Maintenance of Concrete Pavement

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Overview

- Concept of preventive maintenance
- Treatments
Concrete Pavement

- PCC Slab
- Subbase
- Subgrade
Jointed Plane Concrete Pavement

12 to 20 ft 12 to 20 ft

PLAN VIEW

Transverse Joints (with dowels) Longitudinal Joint (with tie bars)
Example Variable Spacing and Skewed Joints
Dowel Bars
Typically Low Budget

• Not enough to maintain current conditions
• Not enough to eliminate backlog

High Needs

Preventive Maintenance Could be the Answer
Preventive Maintenance
Objective of Preventive Maintenance

Keep the pavement condition above a level that would require corrective maintenance or other strategies
When should a pavement preventive maintenance treatment be applied?
How much oil should a car burn before changing oil?
Candidate for PM?
Candidate for PM?
Pumping
Pumping
Pumping

Travel
Faulting

Approach slab

Fault

Leave slab

Joint (or crack)

Wedge of “injected fines”
Faulting
Functions of Maintenance Treatments

- Seal joints and cracks
- Preserve the pavement system
- Retard future deterioration
Effective Preventive Maintenance

$1.00 for preventive maintenance here is 4 to 5 times more cost-effective than here.
When Should PM be Applied?

Pavement Condition

Good

Preventive Maintenance

Defer Action

Rehab.

Reconstruction

Poor

Time (Years)
Maintenance Treatments

1. Joint and crack sealing
2. Retrofitting of dowels
3. Subsealing (undersealing)
1. JOINT & CRACK SEALING

- A routine maintenance activity
- To prevent intrusion of
  - water
  - incompressible materials
Warrants for Sealing

- % failed sealants
- Pavement type, pavement & sealant condition & available fund
- Rating numbers based on sealant & pavement condition, traffic level & climate
Effect of Not Sealing

Water infiltration may cause:

- Pumping
- Faulting
- Joint spalling/deterioration
- Voids under slab
- Corrosion of dowel and tie bars
- Freeze-thaw slab deterioration
Five Steps to Resealing

a. Removing the old sealant
b. Shaping the reservoir
c. Cleaning the reservoir
d. Installing the backer rod
e. Installing the sealant
a. Old Sealant Removal

- Manual
- Sawing
- Plowing
- Cutting
Sawing
Plowing
b. Shaping Reservoir

After removing old sealant
- Widen as necessary (routing)
- Dislodge all old material
Blade for Slight Widening

Old Sealant

Sawing out the old Sealant

0.4 in. 0.5 in.
c. Cleaning
d. Installing Backer Rod
e. Sealing
Sealant Materials

- Thermoplastic materials
  - Hot-applied
  - Cold-applied
- Thermosetting materials
  - Chemically cured
  - Solvent release
- Preformed compression sealants
1. Place filler

2. Place tape separator

3. Place sealant
Preformed Compression Sealant

- Horizontal reaction stresses
- Vertical reaction stresses
- Web stresses
- Balanced vertical stresses
- Space at bottom for seal expansion
Lane/Shoulder Joint

1 in. or greater reservoir against asphalt
Clean/Sandblast
Resealing Cracks

- More difficult to:
  - Shape
  - Clean
  - Seal

- Do not expect uniform reservoir
- Same cleaning steps as joints
- May use tape instead of backer rod
Shape
Clean / Seal
Sealing Performance

- Reduces pumping and creation of voids
- Preserves pavement condition
- Extends pavement life
Sealing Limitations

- Limited to low severity cracks
- Not recommended for cracks extending across full lane
- Routing may cause spalling
2. DOWEL BAR REPFITTING

- Increasingly popular method
- Installation of dowels to transfer load
- Faulted transverse joints and cracks
- Reduces further deterioration
  - Pumping and faulting
  - Spalling
  - Corner breaks
Good Load Transfer

\[ \Delta_L = x \quad \Delta_U = 0 \]

Poor Load Transfer

\[ \Delta_L = x \quad \Delta_U = x \]

Good Load Transfer

\[ \Delta_L = x \quad \Delta_U = x \]
Main Operations

- Cutting slots
- Cleaning and preparing slots
- Placing the dowel bars
- Backfilling the slots
Line Up Slots Parallel to Centerline
Dowel Bar Retrofit Layout

- Saw cut
- Dowel bar tube
- 1 in. expansion
- Full depth joint forming medium & dowel support
- 36 in. or as required
- Side view
- End view
- T
- T/2
- 18 in.
- Clip chair
- 1 in. expansion
Backfilling
3. SUBSEALING (UNDERSEALING)

- Filling voids under the slab
- Stabilize slabs
- Grind to restore ride quality
Void Formation Under Slab at Joint
Void Detection

- Visual inspection
- Proofrolling with heavy equipment
- Deflection nondestructive testing
- Radar or infrared testing
- Epoxy and drilling method
Visual Inspection

Look For:

- Faulted joints
- Stains from pumping
- Shoulder blow holes
- Corner breaks
- Large shoulder drop-offs
- Depression areas
Static Deflection Testing
Dynamic Deflection Testing
Grout Materials

- Cement grout mixtures
  - Pozzolanic - cement grout (most common)
  - Limestone - cement grout
Drilling Injection Holes
Automated Drill Rig
Pumping Grout
Starting Injection
Example Grout Injection Pattern

Push any underlying water out toward shoulders
Stop Injection When

- The slab begins to rise
- Grout no longer pumps below the maximum allowable pressure
- You see grout flowing up through adjacent holes
Checking Slab Lift
Final Steps

- Insert wooden plugs only if required
- Perform post testing 24-48 hours after stabilizing the slab
  - redo any slabs with high deflections
  - consider replacing slab full-depth after third injection
Subsealing Performance

- Increases structural integrity
- Extends pavement life
- Provides smooth ride
- Reduces faulting progression
- Reduces slab deflection
- Reduces reflection cracking
Alternative to Preventive Maintenance

- Grinding
- Major repair
- Rehabilitation
- Reconstruction
Grinding
Major Repair
Rehabilitation
Reconstruction
State-of-the-Practice

Pavement Preservation
State of the Practice
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That's all Folks!