

PCCP Overlays

- Observations & Lessons Learned



MCA Workshop
February 21, 2019

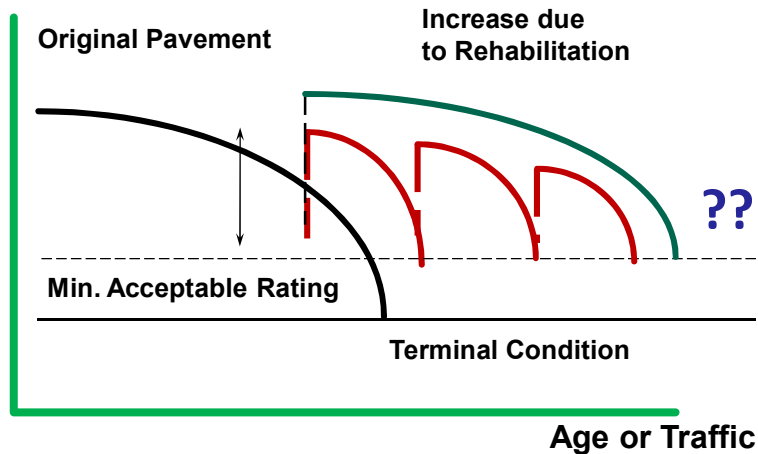
What are we talking about??

- Structural Fiber Reinforced Concrete (SFRC) Overlays – 4" – 6" thick
- Concrete overlays over old asphalt pavements
- Concrete overlays over old composite pavements



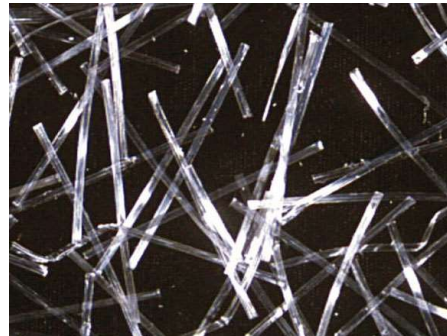
PCCP Overlay Preservation Option

Structural/Functional
Condition

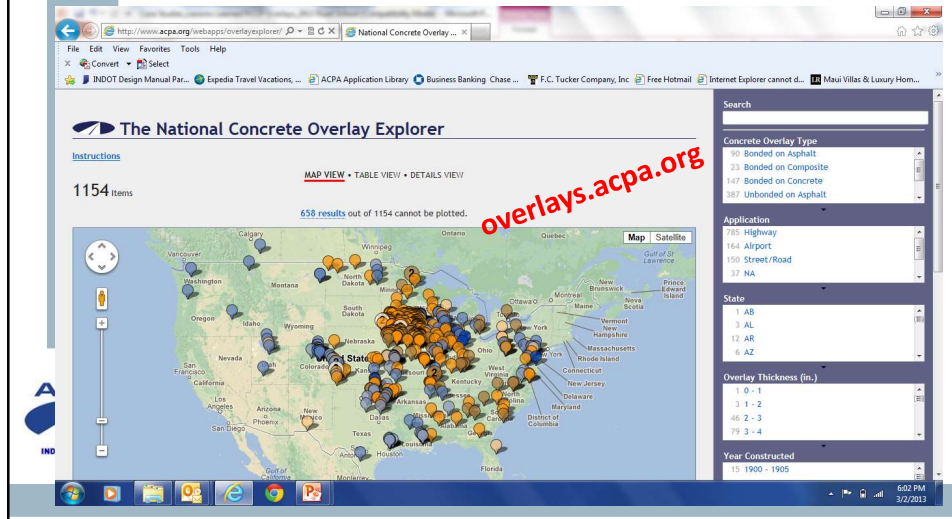


New Technology – high strength macro synthetic fibers

- Dosage required to achieve 20% residual strength gain
- Residual strength = the load that damaged object can carry without failing
- ASTM 1399 & 1609
- 4 – 5 lbs. per cubic yard



Widely Used Across the Country



History of thin concrete overlays

- 10+ years of thin PCC overlays on local roads & airports – but INDOT did not have a long running history of thin concrete overlay projects.
- 7 Local Road projects – 3.5”-6”
- 6 Airport Projects – 3.5”- 6”
- NOW – INDOT has built/building 10 projects to date

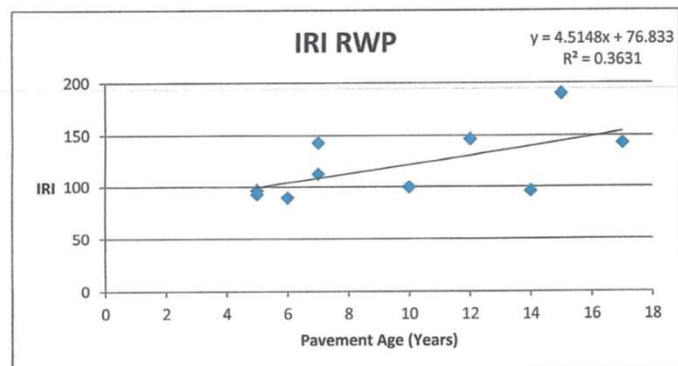


INDOT initiative

- Are thin concrete overlay's a good alternative as a preventative maintenance treatment type?
- Each INDOT District to identify 2-3 projects
- Bonded concrete on asphalt or composite pavement
 - “Thin” classification = 4” - 6”
- Letting by the end of 2017 for all projects
 - A few projects lagged into FY 2018



Performance Data



Pathways Van Data Collection of existing PCCP overlays



Concrete Overlays



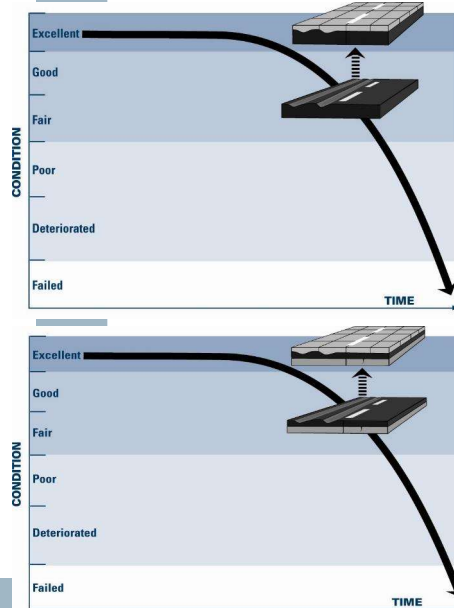
Guidance on Design and Construction

Design criteria

- Design life of 20yrs
- Typical joint spacing is 6'x6' to keep joint lines out of wheel paths
- Joints are saw cut not formed
 - Pressure relief joints required at gap pour locations
- Only patch major distresses
 - Not same approach as an HMA overlay
- No dowels or tie bars required unless tying into existing concrete pavement



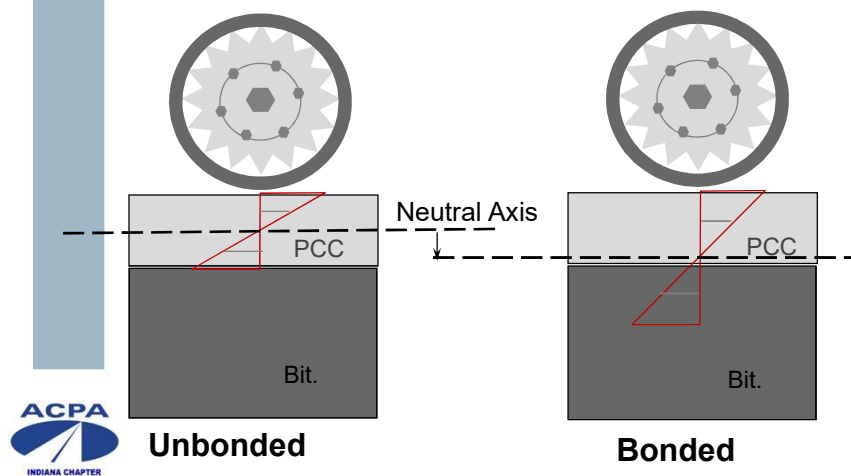
Bonded Resurfacing of Asphalt or Composite Pavements



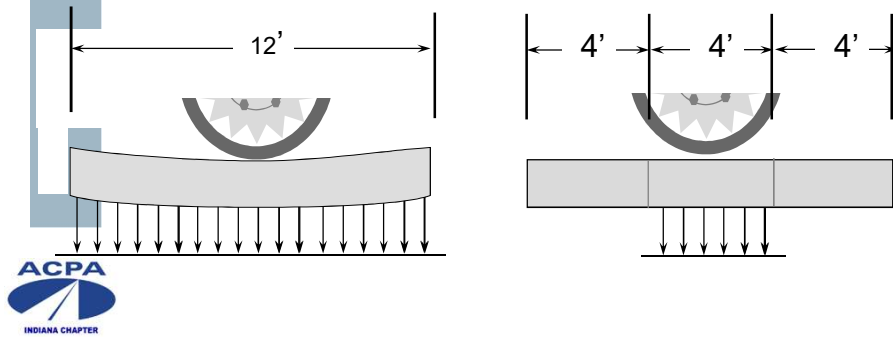
4"-6" thickness

- Use when existing pavement is in fair or better structural condition with surface distress.
- Use to eliminate any surface defects; increase structural capacity; and improve surface friction, noise, and rideability.

Mechanics of PCCP Overlays



Short Joints Reduce Stresses



Evaluations of Existing Pavements for Overlays

- An evaluation of the existing pavement is necessary to ensure it is a good candidate for resurfacing and structurally sound to carry the anticipated traffic loads.
- Information gathered through the evaluation is used to determine required repairs where needed and to establish the concrete overlay design thickness.
- Strongly suggest – **take cores of existing pavement**
- Concrete material condition can be obtained through analysis of cores taken from the existing pavement.

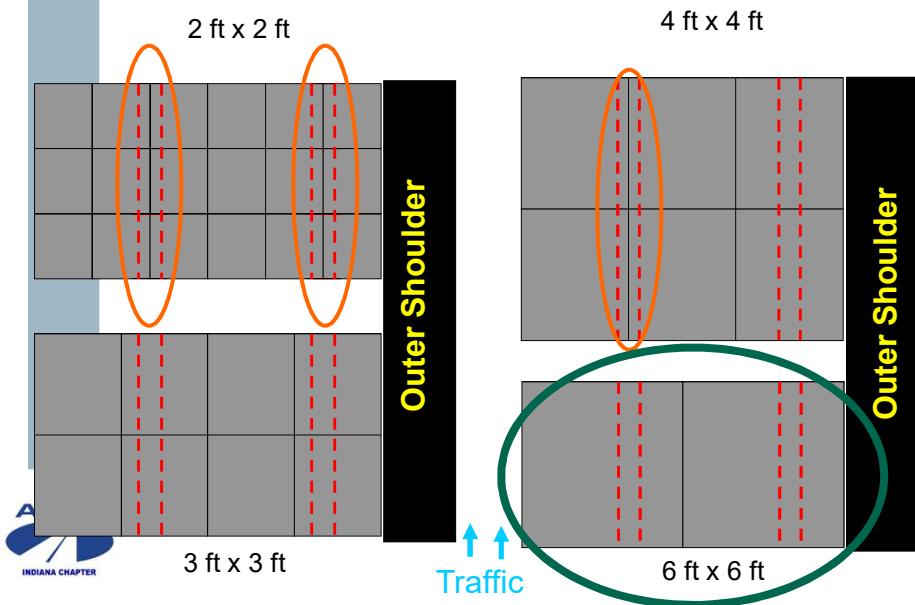


Pavement Evaluation:

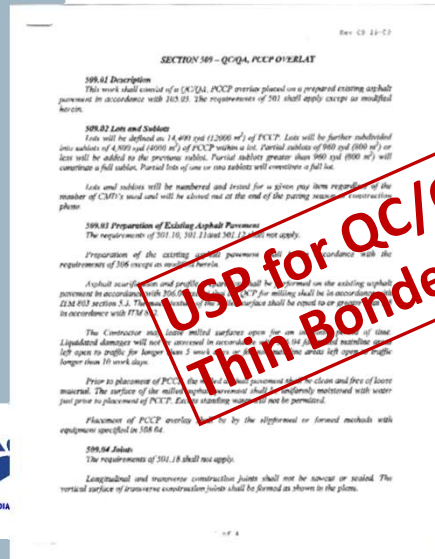
On high-volume roads, falling weight deflectometer (FWD) testing can provide subgrade k-values and variability, concrete modulus, load transfer efficiency, and presence of voids.



Longitudinal Joint Layout



INDOT Specification 509 & USP



SR 161, Dubois County

PCC Overlay USP – Changes of Note

- New Lot & Sublot size
 - Lot – 14,400 sys
 - Sublot – 4800 sys
- Coring for thickness lot size
 - 2 cores per 2400 sys
- Opening to traffic strengths
 - 350 psi for local traffic
 - 550 psi for construction traffic

PCC Overlay USP – Changes of Note

- Construction Engineering shall be provided to control milling operations (**A bid item**)
- The Contractor shall develop a design centerline profile that:
 - optimizes pavement smoothness, maintains minimum overlay depth across the width of the pavement
 - does not exceed the maximum allowable change in profile grade as shown on the plans
 - optimizes the quantity of QC/QA PCC, Additional, as it relates to the material between the milled irregular surface of the asphalt pavement and the bottom of the thin PCC overlay



PCC Overlay USP Mix Changes of Note

- The CMD shall contain at least one, but no more than two SCM's, and produce workable concrete mixtures having the following properties:
 - Minimum total cementitious500 lbs/cy
 - Allowable amount of single SCM, % of total cementitious, by weight.....20.0 - 40.0% ^A
 - Allowable amount of two SCM's, % of total cementitious, by weight.....25.0 – 40.0% ^B
 - Min. portland cement content.....350 lbs/cy
 - Allowable amount of silica fume SCM, % of total cementitious content.....3.0 – 7.0%
 - Max. w/c – mixture with fly ash SCM.....0.440
 - Max. w/c - mixture with ggbfs SCM.....0.450
 - Target air content defined by CMDP.....7.0%
 - Min. flexural strength, 1/3 point loading.....570 psi at 7 days



Quality Tests - Mixes with Macro Fibers

- Flexural Strength
- Air Content
- Unit Weight
- Water/cementitious ratio

**No change – evaluate
with standard tests &
specimen prep**



Residual Strength

Residual strength = the load that damaged object can carry without failing

$$R^D_{T, 150} = \frac{150 * TD_{150}}{f_1 * b * d^2}$$

Fiber dosage required for 20%



PCC Overlay USP – Jointing Changes

- In gap areas $\geq 60'$, pressure relief joint filler shall be installed at each end of the gap. ($< 60'$ only at one end)
- Joints shall be perpendicular to the finished surface of the PCC thin overlay, shall be 1/8 in. in width
- Shall have a minimum depth of $T/3$, where T is the design thickness of the PCC thin bonded overlay.
- Joints are not filled/sealed



Other notable changes

- Curing of the thin PCC overlay shall be in accordance with 501.20 except that each of the two applications of white pigmented curing compound shall be at a rate not less than one gallon/100 sq. ft.
- Smoothness
 - Posted ≥ 45 mph – profilograph spec
 - Posted < 45 mph – 16' straightedge



PCCP Overlays

- INDOT Project Case Studies

Projects & Lessons Learned



Selected & Bid thin PCC overlays

INDOT Projects

- SR 161- Ph I – 6" on asphalt
- SR 55 – 4" SFRC on asphalt
- SR 3 – 4.5" SFRC on composite
- SR 161- PH II – 4.5" SFRC on asphalt
- SR 9 Marion – 4.5" SFRC on composite
- US 50 – 4.5" SFRC on composite
- SR 9 Shelbyville – 6" SFRC on composite
- US 52 – 5" SFRC on composite
- US 52 – 4" & 4.5" SFRC on composite
- SR 9 Huntington – 4.5" SFRC on composite



Projects total approx. 1.5 million sys

INDOT Overlay – Bonded over Asphalt

- SR 161 – SR 64 to Holland - 6"
- Overlay over milled existing HMA pavement
- Joints sawed at 10' – 10'x12' panel
- No Dowels – No tie bars
- Road closed to thru traffic
- Local traffic maintained one way
- Access maintained to residents
- 77,000 sy – bid at \$14.00/sy
- Built 2010



SR 161 Concrete Overlay





INDOT Overlay – Bonded over Asphalt

- SR 55 – SR 2 to US 231 - 4"
- Utilized Structural Macro fibers
- Overlay over milled existing HMA pavement
- Joints sawed at 7' – 7'x6' panels
- No Dowels or tie bars
- Road closed to thru traffic
- Local traffic maintained one way
- Access maintained to residents
- 151,000 sy – bid at \$21.00/sy
- Built 2015



SR 55 Concrete Overlay



INDOT Overlay – Bonded over Composite

- SR 3 – US 67 S of Muncie to CR 300N N of New Castle – 4 lane divided highway
- 4.5" thick - Utilized Structural Macro fibers
- Overlay over milled existing HMA on PCCP
- Joints sawed at 6' x 6' panels
- No Dowels or tie bars
- Traffic maintained one-lane NB & SB
- Access maintained to residents
- 336,186 sy – bid at \$20.05/sy
- 45% Constructed in 2017 & remainder in 2018



SR 3



ACPA
INDIANA CHAPTER

SR 3



ACPA
INDIANA CHAPTER



INDOT Overlay – Bonded over Asphalt

- SR 161 Ph II – From Holland to SR 62 – 4.5”
- Overlay over milled existing HMA pavement
- Joints sawed at 6’ x 6’ panel
- No Dowels – No tie bars
- Road closed to thru traffic
- Local traffic maintained one way
- Access maintained to residents
- 56,626 sys – bid at \$27.00/sy
- Project completed September 2017



SR 161 Ph II



INDOT Overlay – Bonded over Asphalt

- SR 9 - Marion – From SR 26 to SR 37 – 4.5”
- Overlay over milled existing HMA pavement
- Joints sawed at 6’ x 6’ panel
- No Dowels – No tie bars
- Road closed to thru traffic – south 4 mi paved full width – 30’ wide
- Local traffic maintained one way
- Access maintained to residents
- 101,178 sy – bid at \$25.65/sy
- PCC paving completed 10/25/17



SR 9 - Marion





SR 9 - Shelbyville

- 6" SFRC
- 2 lanes wide
- 9 mi long
- 142,456 sys
- Bid: 7/12/17
- \$24.00/SY

SR 9 - Shelbyville

Slip formed
with safety
edge

US 52 – south of US 41 junction

- 4" & 4.5" SFRC
- 4 lanes wide
- Approx. 5 mi long
- 132,208 sys
- Bid: 1/18/18
- \$20.00/SY &
\$22.00/SY



2018 Construction



SR 9 – Huntington – 4.5" PCC Overlay w/ Structural Fiber

- 4.5" SFRC
- multiple lanes
wide
- 37,345 sys
- Bid: 4/11/18
- \$18.99/SY



Completed November 2018

US 52 – south of Lafayette

- 5" SFRC overlay
- 8" SFRC shoulder
- 4 lanes wide
- Aprox. 5 mi long
- 142,560 sys
- Bid: 12/13/17
- \$24.75/SY



2018 Construction

US 50 – west of Aurora

- 4.5" SFRC
- 4 lanes wide
- 12 mi long
- 362,280 sys
- Bid: 10/12/17
- \$24.50/SY



Under Construction 2018 - 2019



Construction Guidance



Surface Preparation



Cleaning the Surface to Prepare for Bonding

- Sweeping surface followed by compressed air cleaning in front of the paver.
- Air blasting or water blasting is only necessary to remove material that cannot be removed any other way.
- Water or moisture should not be on the surface prior to paving or de-bonding can occur.



Duct Tape Test



CONCRETE RESURFACING OF CONCRETE PAVEMENTS

Surface Prep





SR 9

Traditional Construction



Traditional Construction



Placement



Placement



Placement



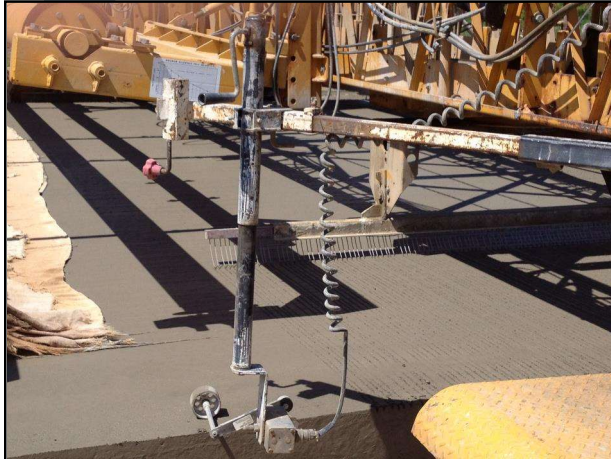
SR 161

Pay attention to finishing & its impact on smoothness



Finishing – SR 3





Tined Surface



SR 3





Curing

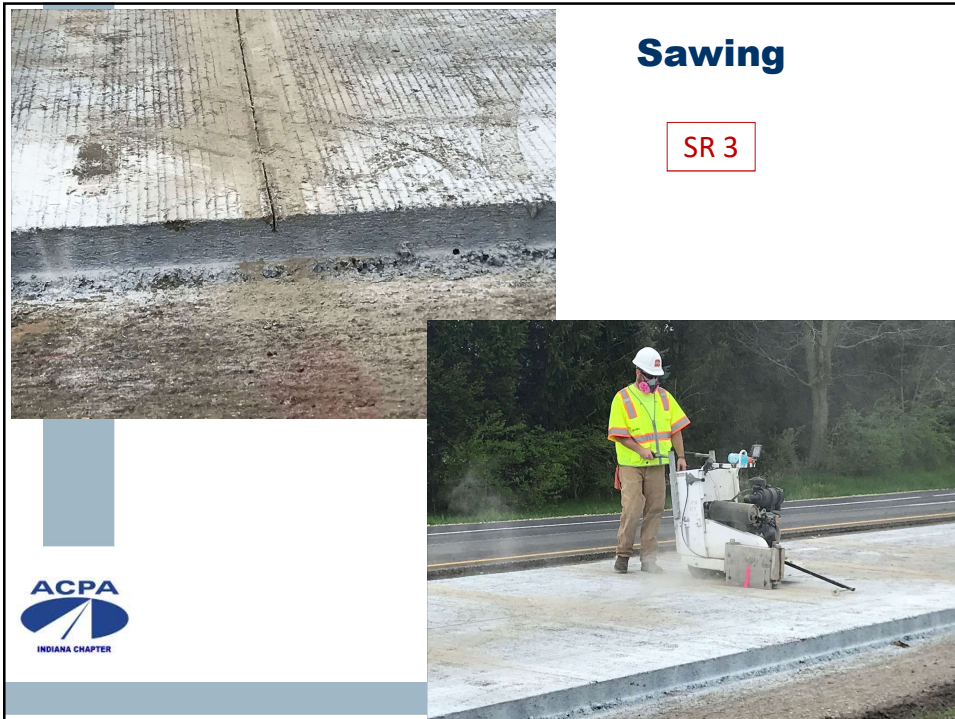
- Curing is especially critical to concrete resurfacing because their high surface area to volume ratio makes them more susceptible to rapid moisture loss.
- Apply **ASAP** – 2X = 2 coats
- Coat all exposed edges.
- Avoid extreme weather.



Avoid contact of cure with prepared surfaces – as it acts as a bond breaker

CONCRETE RESURFACING OF CONCRETE PAVEMENTS





PCCP Overlays

- Indiana Lessons & Experience

Traffic Control Lessons of Note



Traffic Control – Lessons learned

- Can manage traffic through the project
- Closed to thru traffic – local access only appears to work best
 - One way thru work zone
 - Contractor needs to aggressively manage
 - Need adequate signage
 - Need cones & warning tape
 - Aggressive flaggers
- Can manage local access to home & businesses
 - Requires regular communication with locals – discuss schedule & options



Local Traffic – one-way thru project



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One Lane Traffic – thru project



SR 3

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Closed to traffic – Pave Full Width – 30'



SR 9 - Marion

SR 9 – Used Portable Traffic Signals & Pilot Car – on South End of Project



Access to local drives/cross traffic



Access to local drives – SR 55



**Freshly Cured PCCP – looks a lot like
hardened PCCP traffic driving on**



**Focus: Extra attention
to keep drivers off!!**



PCCP Overlays

- Indiana Lessons & Experience

Issues/Problems
Experienced



Better Exploratory coring
of existing roadway

Attention to proper anchoring of tie bars



SR 9 - Shelbyville



Tied 3'
shoulder -
8" thick



US 52 - Lafayette



US 52 - Lafayette



SUMMARY

- Thin PCC Overlays are a viable pavement preservation option/solution
- Data shows have proven long term performance
- Cost competitive
- Constructable
- Can successfully manage traffic



Good Solution – Take a Look !!

Questions?

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