Concrete Pavement Maintenance

Making The Most of Your Concrete Assets

Some Things Last Forever

And others need a little TLC

PCCP Withstands the Test Of Time & Traffic

Priorities Have Shifted

- Maintain the present system
- Minimize traffic disruptions
- Increase safety
- Address operator comfort
  - Reduce Roughness
  - Reduce Noise
- Save money
The Marketplace Has Changed

Preservation and Restoration

- First level of response for deteriorating concrete pavements should always be Preservation/Restoration
  - Least cost – Cheaper than reconstruction
  - Least service disruption
  - Increases safety
  - Environmentally sound
  - Addresses operator comfort

PCCP Preservation Techniques

- Full-depth repair
- Partial-depth repair
- Slab stabilization
- Retrofitting dowels
- Cross-stitching longitudinal cracks/joints
- Diamond grinding
- Joint & crack resealing

How do preventive treatments differ from routine/reactive treatments?

Same treatments …different TIMING!

Rehabilitation Timing

Preventive Maintenance 2
Session 2
Purpose of CPP

- Used early when pavement has little deterioration.
  - Repairs isolated areas of distress.
  - Repairs some construction defects.
  - Manages the rate of deterioration.

Expected Benefits

- Preservation of investment
  - Improved pavement performance
  - Long term cost savings/leveling
- Maintain a high level of service
  - Increased safety
  - Greater customer satisfaction

Preserving the Investment

- Keep water out!
- Reduce debris infiltration into joints or cracks
- Minimize dynamic loads

**SMOOTH PAVEMENTS LAST LONGER!**

Rough Pavement

![Graph showing wavelength and amplitude with wheel load data]

Smooth Profile

![Graph showing smooth road profile with wheel load data]

Diamond Grinding

![Image of diamond grinding process]
What is Diamond Grinding?

- Removal of thin surface layer of hardened PCC using closely spaced diamond saw blades;
- Results in smooth, level pavement surface;
- Longitudinal texture with desirable friction and low noise characteristics;
- Frequently performed in conjunction with other CPR techniques, such as full-depth repair, dowel bar retrofit, and joint resealing;
- Comprehensive part of any PCC Pavement Preservation program.
Advantages of Diamond Grinding

- Cost competitive;
- Enhances surface friction and safety;
- Can be accomplished during off-peak hours with short lane closures and without encroaching into adjacent lanes;
- Grinding of one lane does not require grinding of the adjacent lane;
- Does not affect overhead clearances underneath bridges;
- Blends patching and other surface irregularities into a consistent, identical surface;
- Provides a low noise surface texture!

Surface Characteristic Research

- CALTRANS Diamond Grinding Research
- WSDOT Safety Research
- National Concrete Pavment Technology Center
- Purdue Tire Pavement Testing Apparatus
- ACPA Sound Intensity Testing
- California and Arizona PCCP SI Testing
- NITE Sound Intensity Testing (CALTRANS)

Effectiveness of Diamond Grinding - CALTRANS

- Diamond grinding was first used in California in 1965 on a 19-year old section of I-10 to eliminate significant faulting
- CALTRANS has determined that the average life of a diamond ground pavement surface is 17 years and that a pavement can be ground at least three times without affecting pavement structurally. See IGGA.net for full report

MODOT- Safer, Smoother, Sooner

- MODOT initiates Safer, Smoother, Sooner program in 2005 – 2007
- The initiative invests $400 million on 2,200 miles
- Improve customer satisfaction through
  - Safer pavements
  - Smoother ride quality
  - Quiet ride quality
- Approx 18,000,000 sq yds let since 1st Qtr 2005
- See IGGA.Net for MODOT’s BMP on diamond grinding new PCCP

LOAD TRANSFER RESTORATION

- Dowel Bar Retrofit

Placement of load transfer devices across joints or cracks of existing pavements
- Candidate projects
  - Poor load transfer (< 70 %)
  - Pumping
  - Faulting
  - Corner breaks
Purpose of Load Transfer Restoration

- Reestablish load-transfer across joints or cracks
  - Load-transfer is a slab's ability to transfer part of its load to its neighboring slab
- Used in JRC and JPC pavements to limit future faulting

Load Transfer = 100% (Good)

Load Transfer = 0% (Poor)

Ten-Year Performance of DBR Application ... by WASHDOT

- First production DBR project completed in Washington in 1992
- WASHDOT has retrofitted 225 miles since 1992
- Subject DBR sections still maintain average LTE of 70% to 90%
- Determined that carbide roto-milling is NOT a viable alternative for diamond grinding
- Based on 10 yr results, DBR is considered a successful alternative for rehabilitation of aging PCCPs in WS

Performance of DBR Concrete Pavement Under HVS Loading by CALTRANS, UC Davis and UC Berkeley

- Tested two retrofitted PCCPs under a Heavy Vehicle Simulator (HVS) aka accelerated loading frame
- HVS results demonstrated large improvement in LTE and decrease in vertical deflections
- DBR sections not damaged by HVS loading, unlike control section
- DBR less sensitive to temp changes than control section
- Total of 11,000,000 ESALS applied to DBR sections without failure occurring

Full-Depth Repair

- Purpose
  - Restore structure
  - Restore ride
- Used for:
  - Joint deterioration
  - Transverse cracking
  - Longitudinal cracking
  - Broken slabs & corner breaks

Pre-cast Pavement Panels
**Preventive Maintenance 2**  
**Session 2**

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**Insitu Full Depth Repair**

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**Sizing a Patch**

- Go beyond deterioration
- Remember to check for below-surface spalling
- Minimum length 6 feet
- Adjust as necessary
- Combine closely spaced patches

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**Combine Patches!!**

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**Load Transfer**

- 1.5 inch dowels
- At least 6 inches of embedment on either side
- Minimum of 3 dowels in each wheelpath
- Corrosion resistance necessary if deicing chemicals will be used

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**Performance of Full-Depth Repairs**

- Can provide 20 or more years of service when properly designed and constructed
- High-early strength materials allow early opening to traffic and limited lane closures
Partial Depth Repairs

- Repairs deterioration in the top 1/3 of the slab.
- Generally located at joints, but can be placed anywhere surface defects occur.
Joint/Crack Resealing

- Application of a sealant material in concrete pavement joints and cracks
- Purpose
  - Minimize moisture infiltration
  - Prevent intrusion of incompressibles
- Sealant Materials
  - Rubberized asphalt
  - Silicone

Performance of Joint Resealing

- Original sealant typically requires resealing after 5 to 12 years
- Resealing required every 5 to 8 years thereafter
- Regular resealing may extend pavement life 5 to 6 years
- Most beneficial on pavements that are not badly deteriorated
Good Candidate Pavements for Preventive Maintenance

- Minimal distress (extent and severity)
- Relatively young in age
- Minor functional problems
- Few historical problems with similar projects

Colorado Project # IM 0701-169
Rifle to Silt, Garfield County

Existing PCCP History

- I-70, Rifle to Silt, MP 86.5 to MP 97
  - Only section of PCCP along I-70 from West of Denver to Utah border.
- Portland Cement Concrete Pavement
  - Consisted of only one project which included base and PCCP placement
  - Construction from November 1975 to November 1976.
  - PCCP was selected over ACP as there were oil shortages and the cost of asphalt skyrocketed.

PCCP Condition Prior to Restoration

- Cracked / broken concrete slabs
- Exposed aggregate surface
- Wheel Rutting (wear)
  - 25% of the existing pavement had average rutting of 5/16" to 3/8"
- Settlement in drive lane at the edge of traveled way
  - Settlement of up to one inch below the adjacent shoulder slab
  - Surface runoff pooling at the edge of the traveled way
- Minor faulting

Faulted Panel
**Concrete Pavement Restoration Project Scope**

- Remove and replace broken and cracked concrete slabs
- Re-establish a uniform textured surface
- Remove rutting/reduce significant rutting – drainage improvement
- Feather the outside shoulder – drainage improvement
  - Removing lip at edge of traveled way, allowing positive runoff flow
- Reduce noise

**Salient Items of Work**

- Grinding & Texturing Concrete Pavement 330,000 SY
- Concrete Pavement (Full Depth Patching) 1,200 SY
- Rumble Strip 22,500 LF
- Epoxy Pavement Marking 985 GAL

**Contract Amount $1,797,384**
Preventive Maintenance 2
Session 2

Ride Specification

Grinding & Texturing Concrete

75 % Improvement (I)

Improved Smoothness
IM 0701-169 Rifle to Silt,
Garfield County
East Bound

Ride Improvement (%I)
Driving Lane  78%
Passing Lane 75%

Driving Lane Pre-Grind
Driving Lane Post-Grind
Passing Lane Pre-Grind
Passing Lane Post-Grind
Average Pre-Grind
Average Post-Grind

Improved Smoothness
IM 0701-169 Rifle to Silt,
Garfield County
West Bound

Ride Improvement (%I)
Driving Lane  77%
Passing Lane 77%

Summary

• Many available treatments for PCC pavements
• Each has advantages and limitations
• Performance and cost vary with given conditions
• Applying the right treatment to the right pavement at the right time
• No universal method available
• Take advantage of local contractor experience
• IGGA & ACPA Mid Atlantic Chpt is ready to assist

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• igga.net
• American Concrete Pavement Association
  midatlantic.pavement.com