

**Burns Cooley Dennis, Inc.**  
Geotechnical and Materials  
Engineering Consultants

## **Construction & Maintenance Practices for PFC**

*L. Allen Cooley, Jr.*

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## **Presentation Outline**


- Construction
- Maintenance
  - General Maintenance
  - Winter Maintenance
- Rehabilitation

## **Construction**


- Divided into Four Categories
  - Production – Operations at the Plant
  - Transportation – From Loading Trucks to Paver
  - Placement – Through Paver
  - Compaction – From Paver to Finish Roller
- Much Learned from SMA Applicable

## **Construction**

- Production
  - Materials – “Best Practices” Needed for Aggregate Stockpiles and Asphalt Binder Storage.
  - Stabilizing Additives
    - Special Hopper needed for Fibers
    - Loose and Pelletized Added Successfully



Fibers Added  
Upstream of Asphalt  
Binder Introduction



Asphalt Captures  
Fibers

## Construction

- Stabilizing Additives
  - Best Practice to Have Clear Section in Fiber Introduction Line



## Construction

- Production
  - Batch and Drum Used Successfully
  - Plant Should Be Calibrated
    - May require two cold feed bins for coarse agg.
  - Mixing Temperatures Important
  - Mixing Times Slightly Longer
  - Storage
    - Most Common Limit – 2 hours

## Construction

- Transportation
  - Trucks Should be Covered With Tarps at a Minimum
  - Insulated Trucks Best
  - Heated Dump Body Trucks



## Construction

- Approved Release Agents Should Be Used
  - Truck Beds Should Be Raised So that Release Agents Do Not Pool
  - Watch for Build Up

## Construction

- Placement
  - Pavement Surface Preparation
    - Should Have Proper Cross Slope
    - All Distresses Should Be Corrected
      - Should Not Be Placed on Rutted Pavements
    - Underlying Layer Should Be Impermeable
  - Should be Daylighted on Edge



## Construction

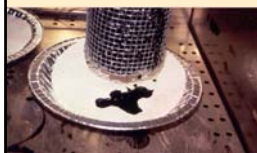
- Placement
  - Longitudinal Joints
    - Should Not Be Tacked Unless They Are At the Crown
    - Mix is Placed  $\approx \frac{1}{8}$  in. Above Previously Placed Compacted Lane
      - Roll Down is Minimal

## Construction

- Compaction
  - Steel Wheel Rollers
  - No Pneumatic Rollers
  - Vibratory only on Transverse Joints
  - Rolling is only to Seat Aggregates
  - No Density Requirements
    - 1 – 2 Coverages at Breakdown and then one coverage with Finish Roller

## Construction

- Quality Control/Quality Assurance
  - Asphalt Binder Content
  - Gradation
  - Draindown
  - Field Permeability???



## Maintenance

- Divided into Two Categories
  - General Maintenance
  - Winter Maintenance

## Maintenance

- General Maintenance
  - Cleaning Clogged Surfaces
  - Preventative Surface Maintenance
  - Corrective Surface Maintenance

## Maintenance

- General Maintenance
  - Cleaning Clogged PFC
    - Not Being Done in US
    - Some Research in Europe
    - Methods
      - High Pressure Hose
      - Truck Mounted "Suck-Sweep" System



## Maintenance

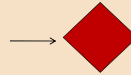
- General Maintenance
  - Cleaning Clogged PFC
    - Cleaning Techniques Should Begin While the Layer is Still Permeable

## Maintenance

- Preventative Surface Maintenance
  - Fog Seals Have Been Used in the Past
    - Fog Seals will Reduce Permeability
    - Do Not Affect Macrotexture
    - Research In Oregon Concluded that Expected Benefits To Prolong Life Were Not Substantiated.
  - Texas Has Used Seal Coats Over Distressed Areas

## Maintenance

- Corrective Surface Maintenance
  - PFCs Can Be Patched
    - Small Patches Can Be Made with Dense-Graded Mix
      - Rotate 45 deg. (Diamond Shape) So Water Will Flow Past.
    - Large Patches Should Be with PFC
    - When Patching, Only a Light Tack Coat Should Be Applied to Vertical Faces



## Maintenance

- Corrective Surface Maintenance
  - Transverse Cracks Can Be Sealed
  - Longitudinal Cracks are Problematic
    - Impede Water Flow to Pavement Edge

## Maintenance

- Winter Maintenance

*GOOD LUCK!!!!!!!*

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## Maintenance

- Winter Maintenance
  - Each Agency/Paper Describes Different Techniques
  - One Constant – More Deicing Materials Are Needed for PFCs

## Maintenance

- Winter Maintenance
  - Quotes From Literature
    - "... no definitive solution for winter maintenance.." Padmos Denmark (2002)
    - "...Since the behavior of the road salts on PFC surface is so different, special locally adjusted strategies are needed." Griebe ISAP (2002)
    - "...experience is the only true method of developing a winter maintenance program." Brousseau et al France (2005)

## Maintenance

- Winter Maintenance
  - Deicing Salts
    - 25 to 100 % more for PFCs (Greibe, 2002)
    - 25 to 50 % more (Litzka, 2002) (Austria)
    - 30 % more (Giuliani, 2002)
    - 100% more in Slovenia (Litzka, 2002)
    - 25% more in Netherlands (Litzka, 2002)
  - Why More?
    - Different Thermal Properties
    - Reaches Freezing Sooner, Stays at Freezing Longer
    - Interconnected Voids

## Maintenance

- Winter Maintenance
  - Colder Temperatures in PFC
    - 3.6 to 5.4 F Cooler (Lefebvre, 1993)
    - 3.6 to 5.4 F Cooler (Huber, 2000)
    - 1.8 F Cooler (Litzka, 2002)
  - Iwata et al (Japan, 2002)
    - Daytime – 3.6 F Cooler
    - Nighttime – 1 F Warmer

## Maintenance

- Winter Maintenance
  - Observation
    - Pumping Action Caused by Traffic May Circulate Salt Solution Within Void Structure
    - Bennert and Cooley (2006) Showed an Influence of Traffic Volume on Friction Test Results – Design Lane = Higher Friction

## Maintenance

- Winter Maintenance
  - Interesting Observation
    - In Italy, A change from a 20 mm MAS to a 16 mm MAS PFC led to a significant improvement in road conditions during winter events.

## Maintenance

- Winter Maintenance
  - Concern
    - Litzka (2002) – Snow Plows Tend to Push the Slushy Material Into the Void Structure. Freezing Temperatures Cause the Slush to Swell.
    - To Prevent, Must Salt Immediately After Snow Plows.

## Rehabilitation

- Typical Distresses
  - Raveling, Delamination, Cracking

### Rehabilitation

- Major Rehabilitation
  - Replacement of Entire Layer
  - Mill and Replace with Another PFC or Other Layer
  - Georgia Has Expressed Concern with Milling
    - Grooves May Hold Water
    - Investigating Micro-Milling

### Rehabilitation

- Major Rehabilitation
  - Inlays Are Not Recommended for PFC
    - Drainage Characteristics
  - Overlaying with Dense-Graded Layer Not Recommended
    - Trapped Moisture – Stripping
  - Some Success with Hot In-Place Recycling
    - However, No Specific Report found
    - Cited in a Paper

### Conclusions

- Method for Cleaning PFCs Needed
- Work is Needed To Determine Winter Maintenance Guidelines
- Mill and Replace Most Common Rehabilitation Activity

NCHRP Report No. 640  
For more details



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*Thanks!*  
*Questions?*



Allen Cooley  
(601) 856-2332  
acooley@bcdgeo.com