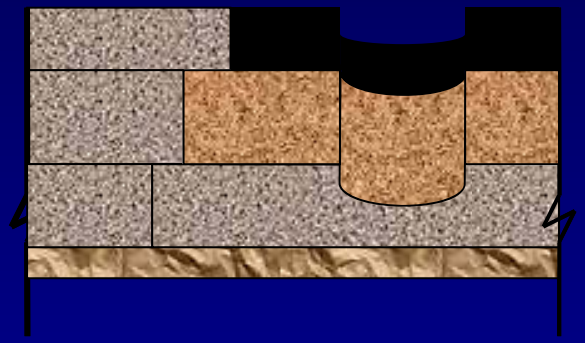
Finish Crack Seal

Patching

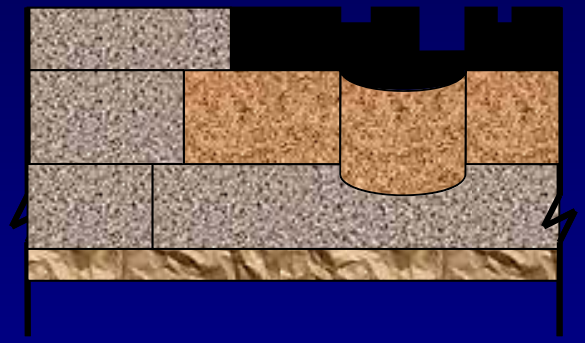
- Patching the existing pavement with
- bituminous materials
  - Extends the service life of the existing HMA
  - Used in the preparation of existing pavement prior to construction of an HMA overlay

Patching

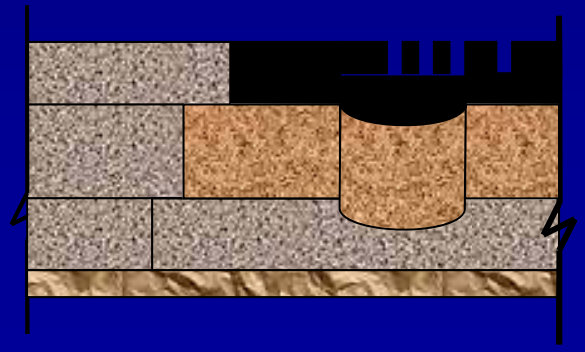
a. Weak area deflects



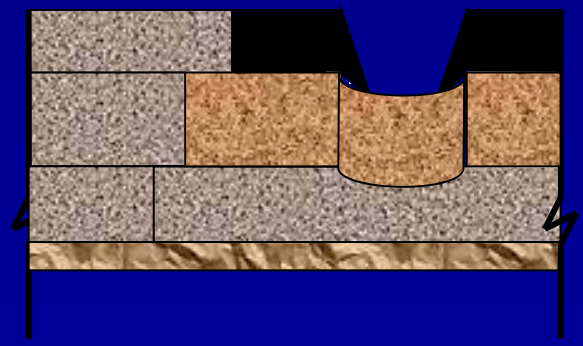
c. Pieces pop out



b. Cracks



d. Pothole



Definitions

Bituminous patching materials

- Cold-mix
  - Used as temporary patches
  - Placed in stockpile and used over a period
  - of time (Emulsion binders)
  - Special open-graded mixes
- Hot-mix asphalt (HMA)
  - Placed immediately while hot
  - Standard dense graded HMA

Purpose and Application

- Patching of existing HMA
  - To repair localized distress
  - To improve motorist safety
  - To reduce pavement roughness
  - To reduce the rate of deterioration
  - Repair pavement prior to overlay

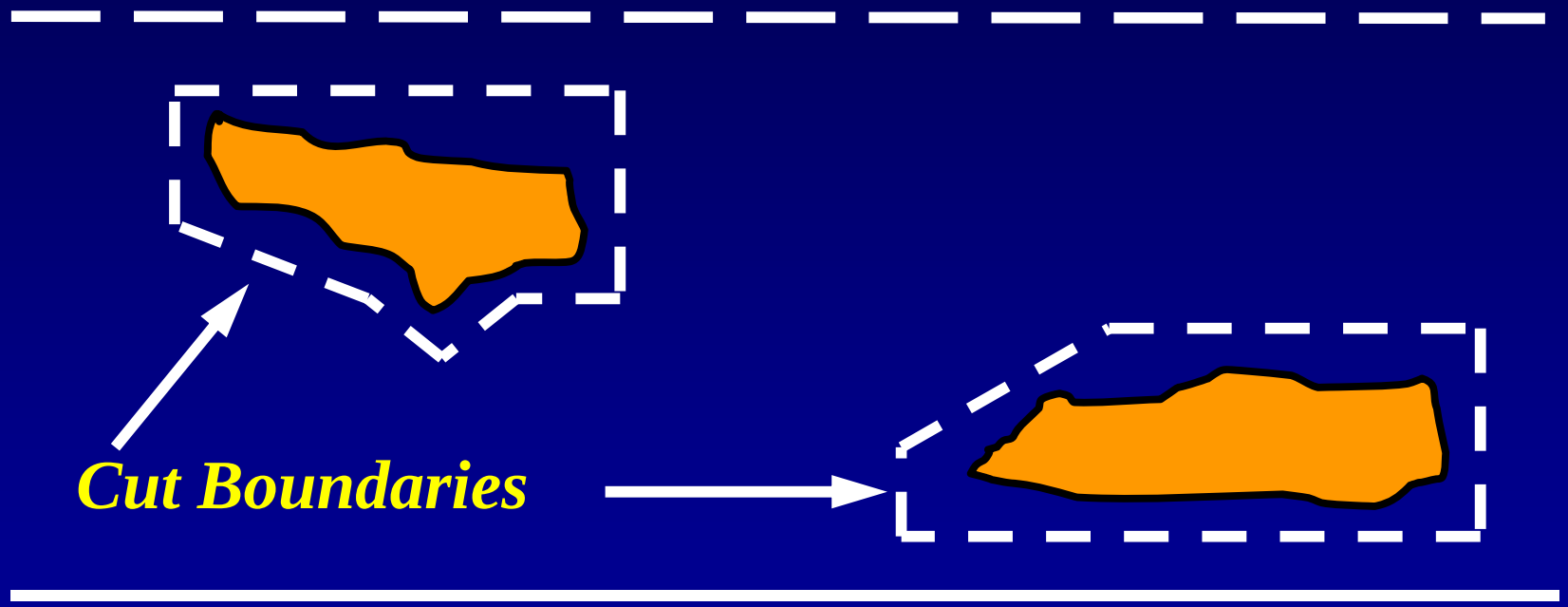
Construction

- Winter maintenance
  - "Throw and Go" the most common method
- Summer maintenance
  - Semi-permanent patch the most cost effective
  - Found to be three times more cost effective when considering full life cycle costs in a Pennsylvania study

Construction

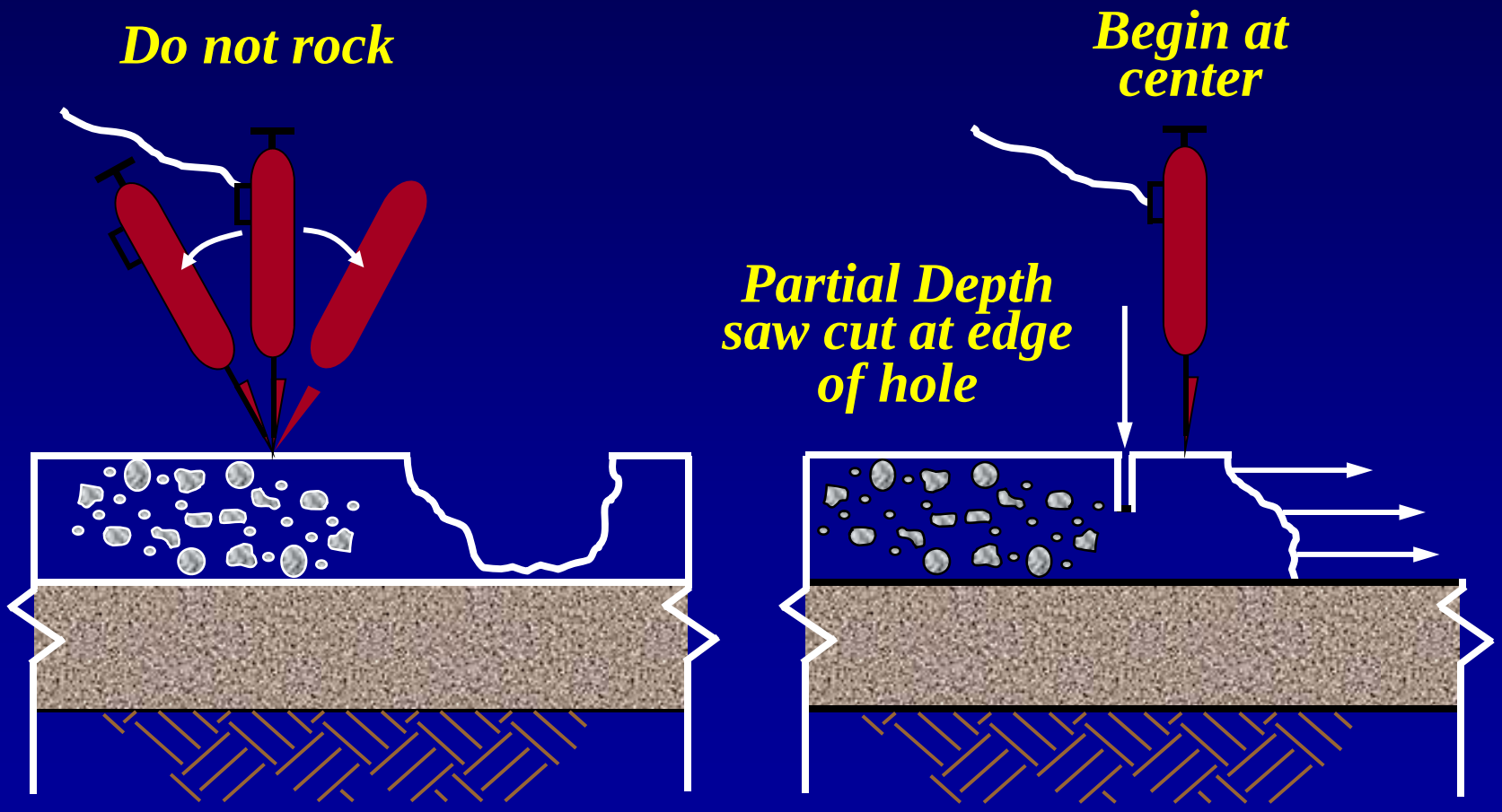
- Procedures for construction of a semi-
- permanent patch
  - Mark patch boundaries
  - Cut boundaries
  - Clean and repair foundation
  - Apply tack coat
  - Fill the hole with patching material
  - Compact the patch
  - Cleanup

Marking Patch Boundaries



- *Straight boundaries, not necessarily rectangular*
- *Adjacent area sound pavement*

Cut Boundaries



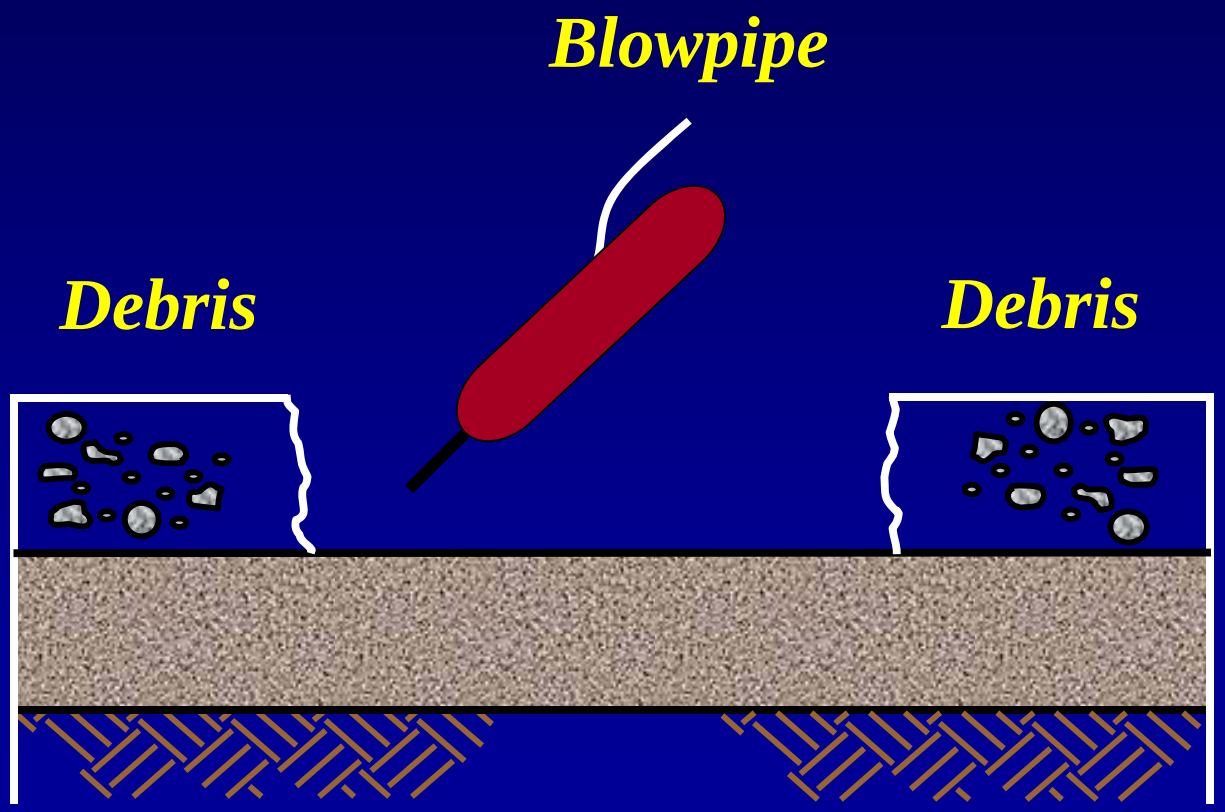
Cut Boundaries


Kawasaki

Remove Material

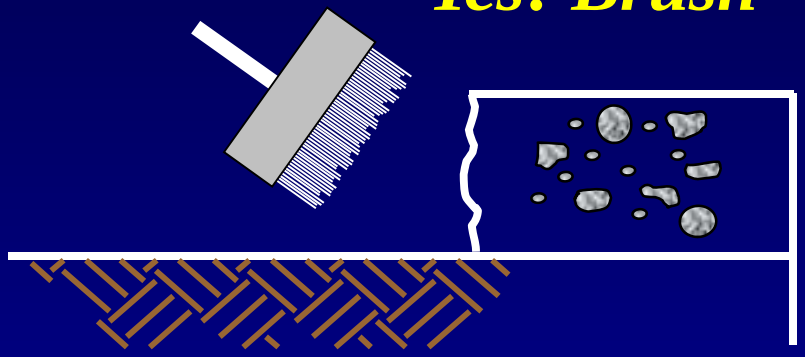

CAT

Clean Debris

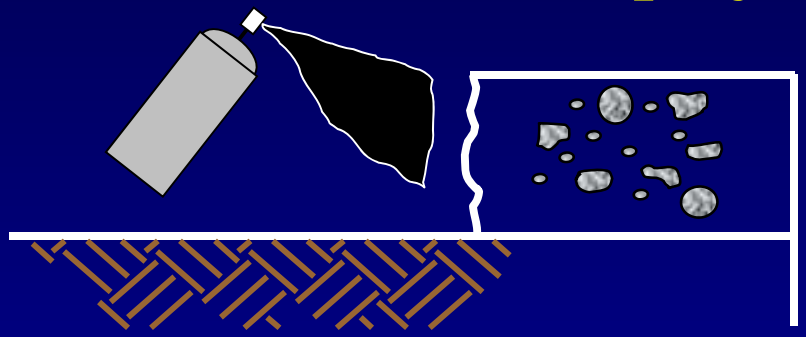


Seal Edges

Yes! Brush



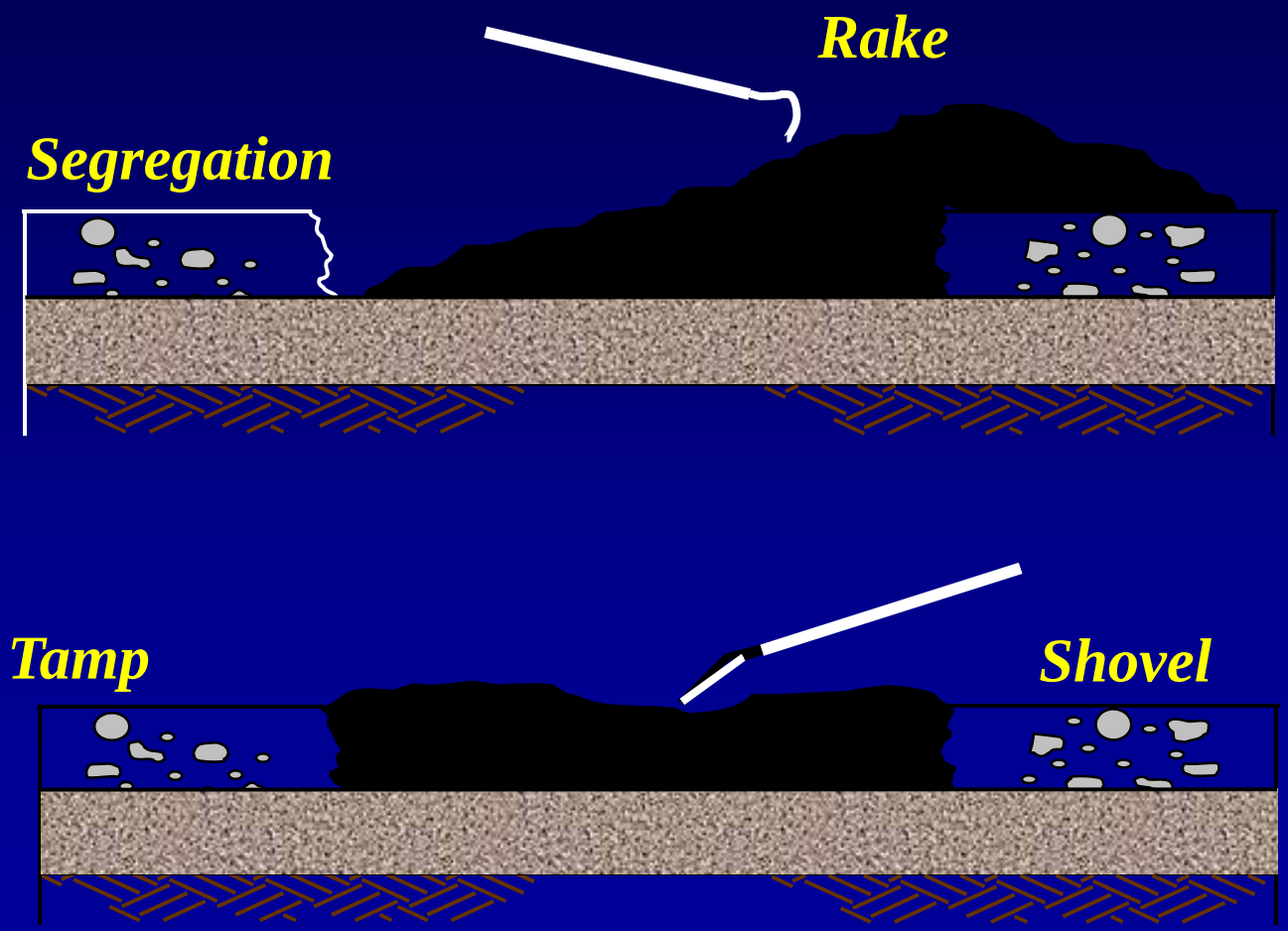
Yes! Spray



No!! Pour

puddle

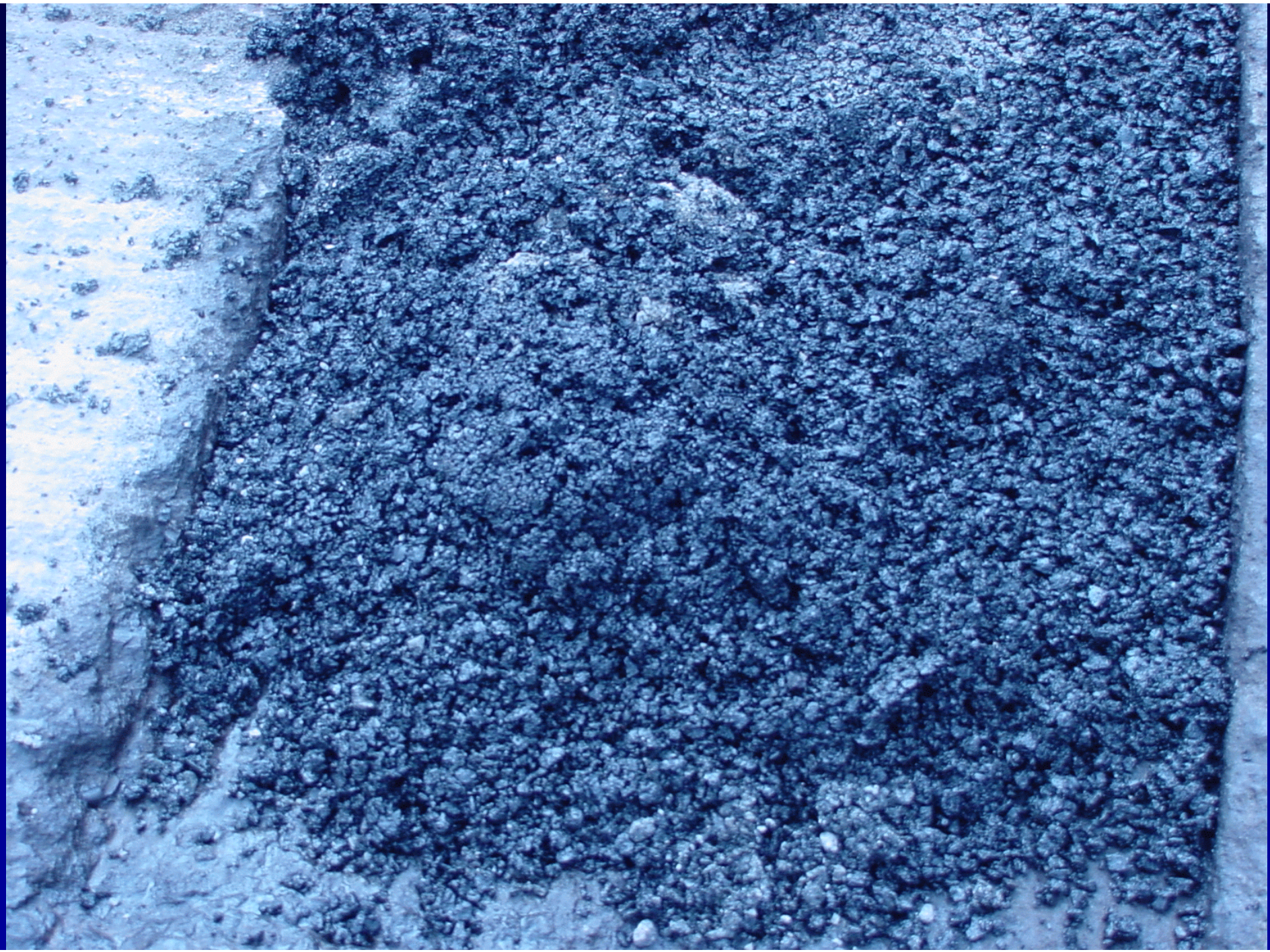
Material Placement



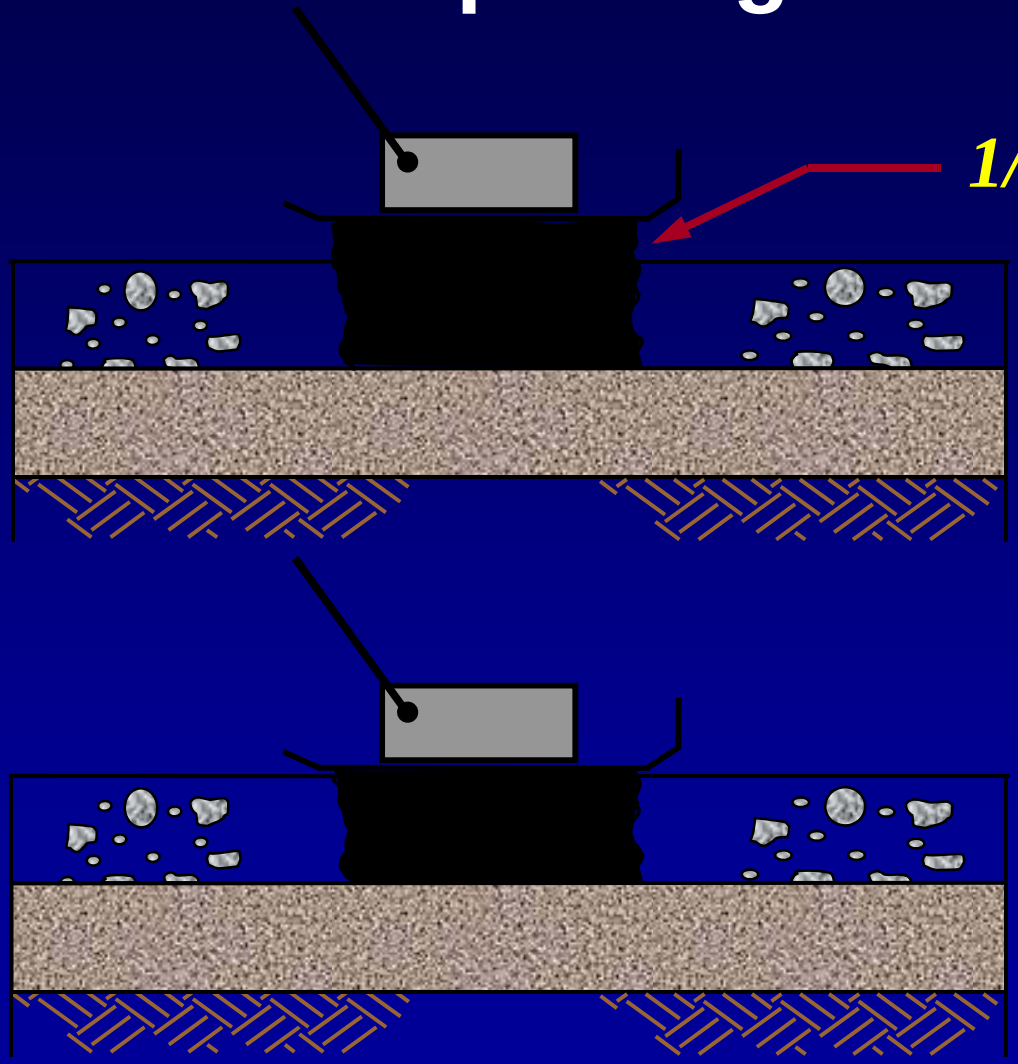

LITCHFIELD RD
763
bobcat
INGERSOLL-RAND
110
bobcat

Sufficient Material for Compaction

Max lift - 6 in



Compacting The Patch



Good compaction

Poor compaction

Compacting The Patch


SPEED
LIMIT
45

Finished Patch

Presentation Outline

- Overlay Prep
- **Composite Pavements**
- Preventive Maintenance

Rehabilitation of Concrete Pavements

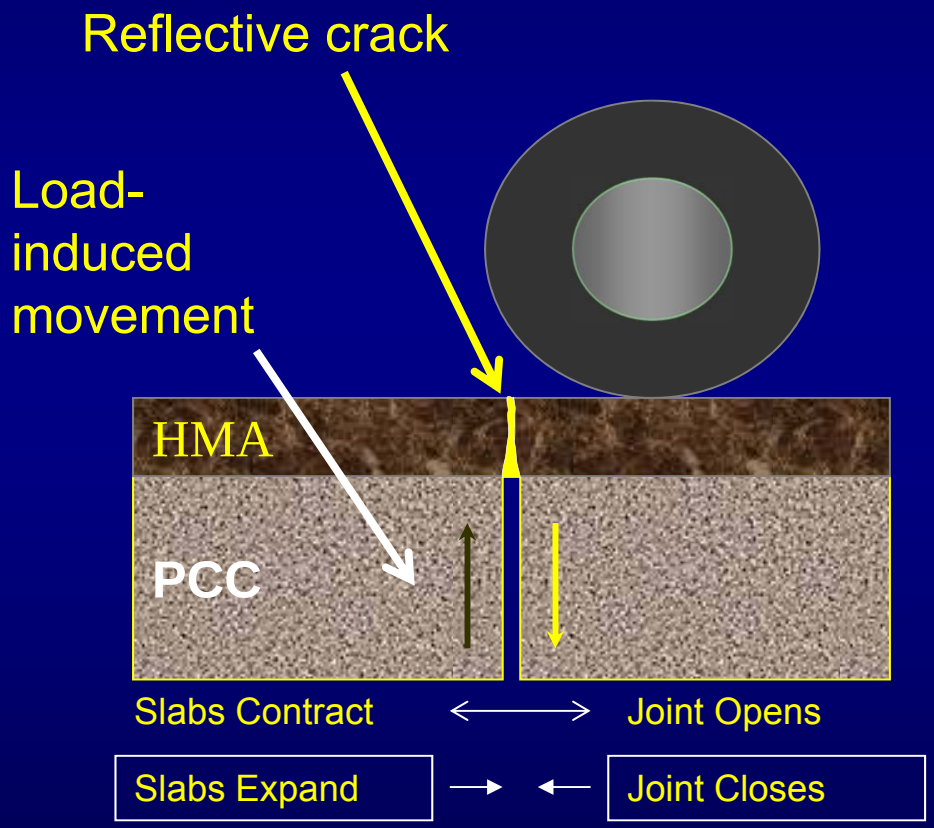
- Improve ride quality
- Correct surface defects
  - improve surface drainage
  - increase surface friction
- Delay/prevent structural deterioration
- Strengthen pavement structure (rehabilitation)

Rehabilitation Design Factors

- Condition of existing pavement
  - Drainage
  - Distress
  - Response to load
- Foundation strength/stiffness
  - Subbase
  - Subgrade
- Future traffic loading
- Additional corrections (safety, capacity, etc)

Reflective Cracking

- By far, the biggest issue in HMA overlays of PCC pavement
- Caused by movement at PCC joints and cracks



Design Issues

- Rate of propagation through overlay
- Number of reflected cracks
- Rate of deterioration of reflected cracks
- Amount of water that can infiltrate through the cracks

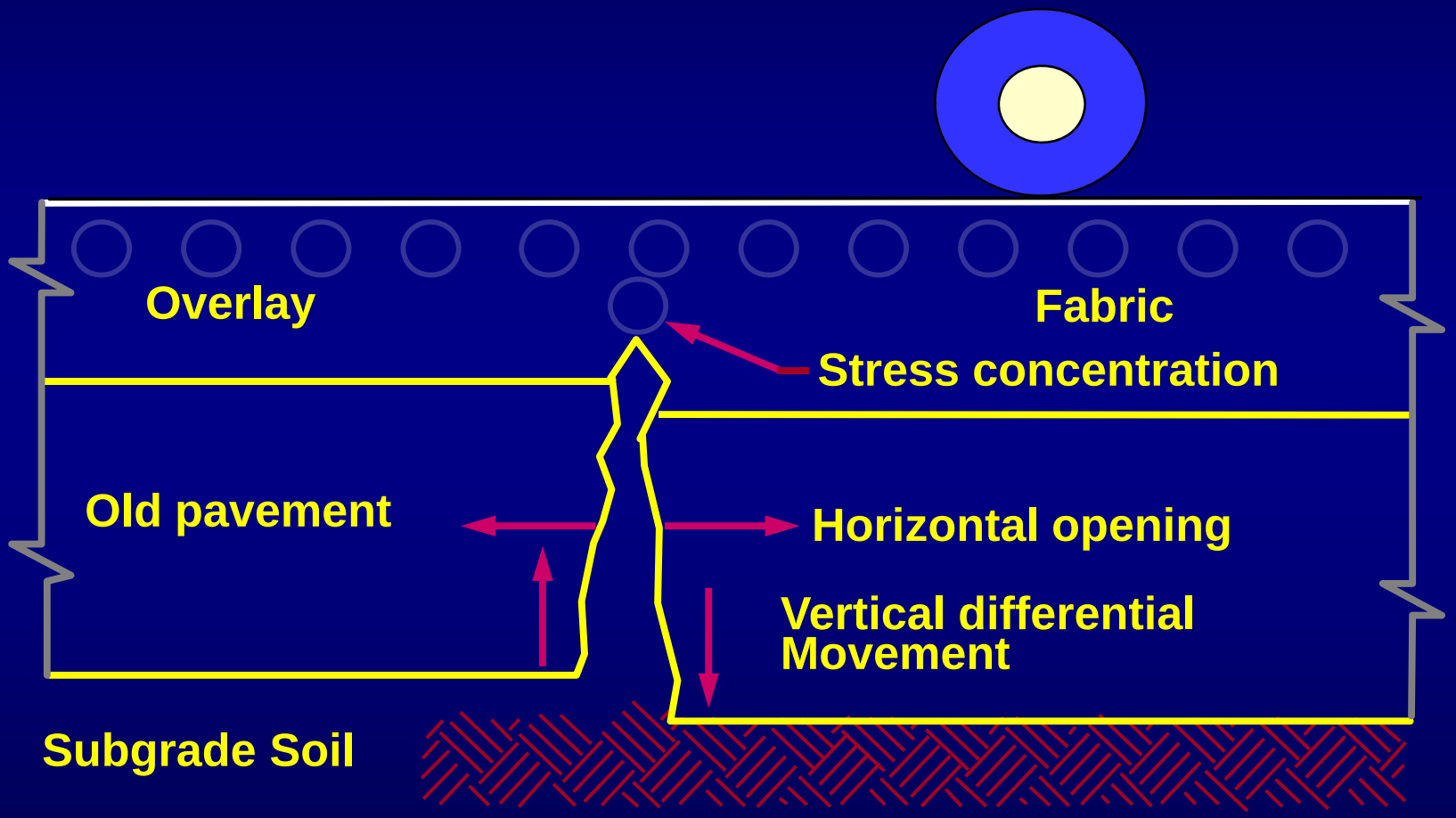
Reflection Crack Control Measures

- Fabrics
- Stress-relieving interlayers
- Crack-arresting interlayers
- Pre-overlay treatments
- Slab repair or replacement
- Sawing and sealing joints
- Increased overlay thickness

Crack Control Effectiveness

- Delay the occurrence of cracking
- Reduce the number of cracks
- Control the crack severity
- Provide other benefits
  - Reduce overlay thickness
  - Enhance waterproofing capabilities

Fabrics


Overlay
Fabric
Stress concentration
Old pavement
Horizontal opening
Vertical differential
Movement
Subgrade Soil

Fabric Application

Pre-overlay Repairs

- Slab stabilization
- Fractured slabs
- Slab repair / replacement
- Load transfer restoration

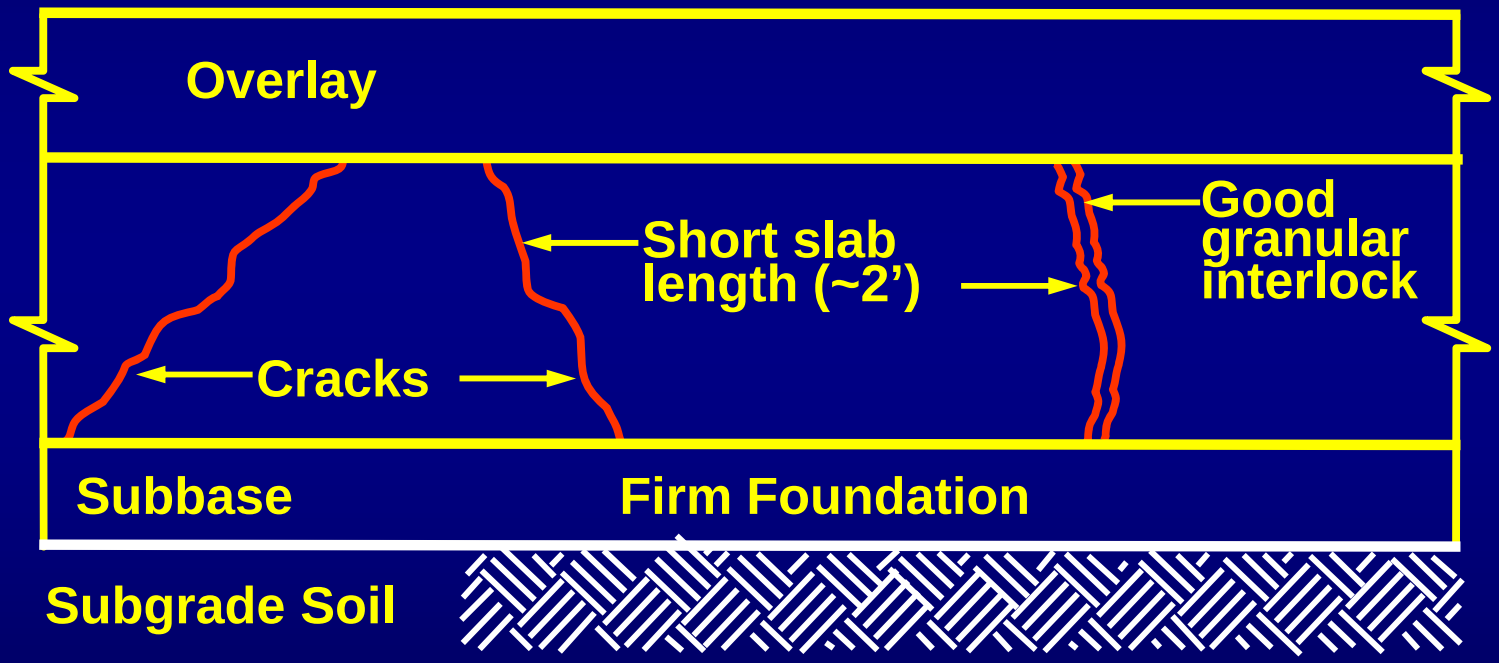
Fractured Slab Techniques

- Crack and seat (JPCP)
- Break and seat (JRCP)
- Rubblize (JPCP, JRCP, CRCP)

Cracking and Seating

- Shortens effective slab length
- Standard practice in many States
- Not "generally" recommended for use on poor subgrades
- Design methods (overlay thickness)

Cracking and Seating



Cracking and Seating

Cracking and Seating

Rubblization

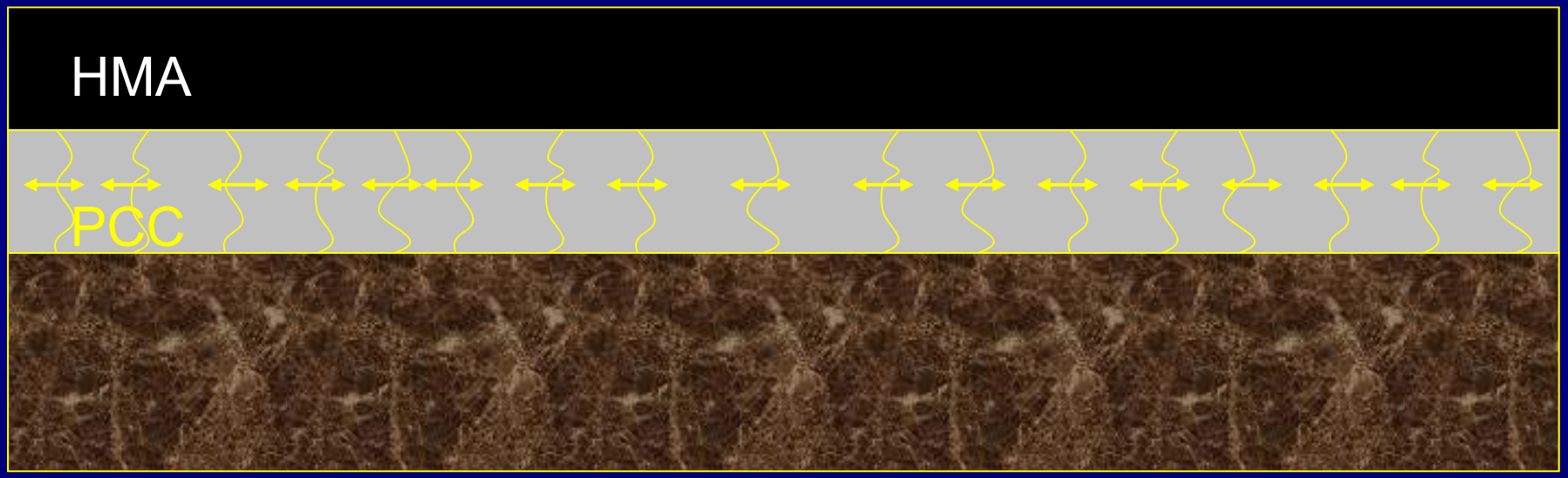
- **Fracturing:**
  - **Eliminates slab action**
  - **Destroys bond between concrete and steel**
- **Rubblized base responds as a tightly keyed, interlocked high-density, unbound layer**
  - **Layer cannot crack; already fractured**

Why Rubblize?

- Fracturing PCC to segments less than 9” precludes reflection of:
  - Joints
  - Cracks
  - Faults
- Production Rates up to 1 lane-mile/day

Rubblization

Smaller Pieces = Smaller Movement = No Cracking



Rubblization - Equipment

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When to Rubblize

- Patching ≥ 10%.
- Severe D-cracking.
- Severe ASR or ACR cracking.
- Dowel bar locking
- Severe joint deterioration
- Persistent faulting.

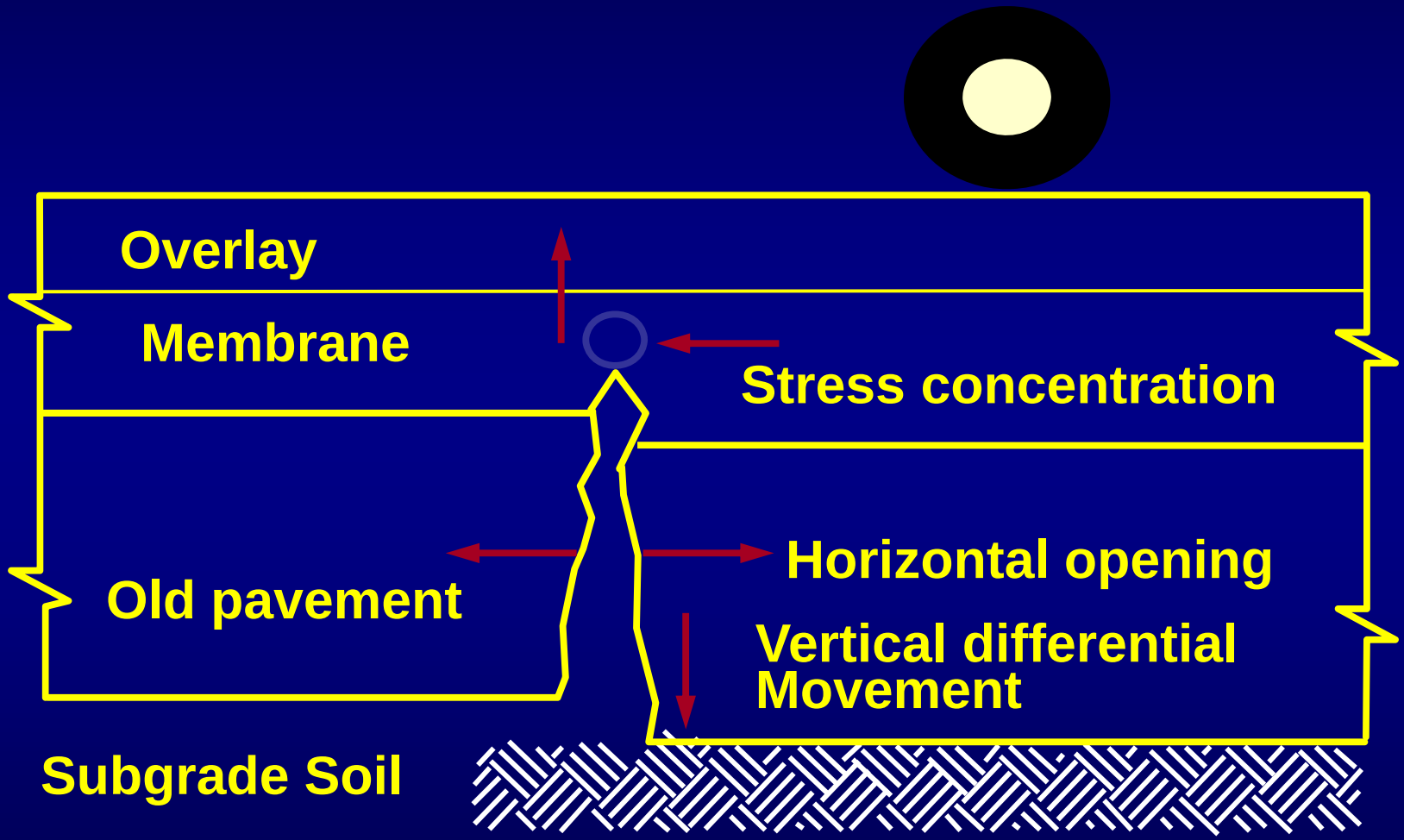
Precaution

- Weak soils may make construction difficult.
- Option 1
  - Adjust breaking pattern (12 - 18”) in soft areas.
  - Use normal seating rolling.
  - Resume smaller pattern after weak area.

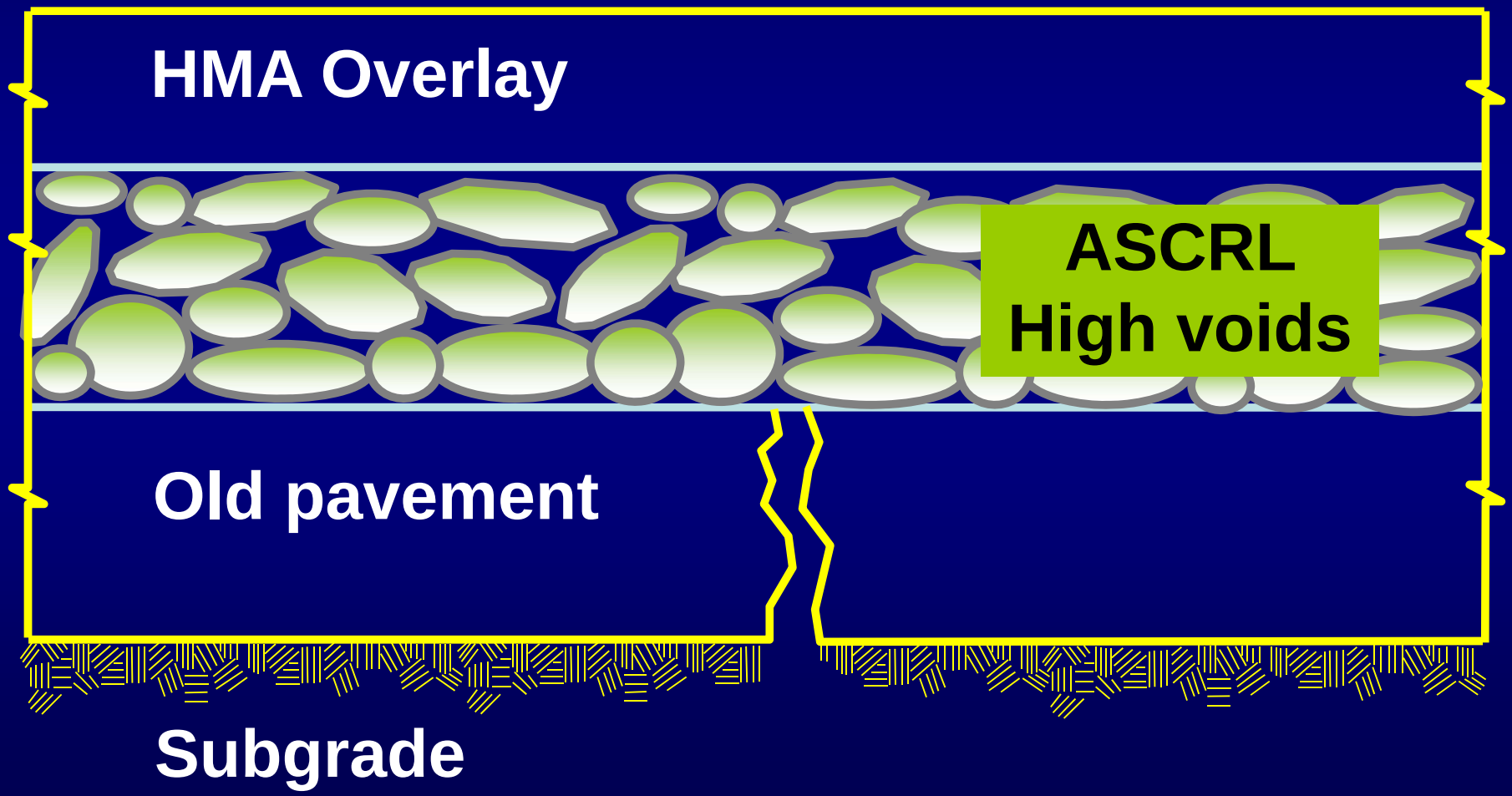
Precaution

- Option 2
  - Cease rubblization
  - Define weak area
  - Remove/replace problem material
  - Resume normal operations when past weak area
- Perform a good soils evaluation prior to construction

Stress-Absorbing Interlayers



Asphalt Stabilized Crack-Relief Layer (ASCRL)



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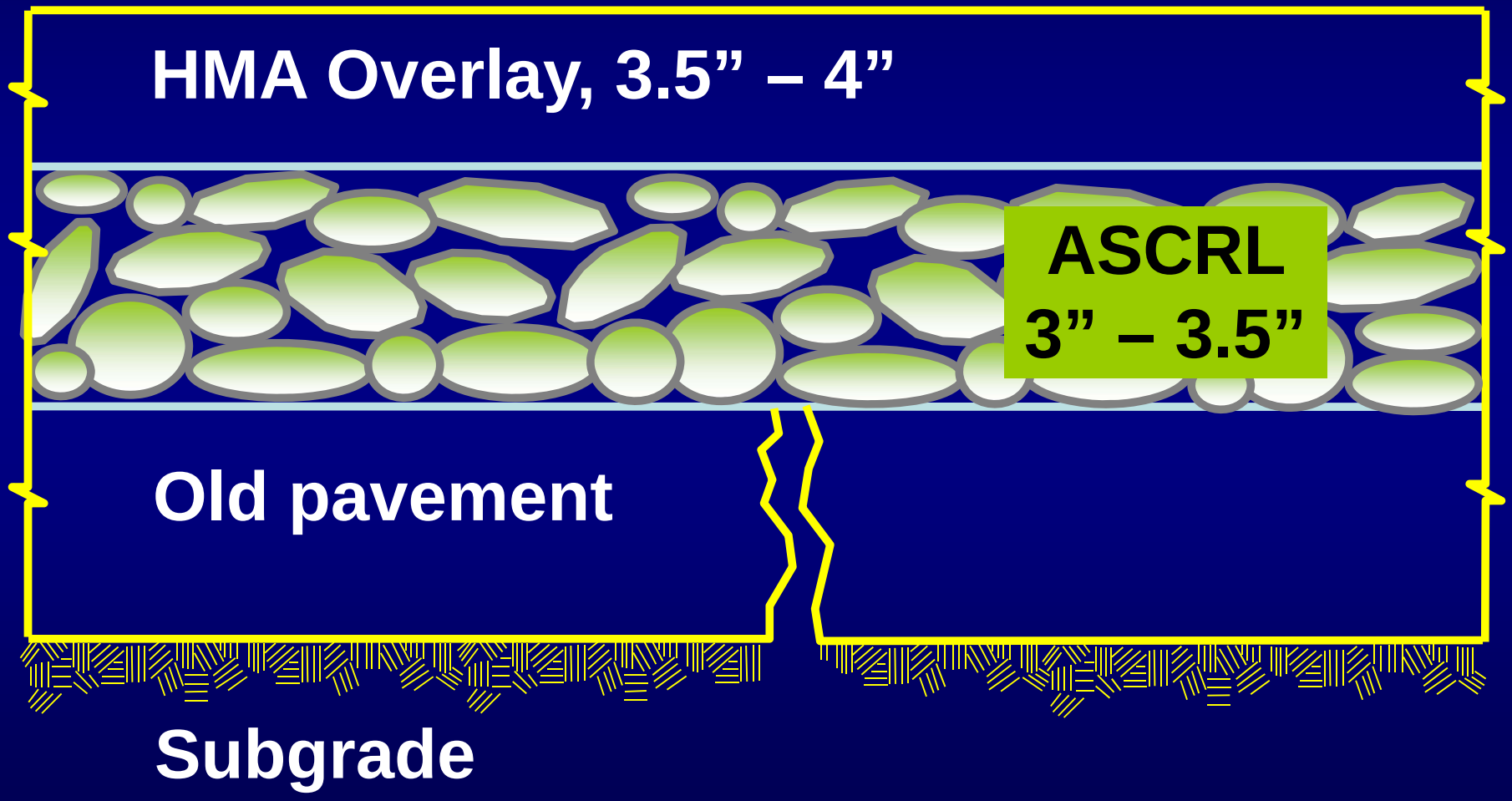

Asphalt Stabilized Crack-Relief Layer (ASCRL)

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
ASPHALT STABILIZED CRACK RELIEF LAYER

C&T:GMM 1 of 4 C&T:APPR:JB:CJB:04-03-04

a. Description. Furnish, place and compact an asphalt stabilized crack relief layer (ASCRL) on a prepared pavement base according to the details shown on the plans or as directed by the Engineer. The HMA mixture will be provided according to the requirements of the 2003 Standard Specifications for Construction, except where modified herein.

b. Materials. The aggregate materials used to prepare the ASCRL shall meet the following requirements.

The coarse aggregate shall originate geologically only from natural sources. Crushed concrete or reclaimed asphalt pavement cannot be used in the ASCRL mixture.

Table 1 Aggregate Specifications

Gradation Requirements						
Sieve Size (inch)	1 1/2	1	1/2	No. 4	No. 30	No. 200 (LBW) (a)
Percent Passing	100	90-100	30-60	10-25	5-15	3-5
Physical Requirements						
Crushed Material, Min. (MTM 117) % (b)	95					
Loss, max., Los Angeles Abrasion (AASHTO T96) %	35					
Soft Particle (max) % (c)	5.0					

a. Loss by Washing shall be by MTM 108. Mineral filler may used to meet the required percentage.
b. The percentage of crushed material will be determined on that portion of the sample retained on all sieves down to and including the No. 4 sieve.
c. The sum of aggregate particles retain on the No. 4 sieve identified as shale, siltstone, clay ironstone and particles which are structurally weak or are found to non-durable in service.

c. Mix Design. The Contractor shall provide a mix design in accordance with the criteria herein. The following are the requirements for the testing, documentation, and material samples for a mix design verification. Submittal of the Mix Design and samples shall be made to MDOT,

Asphalt Stabilized Crack-Relief Layer (ASCRL)

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Asphalt Stabilized Crack-Relief Layer (ASCRL)

Mix Design

- Asphalt Binder – PG 64-28 with 0.5% liquid antistrip additive
- Asphalt content – 3 to 4 %
- Surface Coating – 100 % without excessive draindown (max 0.30 %)
- Minimum Asphalt film thickness - 9.0 microns
- Moisture sensitivity (AASHTO T283)

Asphalt Stabilized Crack-Relief Layer (ASCRL)

Construction

- Placed in a single layer
- Compaction – steel – wheeled tandem roller (1.0 ton per foot of drum length)
  - Static mode only
  - Minimum of three passes (down and back)
  - Compaction test strip may be required (minimize breakage of Agg.)

Asphalt Stabilized Crack-Relief Layer (ASCRL)

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MDOT Projects to Date

Project	# of Jobs	Length (miles)
ASCRL	44	150

Started in 1999

- All are performing very well

Asphalt Stabilized Crack-Relief Layer (ASCRL)

M-21, Before Construction

Asphalt Stabilized Crack-Relief Layer (ASCRL)

M-21, 3 years old

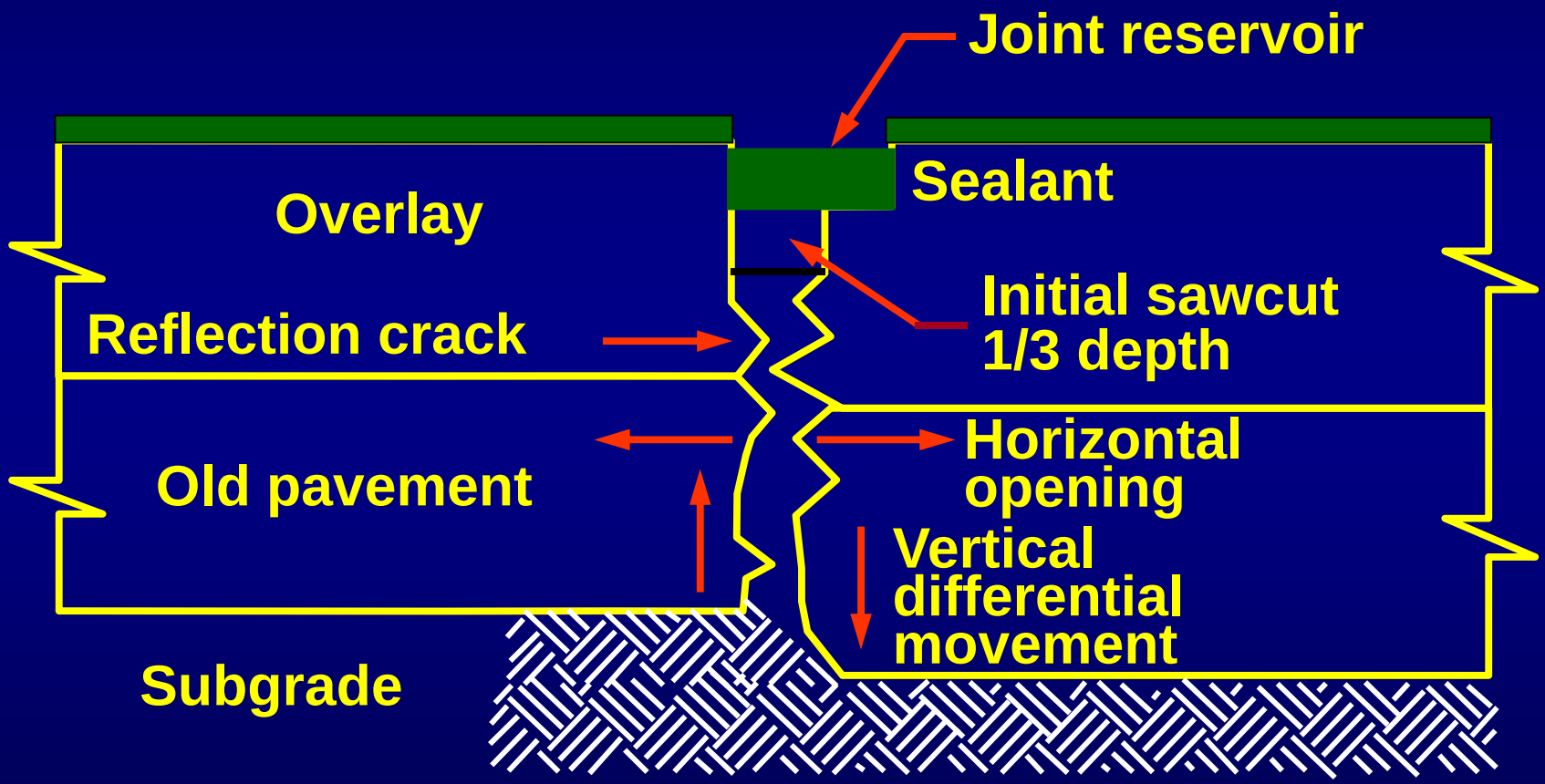
Asphalt Stabilized Crack-Relief Layer (ASCRL)

M-21, 7 years old

Sawing and Sealing Joints

- Concede appearance of reflection cracking
- Objective: control rate of deterioration
- Reduces spalling of reflection cracks
- Candidates should have well-defined joints
- Sawcut must be directly above underlying joint

Sawing and Sealing Joints



Sawing and Sealing Joints

Increased Overlay Thickness

- Delays occurrence of reflection cracking
- Cracks propagate about 1 in. per year
- Reduces temperature fluctuations in underlying pavement

Presentation Outline

- Mix Selection
- Rehab of Concrete Pavements
- **Preventive Maintenance**

Preventive Maintenance

WHAT EXACTLY *IS* YOUR PREVENTIVE MAINTENANCE PROGRAM PREVENTING?

Preventive Maintenance

Asphalt Pavement Association of Michigan

Preventive maintenance is a planned strategy of cost effective treatments to an existing roadway system and its appurtenances that preserves the system, retards future deterioration, and maintains or improves the functional condition of the system without substantially increasing structural capacity.

Preventive Maintenance

Standard Capital Preventive Maintenance Treatment
Pavement Seal

- HMA Crack Treatment
- Overband Crack Fill- Pretreatment
- Chip Seals
- Micro-surfacing
- Ultra-Thin HMA Overlay-Low & Medium Volume (<1″ thick)
- Shoulder Fog Seal
- Paver Placed Surface Seal

Preventive Maintenance

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Crack Treatment

Preventive Maintenance

Asphalt Pavement Association of Michigan

Chip Seal

Preventive Maintenance

Micro-surfacing

Preventive Maintenance

Asphalt Pavement Association of Michigan

HMA Ultra-Thin

High Value Pavement Enhancement

Extends pavement life
Protects pavement structure
Restores pavement smoothness

HMA Ultra-Thin

¾” to 1” Thickness

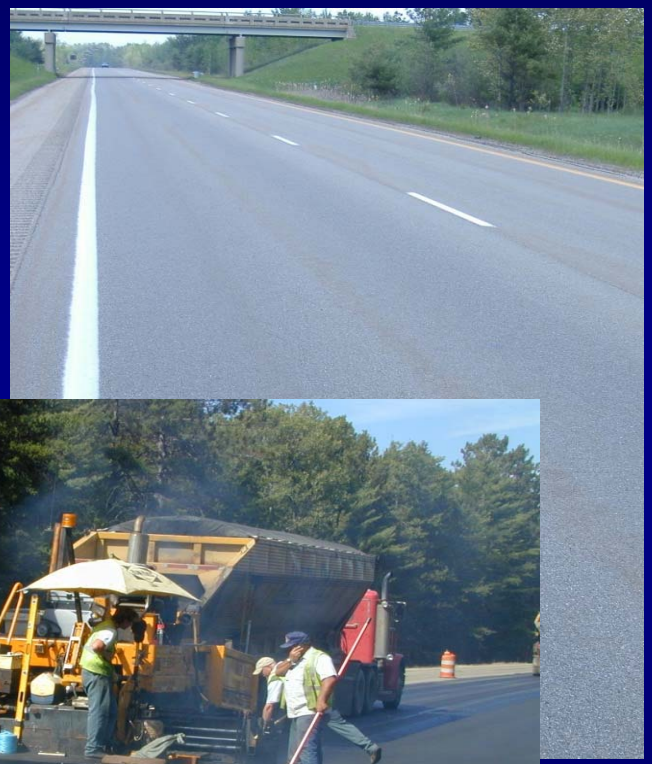
Asphalt Pavements – America’s Most Recycled Product

SMOOTH | DURABLE | SAFE | QUIET

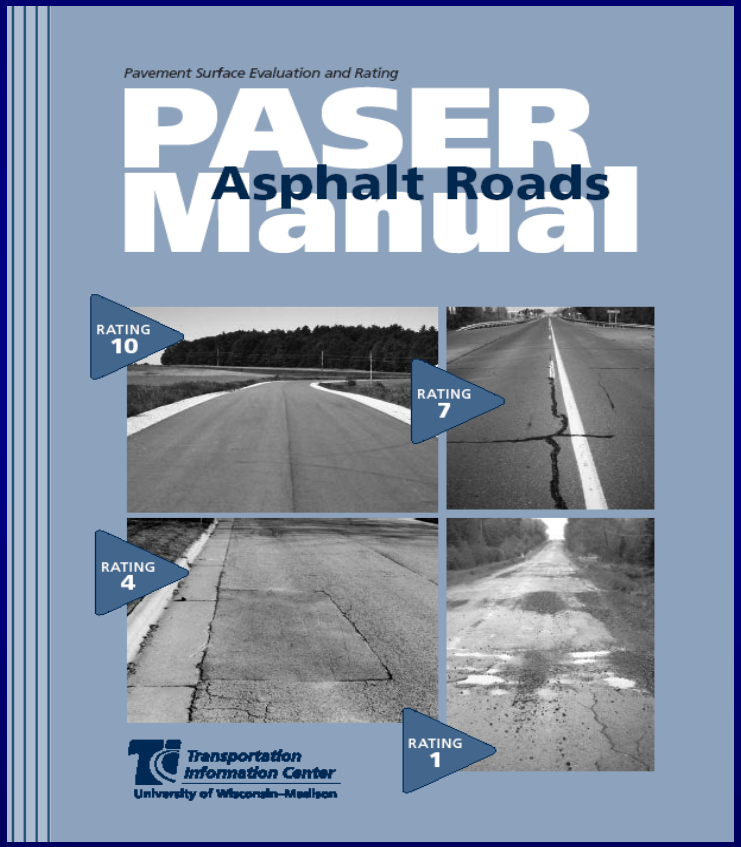
HMA Ultra-Thin

BENEFITS

- 5-9 year life extension
- Seals pavement to delay further deterioration
- Improve ride quality
- Minimize or eliminate structure adjustments
- Reduce noise
- Improve drainage
- Ease of construction, standard paving operation
- Minimal construction time



HMA Ultra Thin



4 – 6 Paser rating

HMA Ultra-Thin Performance

MDOT Projects - Statewide

UT Type	# of Jobs	Length (miles)	Avg. Age (end service)	Avg. Age (in service)	Avg. Age (overall)
Ultra-thin low	52	483	7.6 (20)	9.8	8.6
Ultra-thin med	41	339	5.5 (4)	8.6	6.6
Ultra-thin high	16	89	5.3 (3)	7.3	6.4

HMA Ultra-Thin Statewide

Preventive Maintenance Treatment Cost Comparison

Treatment	$/syd	Cost/mile (24' wide)	MDOT Life extension range (years)*	MDOT Life extension range average (years)*	Cost/mile* per year
Double chip seal	$3.37	$47,448	3-5	4	$11,862
Micro-surface	$2.88	$40,549	3-5	4	$10,137
Ultra-thin low	$2.51	$35,339	5-9*	9*	**$3,927**
Ultra-thin med	$2.75	$38,718	5-9*	8*	**$4,840**
Ultra-thin high	$3.36	$47,307	5-9*	7*	**$6,758**

*Average Life Extension estimated by APAM
Unit Prices based on MDOT Information (thru June 2017)

HMA Ultra-Thin Performance

Asphalt Pavement Association of Michigan

Micro 6 years old

UT 14 years old

Asphalt Pavements – America's Most Recycled Product

SMOOTH | DURABLE | SAFE | QUIET

HMA Ultra-Thin

	HMA UT	Chip Seal	Microsurfacing
Increase skid resistance	✓	✓	✓
Minimizes curb loss	✓	✓	✓
Corrects surface distress	✓	✓	✓
Can be applied in one pass	✓	✓	
Increases structural strength	✓		
Improves ride quality	✓		
Improves pavement draining	✓		
Corrects minor rutting	✓		✓
Eliminates dust, loose aggregate	✓		✓

HMA Ultra-Thin

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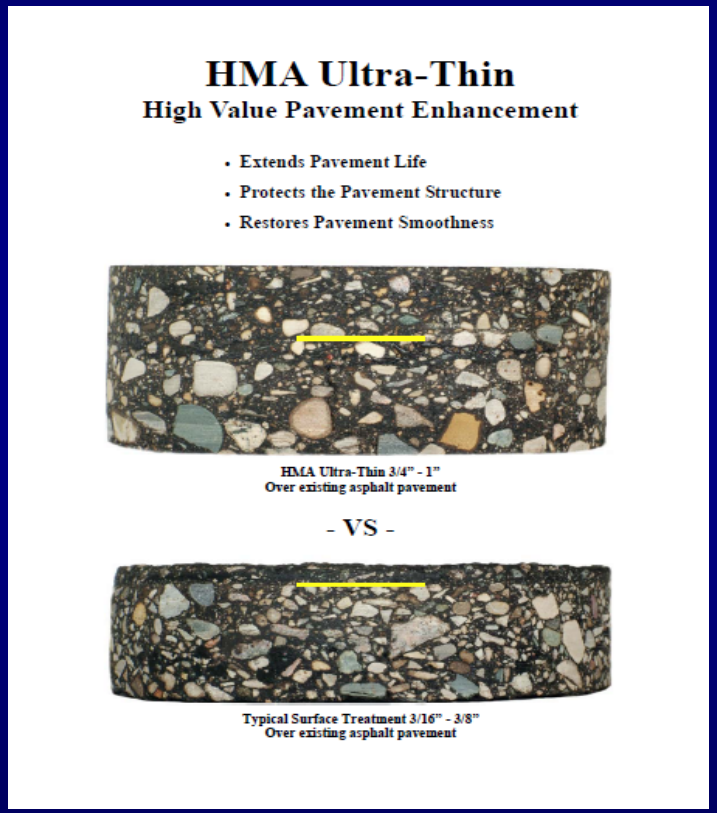
Advantages:

- Adds structural value
- Very smooth riding surface
- Improved ride quality
- No broken windshields from loose aggregate



Pavement Repair Options

Questions?