Pavement Distresses & Treatments

David Spainhour

(2023 Pavement Preservation Manual)

Diagnosing Pavement like Automobiles

- **1. The Breakdown**
- **2. The Parts**
- **3. The Mechanic**

1. The Breakdown

- Load Cracking
- Age/Thermal Cracking
- Delamination
- Oxidation/Hardening
- Texture Loss/Slickness

Load Cracking

- Fatigue Cracking (pictured)
- Edge Cracking
- Reflective Cracking

Age Cracking

- Block Cracking
- Longitudinal Cracking
- Transverse Cracking (pictured)

Delamination

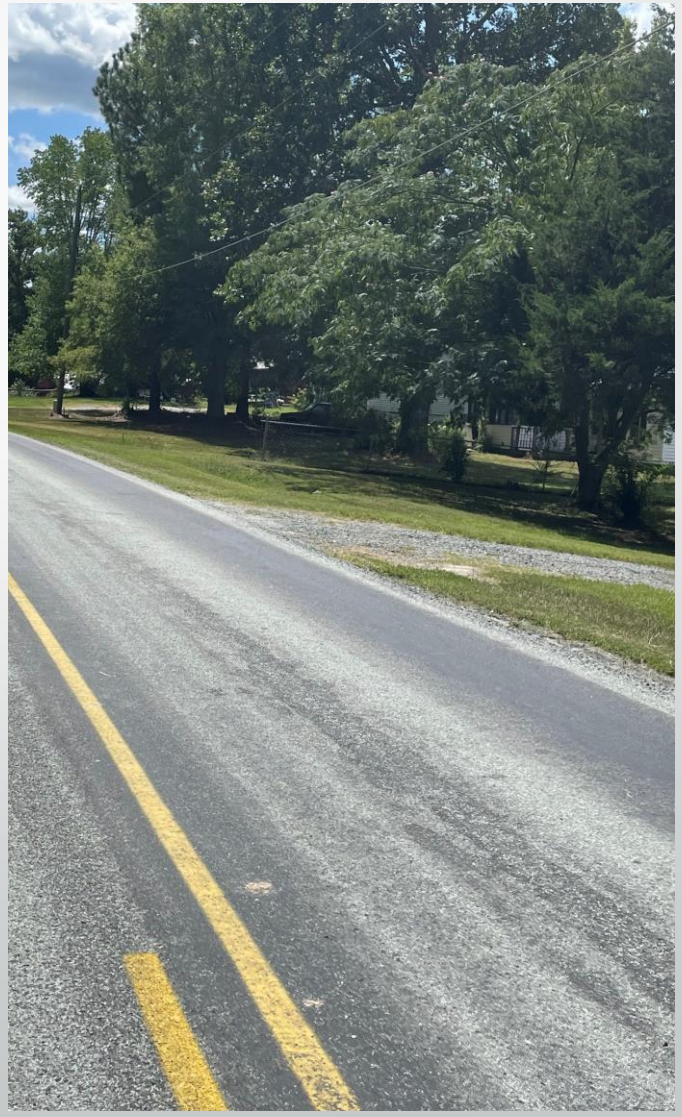
- Rutting
- Shoving (pictured)

Oxidation/Hardening

- Oxidation
- Raveling (pictured)
- Streaking

Texture Loss/Slickness

- Polished Aggregate
- Bleeding (pictured)



2. The Parts

- Full Depth Reclamation
- Crack Seal/Crack Fill
- Fog Seal
- Chip Seal
- HMA Overlay
- Slurry Seal
- Microsurfacing
- Cape Seal
- Full Depth Patching
- UTBWC and OGFC

Full Depth Reclamation

- Treated Recycled asphalt pavement and base material combined to create a stable, sound pavement structure
- Existing material is pulverized, additives are mixed in, then it is shaped and compacted; wearing surface added as final step
- Where to use it: PCR < 30; severe cracking > 50%
- Pros: Improved structure, restored profile, crack elimination
- Cons: Traffic control, cost
- Life Expectancy: 25 years (or until you retire)

Crack Seal/Crack Fill

- Where you use it: 70 <PCR < 85; moderate cracking with some severe cracking; where pavement still has good underlying structure
- Pros: retards water penetration by filling existing cracks , decreases potential of further cracking
- Cons: aesthetics, possible blistering
- Life Expectancy: 2-4 years

Fog Seal

- Where you use it: PCR > 85; Light cracking or oxidation, micro cracks, to slow oxidation process
- Pros: retards water penetration, low cost, reduces raveling and aging
- Cons: reduces skid resistance, lane closure required, minimal long-term benefits
- Life Expectancy: 1-2 years
- Where NOT to Fog Seal: rutted roads, moderate to severe distresses, fresh crack seal, dense graded asphalt mixes, where there's minimal skid resistance

Chip Seal

- Where you use it: 55 < PCR < 85; Light to moderate cracking, bleeding, oxidation; everywhere, according to Spainhour
- Pros: retards water penetration, delays raveling and aging, quick opening to traffic, increases skid resistance, slows or stops cracking
- Cons: loose rock, stripping from existing surface, wide variety of contractors
- Life Expectancy: 3-7 years
- Where NOT to Chip Seal: subgrade failures leading to pumping

Quality Chip Seal

Poor Chip Seal

HMA Overlays

Plant Mix Overlay

- When to use it:
  - 70 < PCR < 90, without milling
  - 60 < PCR < 75, with milling
- When to Mill: extensive cracking, surface profile issues, shoving, slippage
- Pros: retards water penetration into base structure, addresses surfaces issues, adjusts profile
- Cons: requires the base distresses to be addressed, cost
- Life Expectancy: 7-12 years

Thin Overlay (<1" thick)

- When to use it:

  PCR < 90, light or micro cracking, surface distresses only
- Pros: no loose stone, durable, restores profile and ride quality
- Cons: density, delamination, slippage, cost
- Life Expectancy: 2-5 years

Slurry Seal

- What is it: mixture of water, emulsion, aggregate, mineral filler, additives
  - Type I: seals surface cracks, low volume roads
  - Type II: corrects raveling oxidation, moderate to heavy volume roads
  - Type III: fills surface irregularities and restores skid resistance
- Where to use it: 75 < PCR < 90; early, light cracking
- Pros: retards water penetration, low cost, seals light cracks, fills minor voids, increases skid resistance, dark appearance
- Cons: lane closure, special equipment, not effective against most cracking
- Where NOT to use it: roads that are stripping or show moderate to severe cracking

Microsurfacing

- What is it: slurry seal on steroids; differences: polymer modified emulsion and dense graded crushed aggregate
- Where to use it: 50 < PCR < 85; where pavement structure is sound, and the oxidation and cracking issues have been addressed
- Pros: cures quickly, can be done at night, corrects ruts and profile issues, high quality materials, dark appearance
- Cons: cost, special equipment
- Life Expectancy: 4 – 7 years

Cape Seal

- What is it: Combination of Chip Seal (Double Seal) with a layer of Microsurfacing or Slurry on top
- Where to use it: 65 < PCR < 85, light to moderate cracking at least 30%, oxidation, raveling
- Pros: retards water penetration, increases durability, dark appearance
- Cons: two step process, traffic control, cost
- Life Expectancy: 7 – 13 years

Granville County Microsurfacing

Full Depth Patching

- What is it: a full depth milling of distressed pavement that is replaced with an asphalt pavement
- Where to use it: PCR < 75, moderate and severe cracking, localized rutting, potholes
- Pros: addresses the deeper distresses
- Cons: aesthetics and rideability
- Life Expectancy: 2 to 4 years

Ultra-Thin Bonded Wearing Course, Open-Graded Friction Course

- UTBWC (some refer to NovaChip): is an open graded HMA placed over polymer modified asphalt emulsion through a specialized, self priming paver
- OGFC: a type of HMA overlay with coarser rock intended to minimize hydroplaning
- Where to use it: Loss of skid resistance, wet crash patterns, high volume roadways
- Cons: Short life expectancy due to coarse surface

3. The Mechanic

- With a poor mechanic, even the greatest parts in the world won't matter
- A Good Mechanic:
  - Gets the road prepared for Treatment
  - Ensures Best Practices are used during laydown
  - Send your field personnel to our spring workshops!

How do I fix ____?

- Alligator Cracking
- Transverse Cracking
- Rutting
- Raveling
- Oxidation
- Bleeding
- Ride Quality Issues/Patching

Alligator Cracking

- Ideally: multiple asphalt lifts, but not feasible most of the time
- Feasible Repairs
  - Hairline Alligator: Fog, Chip or Slurry Seals as well as thin Lifts
  - Alligator with Pumping and/or Rutting: Pavement removed and patched
  - Alligator Cracks > 1/8” but no vertical movement: Chip Seal followed by additional treatments

Transverse Cracking

- These begin as 1/4" perpendicular cracks, 10-20 feet apart
- Over time they widen to ½" in a block pattern and more cracks within the 20-foot section will develop
- Repairs: crack seal can be applied as soon as the crack is wide enough to receive sealant.
  - Note: Routing is advised where spalling is present.

Rutting

- Causes: unstable mixes, poor compaction, lateral movement from loading
- Repairs:
  - Unstable mixes must be milled and replaced
  - Inadequate Base Material can be mitigated by either full depth patching or additional lifts of pavement
  - “Stabilized Ruts” can be filled then paved with Microsurfacing. Skin patching is also an option.

Raveling

- Repairs: Typical repair would be a Chip Seal, but the severity of the raveling should be considered. Profile should be checked to determine the layers and aggregate type for resurfacing.
  - Microsurfacing, Cape Seals, and Plant Mix Overlays should also be considered.

Oxidation

- Repairs: provided cracking is not an issue, the entire toolbox is available.
  - Short term fix: Fog Seal
- Historically, oxidation alone is not a trigger for action

Bleeding

- Common in AST pavements, but also Plant Mix with low air content
- Repairs: Chip Seals or Microsurfacing, on either pavement type. If bleeding is also present, it is likely an unstable mix and milling would be required.

Ride Quality and Patches

- Ride Quality issues may not mean there are pavement distresses.
- It is typically due to patching, rutting, bumps, or dips.
- If the pavement is structurally sound, a leveling course would be appropriate.
- Patching is a repair, but affects ride quality. Patches don’t always prevent water penetration, so additional treatment may be necessary.