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# Asphalt Repair and Maintenance Techniques Airfields

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# Repair and Maintenance Techniques HMA Airfield Pavements

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- Serviceability/Performance
- Local repairs
- Global Maintenance Alternatives
- Rehabilitation Strategies

- Short introduction
  - More detailed instruction at the 3 day FAA sponsored Airport Pavement Workshop taught by the Asphalt Institute
  - Nov 5 to 7 in Baltimore

# Serviceability

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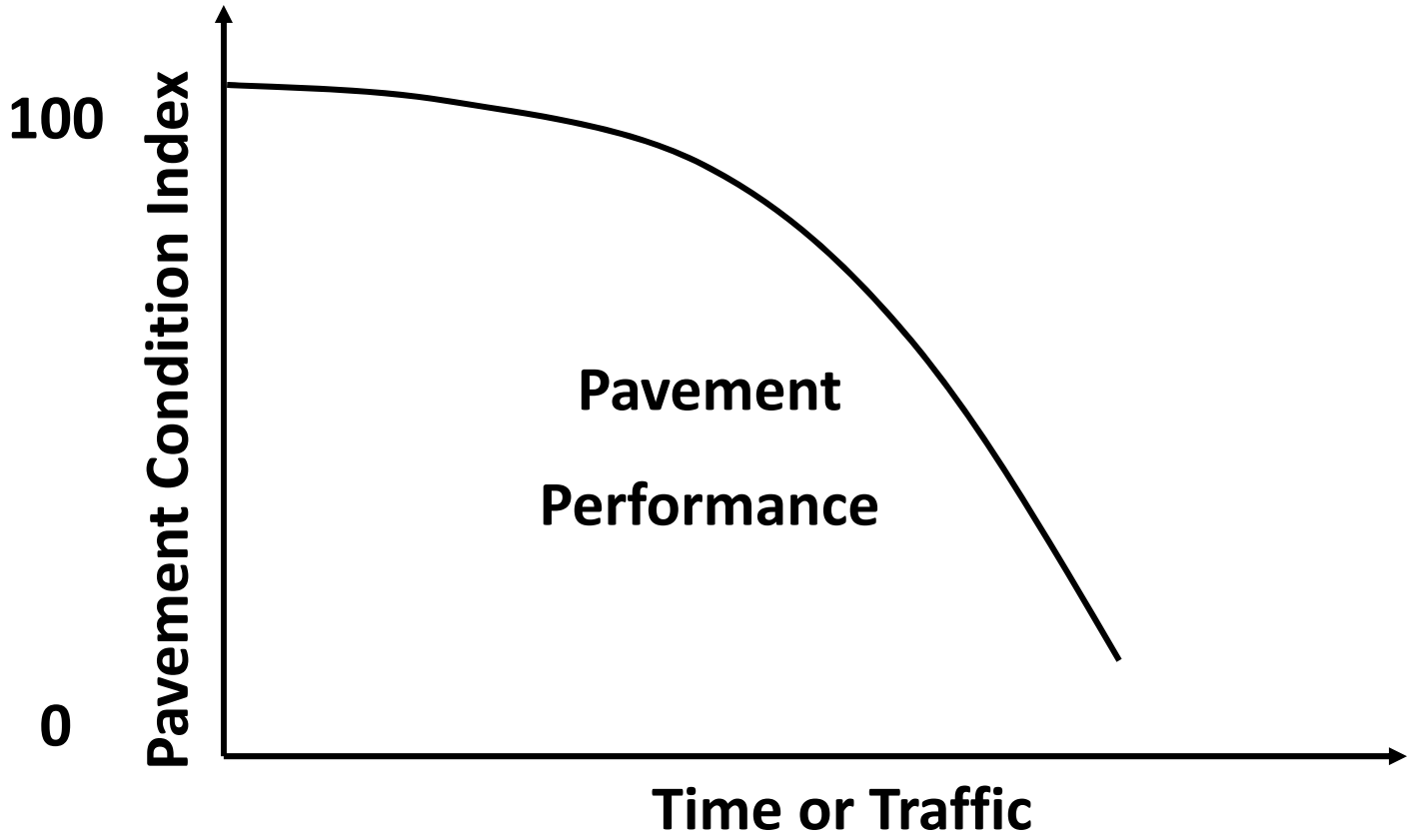
- **Ability of a pavement section to provide the intended service at a given point in time**
- **Method for quantifying the condition of a pavement section**

# Serviceability/Performance



# Pavement Condition





# Pavement Condition

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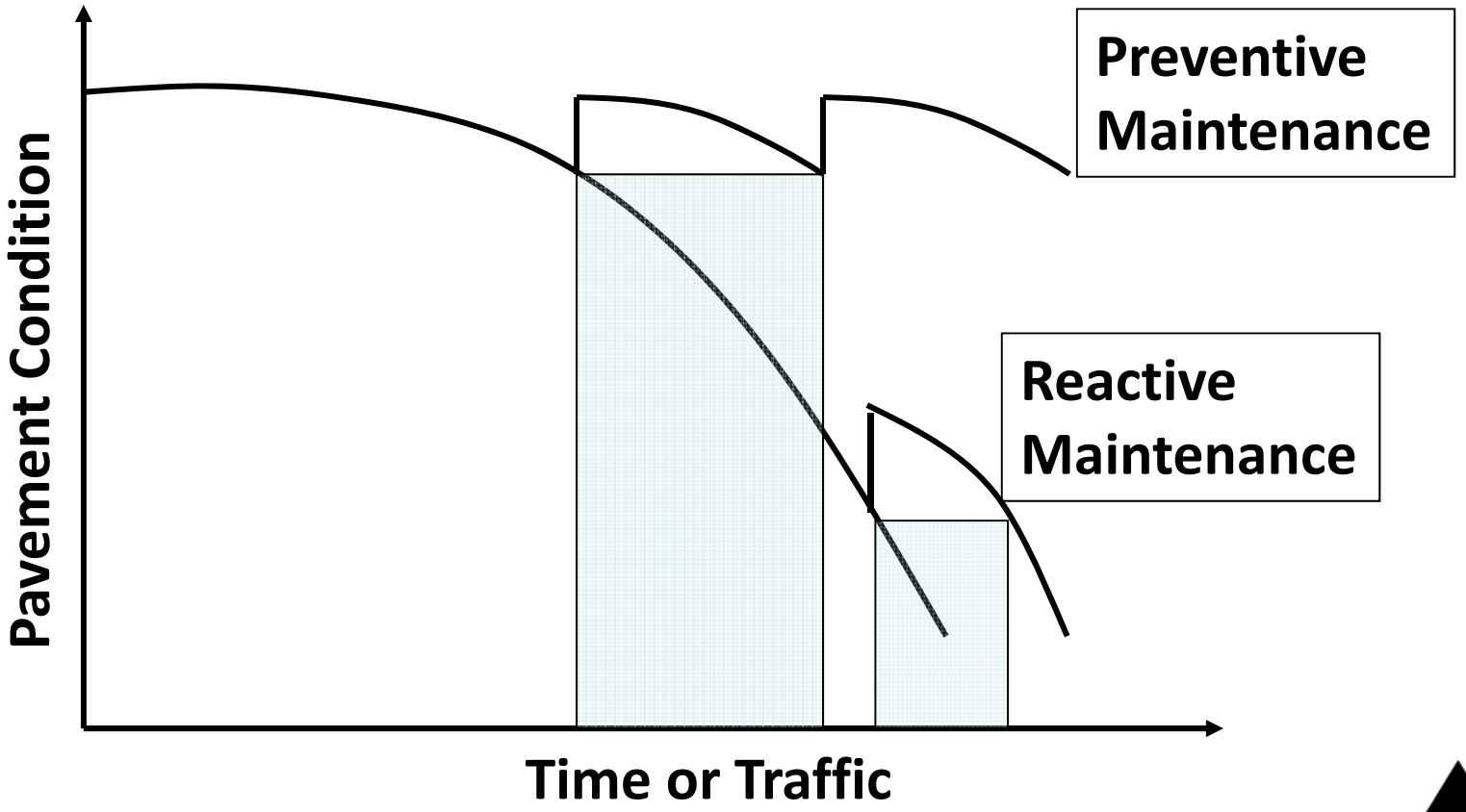

# Pavement Life Cycle

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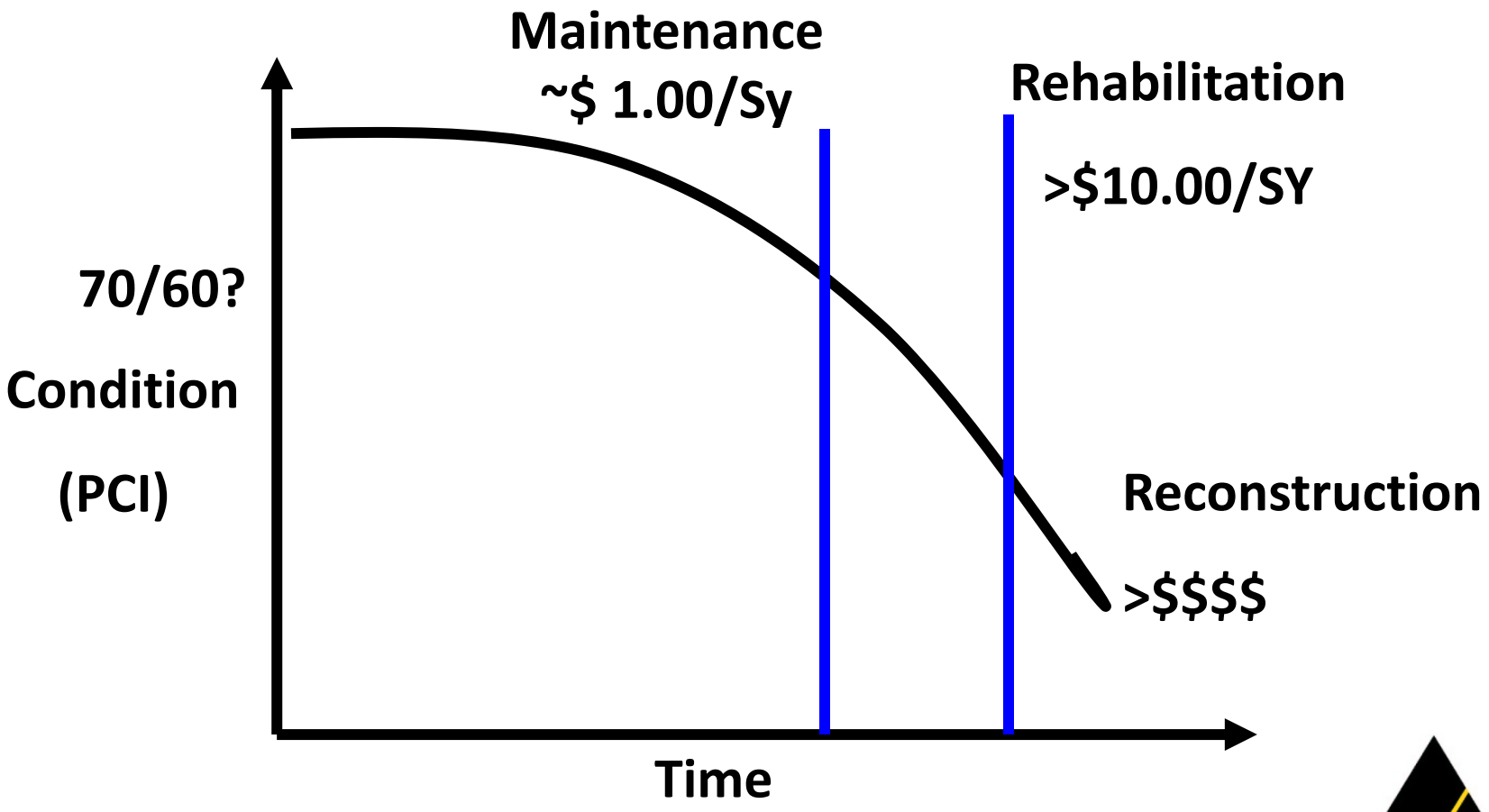

# Pavement Life Cycle Theory

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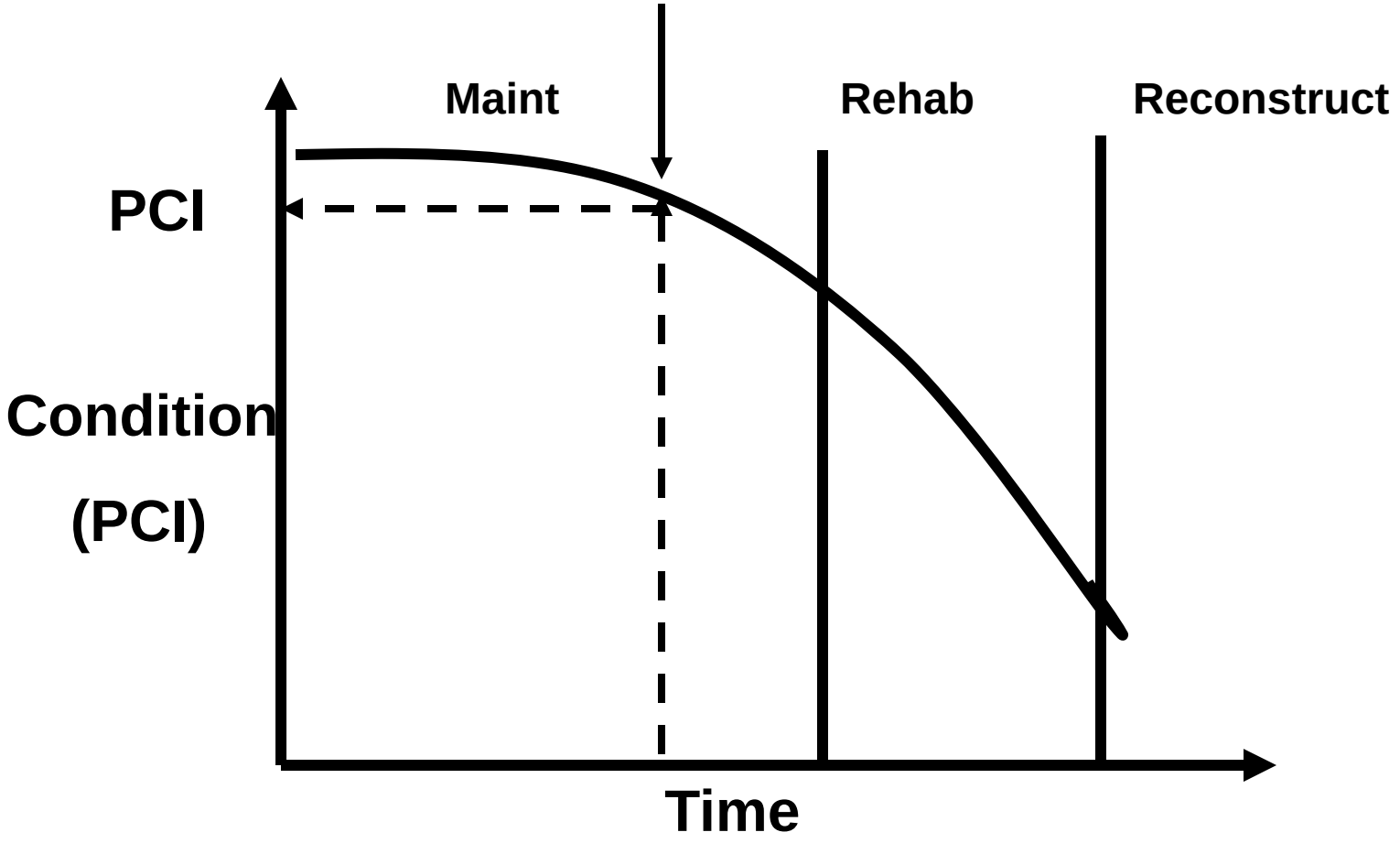
**A Point In Time = Serviceability**



# FAA Critical PCI



## GAO Report No. 98-226
## Airfield Pavement
## Critical PCI Values

- Critical PCI for primary airports is 65
- Critical PCI for small airports is 55

## Asphalt Airfield Pavement Performance

**FAA - July 1999**

# Pavement Condition Index (PCI)

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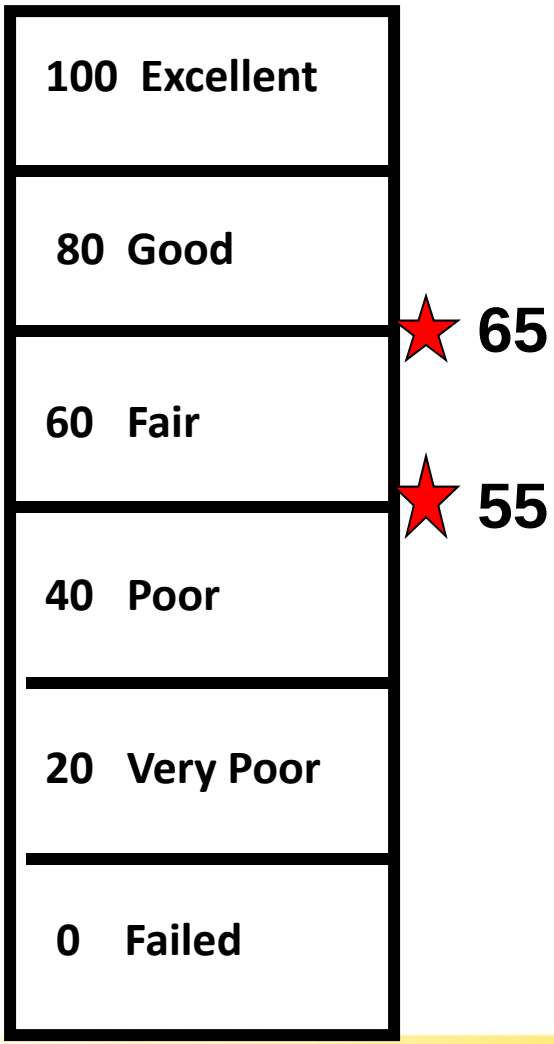


- Condition Survey - visual assessment of the pavement surface
- Survey quantifies the type, severity and extent of pavement distress
- Deduct valves for the distress provides a Pavement Condition Index (PCI)

# Repair and Maintenance Techniques HMA Airfield Pavements

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- Serviceability/Performance
- Local repairs
- Global Maintenance Alternatives
- Rehabilitation Strategies

# Pavement Repairs

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- Reactive activities that keep pavement in adequate functional condition
- Localized - does not affect entire surface
  - Crack filling /sealing
  - Potholes
    - Filling
    - Patching
- Global - normally to improve drainage, surface friction or ride quality

# Crack Repairs

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- Filling
  - Minimal preparation
  - Short-term life
  - Does not keep water out
- Sealing
  - Careful preparation
  - Long-term
  - Keeps water out

# Crack Repair Guidelines

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| Crack Width | Treatment Options |
|---|---|
| < 1/8 inch (3 mm), non-working | • Do nothing<br>• Fog seal<br>• Surface treatment |
| 1/8 – 3/4 inch (3 – 19 mm) | • Crack Fill (short life, prep for resurfacing)<br>• Crack Seal (> 5 yr life) |
| > 3 /4 inch (19 mm) | • Filling (sand or sand-emulsion slurry)<br>• Patching (cut and replace material) |

# Crack Filling

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- Pavements that will be resurfaced within 3 years
- Non-working cracks
- Cracks wider than ¾ inch
  - Often caused by cracking in underlying materials

# Crack Filling – Steps

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- Distress/crack survey
- Remove loose material from crack
  - Vegetation should be treated in advance using a strong herbicide (e.g., Round-Up, Finale)
  - Use compressed (preferably heated) air to clean and dry the crack
- Pour/apply sealant, preferably in flush-fill or over band configuration

# Crack Preparation

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- Cracks Must Be Clean & Dry
- Use Compressed Air

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# F.O.D. Containment



# Crack Filling Techniques

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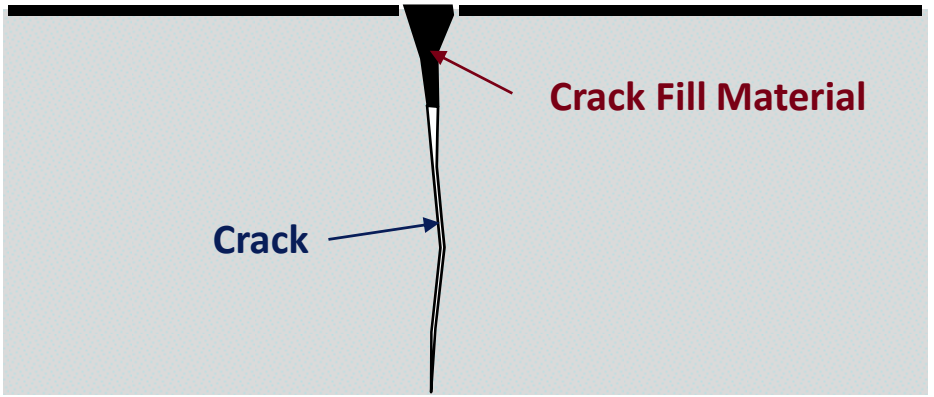
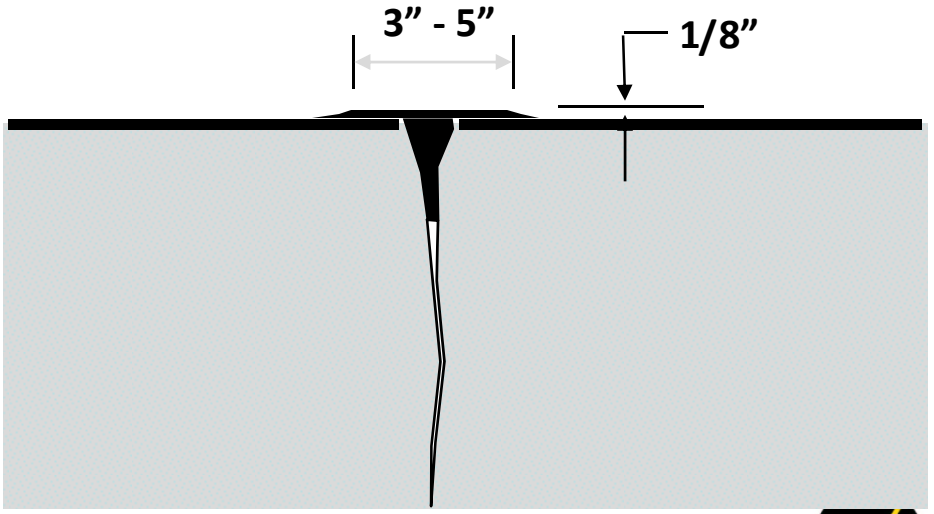
## Flush-Fill




## Over Band



# Don’t do this!

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# Proper Crack Filling Technique

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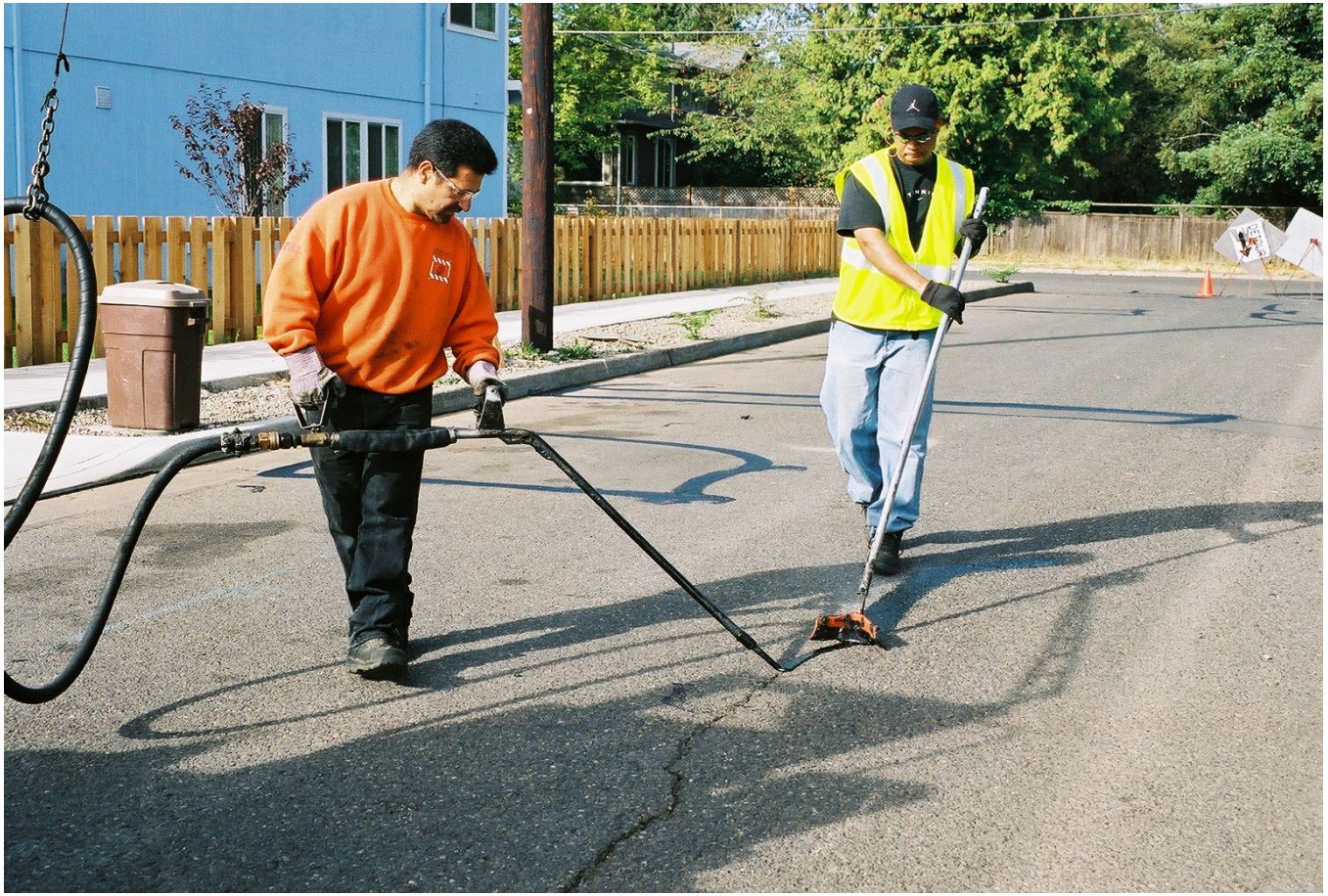

# Crack Filling Materials

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- Asphalt emulsions (CRS-2,-2h,-2P HFRS-2, -2P)
- Asphalt cements (PG 64-22, 67-22, etc)
- Fiber, mineral filled asphalts (proprietary)
- Sand-emulsion slurry
  - Particularly for wide cracks (>3/4 inch)
- Rubberized asphalt (ASTM D 3405)

# Crack Sealing – Steps



- Distress/crack survey
- Routing (establishing sealant reservoir dimensions)
- Blowing
- Apply sealant

# Routing

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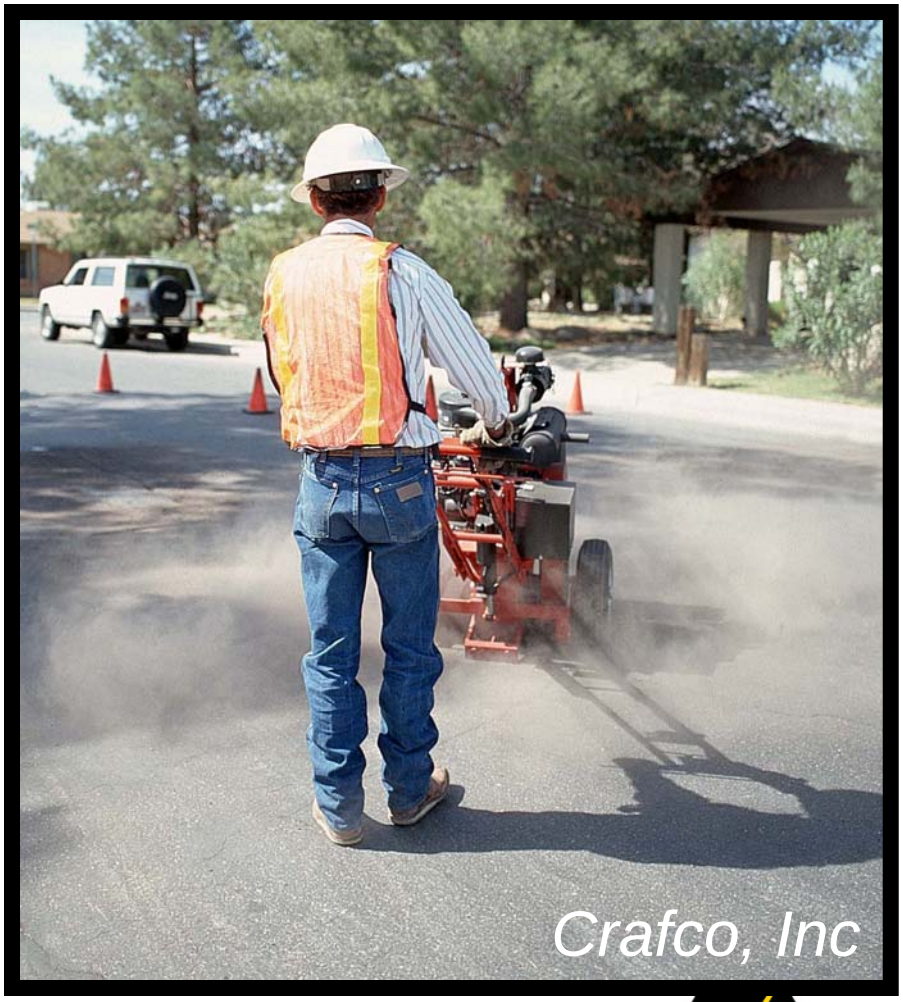
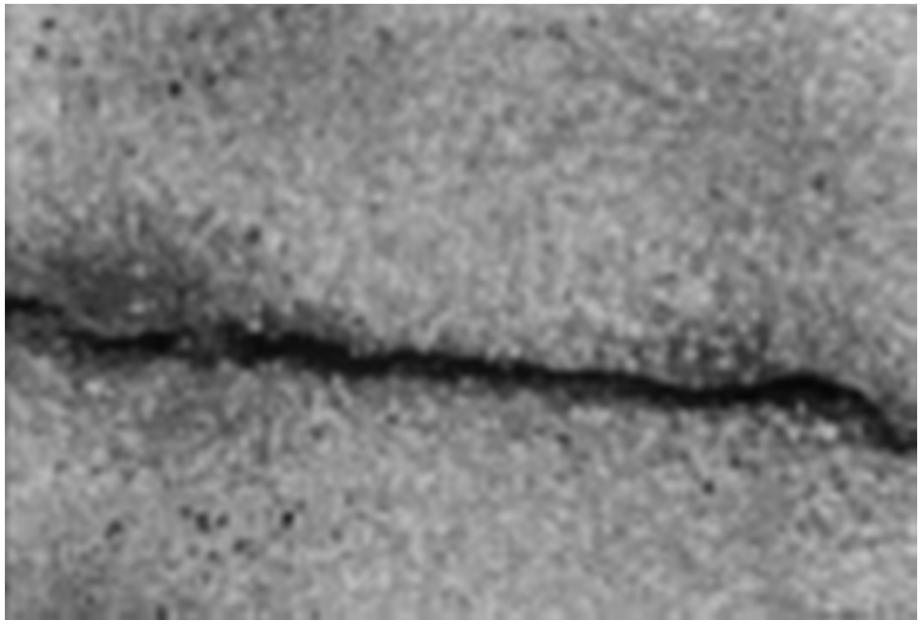
- Cut the pavement to a prescribed width and depth
- Improves sealant performance
  - Better adhesion
  - Reduced tensile stress on material



# Hot Air Lance



- Up to 3000°F
- > 2000 ft/sec blast velocity
- Propane burner heats air – no flame

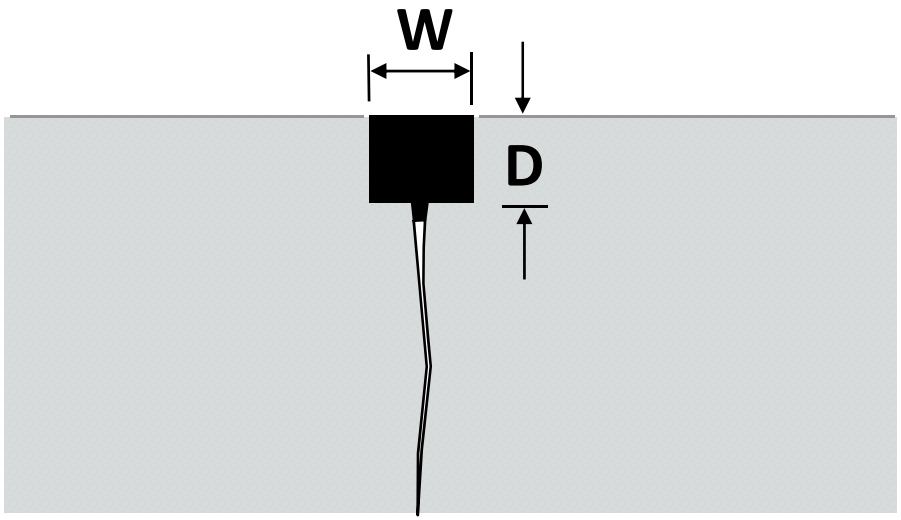


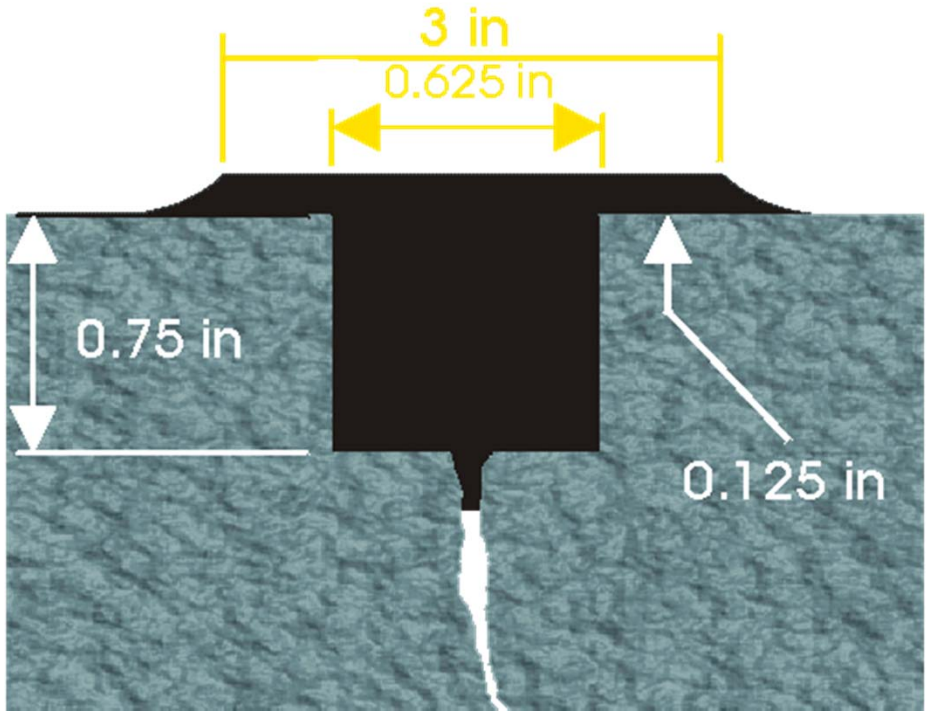
**Comments:**

- For wet conditions, lance can improve performance
- Otherwise, compressed air may be more effective (Québec study)

# Crack Sealing






**Typical Dimensions:**

**W = 12 mm to 19 mm**

**D = 12 mm to 19 mm**

# Crack Sealing Materials



- Rubberized asphalt
  - ASTM D1190
  - ASTM D3405
  - Manufacturers' recommendations for specific climate conditions
- Cold-applied sealants

# Finished Product



# Crack Repairs

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***When do you choose to fill or seal the cracks?***

- **Crack Filling**
  - **Pavement to be resurfaced within 3 years**
    - **Or in preparation for resurfacing**
  - **Extremely wide cracks (actually patching)**
- **Crack Sealing**
  - **No intent to resurface in > 5 years**
  - **Sawcutting over existing PCC joints**

# Pavement Repairs – Patching

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- Reactive activities that keep pavement in adequate functional condition
- Localized-do not affect entire surface
  - Crack filling/sealing
  - Potholes
    - Filling
    - Patching
- Global-normally to improve drainage, surface friction or ride quality

# Patching vs. Filling Potholes

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- Filling uses minimal preparation, can be viewed as "survival" treatments to maintain a safe riding surface
  - Often uses cold mix
  - When using cold mix, allow at least 6 months to cure before placing overlay or seal coat
- Patching is localized reconstruction that requires careful preparation
  - Normally use HMA in preparation for resurfacing or for "permanent" repairs

# Full Depth Patching

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- Removal of materials in failed area
  - Old pavement
  - Aggregate base
  - Subgrade
    - Remove materials down to firm support
  - Removal should extend 0.3 m (1 ft) beyond distressed area in all directions

# Full Depth Patching

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- Removal of materials (cont.)
  - Cut pavement with saw or hammer
  - Outline of area should be rectangular
    - Two faces perpendicular to traffic
  - Faces of excavation should be vertical, straight and solid
- Adequate drainage considerations
  - Wet base/subgrade corrections

# Vertical, Straight and Solid Faces



# Repair and Maintenance Techniques HMA Airfield Pavements

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- Serviceability/Performance
- Local repairs
- **Global Maintenance Alternatives**
- Rehabilitation Strategies

# Global Maintenance Alternatives

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- Thin HMA Overlay
- Surface Recycling (Hot-in place)
- Microsurfacing
- Cape Seal
- Slurry Seal
- Rejuvenator/Sealer
- Fog Seal

# Thin Lift HMA Overlays



- Usually not considered as atructural
- Recent research at the FHWA ALF site
  - Rutting of thin lifts (new and aged)
  - Ability to resist reflective cracking (new and aged)
- Studied previously non-loaded and loaded sections
- Applied a 25 mm inlay of Superpave 4.75 mm mix
- ALF simulates hwy tire wander on a 425 super single and applies a 71 kN (15.9 ton) load with a tire inflation pressure of 827 kPa (119.9 psi)

# Thin Lift HMA Overlays

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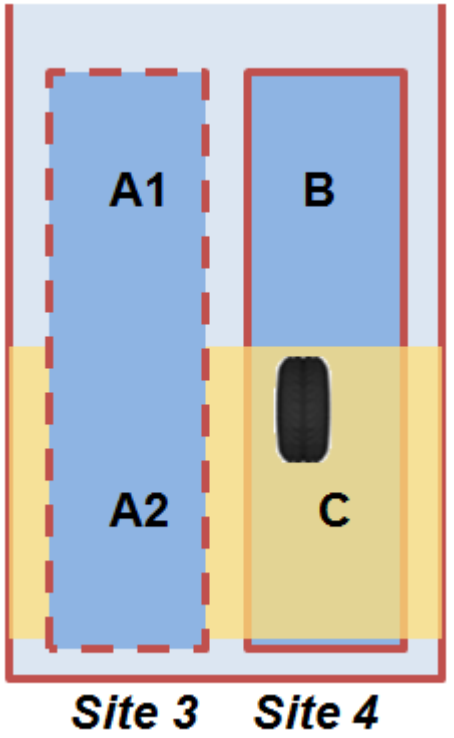
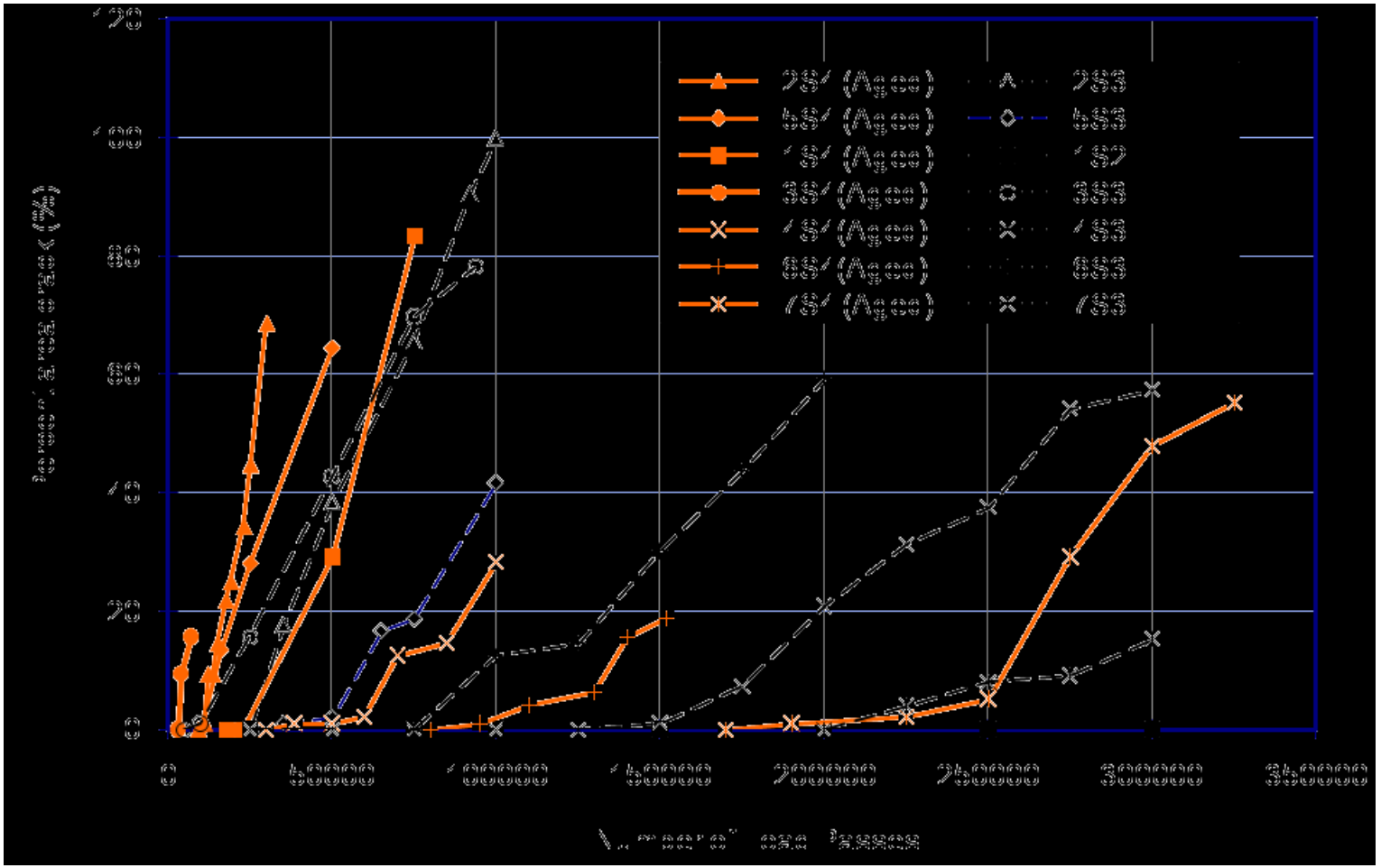



# Thin Lift HMA Overlays





# Thin Lift HMA Overlays

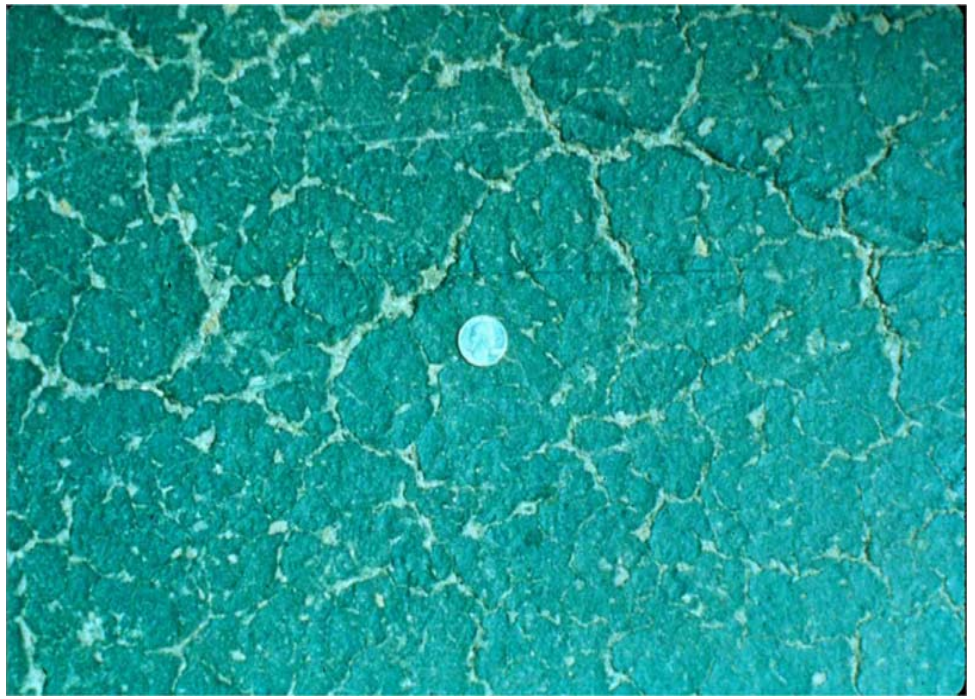


- **Conclusions**
  - "Thin overlay allows 8-year-old-***PLUS*** structure to perform like a 3-year-old structure
    - 425,000 passes to first crack new structure
    - 500,000 passes to first crack for overlay
  - Un-aged overlay had more binder volume with better cracking resistant properties
  - Without milling-and-overlay the structure performed significantly poorer
    - 50,000 passes to first crack"

# Coal Tar-Based Products



- Resistant to damage from fuels and lubricants
- Best applied where there is routine exposure to fuels or lubricants
  - Aprons, refueling areas
- Different coefficient of thermal expansion than asphalt
  - Results in shrinkage cracks in the seal
- Environmental Concerns



# Asphalt Rejuvenators



- Soften asphalt binder
- Reduce raveling
- Close and delay surface cracks

**Performance 3-5 Years**

**Best on shoulders or lightly trafficked GA airports**

# 4 Basic Steps for Hot In Place

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- Soften pavement with heat
- Scarification or mechanical removal of softened material
- Mixing with recycling agent, new aggregate, new binder, or new mix
- Laydown and paving

# Surface Recycling



- Rehabilitation process that restores cracked, brittle, and irregular pavement in preparation for a final thin wearing course
- Depth of 25 mm ( 1 inch) most common, 40 mm (1 1/2 inches possible)

# Surface Recycling



- Radiant or infrared heating
  - New technology uses super-heated air and recirculating plenums
- Propane - most common fuel
- Spring loaded scarifiers
  - New technology uses a small milling head to cut to exact depth

# Heating with Hot Air

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# Single Pass Remixing Equipment

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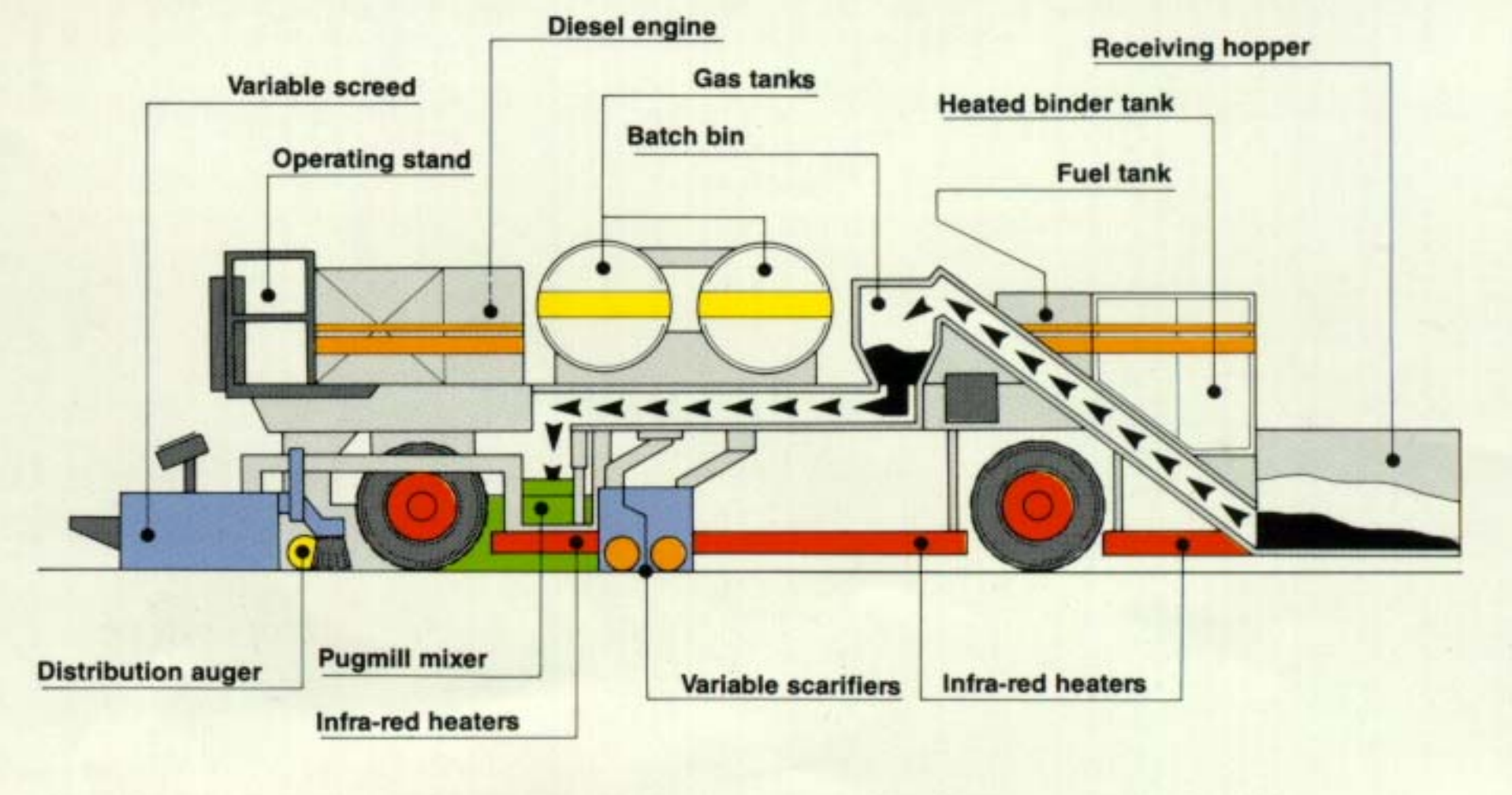

# HMA Compaction-Lift/Layer Thickness

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- Lift thickness
  - At least 3x nominal maximum aggregate size (NMAS)
- Multiple lifts help achieve:
  - Smoothness
  - Grade control
- Thicker lifts
  - Conserve heat longer
  - Provide more time for compaction
  - Easier for aggregate to “seat” under rollers

# Compaction

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- Essential to good performance!
- Need to compact to desirable air voids level
  - conventional dense-grade mixtures: 4-8%
  - gap-grade mixtures: 3-6%
- Compaction can only achieved if:
  - mixture is confined
  - mixture is hot (workable)

# Repair and Maintenance Techniques
# HMA Airfield Pavements

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- Serviceability/Performance
- Local repairs
- Global Maintenance Alternatives
- Rehabilitation Strategies

# Rehabilitation With Asphalt Overlays

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- **Asphalt Pavement**
  - **Overlay**
  - **Mill & Inlay**
  - **Mill & Overlay**

# Structural HMA Overlays



- Often include partial removal of existing pavement
  - Cold milling
  - Generates Reclaimed Asphalt Pavement (RAP)
- Investigate cause of distress before to decide
  - Depth of milling
  - Selection of mixture components
  - Type of Mixture

# Cold Milling

# Cold Milling

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- Mill below depth of distress
  - Rutting
  - Surface-initiated cracking
- Avoid milling to within ½ inch of interface
    - Granular base
    - Intermediate lift
    - Existing PCC
- Consider properties of existing HMA before milling
  - Increase the value of RAP obtained
  - Separate sealers from RAP

# Surface After Milling

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# Surface Preparation for HMA Overlays



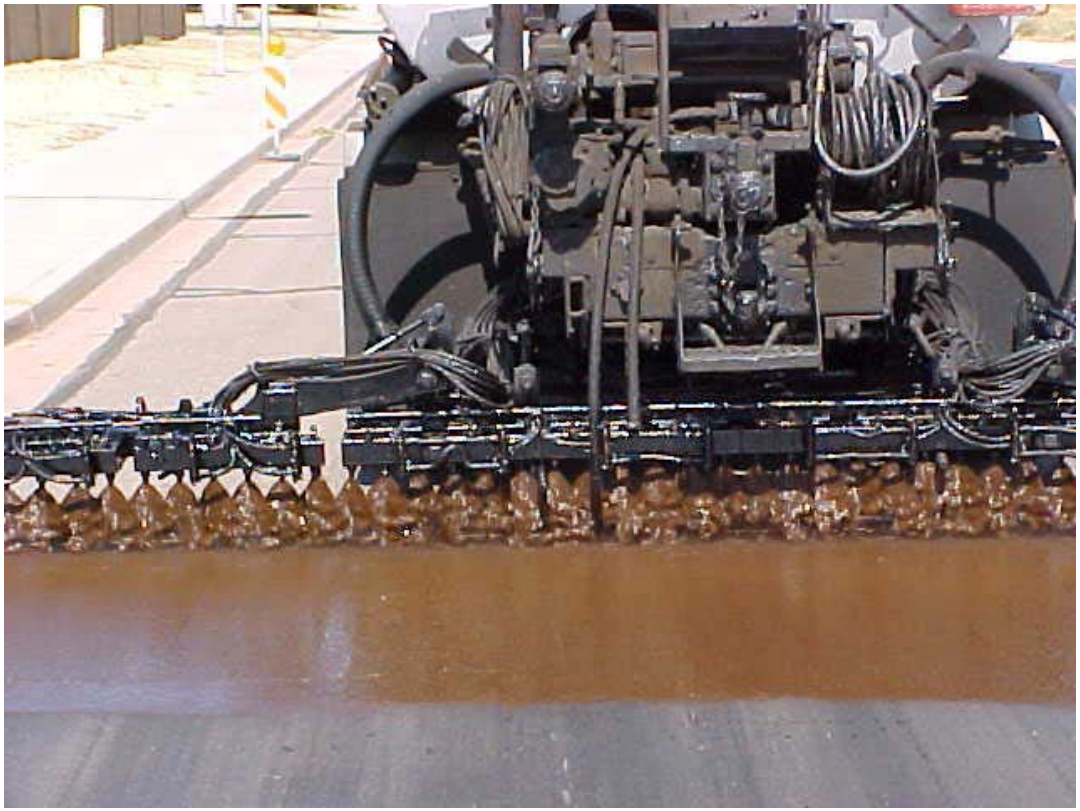
Thoroughly clean the surface

THE BLOWER REMOVES THE DUST THAT HAS NOT BEEN ENTIRELY SWEPT OFF BY THE BROOM.

# Surface Preparation for HMA Overlays


Thoroughly clean the surface

# Tack Coat Application



- Surface & vertical faces of abutting pavement
- Light, uniform application
  - Cut 50% with water
  - 0.04-0.07 gal/sy, residual
- Typical materials:
  - SS-1h, CSS-1h
  - Special Tack emulsions
    - Proprietary

# Fabric Interlayers



- Useful in sealing underlying pavement
- Can effectively delay reflection cracking provided:
  - Minimal lateral movement at joints or cracks
  - No vertical movement under loading
    - Excellent load transfer at PCC joints
    - No voids or evidence of pumping
- MUST BE INSTALLED PROPERLY!!!

# Fabric Interlayers



# When Installing Geotextile



- Fill cracks more than ¼ inch wide
  - Prefer recessed fill in advance
- Patch areas with alligator cracking
- If milling, place thin leveling course (1.5-2 in) using small-aggregate mixture
- Install fabric over compacted leveling course
- Place min 2 inches HMA
  - To adequately cover
- May eliminate recycling in the future

# “Tack” for Geotextile

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- Misnomer-should be called a membrane
- Essential for performance
  - 0.2-0.3 gal/sy of PG 58 or PG 64 asphalt binder
  - IMMEDIATELY behind distributor
    - Otherwise fabric becomes a bond breaker
  - Do not use emulsions or cutback!

# Geotextile Application

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- Easier to install
  - Isolated
  - Global
- Best on leveling course
  - Not bridging void
  - Reference joint/crack
- At least 2 in. HMA cover

- Interlayer Stress Absorbing Composite
  - ISAC®

# Airplanes Love Asphalt!

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