Basic Portland Cement Concrete Maintenance Principles

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Background	• Why is maintenance important • Summary of Maintenance techniques
Pavement Distresses	• Types of distresses • Matching techniques to distresses
Maintenance Technique Design	• Materials
Maintenance Technique Construction	• Equipment and Procedures

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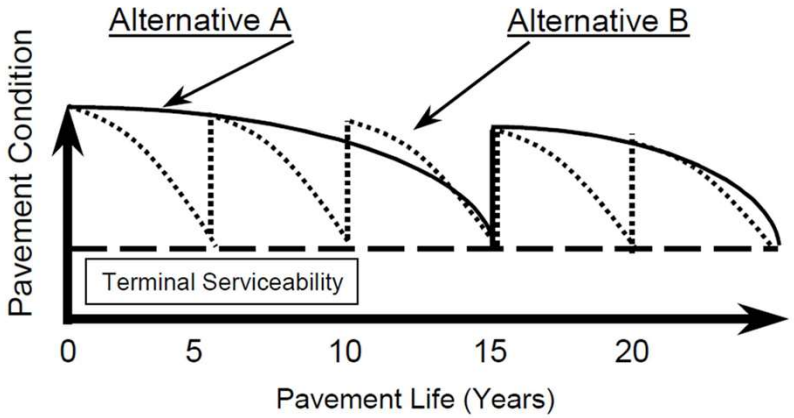
Why is maintenance important?



This is very common plot comparing alternatives in pavement construction

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Summary of maintenance techniques

- Preservation
  - Reseal joints and cracks
  - Retrofit edge drains
- Functional
  - Partial depth repair
  - Diamond grinding
  - Thin overlay (PCC or AC)
- Structural
  - Retrofit load transfer
  - Cross stitching
  - Slab undersealing/stabilization
  - Remove and replace

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Pavement Distresses

- Cracking
  - Corner, durability, longitudinal, transverse, map
- Joint deficiencies
  - Seal damage, spalling, faulting
- Surface defects
  - Scaling, popouts, polished aggregates
- Miscellaneous
  - Blowups, water bleeding/pumping

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Matching techniques to distresses

- Reseal joints and cracks
  - Seal damage
  - Water bleeding/pumping
- Retrofit edge drains
  - Increase drainage capacity
  - Unclog
- Partial depth repair
  - Minor cracking
  - Spalling
  - Scaling, popouts, polished aggregates

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Matching techniques to distresses

- Diamond grinding
  - Faulting
  - Polished aggregate
- Thin Overlay
  - Minor cracking
  - Scaling, popouts, polished aggregate
- Retrofit load transfer
  - Faulting
- Cross stitching
  - Longitudinal minor cracks
- Remove and replace
  - Major cracking
  - Blowups

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Reseal joints and cracks - Materials

- Sealant types
  - Neoprene rubber
  - Silicone
  - Polyurethane
  - Hot pour rubber asphalt
- Tooling
  - Non-sag sealants require
  - Self-leveling sealants do not require

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Partial depth repair

- Cementitious materials
  - Conventional PCC, gypsum based materials, magnesium phosphates concretes
- Polymer based
  - Epoxy, methyl methacrylate, polyster-styrene, polyurethane polymer resins
  - Aggregate
- Bituminous
  - Asphalt cement or emulsion
  - Aggregate

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Thin Overlay

- Portland cement concrete or asphalt concrete
- Bonded versus unbonded
  - Concrete on concrete (bonded)
  - Asphalt concrete interlayer for unbonded
- Maximum aggregate size 1/3 of overlay thickness
- Thermal coefficent of layers must match

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Retrofit load transfer

- Epoxy-coated dowel bars
- Repair/backfill material
  - Little to no shrinkage
  - Similar thermal compatibility
  - Good bond strength
- Similar materials for backfill material to partial depth repair

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Slab undersealing/stabilization

- Pressure insertion of flowable material under concrete slab
- Fill voids to reduce deflections
- Material must be able to flow
  - Cement/flyash grouts
  - Asphalt
  - Polyurethane

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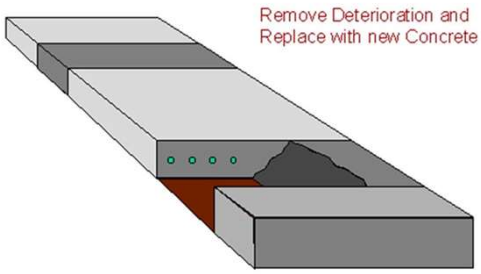
Remove and replace

- Generally conventional PCC
- High strength PCC with lower w/c ratio and chemical accelerator an option
- Can increase cost and require special handling



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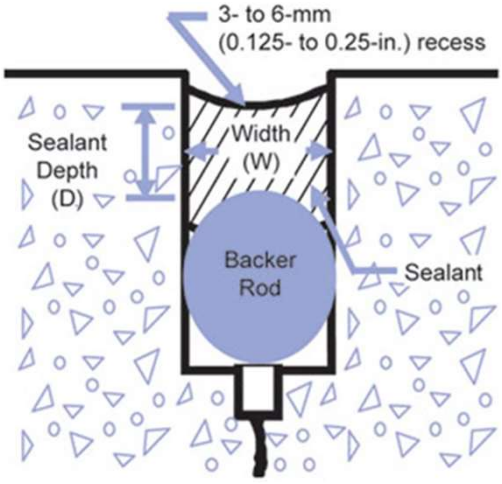
Reseal joints and cracks - construction

- Concrete must be cured
  - ~ 7 days
- Joint reservoirs
  - ~ ½" wide, 2.5" deep
  - Width to depth ratio
- 2:1 silicon
- 1:1 hot poured
- Transverse versus longitudinal
- Sandblasting and cleaned
  - No moisture, saw slurry, dirt, or dust
- Backer rod



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Retrofit edge drains- construction

- Direct water away from pavement layers
- Larger diameter slotted pipes (4”) clog less than smaller (2-3”) pipes
- Need deep trenches and treated permeable bases

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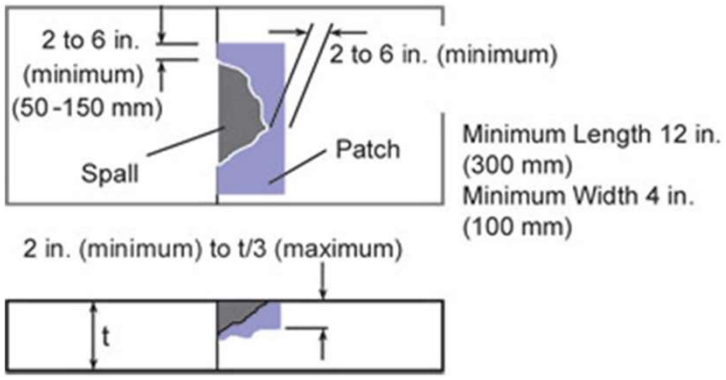
Partial depth repair - construction

- Select repair dimensions
- Concrete removal
- Cleaning
- Joint preparation
- Bonding agent application
- Patch material placement and finishing
- Curing



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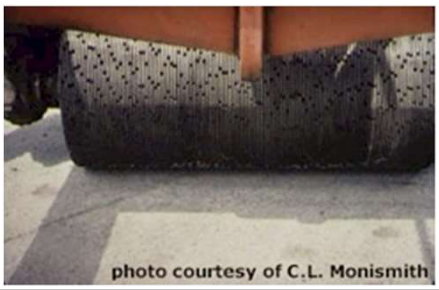
Diamond grinding - construction

- Remove surface irregularities, restore smooth riding surface, increase surface friction, reduce noise
- Depth 0.1 – 0.25in
- Spacing of blades based on aggregate hardness
  - Harder – closer spacing; Softer – wider spacing
  - 50 – 60 blades per foot of width
- Slurry picked up by on board wet vacuums



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Thin Overlay - construction

- Texture existing pavement
  - Shotblasting, sandblasting, cold milling
  - Typical texture readings 0.050 – 0.095”
- Replace existing damaged concrete
  - Asphalt patches removed and replaced with PCC
- Clean surface
- Place overlay

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Retrofit load transfer - construction

- Cut slots
  - 12” spacing center to center
- Prepare slots
  - Remove material
  - Clean and caulk (prevent fill material from entering joint
- Place dowels
- Backfill slot

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Cross stitching - construction

- Holes drilled at angle
  - Intersect longitudinal cracks/joints
  - To mid-depth of slab
- Dust removed with compressed air
- Epoxy injected into holes
- Tie bars inserted and excess epoxy removed

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Slab undersealing/stabilisation- construction

- 1.25” – 2” hole drilled through concrete slab
  - Pressure on drill < 200lbf to avoid slab damage
- Group packer injects material into hole
- Monitor pumping time, slab pressure and slab lift to avoid over grouting
- Just want to fill voids, not lift slab (fill does not increase capacity)

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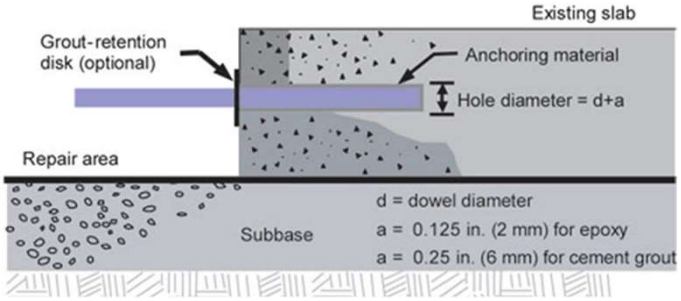
Remove and replace - construction

- Concrete removal
- Repair area preparation
  - Prep base, subbase, and subgrade materials
- Load transfer
- Concrete placement and finishing
- Curing
- Sawing and sealing
  - Joints formed and sealed



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