

Concrete Pavement Maintenance

Making The Most of Your
Concrete Assets

Some Things Last Forever



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And others need a little TLC



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PCCP Withstands the Test Of Time & Traffic



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U.S. ECONOMY

IF YOU'D CARRIED
AS MANY LOADS AS
IT HAS YOU'D BE
SHOWING YOUR
AGE, TOO.

INTERSTATE
HIGHWAY
SYSTEM

DANELOX

Priorities Have Shifted

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

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The Marketplace Has Changed



© WreckedExotics and their Respective Owners

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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

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PCCP Preservation Techniques

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

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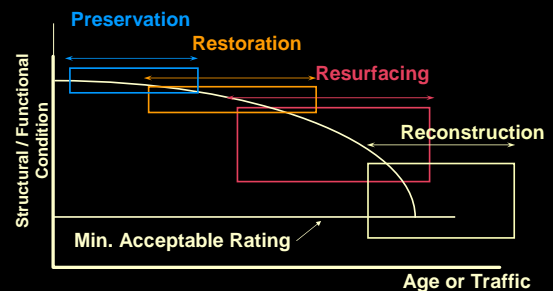
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How do preventive treatments differ from routine/reactive treatments?




Same treatments
...different TIMING!

Rehabilitation Timing



Purpose of CPP

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



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Expected Benefits

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

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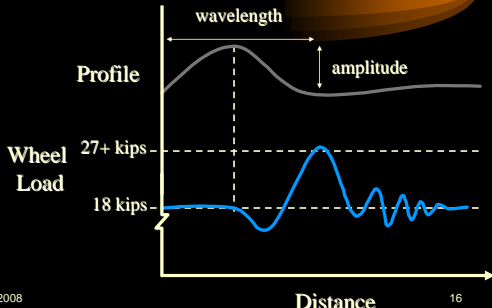
Preserving the Investment

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

SMOOTH PAVEMENTS LAST LONGER!

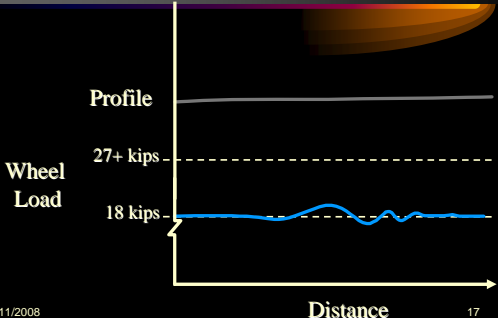
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Rough Pavement



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Smooth Profile



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Diamond Grinding



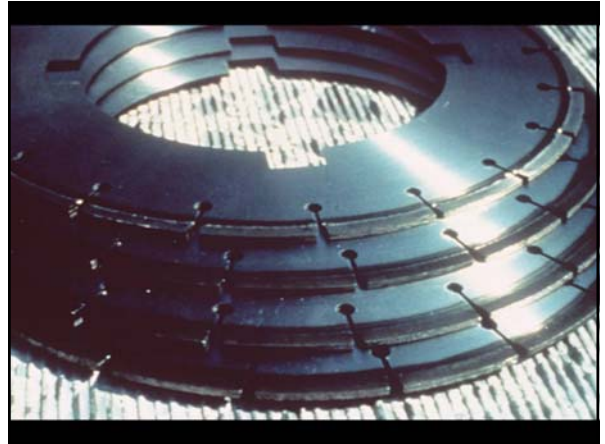
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What is Diamond Grinding?

- 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;**

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Diamond Grinding Cutting Head



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Diamond Grinding Grinding Machine



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Diamond Grinding Grinding Process



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Diamond Grinding Finished Product



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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!**

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Surface Characteristic Research

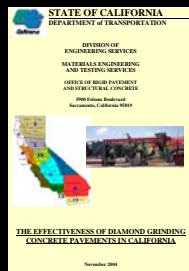
- CALTRANS Diamond Grinding Research
- WSDOT Safety Research
- National Concrete Pvm Technology Center
- Purdue Tire Pavement Testing Apparatus
- ACPA Sound Intensity Testing
- California and Arizona PCCP SI Testing
- NITE Sound Intensity Testing (CALTRANS)

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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



Load Transfer Restoration

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

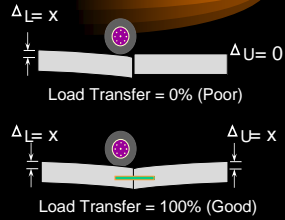


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Purpose of Load Transfer Restoration

- 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



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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

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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

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Full-Depth Patching Operations



Full-Depth Repair

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

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Pre-cast Pavement Panels



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In situ 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

Jointed Pavements:

- 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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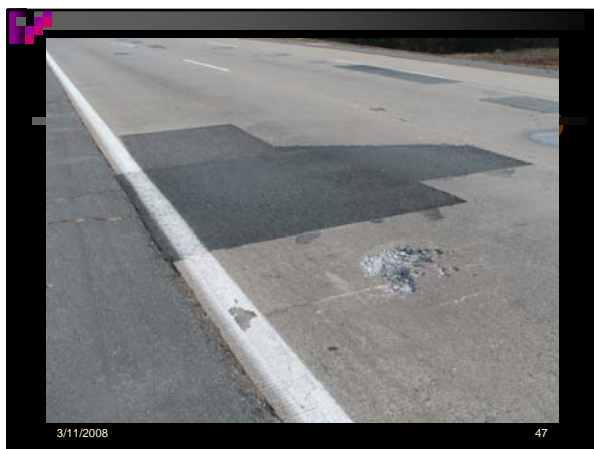
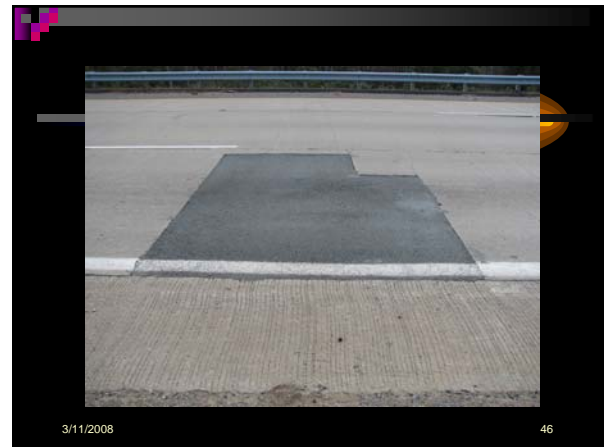
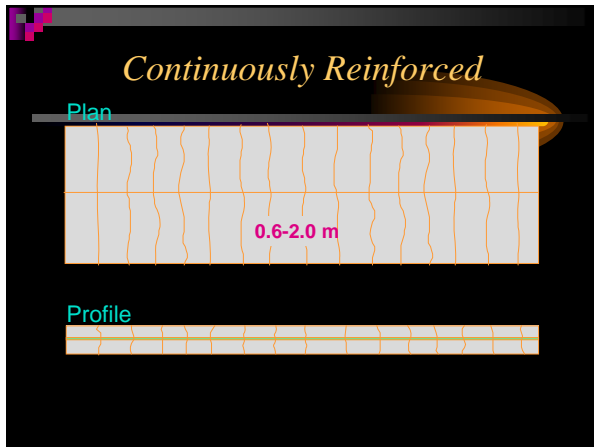
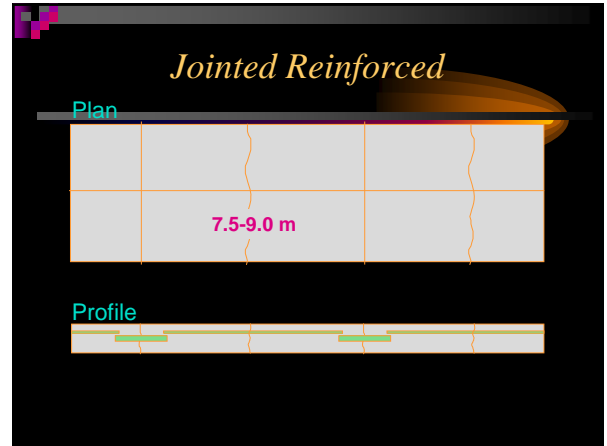
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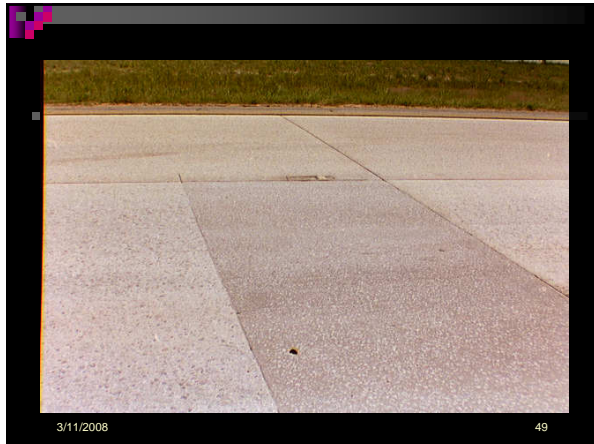
Performance of Full-Depth Repairs

- 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

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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.





*Trunk Highway 53 Ramp
Duluth, MN - 1994*

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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

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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

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Good Candidate Pavements for Preventive Maintenance

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

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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.

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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**

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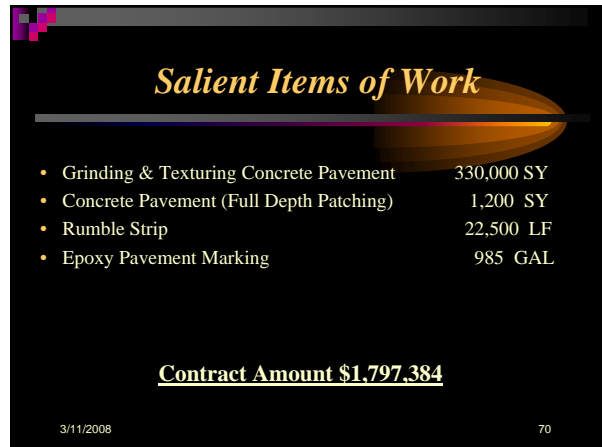
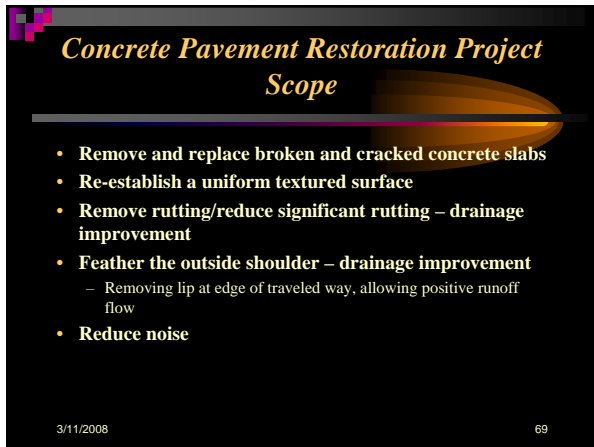
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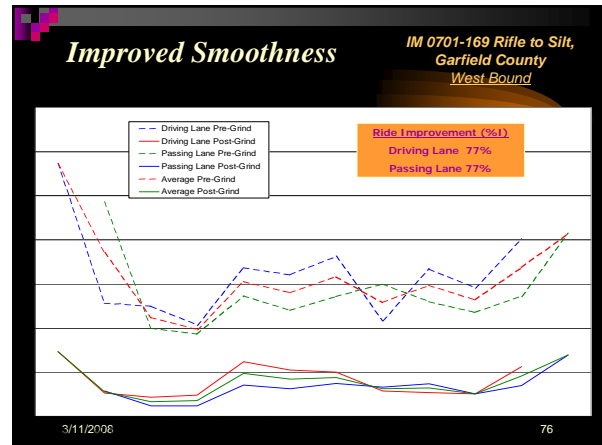
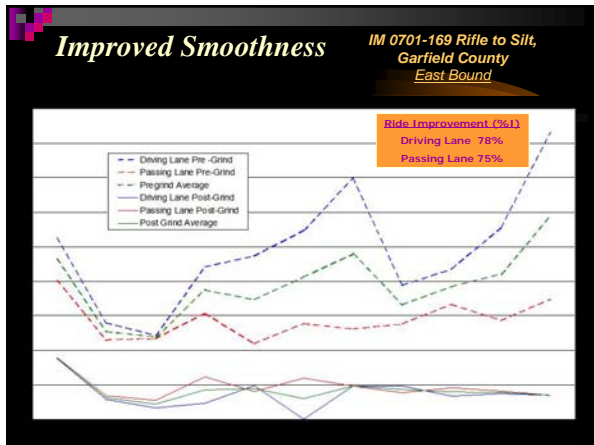
Faulted Panel



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- ### 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

- ### Visit Us on the Web
- International Grooving and Grinding Association
 - igga.net
 - American Concrete Pavement Association
 - midatlantic.pavement.com
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